



ICISES – 2023

3rd international Vietnam Conference on Earth and Environmental Sciences

Nov 27 – Dec 1
ICISE Quy Nhon, Viet Nam



Conference Program and Abstracts



The 3rd *international*/Vietnam Conference on Earth and Environmental Sciences 2023 (iVCEES-2023)

November 27 – December 1, 2023

International Centre for Interdisciplinary Science and Education

Quy Nhon, Viet Nam



iVCEES-2023

PREFACE

On behalf of the Organizing Committee, I am very pleased to extend a warm welcome to nearly 100 participants attending the 3rd *international/Vietnam* Conference on Earth and Environmental Sciences (iVCEES-2023) at the International Centre for Interdisciplinary Science Education (ICISE), Quy Nhon, Vietnam. This year, we have received more than 150 abstracts, and 85 studies have been selected for presentation at this iVCEES-2023 conference. We extend a special welcome to our international participants from Indonesia, Germany, the Philippines, Taiwan, Thailand, Scotland (UK), and the US. The number of participants and selected abstracts this year is equivalent to the statistics from last year's iVCEES-2022. It is worth noting that the first iVCEES-2021 welcomed 43 participants with 30 presentations.

I would like to highlight that the primary goal of the iVCEES conference series is to provide a premier interdisciplinary forum for researchers, students, and practitioners to present and discuss the most recent innovations and advances in the fields of Earth and Environmental Sciences. Additionally, by bringing together diverse areas, the conference aims to foster networking and collaboration among participants, thereby promoting research and developmental activities in Earth and Environmental Sciences. iVCEES will be held annually to make it an ideal platform for people to share views, experiences, and other related ideas.

We acknowledge the Association Rencontres du Vietnam, the International Centre for Interdisciplinary Science Education (ICISE), the University of Science and Technology of Hanoi (USTH), and the project "Sources, Sinks, and Solutions for the Impact of Plastics on Coastal Communities in Viet Nam (3SIP2C)" for their generous support, without which the conference would not be able to happen.

Finally, we are extremely grateful to Prof. Jean Tran Thanh Van – President of the Association Rencontres du Vietnam, Dr. Tran Thanh Son – Vice Director of ICISE, Dr. Ngo Thi Thuy Huong – Phenikaa University, the members of the Scientific Committee, Ms. Nguyen Thi Tra – USTH, and the organizing team for their tireless support and local organizing and hosting this workshop in the wonderful ICISE venue.

On behalf of the Organizing Committee,

Thanh Ngo-Duc,
Department of Space and Applications
University of Science and Technology of Hanoi
Vietnam Academy of Science and Technology

AGENDA

Time: November 27 – December 1, 2023

Venue: International Centre for Interdisciplinary Science and Education (ICISE), Quy Nhon

GENERAL CALENDAR

Monday, November 27th

All day	Arrival to Quy Nhon	All participants
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Tuesday, November 28th

Time	Title	Presenter
8:30 – 9:00	Registration	All participants
Nov. 28 A.M. Opening session		
Meeting room: Conference Hall 1		
Chairman: Dr. Pham Duc Binh, University of Science and Technology of Hanoi		
9:00 – 9:05	Welcoming remarks	Assoc. Prof. Ngo Duc Thanh <i>Chairman of the VCEES's Scientific Committee</i>
9:05 – 9:10	Welcoming remarks: ICISE	Dr. Tran Thanh Son <i>Deputy Director of the ICISE</i>
9:10 – 9:15	Opening remarks: USTH	Dr. Vu Thi Thu <i>Deputy Director, Direction of Research Innovation and Technology Transfer, University of Science and Technology of Hanoi</i>
9:15 – 9:25	Opening remarks: Plastic dialogue	Dr. Ngo Thi Thuy Huong <i>Phenikaa University</i>
9:25 – 9:45	Keynote: Machine learning to support study algal bloom as indicator for eutrophication in freshwater ecosystem	Assoc. Prof. Hoang Thi Thu Huong <i>Hanoi University of Science and Technology</i>
9:45 – 10:20	Coffee break & Photo session	
Nov. 28 A.M. Plenary session I		
Meeting room: Conference Hall 1		
Chairman: Assoc. Prof. Hoang Thi Thu Huong, Hanoi University of Science and Technology		
10:20 – 10:40	Circular Waste Use to Mitigate Aggregates Scarcity in Vietnam	Conrad Dorer <i>University of Applied Sciences Magdeburg-Stendal</i>
10:40 – 11:00	Upper Mekong Dams Cause the Highest Dry Season Discharges in 270 Years	Hong Xuan Do <i>Nong Lam University, Ho Chi Minh City</i>

11:00 – 11:20	Plastic Litter Impact on Water-Atmosphere Gas Exchange	Sevda Norouzi <i>Lyelle Centre</i>
11:20 – 11:40	Natural and artificial radionuclides of seabed sediments in the northeastern Gulf of Tonkin, Vietnam	Van-Hao Duong <i>VNU School of Interdisciplinary Studies, Vietnam National University, Hanoi, Vietnam</i>
11:40 – 13:30	Lunch	
Nov. 28 P.M. Parallel Session S3: Atmospheric Sciences I Meeting room: Conference Hall 1 Chairman: Dr. Nguyen Xuan Thanh, University of Science and Technology of Hanoi		
13:30 – 13:45	Variability of heatwaves across Vietnam in recent decades	Pham Thi Ly <i>Institute of Geography, Vietnam Academy of Science and Technology</i>
13:45 – 14:00	Mechanism of early onset of summer rainfall over the Indochina Peninsula	Bui Minh Tuan <i>Ha Noi University of Science</i>
14:00 – 14:15	Selective ensemble forecast of TC-induced rainfall using GSMaP data for Vietnam Region	Doan Thi The, Vietnam <i>Institute of Meteorology, Hydrology and Climate Change</i>
14:30 – 14:45	Numerical simulations of the impact of Laguna de Bay on the diurnal cycles of Temperature, Relative Humidity, and Winds over Metro Manila	Jose Alvaro Pacheco <i>Ateneo De Manila University</i>
14:45 – 15:00	The spatio-temporal influence of climate drivers on Heat Waves over Vietnam region	Ha Pham-Thanh <i>Hanoi University of Science</i>
Nov. 28 P.M. Parallel session S5: Plastics I Meeting room: Conference Hall 3 Chairman: Dr. Ngo Thi Thuy Huong, Phenikaa University		
13:30 – 13:45	Microplastic Distribution and Characterization in Hau River	Phan Nguyen Nhat Linh <i>Fulbright University Việt Nam</i>
13:45 – 14:00	Co-effects of soil clay and iron on the colloidal dynamic of micropolystyrene	Duong Anh Linh <i>Vietnam National University, Hanoi</i>
14:00 – 14:15	Microplastic Extraction Method for Sediment-Rich Samples: A Case Study at Hau River, Vietnam	Ngo Hoang Thuy Khue <i>Fulbright University Vietnam</i>
14:15 – 14:30	Citizen science in the study of plastic waste distribution in coastal areas	Giang Van Trong <i>Institute of Vietnamese Studies and Development Science, VNU</i>
14:30 – 14:45	Development and characterization of crosslinked dragon fruit peel pectin-based films incorporated with potato starches	Nguyen Ngoc Thanh Tien <i>Department of Food Technology, International University, Vietnam National University, Ho Chi Minh City</i>

14:45 – 15:00	Microplastics in the waters of Cat Ba Island, Vietnam: Potential vectors for hazardous contaminants posing a risk to the ecosystem	Nguyen Thi Hoai Thuong <i>Hanoi university of natural resources and environment</i>
15:00 – 15:30	Coffee break	
Nov. 28 P.M. Parallel session S2: Solid Earth Sciences		
Meeting room: Conference Hall 1		
Chairman: Assoc. Prof. Nguyen Thuy Duong, VNU University of Science		
15:30 – 15:45	Application of spent coffee grounds for soil can increase soil and clay losses	Do Hong Nhung <i>Hanoi University of Science</i>
15:45 – 16:00	Unveiling geological characteristics beneath Northern Vietnam through Traveltime Tomography	Ha Vinh Long <i>Institute of Earth Sciences, Academia Sinica, Taipei, Taiwan</i>
16:00 – 16:15	Characteristics of earthquake sources in northern Vietnam: Observations from two recent moderate earthquake sequences	Nguyen Cong Nghia <i>Institute of Earth Sciences, Academia Sinica</i>
16:15 – 16:30	A geochemical application of the high-resolution X-ray fluorescence core scanning analysis of sedimentary sequence for paleoclimatic implication	Nguyen Dinh Thai <i>VNU University of Science</i>
16:30 – 16:45	Assessing the effect of bentonite and activated carbon on arsenic immobilization in soil	Nguyen Quoc Tuan <i>University of Science</i>
16:45 – 17:00	Origin and geodynamic implications of ultramafic-mafic-felsic rocks in the Olondo greenstone belt on the Siberian Craton in Russia	Tran Thi Duyen <i>Institute of Earth Sciences, Academia Sinica</i>
Nov. 28 P.M. Parallel session S1: Environments I		
Meeting room: Conference Hall 3		
Chairman: Assoc. Prof. Tran Le Luu, Vietnamese-German University		
15:30 – 15:45	Assessment of the accumulation level and ecological risk of heavy metals in surface sediments of Bong Mieu River, Quang Nam Province, Vietnam	Le Phuoc Cuong <i>Da Nang University, University of Science and Technology</i>
15:45 – 16:00	Flooding in rural Southeast Asia: Health impact	Le Thi Ngoc Tu <i>Hoa Sen University</i>
16:00 – 16:15	Dibenzofuran removal from aqueous solution using agricultural waste-derived biochar	Nguyen Minh Nhut <i>Can Tho University</i>
16:15 – 16:30	Spatiotemporal assessment of water quality in Saigon River, Binh Duong province	Dao Van Tri <i>Vietnamese-German University</i>
16:30 – 16:45	Diclofenac degradation by N doped TiO 2 assisted with H 2 O 2 under visible irradiation	Tra Van Tung <i>Nguyen Tat Thanh University</i>
16:45 – 17:00	Analysis of perfluoroalkyl compounds in marine fish samples by liquid chromatography tandem mass spectrometry	Duong Thi Quynh Mai <i>Hanoi University of Science and Technology</i>
17:30 – 19:30	GALA DINER	

Time	Title	Presenter
Nov. 29 A.M. Plenary session II Meeting room: Conference Hall 1 Chairman: Dr. Hong Xuan Do, Nong Lam University, Ho Chi Minh City		
8:45 – 9:05	Keynote: Toward an operational system of seasonal drought prediction for Vietnam using Hybrid Approaches	Phan Van Tan <i>VNU University of Science</i>
9:05 – 9:25	Keynote: The global plastic challenge	Prof. Thomas Wagner <i>Heriot-Watt University</i>
9:25 – 9:45	Twenty-two-year Riverbed Evolution in the Vietnamese Mekong Delta	Doan Van Binh <i>Vietnamese German University</i>
9:45 – 10:05	Examining the mitigation potential for radioactive radon gas via surface barriers on mud walls of earthen dwellings	Nguyen Thuy Duong <i>Ha Noi University of Science</i>
10:05 – 10:30	Coffee break	
Nov. 29 A.M. Parallel Session S1: Environments II Meeting room: Conference Hall 1 Chairman: Dr. Trang Thi Huyen Nguyen, Fulbright University Vietnam		
10:30 – 10:45	Hydrogen sulfide gas changes earthworm cast microstructure	Pham Nguyen Hoang Le <i>Fulbright University Vietnam</i>
10:15 – 11:10	Composition and Distribution of Free-living Nematodes in Lake Apo, Bukidnon, Philippines	Giselle B. Ramos <i>Mindanao State University-Iligan Institute of Technology</i>
11:15 – 11:30	Integrate Mechanistic Model and Field Observations To Understand Microbial Roles In Deep-Sea Carbon Sequestration	Trang Thi Huyen Nguyen <i>Fulbright University Vietnam</i>
11:30 – 11:45	Screening of antibacterial resistant bacteria isolated from yellow seahorse (<i>Hippocampus kuda</i>) using broth microdilution method	Maguate Noel John Ian Feben <i>Mindanao State University-Iligan Institute of Technology</i>
Nov. 29 A.M. Parallel Session S6: Interdisciplinary I Meeting room: Conference Hall 3 Chairman: Dr. Tran Ba Quoc, Duy Tan University		
10:30 – 10:45	Quantifying the Effect of Climate Variability and Human Activities on Flow Regime Alterations in the Sai Gon-Dong Nai River Basin of Vietnam	Luc Anh Tuan <i>Vietnamese-German University</i>
10:45 – 11:00	A study on recovery waste resource potential at school: A case study of Phenikaa University	Nguyen Thi Hanh Tien <i>Phenikaa University</i>
11:00 – 11:15	Assessment of Climate Change impacts on 3S River Basins tributary of the Mekong River Basin	Tran Thanh Nhan Duc <i>University of Virginia</i>

11:15 – 11:30	Potentials and Challenges in Youth Action on Climate Change: a YNET Vietnam Case Study	Do Phong Luu <i>Joint Vietnam-Russia Tropical Science and Technology Research Center (VRTC)</i>
11:30 – 11:45	Household Solid Wastes Generation, Characterization and Management Recommendation in Tuy Hoa city, Vietnam	Vu Phuong Thao <i>Phenikaa University</i>
11:45 – 13:30	Lunch	
Nov. 29 P.M. Parallel session S1: Environment - Air pollution Meeting room: Conference Hall 1 Chairman: Assoc. Prof. Hoang Anh Le, VNU University of Science		
13:30 – 13:45	Atmospheric Hg measurements in Southern Vietnam megacity: temporal variation and sources attribution	Nguyen Ly Sy Phu <i>VNU-HCM, University of Science</i>
13:45 – 14:00	Activity and emission characteristics of motorcycles in Hanoi, Vietnam	Tran Thi Hong Hien <i>School of Interdisciplinary studies, VNU Hanoi</i>
14:00 – 14:15	Improving Energy Efficiency and Reducing CO2 Emissions by Recovering Heat Waste from a Fishmeal Production System	Tran Ba Quoc <i>Institute of Research and Development Duy Tan University</i>
14:15 – 14:30	PM 2.5 Levels, Chemical Composition, and Source Identification in BienHoa City, Dong Nai, Vietnam	Hoang Anh Le <i>VNU University of Science</i>
14:30 – 14:45	Short-term impact of fine particulate matter on hospital admissions in Northern Vietnam in 2019	Vu Tri Duc <i>The Training and Research Institute on Child Health – Vietnam National Children’s Hospital</i>
14:45 – 15:00	Preliminary investigation on the occurrences of PCNs in ambient air of Ho Chi Minh City of Vietnam	Nguyen Duy Dat <i>University of Technology and Education, HCMC</i>
15:00 – 15:30	Coffee break	
Nov. 29 P.M. Parallel session S3: Atmospheric Sciences II Meeting room: Conference Hall 1 Chairman: Dr. Trinh Tuan Long, Center for Environmental Fluid Dynamics		
15:30 – 15:45	Enhancing Dengue Outbreak Forecasting with High-Resolution WRF Modeling in the DART Framework	Nguyen Duy Tung <i>OUCRU</i>
15:45 – 16:00	Sensitivity of WRF-Solar Forecasts to Shortwave Radiation and Microphysics Schemes over the Manila Observatory, Philippines	Patric John Palafox Pascua <i>Ateneo De Manila University</i>
16:00 – 16:15	Flash drought in Vietnam and some of its characteristics during the period of 1961-2020	Hoang Thi Minh <i>Central Project Office, Ministry of Agricultural and Rural Development</i>

16:15 – 16:30	The Future of Drought in Vietnam: A multi-scenario analysis using CMIP6 downscaled products	Nguyen Xuan Thanh <i>University of Science and Technology of Hanoi</i>
16:30 – 16:45	Probabilistic Projection of Future Precipitation and Temperature in Vietnam Using CMIP6-VN Data	Tran Anh Quan <i>Hanoi University of Mining and Geology</i>
16:45 – 17:00	Spatiotemporal projections of precipitation in the Mekong River Basin based on Regional Climate Model	Trinh Tuan Long <i>Center for Environmental Fluid Dynamics</i>

Nov. 29 P.M. Parallel session S5: Plastics II

Meeting room: Conference Hall 2

Chairman: Dr. Ngo Thi Thuy Huong, Phenikaa University

15:30 – 15:45	Building a local sustainable supply chain network for recyclable materials for medium-sized cities in SE Asia (Indonesia)	Ary Mazharuddin Shiddiqi <i>ITS, Indonesia</i>
15:45 – 16:00	Evaluation of the microplastic presence and their potential risks: A preliminary study in Phu Ly, Ha Nam	Le Thanh Thao <i>Phenikaa University</i>
16:00 – 16:15	Youth Engagement in Plastics Research: Lessons, limitations and opportunities in applying multidisciplinary engagement methods to cultivate intergenerational knowledge exchange and action for plastics solutions in Vietnam	Vũ Kim Chi <i>Institute of Vietnamese Studies and Development Science, VNU</i>
16:15 – 16:30	Economic and social cost of plastic waste on the fisheries industry in Viet Nam	Trịnh Quang Tú <i>Vietnam Institute of Fisheries Economics And Planning</i>
16:30 – 16:45	From national targets to local actions in reducing marine plastic wastes: A case study of Viet Nam	Nguyễn Sỹ Linh <i>Institute of Strategy and Policy and Natural Resources and Environment (ISPONRE)</i>
16:45 – 17:00	Evaluating the relationship between antibiotics resistance microbes and microplastics collected in the Red River delta, Vietnam	Vo Hoai Hieu <i>Yersin University</i>
17:00 – 18:30	Plastic exhibition & social networking drink	

Thursday, November 30th

Time	Title	Presenter
Nov. 30 A.M. Plenary session III Meeting room: Conference Hall 1 Chairman: Prof. Nguyen Ngoc Minh, VNU University of Science		
8:45 – 9:10	<i>Keynote:</i> Anaerobic membrane bioreactor for seafood processing wastewater treatment: a comparison between flatsheet and hollow fiber membranes for reuse purpose	Tran Le Luu <i>Vietnamese German University</i>

9:10 – 9:30	Variability of Arsenic Speciation in Rice Grain, Leaf, and Paddy Soil Across Different Growing Conditions in Cambodia	Eden Halpert <i>Fulbright Foundation, Columbia University, Vietnam National University - Hanoi University of Science</i>
9:30 – 9:50	Paleoclimatology of Holocene and Pleistocene sediment from Biển Hồ Maar Lake, Central Highlands of Vietnam	Nguyen Van Huong <i>University of Science</i>
9:50 – 10:15	Coffee break	
Nov. 30 A.M. Parallel Session S4: Aquatic Sciences		
Meeting room: Conference Hall 1		
Chairman: Assoc. Prof. Hoang Thi Thu Huong, Hanoi University of Science and Technology		
10:15 – 10:30	Application of the CuMnOx /GAC catalyst for removing VOCs in the adsorption–oxidation process	Tran Thi Thu Hien <i>Hanoi University of Science and Technology</i>
10:30 – 10:45	Dynamic of microbial development and membrane fouling behaviors in Anaerobic Membrane Bioreactor (AnMBR) system for seafood processing wastewater treatment	Vien Vinh Phat <i>Vietnamese-German University</i>
10:45 – 11:00	Predicting Chlorophyll-a Concentration in the Mekong River of Vietnam using Physicochemical Parameters and Remote Sensing Data	Nguyen Van Trang <i>Fulbright University Vietnam</i>
11:00 – 11:15	Health risks and potential solutions for removing microplastics and co-contaminants in water supply systems: a review	Nguyen Thi Nhan <i>Vietnamese-German University</i>
Nov. 30 A.M. Poster Sessions		
Meeting room: Poster venue		
11:15 – 11:45	Population status of the Red-shanked Douc in Son Tra Nature Reserve, Da Nang	Nguyen Tien Phong <i>Hanoi University of Science</i>
	High-throughput analysis using 16S rRNA gene of bacterial communities present in selected bivalves and gastropods species from Bayug Island, Iligan City, Philippines	Nitcel Aymie Albarido <i>Mindanao State University-Iligan Institute of Technology</i>
	High-throughput analysis using 16s rRNA sequencing of bacterial communities associated in selected mangrove species from Bayug Island, iligan city, Philippines	Stefenie Katrin V. Siblos <i>Mindanao State University Iligan Institute of Technology</i>
	Antibacterial activity of sea hare (Dolabella auricularia) egg string extracts against potentially pathogenic bacteria using broth microdilution method	Chency Grace Liguez <i>Mindanao State University-Iligan Institute of Technology</i>
	High-throughput sequencing of Diatoms using V4 region of 18S rRNA gene in Bayug Island, Iligan City, Philippines	Darshel Ester P. Estor <i>Mindanao State University-Iligan Institute of Technology</i>

Nov. 30 A.M. Side event: Plastic Dialogue Meeting room: Conference Hall 3 Chairman: Dr. Ngo Thi Thuy Huong, Phenikaa University		
8:30 – 8:45	Registration for the Plastic Dialogue	
8:45 – 9:00	Welcome and introduction	Prof. Thomas Wagner Dr. Ngô Thị Thuý Hường
9:00 – 9:15	WP 1: Key results and work plan	Dr. Ngô Thị Thuý Hường
9:15 – 9:30	WP 2: Key results and work plan	Mr Trịnh Quang Tú
9:30 – 9:45	WP 3: Key results and work plan	Dr. Ngô Thị Thuý Hường Dr. Trương Văn Thượng
9:45 – 9:50	Group photo	Participants
9.50 – 10:15	Coffee break	Participants
10:15 – 10:30	WP 4: Key results and work plan	Dr. Nguyễn Sỹ Linh
10:30 – 10:45	WP 5: Key results and work plan	Prof. Thomas Wagner Dr. Vũ Kim Chi Dr. Nguyễn Thị Hạnh Tiên
10:45 - 11:30	General Discussion	Participants
11:30 - 11:45	Summary and Plan	Prof. Dr. Thomas Wagner
11:45 – 13:30	Lunch	
Nov. 30 P.M. Side event: Plastic Dialogue II Meeting room: Conference Hall 3 Chairman: Dr. Ngo Thi Thuy Huong, Phenikaa University		
13:30 – 13:40	Introduction of the roundtable discussion	Dr. Nguyễn Sỹ Linh
13:40 – 13:45	Welcome speech of the 3SIP2C project	Prof. Dr. Thomas Wagner
13:45 – 14:00	Introduction of 3SIP2C project	Dr. Ngô Thị Thuý Hường,
14:00 – 14:45	Some initial results of the project and policy recommendations	Dr. Nguyễn Sỹ Linh
14.45– 15:00	Coffee break	
Nov. 30 P.M. Parallel session S6: Interdisciplinary - Modelling Meeting room: Conference Hall 1 Chairman: Dr. Tran Anh Quan, Hanoi University of Mining and Geology		
13:30 -13:45	Medium-range weather forecast using Predictive Recurrent Neural Networks	Hong Xuan Do <i>Nong Lam University, Ho Chi Minh City</i>
13:45 – 14:00	Application of Long Short-Term Memory (LSTM) Network in seasonal weather forecasting for Vietnam	Nguyen Duc Phu <i>VNU-University of Science</i>
14:00 – 14:15	Numerical investigations on seasonal variation of waves in the Cat Ba - Ha Long coastal area	Nguyen Minh Hai <i>Institute of Marine Environment and Resources</i>
14:15 – 14:30	Applying a machine learning-based method for the prediction of suspended sediment concentration in the Red River basin	Nguyen Quoc Son <i>University of Science and Technology of Hanoi</i>

14:30 – 14:45	Single <i>vs.</i> combined models: A review of current trends in flood modelling and drivers for prediction models selection	Nguyen Thi Hoang Nguyen <i>Vietnamese-German University</i>
14:45 – 15:00	Numerical Modeling of Turbidity Maximum Dynamics in the Cam -Nam Trieu estuary (Vietnam)	Nguyen Thanh Duong <i>Institute of Marine Environment and Resources, Vietnamese Academy of Science and Technology</i>
15:00 – 15:30	Coffee break	
Nov. 30 P.M. Side event: Plastic Dialogue II Meeting room: Conference Hall 3 Chairman: Prof. Dr. Thomas Wagner, Heriot-Watt University		
15:00 – 17:00	Roundtable discussion about plastic policy in Vietnam	Prof. Thomas Wagner Dr. Igrid Kelly Dr. Nguyễn Sỹ Linh
15:00-15:20	Topic 1: Where does plastic waste in coastal areas in Vietnam come from? Is there a policy to control these sources?	All participants
15:20-15:40	Topic 2: Where does plastic waste often accumulate in coastal areas? Does the current management policy have specific solutions for areas with much waste accumulation?	All participants
15:40-16:00	Topic 3: How does plastic waste impact Vietnam's coastal areas? What policies are in place to minimise impacts on coastal areas?	All participants
16:00-16:20	Topic 4: What are the challenges to reducing plastic waste in coastal communities? What is the role of state management agencies, research and training agencies and private sectors?	All participants
16:20-16:40	Topic 5: What are the policy solutions (central and local levels) to minimise the impact of plastic waste on coastal communities in Vietnam?	All participants
16:40-17:00	Summarising, future research directions and collaborations	Dr. Nguyễn Sỹ Linh
17:00 – 18:30	Networking drink	All participants
Nov. 30 P.M. Parallel Session S6: Interdisciplinary II Meeting room: Conference Hall 1 Chairman: Dr. Bui Van Hoi, University of Science and Technology of Hanoi		
15:30 – 15:45	Large dam impact recorded in Tien Hai wetland sediment core, the Red River delta, Vietnam	Nguyen Hong Quan <i>University of Science</i>
15:45 – 16:00	Preliminary insight into distribution and source of clastic materials in surface sediments in the Ba Be Lake, Vietnam	Nguyen Thuy Duong <i>Ha Noi University of Science</i>

16:00 – 16:15	Mangrove restoration elevates local carbon storage but changes centennial-scale carbon burial dynamics	Ha Thi Hien <i>Khanh Hoa University</i>
16:15 – 16:30	Riverbank evolution assessment using remote sensing and GIS-DSAS: A study on the Ham Luong River, Vietnamese Mekong Delta	Le Van Quyen <i>Vietnam-German University</i>
16:30 – 16:45	Building a near real-time biomass burning and wildfire monitoring system in Southeast Asia countries with Google Earth Engine Dynamic World database	Hoang Pham Gia Khang <i>King Mongkut's University of Technology Thonburi</i>
16:45 – 17:00	Comparison of multi-source satellite remote sensing observations for monitoring the variations of small lakes: A case study of Dai Lai Lake (Vietnam)	Pham Duc Binh <i>University of Science and Technology of Hanoi</i>
17:00 – 18:30	Networking drink	All participants

Friday, December 1st

Time	Title	Presenter
Dec. 1 A.M. Plenary session IV - Intedisiplinary Meeting room: Conference Hall 1 Chairman: Prof. Nguyen Ngoc Minh, VNU University of Science		
8:30 – 8:50	Keynote: Innovative youth-led solutions to localized climate-related issues in the Red River Catchment of Vietnam	Hue Le <i>Vietnam National University Central Institute for Natural Resources and Environmental Studies (VNU-CRES)</i>
8:50 – 9:10	Keynote: Distribution and characteristics of microplastics across a large river basin: A first comprehensive study in the Red River delta and Cat Ba island	Ngo Thi Thuy Huong <i>Phenikaa University</i>
9:10 – 9:25	UAV, a close-range remote sensing system, examples from the Department of Space and Applications, USTH	Tong Si Son <i>University of Science and Technology of Hanoi</i>
9:25 – 9:40	Evaluation of food security and cultural landscape services for paddy ecosystems in developing countries: a case study in Vietnam	Tran Thi Nhung, Trinh Phuong Ngoc <i>Tan Trao University</i>
9:40 – 10:15	Coffee break	

Saturday, December 2nd

Time	Title	Presenter
Dec. 1 A.M. Closing session Meeting room: Conference Hall 1 Chairman: Assoc. Prof. Ngo Duc Thanh, University of Science and Technology of Hanoi		
10:15 – 10:45	Next iVCEES planning	
10:45 – 11:00	Closing speeches	
11:00 – 12:30	Lunch and departure	

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MACHINE LEARNING TO SUPPORT STUDY ALGAL BLOOM AS INDICATOR FOR EUTROPHICATION IN FRESHWATER ECOSYSTEM

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Abstract

The prediction of algal blooms using traditional water quality indicators is expensive, labor-intensive, and time-consuming, making it challenging to meet the critical requirement of timely monitoring for prompt management. Using optical measures for forecasting algal blooms is a feasible and useful method to overcome these problems. This study explores the potential application of optical measures to enhance algal bloom prediction in terms of prediction accuracy and workload reduction, aided by machine learning (ML) models. Compared to absorption-derived parameters, commonly used fluorescence indices such as the fluorescence index (FI), humification index (HIX), biological index (BIX), and protein-like component improved the prediction accuracy. However, the prediction accuracy was decreased when all optical indices were considered for computation due to increased noise and uncertainty in the models. With the exception of chemical oxygen demand (COD), this study successfully replaced biochemical oxygen demand (BOD), dissolved organic carbon (DOC), and nutrients with selected fluorescence indices, demonstrating relatively analogous performance in either training or testing data, with consistent and good coefficient of determination (R²) values of approximately 0.85 and 0.74, respectively. Among all models considered, ensemble learning models consistently outperformed conventional regression models and artificial neural networks (ANNs). However, there was a trade-off between accuracy and computation efficiency among the ensemble learning models (i.e., Stacking and XGBoost) for algal bloom prediction. Our study offers a glimpse of the potential application of spectroscopic measures to improve accuracy and efficiency in algal bloom prediction, but further work should be carried out in other water bodies to further validate our proposed hypothesis.

Keywords: *Algal bloom, Water pollution, Machine learning, Fluorescence Spectroscopy*

CIRCULAR WASTE USE TO MITIGATE AGGREGATES SCARCITY IN VIETNAM

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Abstract

In Asia, demand for mineral raw materials, such as aggregates, is expected to increase further in the coming years. The main drivers of aggregates mining and consumption are infrastructure development projects due to population growth and economic growth. Aggregate alternatives, particularly byproducts disposed of as waste, can be an option to replace primary mineral resources. General sources of secondary mineral materials comprise residues of agricultural activities, e.g. rice husk ash, metallurgical or mineral waste, e.g. construction and demolition waste (CDW), and mining waste, e.g. instance tailings' sediments. Whereas some of these waste streams are available in bigger amounts in Vietnam – in 2017 the republic had generated approx. 15 million tons of rice husk [1] - the peak for CDW availability is expected by the Asian Development Bank in Vietnam only in 2040 [2].

The German-Vietnamese research project SAND! (2019 – 2022), funded by Germany's Federal Ministry of Education and Research (BMBF), focused on mitigating aggregates scarcity through the feasibility assessment of secondary raw materials, e.g. mineral waste materials. The feasibility of substitutive materials was investigated for three applications: landfill capping systems, concrete production, and road subbase constructions. The substitutes were tested for compliance with parameters that ensure their quality for the corresponding application and their harmlessness to humans and the environment. In addition, potentially suitable alternatives were investigated for their environmental impacts in the context of Vietnam as part of a life cycle analysis, which means the usage of primary raw materials was compared to secondary raw materials.

Results showed that the majority of tested secondary mineral materials can be applied for full or partial substitution. 1) For landfill mineral sealing layers, milled bricks and rice husk ash at a ratio of up to 50% can replace clay and bentonite. The avoidance factor over the alternative mixes has an effective approximate 25–50% Global Warming Potential impact reduction and a significant mineral resource scarcity impact reduction. 2) Material mixes with up to 10% coal filter ash or rice husk ash were equivalent to the C25/30 standard concrete formulation. These mixes exhibited an average 10% reduction among all the impact categories except water consumption. 3) Fly ash and CDW were feasible

as a road subbase alternative. In the case of CDW, the energy demand reduction was about 80% compared to the conventional layer in the non-renewable fossil category.

The following major conclusions were drawn from the SAND! Project research:

- The use of substitutive building material provides environmental advantage.
- Sources of alternative materials should be close to the site of their application or the use of low-emission transport alternatives is needed.
- To better identify building materials with lower environmental impact in Vietnam, a national and regional specific lifecycle inventory data for construction sector is needed.

Future investigation should focus on a deeper understanding of the available secondary material flows. Mining residues that have not been used so far, e.g. from titanium mineral placer mining, should be investigated for feasibility

In Vietnam, secondary material flows are not yet available to an extent to replace all primary raw materials. [3], [4], [5], [6]

Key words: river sand alternatives; substitutive building materials; life cycle assessment; road subbase material, landfill capping; circular economy

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UPPER MEKONG DAMS CAUSE THE HIGHEST DRY SEASON DISCHARGES IN 270 YEARS

Hung T. T. Nguyen¹, Dung Trung Vu², Stefano Galelli^{1,2}, Brendan M. Buckley¹, Edward R. Cook¹, Ian G. Baird³, Doan Van Binh⁴, Thanh Duc Dang⁴, Sameh A. Kantoush⁵, Hong Xuan Do^{6,7}

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Abstract

The Lancang River, the upper part of the Mekong, is punctuated by eleven mainstream dams that store water in the wet season and release water in the dry season. Since 2013, extremely high flow has been observed downstream of these dams in the dry season. These changes have been attributed to dam operations, but the potential role of climate variability cannot be ruled out, given the short instrumental records dating back only to 1961 CE. To augment the instrumental data, we reconstruct dry season discharges at Chiang Saen, Thailand (the closest gauge downstream of the cascade) back to 1750 CE using tree rings. The reconstruction shows that discharges between 2013–2020 are indeed the highest in 270 years, eclipsing the 1/1000 non-exceedance probability event based on natural variability. We then estimate what the natural flow would be without dams using a process-based hydrological model, and thus quantify that on average, upstream dams add about 60% more flow to the river in the dry season. Our results show unequivocally that dam releases cause high dry-season discharges far exceeding natural variability in the Upper Mekong River. This disruption of the flow regime threatens the ecosystems and socioeconomic aspects of downstream countries.

PLASTIC LITTER IMPACT ON WATER-ATMOSPHERE GAS EXCHANGE.

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Abstract

Since the first observation of buoyant plastics in the ocean in the early 1970s, numerous studies have been conducted on the understanding of plastic litter transport and impact in aquatic environment (Carpenter et al., 1972; Carpenter and Smith Jr, 1972; Colton Jr et al., 1974; Fowler, 1987; Schwarz et al., 2019). Plastic pollution is a global threat to the health of marine ecosystems (Bagaev et al., 2017). The adverse effects of plastic pollution include entanglement of marine fauna, ingestion by seabirds and organisms ranging in size from plankton to marine mammals, dispersal of microbial and colonizing species to potentially non-native waters, and concentration and transport of organic contaminants to marine organisms at multiple trophic levels (Laist, 1987; Law et al., 2010; Thompson et al., 2004). The most common plastics are polyethylene (PE), polypropylene (PP), poly(vinyl chloride) (PVC), polystyrene (PS), poly(ethylene terephthalate) (PET), and polyurethane (PU) which were found in a wide range of aquatic environments (Chubarenko et al., 2023; Galgani et al., 2022; Gewert et al., 2015; Hantoro et al., 2019).

One aspect of the plastic problem is tiny plastic fragments, fibres and granules collectively known as “micro plastics” (MiP) (Cole et al., 2011; Yakushev et al., 2021). MiP are defined as plastic particles in the size range from a few nanometres up to 5 mm (Andrady, 2011). Due to their small size, large surface area, and bioavailability MiP are prone to adhere waterborne organic pollutants and introduce toxins to the base of the food chain. MiP could be primary microplastics, manufactured to be of a microscopic size, or secondary microplastics, tiny fragments derived from breakdown of larger plastic debris (Cole et al., 2011).

Plastic litter and MiP can float on the water surface influencing the exchange of greenhouse gases (GHGs) between water and atmosphere. This occurs by affecting the dynamics of water-atmosphere interface and perturbing water and air-side turbulence. Their interaction with bubbles can also contribute to the gas exchange alteration. They have the potential to both enhance and reduce GHGs flux (Goddijn-Murphy et al., 2023). Despite the substantial environmental concerns posed by plastic litter and their impact on greenhouse gases, there is a current lack of empirical evidence or real-world data in existing literature to quantify the extent of GHG flux enhancement or suppression caused by these factors.

To address this data and knowledge gap, we utilized GETCO₂, an advanced automated gas exchange tank system, to assess the impact of plastic litter on gas transfer velocity. GETCO₂ offers a controlled environment, enabling precise tracking of CO₂ concentration changes in water and air. PET plastic bottles were introduced to the tank to explore the relationship between plastic litter quantity and gas exchange. Water samples were analysed to understand potential carbon leaching from plastics, contributing to organic matter's role in suppression of gas transfer velocity. Preliminary findings reveal a robust linear correlation ($R^2=0.99$) between the number of PET bottles (N) and gas transfer velocity suppression (R_{600}), described as $R_{600}=0.042\times N$. Our study introduces a methodology for investigating

the impact of plastic litter on water-atmosphere gas exchange. Future research is required to examine MiP polymer type, size, concentration, and biofilm effects on gas transfer velocity. Furthermore, alterations in water/air turbulence could modulate the extent of plastic litter's influence on gas exchange and requires further investigation.

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NATURAL AND ARTIFICIAL RADIONUCLIDES OF SEABED SEDIMENTS IN THE NORTHEASTERN GULF OF TONKIN, VIETNAM

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Abstract

One of the most toxic of pollution is radionuclides which could be derived from the weathering of rocks, deposited from the atmosphere, and transported by river discharge and human activities. Therein, the most significant sources of man-made radionuclides is the fallout of nuclear tests and lost nuclear weapons. Nuclear accidents caused by atomic power plants built on coastal area are also radionuclide source that discharges waste into the marine environment. The measurement of radionuclides in seabed sediments plays an essential role in evaluating marine environmental characteristics and their effect on marine species. The Gulf of Tonkin is one of the biggest gulfs in the world, and it is crucial for economic development, international trade, and national security. However, very few previous works have mentioned the characterization of radionuclides in this region. Therefore, this study evaluated the characteristics of radionuclides of eighteen seabed sediment sampling stations in the northeastern Gulf of Tonkin. The results showed ²¹⁰Pb, ²³⁸U, ²²⁶Ra, ²³²Th, ⁴⁰K, and ¹³⁷Cs concentrations range from 23.2±4.34 to 119±4.46 Bq/kg, from 19.9±1.54 B to 58.9±3.05 Bq/kg, from 12.1±0.32 to 43.8±1.27 Bq/kg, from 21.2±0.46 to 63.8±2.33 Bq/kg, from 183±5.26 to 587±14.7 Bq/kg, and from limited level detection (LLD) to 1.23±0.13 Bq/kg, respectively. The study radionuclides had activities order of ⁴⁰K>²¹⁰Pb>²³²Th>²³⁸U>²²⁶Ra>¹³⁷Cs (Fig 1). Those radionuclides could be similar original sediment sources with the positive correlations between the study radionuclides and different grain sizes, such as the ²¹⁰Pb, ²³²Th, and ⁴⁰K have positive correlations with silt content. The different mobility of each isotope was observed with proof of the disequilibrium between ²³⁸U and ²²⁶Ra activities and the highest negative correlations between the ⁴⁰K concentrations and sand content in comparison with other radionuclides. The Th/K ratios showed that seabed sediments in this region consist mostly of smectite (i.e., montmorillonite), with minor kaolinite and illite (Fig 2). The radionuclides distribution and seabed sediment compositions indicated that terrigenous sediments originate mainly from rivers in the northeastern region of Vietnam, and other rivers contribute negligibly.

Keywords: radionuclides, seabed sediment, grain size, Gulf of Tonkin, East Vietnam Sea

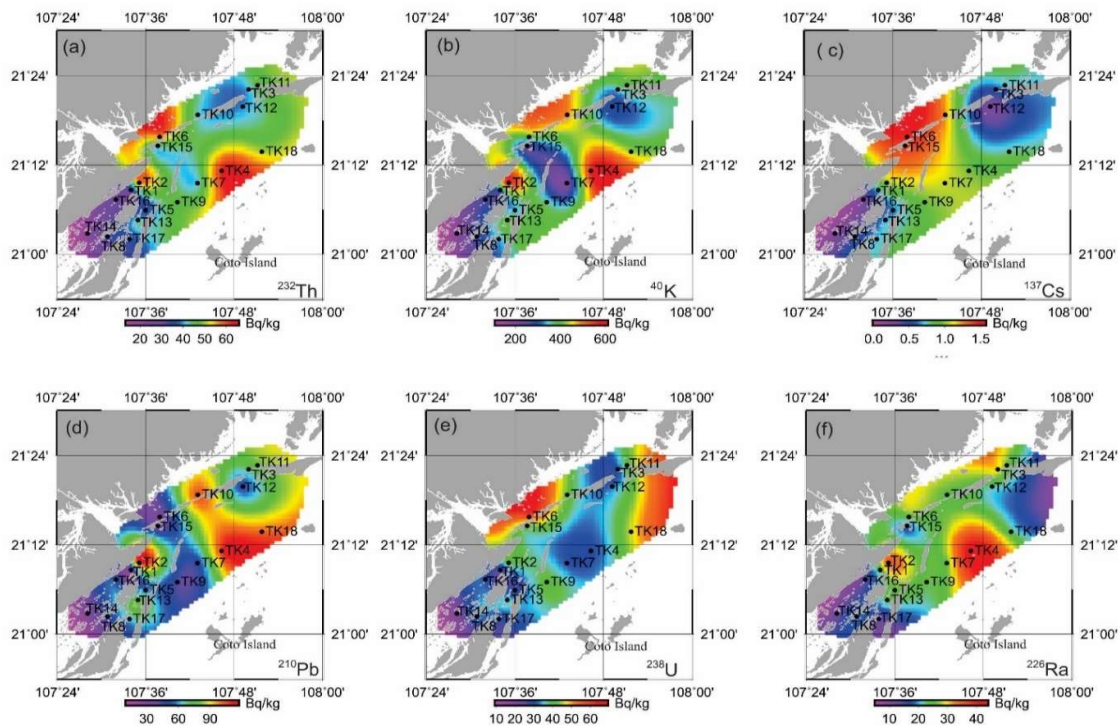


Fig 1. The distribution of radionuclide concentrations and grain sizes of the seabed sediments in the study area.

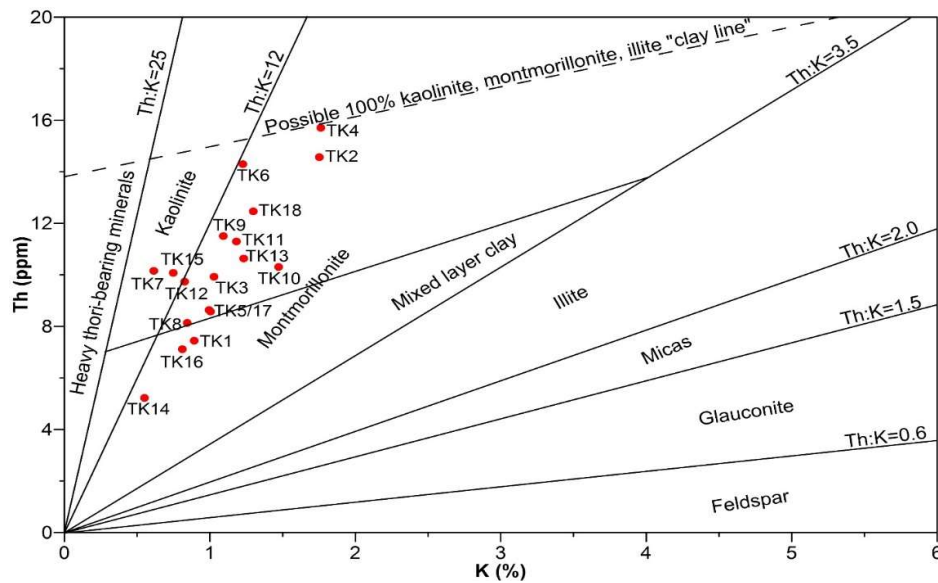


Fig 2. The cross plot of Thorium (Th-ppm) versus Potassium (K-%)

Acknowledgements

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VARIABILITY OF HEATWAVES ACROSS VIETNAM IN RECENT DECADES

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Abstract

There have been several studies on heatwave (HW) in Vietnam but they all examine only one heatwave characteristic. The comprehensive information about heatwave plays an important role in doing research on heatwave impacts and contributes to making plans for climate change mitigation and adaptation in the country. This study investigates the spatial variability and changing trends of the heatwave characteristics over climatic sub-regions in mainland of Vietnam based on observed daily maximum temperature (Tx) at 144 meteorological stations in the period of 1980-2018. HW is identified by using the relative threshold as the local 90th percentile of Tx in 183 days during the summer (1st April - 30th September). Results showed that 1) The threshold values used to determine the HW events strongly varied among the sub-regions and stations depending on their geographical locations; 2) Across the country, HW was observed to be more frequent, more intense, more severe and longer in the R3 and R4 sub-regions than in others; 3) In recent decades, the frequency and severity of heatwaves have significantly increased throughout Vietnam, particularly in sub-regions R3 and R4. However, the changing trend of heatwave duration and intensity remains unclear.

Keywords: *Heatwaves, Vietnam, trend, local threshold.*

MECHANISM OF EARLY ONSET OF SUMMER RAINFALL OVER THE INDOCHINA PENINSULA

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Abstract

Rainfall typically occurs in the Indochina Peninsula (IP) from mid April to early May, marking the earliest onset of rainfall in the Asian summer monsoon regions. In this study, the NCEP/NCAR reanalysis data and PERSIANN rainfall data are employed to investigate the underlying mechanism behind this process. Our objective is to understand why rainfall occurs earliest in the IP instead of other monsoon regions. The findings reveal that the early rainfall is closely related to an early development of upper-level divergence over the IP, which is linked to the formation of planetary-scale waves in the extratropical region. Thermal contrasts between continents and oceans is the primary factor leading to the formation of the planetary-scale wave. Because the distribution of the continents and oceans, the upper-level divergence is initially generated over the IP instead of other Asian summer monsoon regions, favoring for the early occurrence of rainfall there. Our results also point out that the upper-level divergence contributes to the formation of cross-equatorial flows and facilitates the northward propagation of the ITCZ, responsible for the onset of monsoon rainfall over the southeast Asian in the following pentads.

Keyword: summer monsoon, monsoon onset, monsoon rainfall, tropospheric warming, jet stream, surface heating, Hadley circulation, ITCZ

SELECTIVE ENSEMBLE FORECAST OF TC-INDUCED RAINFALL USING GSMAP DATA FOR VIETNAM REGION

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Abstract

Machine learning (ML) has been one of the important topics in many applications, including weather forecasting. Together with various satellite information provided as a big input data, ML is becoming competitive with numerical weather prediction models. This study is an attempt to apply ML algorithm to improve tropical cyclone (TC) induced rainfall forecast using combination of ECMWF ensemble rainfall predictions and GSMaP estimates for TCs affecting Vietnam region. The method involved a pattern matching algorithm by combining decision tree with K-means clustering and combining decision tree with HAC (Hierarchical Agglomerative Clustering). As a result, the best ensemble of the 51 ECMWF model components will be selected to provide more accurate TC-induced rainfall forecasts. The results demonstrate that the selective ensemble forecast using GSMaP data shows some improvements in the percentage of forecast accuracy over the raw ensemble in terms of evaluation criteria. Specifically, the approach that combines Decision Tree (DT) and K-means clustering yields the best results, while the other methods exhibit only a slight improvement over the raw ensemble. Additionally, ensemble forecasts for the 00-06h prediction period perform better than those for the 12-24h prediction period.

Keywords: selective ensemble forecast, pattern matching, K-means clustering, HAC, Vietnam.

NUMERICAL SIMULATIONS OF THE IMPACT OF LAGUNA DE BAY ON THE DIURNAL CYCLES OF TEMPERATURE, RELATIVE HUMIDITY, AND WINDS OVER METRO MANILA

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Abstract

Lake-atmosphere interactions play a significant role in modifying local and regional climate. Laguna de Bay (LDB), despite being the largest lake in the Philippines, has been relatively unexplored with no major studies regarding its impact on local climate. Previous improvements in simulating Metro Manila's climate were conducted successfully using the Weather Research and Forecasting (WRF) Model with an updated Greater Metro Manila (GMA) land cover (Llorin et al., 2021), however, it did not utilize model lake physics leading to weaker simulations. Utilizing the updated GMA land cover of Llorin et al, this study investigates the impact of Laguna Lake on Greater Metro Manila's temperature (T_2), relative humidity (RH_2), and winds during April 2015 based on four experiments, an experiment without lake physics (CTRL), a lake physics model (ALP) and two experiments where the Lake proper land cover was changed, Permanent Wetlands (PW) and Urban & Built Up (UBU). After the ALP was found reasonably to produce the daily lake surface water temperature and the diurnal cycles of T_2 and RH_2 over GMA, the differences between and the land cover experiments were used to quantify the effects of Laguna de Bay on Greater Metro Manila. Generally, the results found that the LDB was found to have a pronounced cooling effect on the local T_2 , enhances the RH_2 and increases winds with daytime breezes, promoting local circulation, over the lake and the surrounding area over the daytime. At nighttime, the LDB the latent heat flux of the lake and radiation is lessened, leading to the cooling effect and enhancing of relative humidity effect on GMA being reduced. At both day and night, the variation in land cover roughness leads to LDB modifying the wind direction. These effects are more prominent throughout the lower central and southern GMA, with the impact of the lake being reduced with the further distance of the northern portions of GMA. This study lays a foundation for further exploration of the role of Laguna De Bay in the local and regional climate of the Philippines at different time scales.

Keywords: Lake-Atmosphere Interactions, Laguna Lake, Diurnal Cycles, Relative Humidity, Temperature, Winds

THE SPATIO-TEMPORAL INFLUENCE OF CLIMATE DRIVERS ON HEATWAVES OVER VIETNAM REGION

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Abstract

Extreme weather events, such as droughts, floods, and heat waves, have exerted a significant impact on Vietnam. As a result, this study investigates the spatial and temporal variability of heatwave characteristics, including frequency, duration, and severity, in the Vietnam region for the period 1980 to 2020. For the purposes of this study, a heatwave event is defined as a period lasting for at least three consecutive days in which the maximum daily temperature exceeds the 90th percentile. In addition, Principal Component Analysis (PCA) was applied to each of heatwave characteristics to extract the dominant modes. The results show that the primary climatic driver linked to heatwave characteristics in the Vietnam region is the El Niño-Southern Oscillation (ENSO). The findings from this study contribute significantly to our understanding of heatwave variability and can enhance heatwave forecasting efforts in Vietnam.

MICROPLASTIC DISTRIBUTION AND CHARACTERIZATION IN HAU RIVER

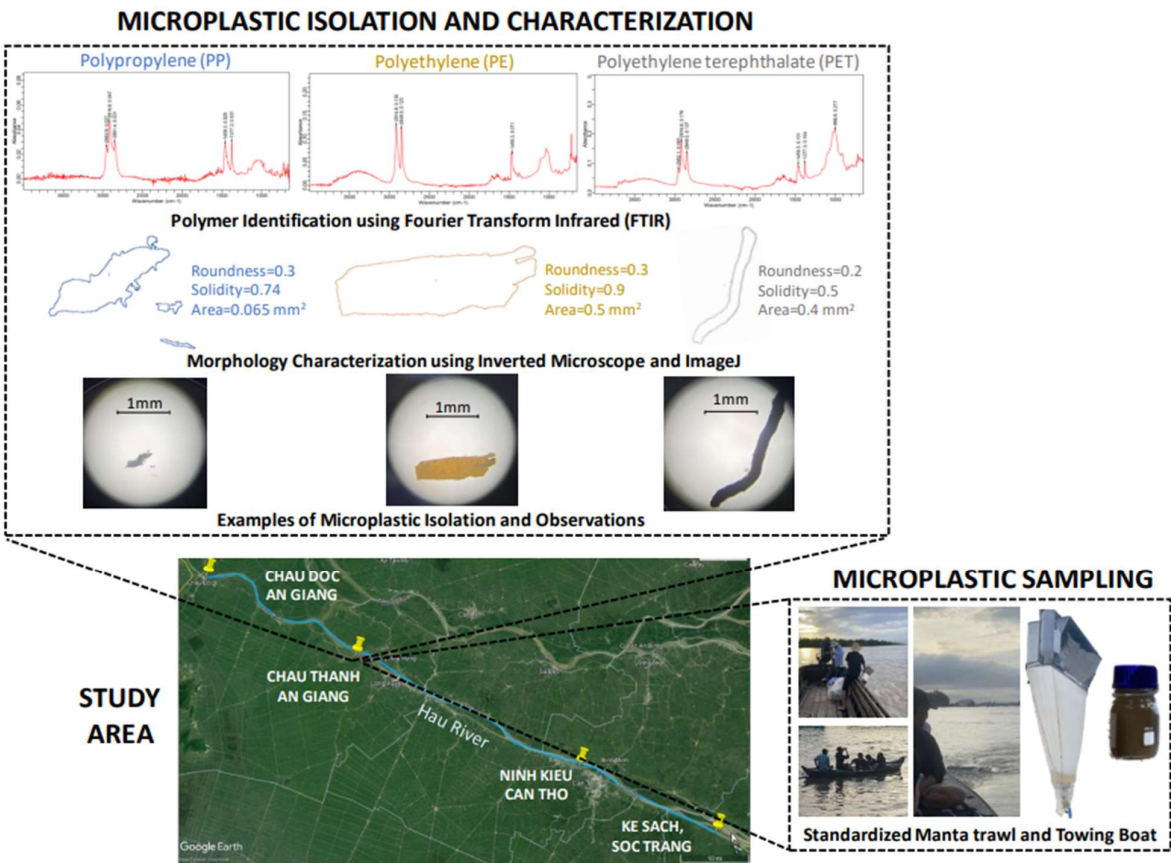
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Abstract

Hau river, also known as Bassac river, one of the two major distributaries of the Mekong River in Vietnam, plays vital roles in agriculture, industry, and transportation services. Previous studies show that 42% of plastic from Phnom Penh, Cambodia ended up in the Mekong river and most of this plastic is transported downstream at the surface and eventually turns into microplastic. Once entering Vietnam, Bassac river or Hau river continues to flow through several populated and agriculture/industrial-focused provinces and worsens the microplastic situation. This study aims (1) to preliminarily determine the occurrence and distribution of microplastic along 145 km in total of 226 km length of the Hau river in Vietnam, (2) to characterize the quantity, size, shape (including roundness and solidity of the particles) using ImageJ (a Java image processing program), and polymer composition of these microplastic particles using Fourier transform infrared (FTIR), and (3) to investigate the correlation of industrial activities (measured through the Industrial Production Index, IPI) and the distribution patterns of microplastics in the Hau River. Twelve samples of surface water are collected using a standardized Manta trawl net system along the Hau River at four locations, including two locations in Chau Doc and Chau Thanh district in An Giang (IPI=111.1), Ninh Kieu district in Can Tho (IPI= 129.2), and Ke Sach district in Soc Trang (IPI= 105.1) with three replications per location. We hypothesize there are more microplastic particles in Can Tho in comparison to An Giang and Soc Trang. For each location, the Manta trawl system is towed by a small boat moving at 8-10 km/h in 15 minutes in the middle of the river. Samples are stored in 100 ml Duran bottles in the refrigerator until microplastic isolation and analysis. Preliminary results from this study demonstrate the cost-efficient method to separate microplastic from sediments including density fractionation using saturated sodium chloride and organic matter digestion using hydrogen peroxide 30%. We find 1 mm-sized or smaller microplastic particles are dominant in all surface river water samples. Our preliminary data show that these particles display various colors (red, yellow, green, white, and blue), sizes, shapes (solidity and roundness), and polymer composition indicating a wide range of plastic sources. Our finding provides a robust foundation to understand the occurrence and distribution pattern of microplastic in Hau river and later can be extrapolated to investigate the environmental impacts of microplastic in the entire Mekong river region.



CO-EFFECTS OF SOIL CLAY AND IRON ON THE COLLOIDAL DYNAMIC OF MICROPOLYSTYRENE

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Abstract

There is a growing problem of plastic waste accumulating in ecosystems around the world. Rivers are a major contributor to this issue, as they are significant sources of microplastics that ultimately end up in soils and oceans. However, much still needs to be learned about the fate and transport of microplastics in agricultural soil. Our research focuses on the stability of colloidal polystyrene microplastics (PSMPs) under the co-presence of iron and soil clays (original, H₂O₂- and dithionite-treated clays). Our investigation included an analysis of the PSMPs' colloidal stability, aggregation kinetics, and surface charge simultaneously. Using the dynamic light scattering technique, our approach involved measuring the time-evolution hydrodynamic diameter and zeta potential. The iron cation acts as a bridge to form a matrix of PSMPs and clay particles, thereby promoting coaggregation. Iron solutions prepared from different salts facilitate the coaggregation of PSMPs-Fe-clays at different rates. The impact of anions on the effects of Fe cannot be ignored, as their presence can significantly modify the outcome. pH can play an additional effect, in which alkaline condition counteracts the coaggregation of PSMPs-Fe-clay. This study implies that microplastics can be immobilized in the soil if Fe and clays co-occur.

Keywords: Colloidal dynamic; polystyrene; microplastics; clay; iron; aggregation

MICROPLASTIC EXTRACTION METHOD FOR SEDIMENT-RICH SAMPLES: A CASE STUDY AT HAU RIVER, VIETNAM

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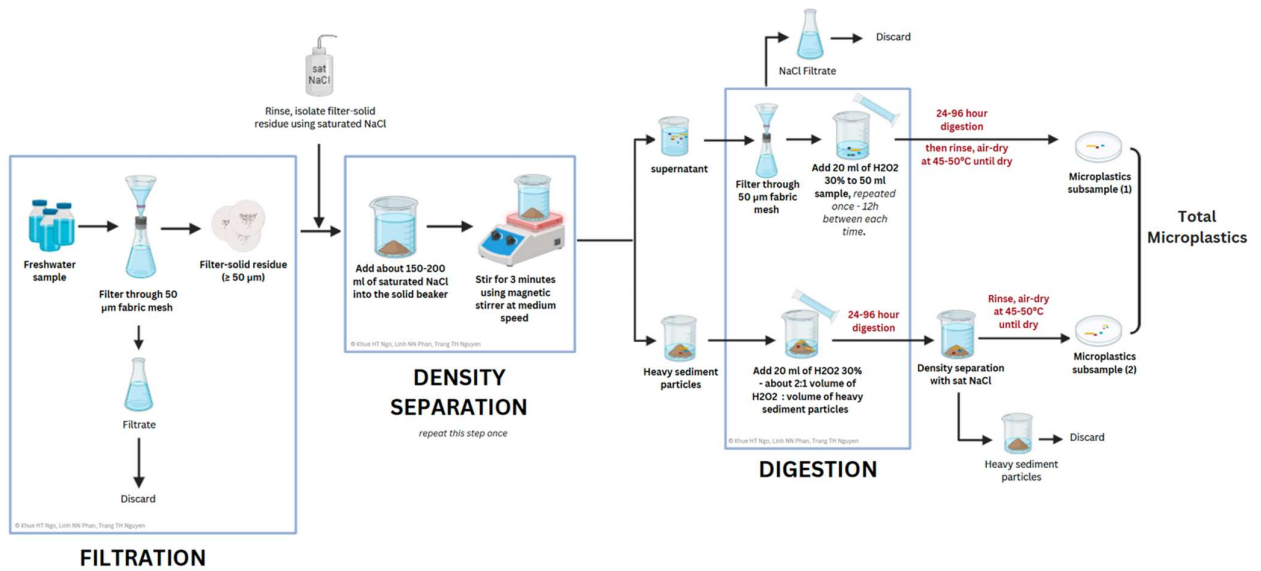
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Abstract

Microplastic pollution in freshwater has increasingly been a global concern in recent years, especially in developing countries like Vietnam. The Mekong Delta is heavily under the influence of human activities, hence is prone to microplastic pollution. However, there has been a lack of a standardized and cost-effective method to extract microplastic from environmental samples, hence unmeaningful comparison between regions or between research, especially in the Mekong region. In this study, we propose a standardized microplastic extraction method to isolate microplastic from sediment-rich freshwater samples, particularly in the Hau River (Bassac river) in Vietnam. Extracting microplastic from sediment-rich samples is considered challenging due to the similarity in size between microplastic and sediment particles and the diversity of microplastic morphologies. Our extraction protocol focuses on improving the technique of isolating microplastic from sediment-rich samples. The method includes three main steps: (1) Filtration using 50 μm filtering fabric to remove the liquid component of the samples, (2) Density separation by saturated sodium chloride to segregate light microplastic and heavy sediment particles, and (3) Digestion by hydrogen peroxide 30% to remove organic matter. Compared to the conventional tools using stainless-steel sieve and filter paper, using filtering fabric costs less while also avoiding the excessive use of filter papers which may disintegrate and cause cross contamination. Density separation is repeated three times with the sediment using 150 to 200 ml saturated NaCl solution. In between each cycle of density separation, the samples are set to settle in at least five hours then about 150 to 200 ml of supernatant (presumably containing light microplastic particles) is carefully drawn using a combination of siphon system, syringe, and hand-dropper to minimize the mixing of sediments. Products before and after sediment density fractionation are digested from 24 to 96 hours before the final rinse and air-dry at 45-50 degrees Celsius. The detailed method allows us to maximize the isolation of microplastic from sediment based on density while minimizing the false positives, and accounting for microplastic that might be trapped in the sediment and organic matter complexes. In short, our method proposes a standardized framework that allows high yield and cost-effective extraction of microplastics from sediment-rich freshwater samples that will facilitate microplastic pollution research in less developed countries.

MICROPLASTIC EXTRACTION PROTOCOL FOR SEDIMENT-RICH FRESHWATER SAMPLES

Khue Hoang Thuy Ngo, Linh Nguyen Nhat Phan, Trang Thi Huyen Nguyen (2023)



CITIZEN SCIENCE IN THE STUDY OF PLASTIC WASTE DISTRIBUTION IN COASTAL AREAS

Vu Kim Chi, Nguyen Thi Hanh Tien, Inna Yaneva-Toraman, Giang Van Trong, Nguyen Duc, Trinh Quang Tu, Phan Phuong Thanh, Nhung Do, Liao Zhiling, Zou Qingping, Thomas Wagner, Ngo Thi Thuy Huong, Michel Kaiser

Abstract

Plastic waste, a type of environmental pollution created by humans, is adversely affecting the environment, health, and economic activities in various locations, especially in coastal areas. The project "Sources, Sinks, and Solutions for the Impact of Plastics on Coastal Communities in Vietnam" (3SIP2C) is being carried out with a significant role in community outreach and engagement to mitigate plastic waste. Since 2022, the project has conducted several community engagement activities in various coastal areas of Vietnam, aiming to enhance community participation and awareness of plastic waste and, through community knowledge, gain a better understanding of the distribution of plastic waste. At this conference, one poster will be designed to present citizen science studies in the Cat Ba islands area through two activities: (1) Using a 3D model to engage the community in building and sharing information about plastic waste, and (2) involving the local community in painting coconuts, releasing coconuts, and tracking the movement of coconuts at sea. These activities have yielded interesting results regarding the distribution of plastic waste in the Cat Ba islands area and can potentially be applied to other coastal areas in Vietnam.

DEVELOPMENT AND CHARACTERIZATION OF CROSSLINKED DRAGON FRUIT PEEL PECTIN-BASED FILMS INCORPORATED WITH POTATO STARCHES

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Abstract

This research aimed to fabricate and characterize the biodegradable films from pectin extracted from dragon fruit peel (*Hylocereus polyrhizus*) incorporated with native, heat-moisture treated, acetylated, or annealed potato starches with the aid of glycerol through the casting method and subsequently crosslinked with 20 % glutaraldehyde solution in ethanol. All achieved films were optically yellowish, semi-transparent to translucent, flexible, glossy, and effortlessly detached from the petri dish, while crosslinked ones were darker, more tenacious, and less glossy. Additionally, these products had smooth facades without any visible cracks or pores and moderate moisture content. Regarding without crosslinking, the blend films had lower solubility, transparency, and tensile strength, and higher thickness, density, and water vapor permeability as compared to the pectin film. Particularly, glutaraldehyde-crosslinking could not only enhance the tensile strength and elongation at break of these films but also positively lessen their thickness, solubility, density, and water vapor permeability. Moreover, all products had good thermal stability. Among all products, the crosslinked film prepared from pectin and annealed starch had great properties in terms of thickness, moisture content, solubility, transparency, water vapor permeability, and thermal stability, which was acknowledged potential material applied in food packaging industries.

Keywords: *casting, chemical crosslinking, food packaging materials, mechanical properties, pectin-based films, thermal stability*

MICROPLASTICS IN THE WATERS OF CAT BA ISLAND, VIETNAM: POTENTIAL VECTORS FOR HAZARDOUS CONTAMINANTS POSING A RISK TO THE ECOSYSTEM.

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Abstract

Microplastics (MiPs) pollution has become a global environmental concern due to its potential adverse effects on ecosystems and human health. In recent years, the presence of MiPs in aquatic environments, including oceans, rivers, and lakes, has been extensively studied. However, more research has yet to be conducted on the ecological risk assessment of MiPs pollution and their associated contaminants, particularly in specific locations such as Cat Ba Island, Vietnam, a tourist destination, known for its rich biodiversity and fragile ecosystems. Thus, this research aims to evaluate the extent of MiPs pollution and their associated contaminants and determine the potential ecological risks it poses to the key species and human health. To achieve the research objectives, a comprehensive sampling strategy was implemented. Water and sediment samples were collected from 5 representative locations across Cat Ba Island including coastal estuary tidal area (CB1), Ocean current (CB2 and CB5), the concentrated aquaculture region (CB3) and tourism area (CB4). The samples will then undergo laboratory analysis. Furthermore, indoor exposure experiments will be carried out with some economically marine species, i.e., fish and bivalve. Composition of polymer types and persistent organic pollutants (POPs) will be analyzed by Fourier-transform infrared spectroscopy (FTIR) and Gas chromatography-mass spectrometry (GC-MS), respectively. The data will then be subjected to different mathematical models in order to assess the potential effects of MiPs as well as associated POPs to the ecological and human health.

The findings will contribute to the existing knowledge of MiPs pollution and the associated contaminants, and provide crucial information for policymakers, environmental agencies, and local communities to develop targeted interventions and strategies for the sustainable management of this fragile marine ecosystem.

Keywords: Cat Ba Island, Microplastics pollution, POPs, Risk assessments

APPLICATION OF SPENT COFFEE GROUNDS FOR SOIL CAN INCREASE SOIL AND CLAY LOSSES

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Abstract

Application of spent coffee grounds (SCGs) for soil is widely encouraged as this practice is greatly in line with current environmental campaigns such as circular economy, net zero carbon emission. However, negative impacts from this practice were not fully understood. This study aims to present the effect of nanosized SCGs (*n*SCGs) on dispersibility/transportability of a soil clay. *n*SCGs sample was extracted from SCG waste and its effects on the dispersion of clay were tracked over the pH range ~3 to ~9 and ionic strength from 0.001 to 0.1 N by using dynamic light scattering technique and test tube method. *n*SCGs was found to carry negative charges and the presence of *n*SCGs in the suspension of clay resulted in decreases in surface charge (toward more negative) of the clay suspension, particularly at pH < 6. Through providing more negative charges for the clay system, *n*SCGs stimulated and favoured clay dispersion. Herein, edge surface of clay and Fe oxides may play a central role in associating soil particles, but this role was likely declined due to the presence of *n*SCGs. In general, it can be implied that our effort to utilize SCGs may bring adverse impacts such as soil/clay losses or soil structural-induced changes, and these impacts need to be considered.

Keywords: *Spent coffee ground; circular economy; nano particles; clay dispersibility; soil loss*

UNVEILING GEOLOGICAL CHARACTERISTICS BENEATH NORTHERN VIETNAM THROUGH TRAVELTIME TOMOGRAPHY

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Abstract

The extrusion tectonics driven by the collision between the Indian and Eurasian continents has given rise to a complex and multi-phase geological activity in Northern Vietnam. Although extensively investigated, the precise crustal architecture of this region remains elusive and is pivotal in resolving long-existing tectonic debates over time. In this study, we establish the first 3-D regional model for S-wave velocity (V_s), and the consistent P-wave velocity (V_p) and V_p/V_s ratio models. To achieve this, we employ a combined dataset of crustal and head waves (e.g. Pg/Sg and Pn/Sn) from an expanded earthquake catalog. This catalog is compiled from the Vietnam National Earthquake Catalog (VNCAT) and data from several neighboring seismic networks. Our study employs a stepwise joint inversion approach to sequentially refine our understanding of earthquake locations, as well as 1-D and 3-D velocity models. The resulting models indicate that the Song Ma suture may be a more suitable candidate for delineating the boundary between Indochina and South China rather than the Red River Shear Zone. The Red River Shear appears to be a crustal structure, whereas the Dien Bien Phu Fault likely represents a lithospheric structure. Additionally, our models clearly depict and discuss several other geological features, including the Tu Le volcanic basin, the Song Hong basin, and the Day Nui Con Voi metamorphic complex. This new set of V_p , V_s , and V_p/V_s models holds the potential to significantly enhance our ability to assess seismic hazards in Northern Vietnam.

Keywords: *Vietnam national earthquake catalog, traveltime tomography, Northern Vietnam, V_p/V_s ratio, crustal seismic structures, Red-River shear zone, Song Ma Suture, Indochina – SouthChina boundary*

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CHARACTERISTICS OF EARTHQUAKE SOURCES IN THE NORTHERN VIETNAM: OBSERVATIONS FROM TWO RECENT MODERATE EARTHQUAKE SEQUENCES

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Abstract

The Northern Vietnam is characterized by large-scale seismic faults, and moderate to large earthquakes have occurred in the past. In 2020, two moderate-scale earthquakes occurred in northern Vietnam, namely the Moc Chau earthquake with a magnitude of 5.0 and the Muong Te earthquake with a magnitude of 4.9. Both earthquake sequences caused damage to infrastructure in the source area. We investigated these sequences by locating the earthquakes, determining the focal mechanisms of the mainshock and the largest aftershocks, stress inversion, and finding out the seismogenic fault. The Moc Chau mainshock and its aftershocks were determined to be mostly right-lateral strike-slip events that related to the active Da River fault. The stress inversion results in maximum horizontal compression direction in north–south and the maximum extension direction is northeast-southwest. The Muong Te earthquake sequence occurred in a region with a well-developed faults system, parallel to the major Dien Bien Phu fault and Red River fault. The focal mechanism indicates a combination of mostly strike-slip with some normal faulting. The earthquake locations suggest that the seismogenic faults are two conjugate faults parallel to the Dien Bien Phu fault and Red River fault, correspondingly. The stress regime inverted from the focal mechanism shows a stable northeast-southwest direction of minimum compression axis σ_3 , while the alternating direction of immediate and maximum compression axis σ_1 and σ_2 in the northwest-southeast direction, which support the stress permutation model of the regional stress.

Keywords: Vietnam earthquakes, strike-slip, focal mechanism inversion, earthquake location, stress inversion

A GEOCHEMICAL APPLICATION OF THE HIGH-RESOLUTION X-RAY FLUORESCENCE CORE SCANNING ANALYSIS OF SEDIMENTARY SEQUENCE FOR PALEOCLIMATIC IMPLICATION

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Abstract

Knowledge of past climatic variability at regional to local scales is significant for assessing the likelihood of current and potential future repercussions from global climate change. The South East Asian tropics, also as well Vietnam and its Central Highlands, are critically located at the intersection of the East Asian Summer Monsoon and the Indian Summer Monsoon with highly important socio-ecological consequences from changes in the climate system, there are still severely under-represented in paleoenvironmental and paleoclimatic reconstructions. This study presents a high resolution sedimentary climate based on elemental data for sediment sequence from Ea Tyn Lake in Vietnam's Central Highlands as acquired using an X-ray fluorescence core scanning system. It was found that the strength of associations between the elements in the Ea Tyn sediments (e.g. Ti, Rb, K, Zr, Si, Ca, Sr, Mn, and Fe) varied over time with changes in lake status, which are ultimately driven by changes in climate. Increases in fine-grained, detrital input (as indicated by Ti, Rb, K and Zr/Rb) overlap with independently established periods of lower lake productivity and are interpreted to represent more arid conditions. Using geochemistry proxies combined with principal component analysis, we reconstructed at least 12 drought events covering the last 1250 years, some of which appear to be of supraregional significance as they coincide with historically documented droughts in India, China, and Cambodia. In addition, the long-term monsoon variability throughout the last millennium, previously only re-structed via $\delta^{18}\text{O}$ speleothem records from China and India, is reflected based on the Rb/Sr elemental ratio along the Ea Tyn Lake sediment sequence. The elemental data provide new insights into hydrological changes and related sediment processes within the catchment, and highlight the need for multi-element and multi-proxy approaches when reconstructing climate change using lacustrine sediment sequences.

Keywords: lake sediment; elemental chemistry; drought; paleoproxy.

ASSESSING THE EFFECT OF BENTONITE AND ACTIVATED CARBON ON ARSENIC IMMOBILIZATION IN SOIL

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Abstract

The study compared the effects of three materials: bentonite, activated carbon, and composite materials with an application rate of 2% on the possibility to immobilize Arsenic in polluted soil. Immobilization efficiency of Arsenic in soil was evaluated by the following methods: i) Synthetic Precipitation Leaching Procedure (SPLP), Toxicity Characteristic Leaching Procedure (TCLP), and extracted with 0.1M HCl solution to evaluate Arsenic leaching behavior; ii) Sequential Extraction to evaluate the fractions of Arsenic in soil. The results show that the presence of amendments help to increase soil pH, and change the mobility of Arsenic in soil. The immobilization efficiency of Arsenic increased up to 52% in soil treated with combination of bentonite and activated carbon (BAC). Arsenic bounded-mobility fractions (exchangeable and carbonate fraction) were transformed to immobility fraction in soil, especially for BAC treated soil. From these findings, the study suggest that bentonite and activated carbon can help to remediate Arsenic in soil by immobilizing Arsenic in soil. Furthermore, the combination of amendments needs to be continuously researched to enhance not only immobilization efficiency but also soil properties.

Keywords: Arsenic, bentonite, activated carbon, heavy metal immobilization in soil.

ORIGIN AND GEODYNAMIC IMPLICATIONS OF ULTRAMAFIC-MAFIC-FELSIC ROCKS IN THE OLONGO GREENSTONE BELT ON THE SIBERIAN CRATON IN RUSSIA

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Abstract

The Archean Olondo greenstone belt (OGB) is located on the Aldan shield, the largest basement of the Siberia craton. With well-preserved abundant mafic-ultramafic rocks, $\geq 30\%$ in volume, the OGB is unique among other greenstone belts in the world. In this study, I present a comprehensive geochemical and isotopic data for the OGB rocks, in order to better constrain their origin and the geodynamic process involved in their formation in the Archean time. Rhenium-osmium isotopic data of the ultramafic rocks yield T_{MA} model age of 2960–3020 Ma, comparable to the formation age of the OGB at 3 Ga. The ultramafic rocks vary from fresh to serpentinized dunites, which are highly refractory residual mantle rocks evidently indicated by depletion in P-Platinum Group Elements (PGE) relative to I-PGEs. Fresh dunites show U-shaped rare earth element (REE) patterns, with positive to negative Nb anomalies, indicative of metasomatic overprint. Unlike having a cumulate origin for most Archean ultramafic rocks, the OGB dunites were mantle residues after high degree of partial melting ($>30\%$), subsequently metasomatized by the subduction-related melt/fluid. On the other hand, the OGB volcanic rocks including komatiitic and tholeiitic basalts show geochemical characteristics relative to the residual dunites, reinforcing subduction-related processes involved in some of their formation, despite extra mid-ocean ridge and plume activities associated with other mafic rocks. Tholeiitic basalts yield variable REE patterns from depleted, flat, to enriched light rare earth elements (LREE) patterns, with variable Nb-Ta anomalies, indicating their similarities with modern N-MORB and boninites, comparable to those found in typical supra-subduction zone (SSZ) ophiolites. Such elemental characteristics with combined lower $\epsilon_{Nd}(t)$ and negative Nb-Ta anomalies are most likely a result of mixing with subducted components, consistent with the observed Nb depletion in the residual dunites. The Al-depleted komatiitic basalts may have originated from deep mantle source, corresponding to garnet stability field, confirmed by their depletion in HREE and requires a mantle plume to transport and melt at deeper depth. Additionally, the OGB has recorded the occurrence of magnesian andesites, adakites and Nb-enriched basalts, which is evidence of a young, hot subduction process. Like several other greenstone belts during the Mesoarchean period, it is likely that the OGB was formed in a combined plume-arc setting. This suggests that the Mesoarchean time might mark the transition stage from dominantly plume to plate tectonic regime on the Earth.

ASSESSMENT OF THE ACCUMULATION LEVEL AND ECOLOGICAL RISK OF HEAVY METALS IN SURFACE SEDIMENT OF BONG MIEU RIVER, QUANG NAM PROVINCE, VIETNAM

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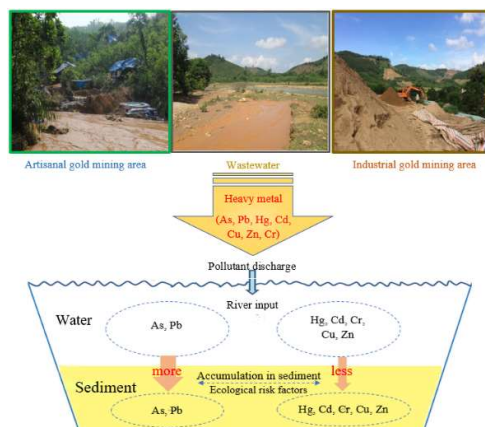
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Abstract

In this study, the accumulation level and ecological risks of several heavy metals (As, Pb, Cd, Hg, Cu, Cr, Zn) in surface sediments of Bong Mieu river, Quang Nam province, Vietnam were assessed. Bong Mieu river belongs to Vu Gia - Thu Bon river system, the quality of river sediment was strongly affected by gold mining activities. Research results showed that the content of heavy metals fluctuates in different value ranges, specifically: As (70.6 - 341.2mg/kg), Pb (216.3 - 504.1mg/kg), Hg (0.138 - 0.252mg/kg), Cd (0.91 - 1.51mg/kg), Cu (18.3 - 45.5mg/kg), Cr (10.5 - 19.1mg/kg), Zn (49.3 - 84.1mg/kg). In seven studied heavy metal parameters, the contents of Hg, Cu, Cr, Zn, Cd elements were all within the acceptable limits of VNTR 43:2017/MONRE (National Technical Regulation/Ministry of Natural Resources and Environment of Vietnam), particularly As and Pb content at all sampling locations were significantly higher than VNTR 43:2017/ MONRE, specifically As was 4.1 - 20 times higher, Pb was 2.3 - 5.5 times higher. The assessment of heavy metal accumulation by I_{geo} index showed that the sediments in the study area were heavily polluted by As, Pb, the remaining metals did not show signs of pollution. The ecological risk factors for heavy metal parameters in Bong Mieu river area were sorted in descending order of E_r^i (As) > E_r^i (Pb) > E_r^i (Hg) > E_r^i (Cd) > E_r^i (Cu) > E_r^i (Cr) > E_r^i (Zn). The level of potential ecological risk was assessed by a low to moderate RI, with values ranging from 73.4 to 252.8.

Keywords – heavy metals; surface sediments; Bong Mieu river; accumulate; ecological risk

Graphical Abstract:



In recent years, as economic development has advanced more quickly, industry and agriculture have expanded their levels of output. Environmental contamination, and specifically the accumulation of heavy metals in sediments, is a growing concern alongside the economic growth. Due to the deposition of heavy metal pollution in water, heavy metal pollution in sediment is thought to accumulate over an extended period of time.

Organisms in an ecosystem are intimately connected to one another and play a crucial role in the food web and food chain. Environmental interactions occur throughout an organism's life cycle, and heavy metals from the environment can be absorbed and accumulated in the body. Because of this, the quantity of heavy metals in the organism increases and is harmful to both the organism and humans (P. C. Le et al., 2022) due to bioaccumulation and biological amplification. In the study by Bui & Nguyen, (2020) on the capacity of the species of Trung Truc (*Lanceolaria* sp), an animal that lives in the mud of the bottom, accumulates heavy metals in the Cau River area, the section flowing through Hai Duong province, Northern Vietnam. The study's findings demonstrated that both the Pb concentration in the sediments in this location and the Pb content in the species of Trung Truc were over the permitted limits. There was a significant positive link between the Pb concentration in the sediments and in Ngao Dau (*Meretrix meretrix* Linnaeus), according to research by Khanh et al., (2014) on the accumulation of heavy metals in sediments.

In this study, the author evaluated the accumulation of seven heavy metals (As, Pb, Hg, Cu, Zn, Cr, Cd) and ecological dangers in the surface sediments of the Bong Mieu river. There was few specific research on the assessment of pollution accumulation and ecological dangers of heavy metals in sediments in the Bong Mieu river basin of Quang Nam province. As a result, the study's findings created a database that the management agency could use to track the level of heavy metal pollution in sediments and provide appropriate management solutions. Additionally, the research results created a database source for further in-depth studies on the accumulation and ecological toxicity of heavy metals in surface sediments.

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FLOODING IN RURAL SOUTHEAST ASIA: HEALTH IMPACTS

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Abstract

This research combines an external long-term flood data extracted from satellite images with a rich panel data set of household surveys to examine the effects of floods on human health in six provinces of Vietnam and Thailand. We examine three health status outcomes covering nutritional status and disease exposure, and investigate heterogeneous effects by gender and age group, as well as the effectiveness of different coping mechanisms. We find some evidence for floods creating a burden on human health. At individual level, increase in the share of village area covered totally by water is associated with an average increase of 3.1% in the likelihood of being underweight, and of 10.6% in the likelihood of contracting serious disease at the mean. We find slight indications that the effects are stronger for females and working age individuals. We investigate a variety of coping strategies; the results show that the effects of floods on health are difficult to cope with. We do not find a significant degree of success in coping strategies dealing with flood-related health effects.

Keywords: *Flood impacts, Health impacts, Geographic Information Systems (GIS), MODIS images*

DIBENZOFURAN REMOVAL FROM AQUEOUS SOLUTION USING AGRICULTURAL WASTE-DERIVED BIOCHAR

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Abstract

Dioxins and dioxin-like compounds are pollutants of extremely high environmental impact due to their very high toxicity to human organisms and animals causing serious diseases even at low concentrations. Those compounds are mainly undesired byproducts of industrial operations from a variety of incineration processes including improper municipal waste combustion and burning of trash as well as chemical manufacturing processes and natural combustion. They are persistent in the natural environment for a long time causing significant impact on soil, water resources, and ecosystems. However, it is found that the conventional treatment methods are not efficient in removing those contaminants. A novel technology has been proposed to treat highly toxic compounds with high removal efficiency and low cost which can provide a promising approach for large-scale applications. Biochar derived from agricultural wastes has shown excellent performance in pollutant treatment due to its properties and abundance. In the present research, sugarcane bagasse-based char (SGC) and rice straw-based char (RSC) were prepared to evaluate the treatment performance of dibenzofuran (DBF), a dioxin-like compound, (Fig. 1). The structure of biochar was characterized by SEM, BET, FTIR, EDX and TGA, and the effect of various adsorption parameters on the DBF treatment was discussed. The surface area of porous materials is found to be approximately 498 and 411 m² g⁻¹ for SGC and RSC, respectively. The removal efficiency of DBF reached a peak of approximately 98% for both chars and remained more than 81% after four cycles of reuse. Thus, biochar derived from agricultural wastes shows an obvious removal effect on DBF in an aqueous solution, which could be promoted to treat efficiently dioxins and dioxin-like compounds in the wastewater.

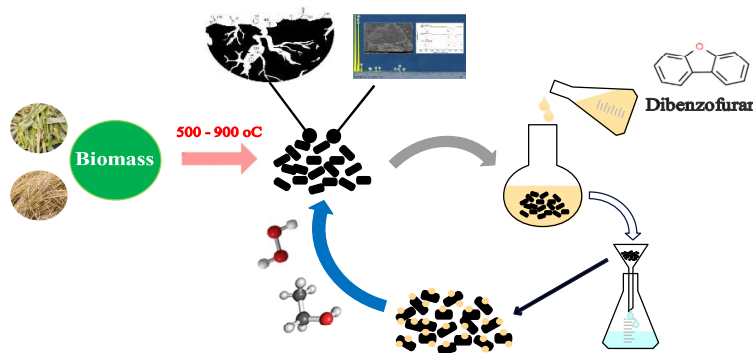


Fig.1. Flow char of biochar preparation and adsorption

SPATIOTEMPORAL ASSESSMENT OF WATER QUALITY AND PER-/POLYFLUOROALKYL SUBSTANCES (PFAS) CONTAMINATION IN SAIGON RIVER, BINH DUONG PROVINCE

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Abstract

Saigon River basin is considered as one of the most important basins in the Southeast region and flows through many industrial zones producing consumer goods and urban areas. The river is currently facing water pollution problems, particularly concerning the high concentration of oxygen-demanding components and the presence of per-/polyfluoroalkyl substances (PFAS). The study focuses on assessing spatiotemporal variations in river water quality based on analyzed physicochemical characteristics, thereby serving as a basis for predicting the availability of PFAS. The change in pollution levels between rainy and dry seasons needs to be evaluated to get an overview of the fluctuations in physicochemical characteristics. A total of 28 surface water samples were collected at 14 locations along the Saigon River, passing through Binh Duong province. Eleven physicochemical variables were evaluated, and the dataset was subsequently analyzed using statistical methods including cluster analysis (CA) and correlation analysis. The results show significant correlations ($r > 0.5$, $p \leq 0.01$) between ammonia (NH_4^+), chemical oxygen demand (COD), and total organic carbon (TOC), particularly during the rainy season when higher concentrations were observed. Furthermore, hierarchical cluster analysis has classified four clusters of sampling locations, and cluster C exhibited heavy pollution levels characterized by elevated concentrations of COD (90.4 mg/L), TOC (9.9 mg/L), phosphate (PO_4^{3-}) (0.36 mg/L), iron (Fe) (0.11 mg/L), and nitrite (NO_2^-) (1.43 mg/L). Most of the locations in cluster C are concentrated in the Vietnam-Singapore Industrial Park 1 (VSIP 1) and Thuan An residential areas, where the presence of PFAS in water sources has been demonstrated. Therefore, PFAS contamination can be determined by typical physicochemical parameters such as NH_4^+ and TOC, however, more research needs to be done to elucidate the mechanism of this association.

Key words: Water quality, physicochemical, PFAS, correlation, hierarchical cluster.

DICLOFENAC DEGRADATION BY N DOPED TiO₂ ASSISTED WITH H₂O₂ UNDER VISIBLE IRRADIATION

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Abstract

This study presents findings concerning the photocatalytic decomposition of diclofenac (DCF) in aqueous media employing nitrogen-doped titanium dioxide (N-TiO₂) under visible light irradiation, both in the presence and absence of hydrogen peroxide (H₂O₂). The experimentation was conducted utilizing a Submerged Membrane Photocatalytic Reactor (SMPR). Various critical factors influencing the degradation of DCF were systematically investigated, including the solution's pH level, and the concentrations of the catalyst, DCF, and H₂O₂. The study results underscore the pronounced influence of these variables on the photocatalytic degradation of DCF when employing N-TiO₂ under visible light irradiation. Particularly noteworthy is the observation that DCF degradation efficiency reached its zenith under neutral pH conditions, surpassing degradation rates attained in both acidic and alkaline environments. Moreover, an escalation in DCF concentration exhibited a diminishing impact on its removal efficiency. Significantly, the addition of H₂O₂ was revealed to augment the photocatalytic degradation process. This research contributes valuable insights into the degradation of DCF facilitated by N-TiO₂ under visible light irradiation, shedding light on potential applications and optimizing conditions for this photocatalytic process.

Keywords: Diclofenac, Photocatalytic, Titanium Dioxide, N-doped TiO₂, Visible Light, Oxidation

ANALYSIS OF PERFLUOROALKYL COMPOUNDS IN MARINE FISH SAMPLES BY LIQUID CHROMATOGRAPHY TANDEM MASS SPECTROMETRY.

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Abstract

Seafood consumption has been identified as one of the major contributors per- and poly(fluoroalkyl) substances (PFASs) in the human diet. The analysis of PFASs in seafood is currently a challenge because these compounds are usually accumulated at trace level and the high lipid content in seafood plays important role as a matrix effect. This study focuses on the development and the validation of an analytical method for quantifying 21 PFASs compounds in marine fish. Dried marine fish samples were subjected to a straightforward extraction process using methyl tert-butyl ether (MTBE) and the addition of tetrabutylammonium hydrogensulfate (TBA) as an ion-pairing reagent. In addition, a clean-up step was selected to remove the phospholipids that affect to the analytical signals. Two types of cartridges (ERM and HybridSPE®) were used to optimize the clean-up step and HybridSPE® cartridge was finally used. The in-house method validation (matrix effects, accuracy, precision and reproducibility) were investigated using certified reference materials. The recoveries were from 55% to 132% while the method detection limits (MDLs) ranged from 0.05 to 0.54 µg/kg. This validated UPLC-MS/MS method has been successfully applied for the quantification of PFASs in 10 marine fish samples and results ranging from 12.9 to 166.4 (µg/kg).

TOWARD AN OPERATIONAL SYSTEM OF SEASONAL DROUGHT PREDICTION FOR VIETNAM USING HYBRID APPROACHES

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Abstract

Drought is a severe natural disaster with the potential for devastating impacts on agriculture, water resources, the economy, and the environment in any given region. In Vietnam, droughts frequently result in substantial damage and losses, consistently placing them among the country's most formidable natural disasters, alongside tropical cyclones and floods. However, predicting droughts remains a significant challenge. This study represents an initial effort to establish a seasonal drought prediction system by combining dynamical downscaling and statistical adjustment methods. In the first step, we employed two Regional Climate Models (RCMs) to forecast monthly rainfall and temperature by downscaling data derived from the National Centers for Environmental Prediction (NCEP) Climate System Forecast version 2 (CFSv2). Subsequently, statistical methods were applied to correct the monthly rainfall and temperature data obtained from the downscaling process. Drought events were identified using drought indices computed based on the corrected monthly rainfall and temperature datasets. The obtained results indicate that, after bias adjustment, the model's predictions for rainfall and temperature closely match the observed data. When compared to the actual observations, the drought predictions generally show an overestimation in the central and southern regions of Vietnam, and an underestimation in the northern parts of the country.

THE GLOBAL PLASTIC CHALLENGE

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Abstract

The stakes for society and the environment can hardly be higher. Plastic pollution is a global and pressing problem that requires urgent and coordinated action at the global, national and local scale.

On average, the world is producing a staggering 430 million tonnes of plastic per year – two thirds of which are only used for a short period of time. This short life cycle has major and devastating consequences; every day, the equivalent of over 2,000 garbage trucks full of plastic are dumped into our oceans, rivers and lakes. As a result, plastic pollution is expected to triple by 2060 if no action is taken.

Plastic pollution can impact habitats and natural processes, reducing ecosystems' ability to adapt to climate change, directly affecting millions of people, food production capabilities and social well-being. The environmental, social, economic and health risks of plastics need to be understood and assessed alongside other environmental stressors, like climate change, ecosystem degradation and resource use.

The global scale of the challenge are well recognised and has recently been discussed at the second meeting of the Intergovernmental Negotiating Committee (INC-2) to develop an international legally binding instrument on plastic pollution, including in the marine environment, summarised in 'The Plastic Zero Draft'.

Implementation of these high level aims at the regional to national scale require deep understanding of the drivers, responses and consequences, and tailored strategies that deliver solutions to sustainable development with a local context. It is at this basic level where the problems need to be understood and a consensus between local communities and other stakeholders must be achieved.

South-East Asia stands out with projected forecasts estimate that they will become the second largest waste producer by 2100. This is due to a number of factors including rapid urban growth, large-scale increases in food production from the sea, and lack of sufficient knowledge, participation, and infrastructure to address waste demand through recycling.

Viet Nam takes a leading role on this agenda with a firm ambition to reduce plastic waste and its impact on society and the environment. One large and ongoing research and capacity building program, the UKRI-GCRF funded Sources, Sinks & Solutions for Impacts of Plastics on Coastal Communities in Viet Nam [3SIP2C] project, comprises a multidisciplinary team from Heriot-Watt University Edinburgh, UK, and eight academic partners from Vietnam, with a large supporting group in Vietnam, and backing from UK retailers and two global NGOs. The team embraces specialists in modelling of physical oceanography, environmental toxicology and microbiology and pathogen transmission, fisheries and aquaculture, social and economic sciences, governance and policy. Organised in 5 thematic areas, the focus is on quantifying the types and amount of plastic waste entering the coastal margin of Viet Nam and understanding the pathways and destination of that plastic into the wider environment and marine life, and how this plastic impacts upon business activities such as aquaculture, fisheries, tourism and coastal communities.

The presentation will provide a summary of the current status of discussion and ambition and introduce 3SIP2C as a flagship research project that aims to understand the dynamic behaviour of plastic in the Red River and Mekong Delta regions.

TWENTY-TWO-YEAR RIVERBED EVOLUTION IN THE VIETNAMESE MEKONG DELTA

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Abstract

Over decades, the Vietnamese Mekong Delta (VMD) has suffered severe morphological changes, resulting in serious social, economic, and environmental consequences. Several natural and anthropogenic key factors have contributed to the increasing rate of riverbed incisions along the VMD. While previous studies have assessed riverbed incision in specific regions, a comprehensive analysis of long-term spatiotemporal variations in riverbed evolution across the entire delta has been lacking. This study aims to quantitatively evaluate spatiotemporal morphological changes in the VMD, utilizing bathymetric data from 1998, 2005, 2017, and 2020. The analysis reveals pronounced and irregular morphological changes in the delta's rivers over the 22-year comparison period (Fig. 1). The mean annual riverbed incision rates of the entire VMD were -0.19 m/year in 1998–2005, -0.11 m/year in 2005–2017, and -0.10 m/year in 2017–2020. The respective mean annual net incision volumes were -120 Mm³/year, -70 Mm³/year, and -64 Mm³/year. An important finding is that the riverbeds in the upper VMD (i.e., Tan Chau-My Thuan and Chau Doc-Can Tho) have increasingly incised, whereas the riverbeds in the estuaries (downstream of My Thuan and Can Tho) have accreted (Figs. 1–2). The Tien River was more incised than the Hau River. The riverbed of the Vam Nao channel has slightly changed over 1998–2020 (Fig. 2). We found that the majority of incision locations were situated, at least in part, within regions grappling with the impacts of sand mining activities, exacerbated by the large-scale impact of dam-induced sediment reduction from the Mekong River. This study highlights the influence of anthropogenic factors on different vulnerable areas in the VMD, providing valuable insights for researchers and planners aiming to devise strategies for effective sediment management.

Keywords: Vietnamese Mekong Delta, riverbed incision, sand mining, dams

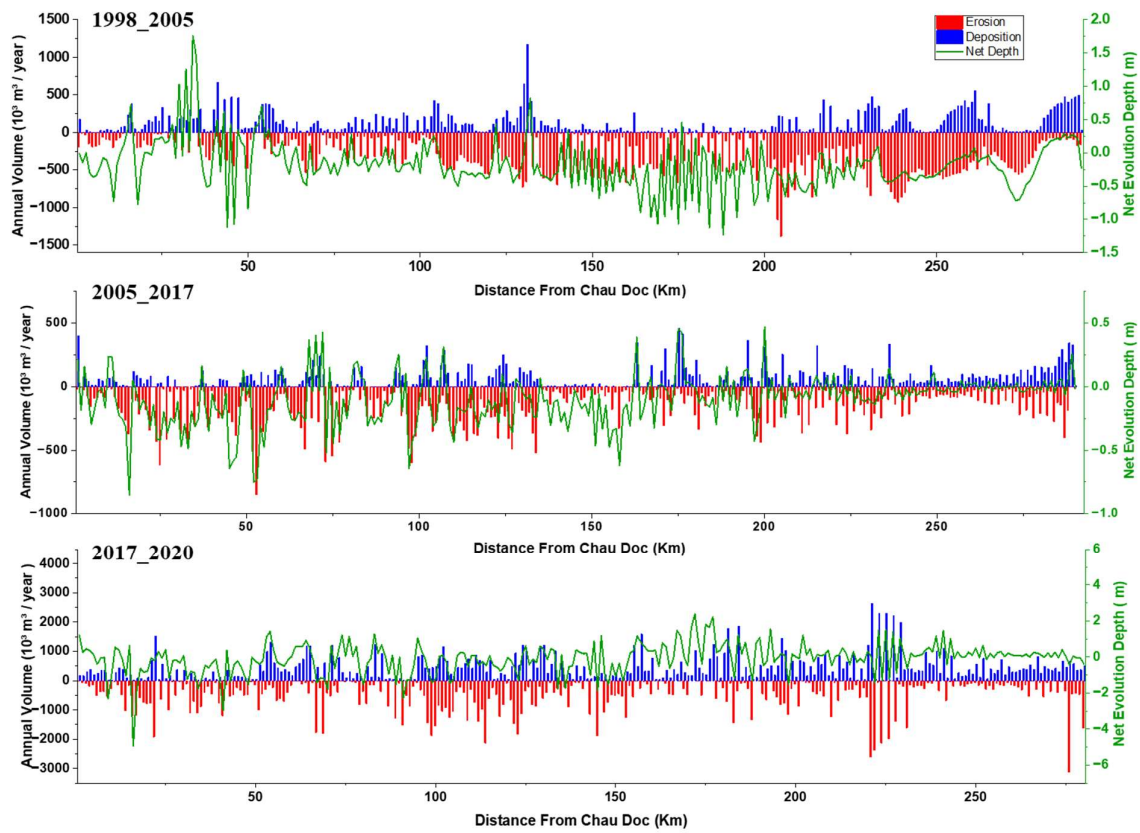


Fig. 1 Mean annual riverbed incision volume and depth along the Hau River in three periods.

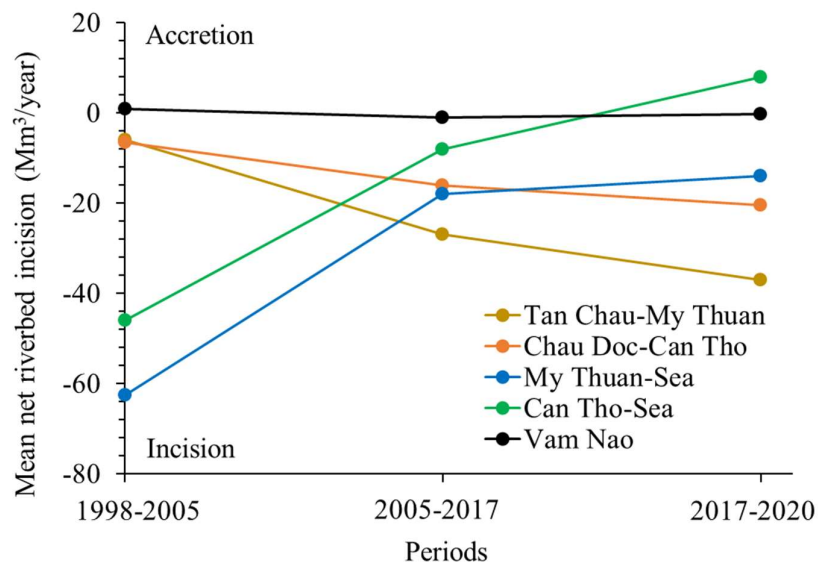


Fig. 2 Riverbed has incised in the upper VMD and accreted in the estuaries over three periods.

EXAMINING THE MITIGATION POTENTIAL FOR RADIOACTIVE RADON GAS VIA SURFACE BARRIERS ON MUD WALLS OF EARTHEN DWELLINGS

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Abstract

Radon-based natural radiation from soil-based building materials is an important factor influencing residents' health. Over half of natural environmental radiation dosage in room air originates from radon-emitting building materials. Currently, rammed earth constructions used popularly for house towards a green environmental trend of building material have been increasingly growing around the world. The earthen dwellings have been inexpensive, low-environmental impact, very low-embodied energy and good insulation for heat and sound (<https://unhabitat.org/green-building-materials-fact-sheet-earth>). Many countries and regions, including Việt Nam, where earthen dwellings have been used to live for centuries, have been promoting and preserving earthen structures to sustain cultural heritage. However, a considerable abundance of radon gas, especially Rn-220 isotope – thoron, was found in the indoor air of the traditional earthen dwellings in mountainous regions in northern Việt Nam due to its outgassing from the mud walls and floor, and it poses a significant health risk for inhabitants. Therefore, this study focuses on the mitigation potential of suitable surface treatments in order to restrict radon gas emission from bare clay-rich soil walls and floor. Mud-bricks made from the same type of soil building materials for earthen constructions were coated by several covering materials, such as general building materials (e.g., paints, cement, gypsum, etc.) and common covered-materials used in daily life (e.g., paper, plastic wrap, tape, etc.). Experiments to examine the change in radon gas exhalation from mud-bricks applied with or without surface barriers in an accumulation chamber. The findings show that almost all surface covering materials can provide a potentially significant reduction in radon gas exhalation, which can reach more than 80%. This is an important record for a suitable surface barrier for the earthen dwelling. We plan to look for a low-cost covering material that can work well for treating bare mud walls and floor in order to save health of inhabitants and their investment for living house.

Keywords: *radon gas, earthen dwelling, covered-materials, surface barriers.*

HYDROGEN SULFIDE GAS CHANGES EARTHWORM CAST MICROSTRUCTURE

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Abstract

Earthworm cast is a seasonal freshly-formed part of soil which contains highly-reactive compounds including nutrients, e.g., phosphorus, potassium, and other toxic elements, e.g., arsenic. Although earthworm casts have been intensively studied, their periodic dissociation (in soil) is not fully understood. In paddy soil ecosystems, particularly acid sulfate soils, hydrogen sulfide (H₂S) occurs as a consequence of the anoxic transformation of S-rich materials, and this gas is hypothesized to affect the dissociation of earthworm cast. To investigate this phenomenon, the present research performed a 10-day-long batch experiment, in which earthworms cast from the Red River Delta (RRD) and the Mekong River Delta (MRD) are either aerated with H₂S or left in ambient air as a control. Dynamic light scattering and test tube method were applied to track electrostatic interactions (ζ - zeta potential) and colloidal stability (d_h - hydrodynamic size; T - transmission) of the cast suspensions. The results show that in both RRD and MRD samples, while ζ , d_h , and T values decreased over time, pH was observed to increase. Cast with H₂S aeration exposed a less negative-charge surface, smaller size, and higher dispersibility compared to those without H₂S aeration. Intensifying releases of Fe, Si and DOC have also been observed under the H₂S aeration. This reflects a possibility in which H₂S facilitated the dissociation of cast through dissolving cast constituents such as Fe oxides, silicates and organic matter. It can be implied that the formation/diffusion of H₂S in soil, particularly sulfate soils, can in turn accelerate cast cycle and mobilize cast-containing pollutants (e.g., As). Therefore, field care practices that can reduce the reactivity of H₂S also need to be considered.

COMPOSITION AND DISTRIBUTION OF FREE-LIVING NEMATODES IN LAKE APO, BUKIDNON, PHILIPPINES

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Abstract

This study is the first report evaluating the community structure and diversity of free-living nematode assemblages from Lake Apo, Bukidnon. The primary objective was to gauge the lake's functional biodiversity by assessing the nematode diversity and community structure shifts. Nematodes were identified up to genus level using morphology-based identification methods. Key findings indicate that Lake Apo hosts a diverse nematode assemblage of 97 individuals from 28 genera, representing 21 families and eight orders. Notably, specific genera indicators, c-p taxa composition, life-history-based maturity index, and Shannon diversity index were employed to assess the lake's ecological quality status efficiently. Bacterial feeders were the dominant genera, with a distinctive abundance of c-p 2 taxa, primarily *Monhystera* and *Eumonhystera*, characterizing Site 1 shoreline. Conversely, S2-SL was marked by the prevalence of *Rotylenchus*. The most abundant species belonged to Rhabditida (30%), Dorylaimida (22%), and Triplonchida (15%). Furthermore, this study unveiled that Lake Apo exhibits mesotrophic characteristics, suggesting a correlation between the lake's trophic state and the nematodes' functional composition. These findings serve as foundational knowledge on the lake's ecosystem functioning and provide insights into the potential influence of environmental variables on nematode distribution and community structure.

Keywords: *free-living nematodes, Lake Apo, Bukidnon, community structure, diversity, ecosystem functioning*

INTEGRATE MECHANISTIC MODEL AND FIELD OBSERVATIONS TO UNDERSTAND MICROBIAL ROLES IN DEEP-SEA CARBON SEQUESTRATION

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Abstract

The ocean is by far the largest global carbon pool due to several primary carbon storage mechanisms, including the biological carbon pump. Microorganisms are the key drivers of the biological carbon pump through the transformation of inorganic carbon into organic carbon (autotrophic microorganisms) and the transformation of organic carbon back to inorganic carbon via remineralization (heterotrophic microorganisms). The rate of carbon sequestration in the deep sea is dependent on how fast the particulate organic matter (POM) sinks and gets remineralized before it reaches the ocean floor. Who there is and What they do at times and depths on each particle might determine the fate of the organic carbon. However, there is a lack of research on individual marine particles and the associated microscale dynamics to mechanistically understand how this part of the biological carbon pump works. In this research, we integrate the previously developed POM degradation mechanistic model with spatial and temporal field observations of individual particles from EXPORTS (stands for EXport Processes in the Ocean from Remote Sensing, a large-scale NASA-led ocean field campaign) to understand the role of microbial community succession on the rate of carbon export to the abyss. The ecological changes of particle-associated microbial community with depth are confirmed to correspond to the change of POM remineralization rate and the rate at which organic carbon is deposited to the deep sea. The results shed light on the importance of the microscale dynamics on global carbon cycling.

SCREENING OF ANTIBACTERIAL RESISTANT BACTERIA ISOLATED FROM YELLOW SEAHORSE (*HIPPOCAMPUS KUDA*) USING BROTH MICRODILUTION METHOD

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Abstract

The rise of antimicrobial resistance poses a significant threat as many bacterial strains have developed resistance to almost all available antibiotics. Seahorses, known for their therapeutic properties in Traditional Chinese Medicine, host various bacterial species in flame cone cells present in their epidermis, which environmental factors can influence. This study aims to identify multidrug-resistant bacteria associated with yellow seahorses (*Hippocampus kuda*). Samples of seahorses were collected from Parang, Maguindanao, and bacteria from their epithelial surface were isolated using sterile cotton swabs at Premier Research Institute of Science and Mathematics (PRISM). A total of six isolates were identified and tested for multidrug resistance using the Broth microdilution method, which determines minimum inhibitory concentration (MIC) of a bacterium against a specific antibiotic. Results indicated that only two isolates displayed antibiotic resistance. Whole genome shotgun sequencing revealed Isolate A, gram-negative bacillus belonging to Pseudomonadaceae family, exhibited resistance to three commercially available antibiotics (Azithromycin, Cefixime, and Cefuroxime) with a MIC of 32 mg L⁻¹. Isolate B, gram-negative bacillus belonging to Vibrionaceae family, showed resistance to only one antibiotic (Cefuroxime) with a MIC of 32 mg L⁻¹. As a result, isolates A and B were selected for further investigation through antimicrobial resistance (AMR) surveillance.

Keywords: *Hippocampus kuda*, MIC, AMR

QUANTIFYING THE EFFECT OF CLIMATE VARIABILITY AND HUMAN ACTIVITIES ON FLOW REGIME ALTERATIONS IN THE SAI GON-DONG NAI RIVER BASIN OF VIETNAM

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Abstract

The flow regime in the river, which affects the riverine ecosystem and the development of society, is always moving and changing. Climate variability controls the river flow regime in nature, but human activities are also a factor that leads to unfavorable changes in the flow regime, especially in the current context. This study focuses on quantifying the impact of climate variability and human activities on the alterations in seasonal and annual flow regimes in the Sai Gon-Dong Nai River Basin of Vietnam by employing statistical methods that combine statistical tests, linear regression, and double mass curves. The results show that the flow regime alterations in the headwaters are largely impacted by land use land cover (LULC) change. At the Thanh Binh and Dak Nong hydrological stations (the headwaters in the Dong Nai River (Fig. 1)), the trends of discharge and rainfall are inconsistent (Fig. 2), implying that human activities are the primary drivers of the discharge alterations. Specifically, LULC change by converting forest to agriculture and built-up area is attributed to driving discharge increases at these two stations. At the Dai Nga hydrological station (the headwater in the La Nga River (Fig. 1)), the discharge in both dry and flood seasons has significantly decreased (Fig. 2a), mainly due to significant rainfall reductions (Fig. 2b). Moreover, the Dai Nga diversion reservoir (Fig. 1), which diverts water to another river basin, is also an essential factor. On the other hand, the discharge at the downstream hydrological stations (Ta Pao and Phu Hiep in the La Nga River, Phuoc Hoa in the Be River, and Ta Lai in the Dong Nai River) increased in the dry season but decreased in the flood season, which is inconsistent with the trends in the rainfall (Fig. 2). Additionally, trends in the discharge alterations in the downstream stations were different from those in the headwaters, thus, human activities are the driving factor. While converting forests to agriculture and built-up areas, which may have increased the flood-season discharge, is likely not the leading cause of the discharge reduction, river damming is considered the

controlling factor. Although the primary driver of flow regimes is climate variability, human activities strongly dominate statistically significant alterations in these regimes. Quantitatively, human activities contributed -14.2% to +22.3% and -55.7% to +66.5% of the annual and monthly discharge changes, respectively, in the Sai Gon-Dong Nai River Basin. The methodology used in this study can be easily applied to quantifying climate variability and human effects in other river basins. This study provides valuable information for integrated water resources management for sustainable development.

Keywords: Human activities, climate change, climate variability, land use land cover change, dam impact, tropical river, Sai Gon-Dong Nai River Basin

Graphics abstract:

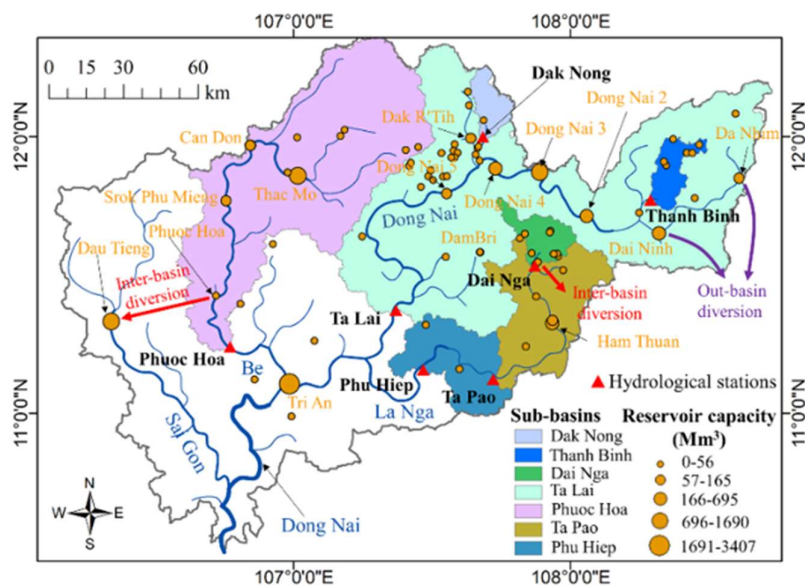


Fig. 1 Geospatial map of seven studied sub-basins in the SGD N Basin

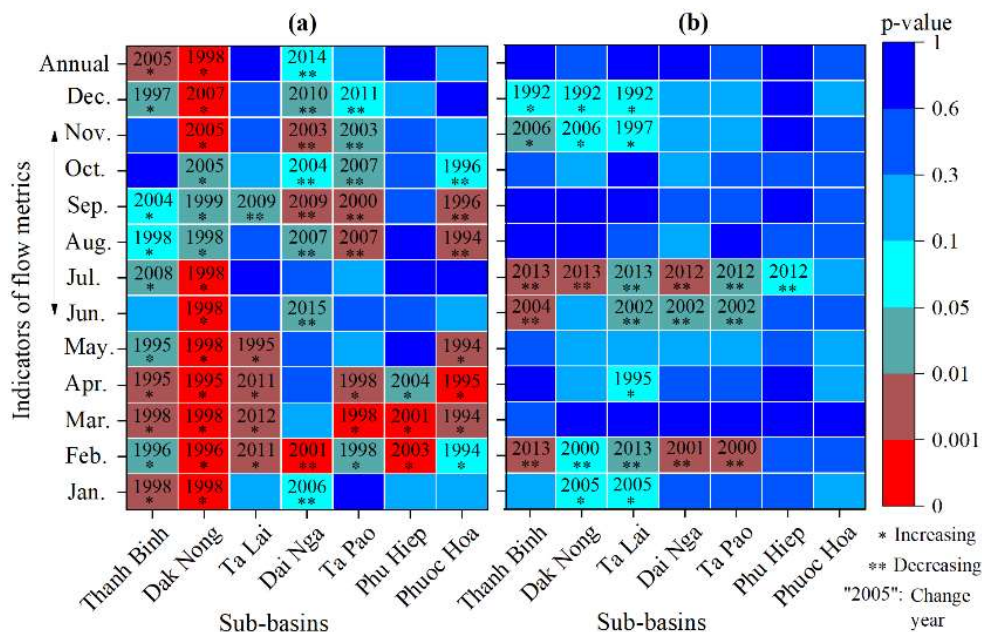


Fig. 2 Heat map showing *p*-value, change year, and trend of the monthly and annual (a) discharge and (b) rainfall in the seven studied sub-basins. The arrow extent shows the flood-season months.

A STUDY ON RECOVERY WASTE RESOURCE POTENTIAL AT SCHOOL: A CASE STUDY OF PHENIKAA UNIVERSITY

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Abstract

Universities are ingrained in society and connected to it through a variety of interactions; they shape social discourses and frequently have a significant impact on them. Thus, universities across the world are trying to create green and sustainable campuses. The objective of this study was to evaluate the current situation of waste management, and the possibility for resource recovery from trash at Phenikaa University. A waste audit was conducted from 3rd to 9th April, 2023 in various locations, including classrooms, offices, student dormitories, laboratories and sport centers at the university campus. According to the survey, trash generation ranged from 243.6 to 441.7 kg per day, with an average weight of 370.2 kg. The results of the waste characterization showed that plastic waste makes up the majority of the garbage produced (41%) and is followed by paper and cardboard (28%), organic waste (27%) and other materials (4%). The waste ratio was similar with other universities, such as German Jordanian University (GJU) or Danang University. The breakdown of plastic waste revealed that PET bottles make up the largest portion of the garbage produced in plastic (79%), followed by PS (12%). The results of this study indicate high potential in the recycling program for university waste, organic and inorganic waste treatment. Paper and plastic can be recycled, while organic waste can be composted and used as fertilizer for plants in the university campus. The improvement of waste segregation at source and environmental awareness-raising initiatives for students can reduce a significant amount of waste-to-landfill and enhancing a sustainable green university.

Keywords: solid waste, waste composition; plastic waste, organic waste, resource recovery

ASSESSMENT OF CLIMATE CHANGE IMPACTS ON 3S RIVER BASINS TRIBUTARY OF THE MEKONG RIVER BASIN

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Abstract

Quantifying the extent of drought and flood under the impacts of climate change is important for effective water management. In this study, we use the Soil and Water Assessment Tool (SWAT) hydrological model to examine the response of river flow to projected climate change scenarios in one of the main tributaries of the 3S (Sekong, Sesan, and Srepok) River Basin, Southeast Asia. Eight future climate scenarios from four Coupled Model Intercomparison Project Phase 6 (CMIP6) ensemble General Circulation Models (GCMs), namely: BCC-CSM2-MR (China), CanESM5 (Canada), MIROC6 (Japan), and MRI-ESM2-0 (Japan), have been used for simulated future projected runoff (2023-2100). Our objective is to reveal the climate change impacts on future drought events in terms of frequency, intensity, and potential consequences for local livelihoods using common indices (i.e., the Standardized Streamflow Index (SSI), Standardized Runoff Index (SRI), Standardized Precipitation Index (SPI), and Standardized Precipitation-Evaporation Index (SPEI)). Our findings are (1) Hydrological and meteorological drought properties are influenced by precipitation as well as minimum and maximum temperatures; and (2) Drought duration and severity tend to decrease in the future time scales especially under the high emission scenarios. This work provides valuable insights into the anticipated shifts in drought and flood patterns due to climate change. The result of this study serves as the scientific basis for stakeholders and decision-makers in developing adaptative strategies and sustainable plans to promote the region's resilience.

Keywords: Climate Change, Drought, Streamflow, SWAT, Srepok River Basin, 3S River Basin.

POTENTIALS AND CHALLENGES IN YOUTH ACTION ON CLIMATE CHANGE: A YNET VIETNAM CASE STUDY

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Abstract

This research presents a study of the climate activities of Vietnamese Youth, potentials, and challenges that young people face when participating in the climate fight through Vietnam Youth Action for Climate Network - YNET, an influential independent youth group specializing in climate activism in Vietnam. Can young people keep the "fire" to continue working in this challenging field for a long time, in the face of economic and social pressures? With a qualitative approach, data research and in-depth interviews. Research results show that YNET young people have been very actively participating in climate activities. Conversely, YNET has also created conditions for young people to develop their abilities. YNET has been successful in many activities with many available resources. However, operational ability is determined by many different conditions and resources. Some resources and strategies for young people do not always get results and are successfully exploited by you. As for individual young people, each interviewee in this study has a story to tell about the process of participating and adapting to integrate into YNET. Young people have become aware of those most affected by the climate crisis, today and in the future. The spontaneous formation of a network of activities together shows that they are aware of the power of the crowd and the influence of a common voice better than working separately, which they had done before participating in YNET. There have been environmental-related activities. Their own assessment results show that participating in the network motivates them to seek information and become more knowledgeable about climate. For the future, it is important that governments, political institutions, corporations, and other social agencies take the younger generation seriously in their messaging on social and environmental justice. At the participant level, the core group of YNET youth have a sense of ability to make a political statement and understand how their actions are important to the good of society. Challenges can be addressed by listening to young people and advocating for their communication and social justice values. The young people in this study have the potential to become leaders of the future climate movement. All key issues discussed throughout this study related to the sustainability of youth climate activist organizations in Vietnam, with YNET being a typical example. Difficulty with soft skills is a challenge to maintaining group activities when youths have unclear motivation for participation or leave quickly in some cases. A reason shows that those who left did not receive the support, or mentor or found it difficult to balance such extracurricular activities with their official work of studying or working. These difficulties may

come from the harmony between members or from the leader with teammates because it can be seen that in the same group, a person with outstanding ability can become a leader but can also move because YNET is a launching pad for young people to continue studying or have new, better opportunities. Thus, they face uncertainty and many changes. Further research should explore the best methods to reduce this ambiguity. A team advisor is needed in the developing stage of YNET when the time from establishment to the time of the study is 3 years. This can include appropriate policy support and alignment, mental health resources, as well as career opportunities and incentives for young people working in this sector. This research shows the necessity to deeply investigate the influence of young generations' climate activism on developing and implementing beneficial climate policies that can avert the climate crisis and develop strategic take advantage of youth resources to participate in mitigating and adapting to climate change.

Keywords: youth, climate change, climate activism, YNET, Vietnam youth

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HOUSEHOLD SOLID WASTES GENERATION, CHARACTERIZATION AND MANAGEMENT RECOMMENDATION IN TUY HOA CITY, VIETNAM

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Abstract

This study quantified the amounts of solid waste generated and its composition in order to recommend the best course of action for enhancing the solid waste management procedures of Tuy Hoa city in Vietnam. The study was carried out in Ward 7, Hoa Kien and Binh Ngoc communes which are representative for three different social economic conditions. 109 households representing various income levels were selected for waste characterization study in nine consecutive days in July 2022. The results of this study show that the average household in a high-income area produced 0.39 kg/person/day, compared to 0.19 kg/person/day in middle - and low-income areas. The average waste composition for Tuy Hoa city reveals that organic waste constitute the largest share of the waste generated (73.9% in weight), followed by plastics (12.2%), others (8.9%), paper and cardboard (3%), glass (1.3%) and metals (0.7%). Plastic waste is consistently dominated by LDPE (39.7- 47.1%), followed by PET (16.5 – 22.5%) and PP (10.5%), with smaller proportions of HDPE (2.9-7.1%) and other plastic materials. For Tuy Hoa, reducing the amounts of waste to be deposited in the landfill is a priority as the available space is rapidly decreasing. The results show that the amounts of waste to be landfilled have potential to be highly reduced. Social programming is crucial to raising household awareness of the need to use less single-use plastic as it represents a high share of the plastics generated. Additionally, household waste separation could help to increase the recycling rate and resource recovery through the treatment of organic waste – transforming current waste into a resource and limiting the impacts of final disposal.

ATMOSPHERIC Hg MEASUREMENTS IN SOUTHERN VIETNAM MEGACITY: TEMPORAL VARIATION AND SOURCES ATTRIBUTION

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Abstract

Southeast Asia (SEA) has been suggested as a hotspot of mercury (Hg) emission worldwide but research on atmospheric Hg remains scarce in this region in terms of both spatial and temporal scales. This study reported year-round (May 2022 to April 2023) monitoring data of total gaseous mercury (TGM) and particulate-bound mercury (PBM) at 3 sites (2-urban and 1-suburban) in Ho Chi Minh City (HCMC), a tropical megacity in Southern Vietnam. The average concentrations of TGM and PBM were 2.13 ± 0.68 ng m⁻³ (1.23-6.18 ng m⁻³) and 48.3 ± 38.8 pg m⁻³ (2.5-217.2 pg m⁻³), respectively. TGM and PBM levels were found to be higher in urban (TGM = 2.33 ± 0.71 ng m⁻³ and PBM = 56.6 ± 40 pg m⁻³) as compared to suburban (TGM = 1.73 ± 0.39 ng m⁻³ and PBM = 34.2 ± 32.4 pg m⁻³) resulting primarily from greater anthropogenic activities. During the Northeast monsoon season (Nov-Jan), higher TGM concentrations at all sites were observed as compared to the Southwest monsoon season (July-Sept) due to changes in air mass origin and transport paths. Meanwhile, greater rainfall amounts in the southwest monsoon season could play a role in controlling PBM seasonal variations in HCMC. Local and regional Hg sources could contribute to atmospheric Hg in HCMC. Both backward trajectory and CWT analysis revealed East Asian outflow as an important factor contributing to higher TGM and PBM levels at the sampling sites. This TGM and PBM dataset over SEA, a region with high atmospheric Hg emissions, provides a valuable resource for the Hg scientific community to improve our understanding of Hg biogeochemical cycle.

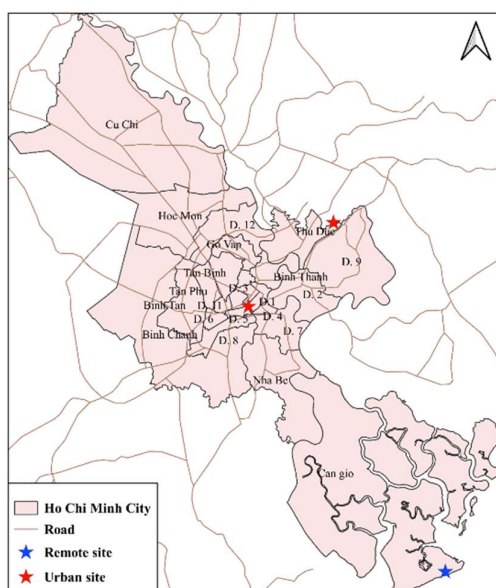


Fig.1 Sampling sites in this study include a remote site (CG) and 2 urban sites (NVC and LT).

ACTIVITY AND EMISSION CHARACTERISTICS OF MOTORBIKES IN HANOI TRAFFIC

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Abstract

Motorcycles account for a large proportion of traffic in Hanoi, the current growth rate of motorbikes is 7.66% per year, Hanoi city will have 7.3 million motorbikes in 2025, and by 2030 there will be 7.7 million motorbikes (Le Anh Tuan et al., 2021). To have an emission reduction strategy for urban areas, emissions data and traffic conditions need to be accurately assessed. This study focuses on clarifying the emission characteristics of motorbikes in Hanoi, providing data on motorbike activities and vehicle emission factors based on field surveys, interview and applying calculations through on the IVE model - international vehicle emissions model. Of the total 6,091,986 motorbikes listed under the management of the Department of Transport, from the vehicle counted results, calculated that the average number of vehicles running per hour on all types of roads in Hanoi, there are 11,125 vehicles, including motorbikes, cars, buses, heavy and light trucks. The vehicle flow is very mixed, motorbikes account for a large proportion of all sub-urban roads, main urban roads, national highways, provincial roads and industrial park roads because of many lanes and interwoven areas in Hanoi. The average age of motorbikes is 11.2 years, the group of motorbikes and mopeds aged 6 to 10 years accounts for the majority in the study area. Data on motorbike activities in Hanoi shows that, on average, each vehicle travels 16.4 km per day with an average usage frequency of 3,463 times per day. With the characteristics of motorbikes, the emission factors of greenhouse gases in the field of hot engine movement e_{running} has been determined as CO₂ is 133.1 g/km, CH₄ is 0.78 g/km and some air pollutants are 0.175 g/km for PM, 20.4 g/km for CO and 0.012 mg/km for SO₂, respectively. And the emission factors during the start time of the motorbike $e_{\text{start-ups}}$ is CO₂ is 6.605 gams per start-up times, CH₄ is 0.533 gams per start-up times, N₂O is 0.87 milligrams per start-up times and some air pollutants are 0.12 gams per start-up times with PM, 10.87 gams per start-up times with CO and 0.6 milligrams per start-up times with SO₂.

Keyword: Motorcycle Hanoi, exhaust emissions, Activity characteristics

IMPROVING ENERGY EFFICIENCY AND REDUCING CO₂ EMISSIONS BY RECOVERING HEAT WASTE FROM A FISHMEAL PRODUCTION SYSTEM

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Abstract

Producing fish meal from fish byproducts using boiler technology consumes large amounts of energy and releases pollution into the environment. This study provides an example of a factory in Vietnam (Khanh Hoang Seaprexco. Ltd. (KHS)) that has succeeded in improving energy efficiency and reducing CO₂ emissions into the atmosphere by installing an economizer. This study uses the specific energy consumption (SEC) quotient to evaluate the energy efficiency of the KHS factory, focusing on a recently installed heat-capturing economiser to optimize the plant's energy efficiency. The energy consumed and the amount of CO₂ released into the environment is also calculated with and without the economizer, which recovers and reuses heat from the plant boiler. The results show that the plant's energy efficiency is higher when the economizer is installed. After installing the economizer (2018) the SEC index of the plant was lower than before (2017), (12.0 GJ/tonnes compared with 21.5 GJ/tonnes). In addition, the economizer lowers energy consumption as well as CO₂ emissions into the environment, which decreased by 5.53%/year and 1,199.43 tonnes of CO₂/year, respectively. The results of this study can provide reliable scientific evidence and reference data for other fish meal production plants to install an economizer.

Key word: *fishmeal, specific energy consumption (SEC), economizer, reducing CO₂ emissions, rice husk pellets.*

PM_{2.5} LEVELS, CHEMICAL COMPOSITION, AND SOURCE IDENTIFICATION IN BIEN HOA CITY, DONG NAI, VIETNAM

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Abstract

Air pollution has become a significant issue in Southeast Asian countries due to rapid development and urbanization driven by substantial economic activities. This study focuses on Bien Hoa, an emerging city in Vietnam, and investigates the average mass concentration of PM_{2.5} during two distinct periods: the rainy season in October 2021 and the dry season in March 2022, in both residential and industrial areas simultaneously. A total of forty (40) daily PM_{2.5} samples were continuously collected using the TE-1000DBLX High-volume Air Sampler (Tisch Environment, Inc). The collected samples underwent chemical composition analysis using ICP-MS/ICAP RQ to assess 12 key elements (As, Pb, Mn, Fe, Cd, Cr, Zn, Co, Al, Cu, Ni, and Mg) and 8 ions (NH₄⁺, Cl⁻, NO₃⁻, SO₄²⁻, K⁺, Ca²⁺, Na⁺, Mg²⁺). To effectively identify the main sources impacting air quality in the region, the study employed the Positive Matrix Factorization (PMF) and the Potential Source Contribution Function (PSCF) models. The results revealed that during the rainy season, the average mass concentration of PM_{2.5} was $29.68 \pm 11.97 \mu\text{g}/\text{m}^3$ in residential areas and $40.85 \pm 25.55 \mu\text{g}/\text{m}^3$ in industrial areas. However, in the dry season, the concentrations significantly increased to $65.52 \pm 18.74 \mu\text{g}/\text{m}^3$ in residential areas and $79.92 \pm 24.30 \mu\text{g}/\text{m}^3$ in industrial areas, indicating higher pollution levels compared to the wet season. Chemical analysis of PM_{2.5} samples collected during both seasons demonstrated the presence of dissolved ions, with SO₄²⁻, NO₃⁻, K⁺, and Ca²⁺ dominating in the rainy season, while NH₄⁺, Cl⁻, SO₄²⁻, and NO₃⁻ prevailed during the dry season. The PMF model results indicated that during the dry season, burning contributed 41.9% to pollution, followed by industry (22%), secondary dust (18.8%), traffic (15%), and road dust and sea salt (2.3%). In contrast, the rainy season exhibited four main sources: secondary dust (56.8%), road dust and sea salt (22%), industry (12.5%), and traffic (8.8%). Furthermore, the PSCF model results suggested the possible impact of remote factors such as coal-fired power plants in the Mekong Delta, regions with high population density, and large industrial zones like Ho Chi Minh City and Binh Duong province. The contribution of transportation and fishing activities in the East Sea and Mekong River was also identified as relevant factors influencing air quality. Overall, this study highlights the sources of air pollution in Bien Hoa and emphasizes the need for targeted measures to mitigate pollution levels, especially during the dry season when pollution reaches critical levels.

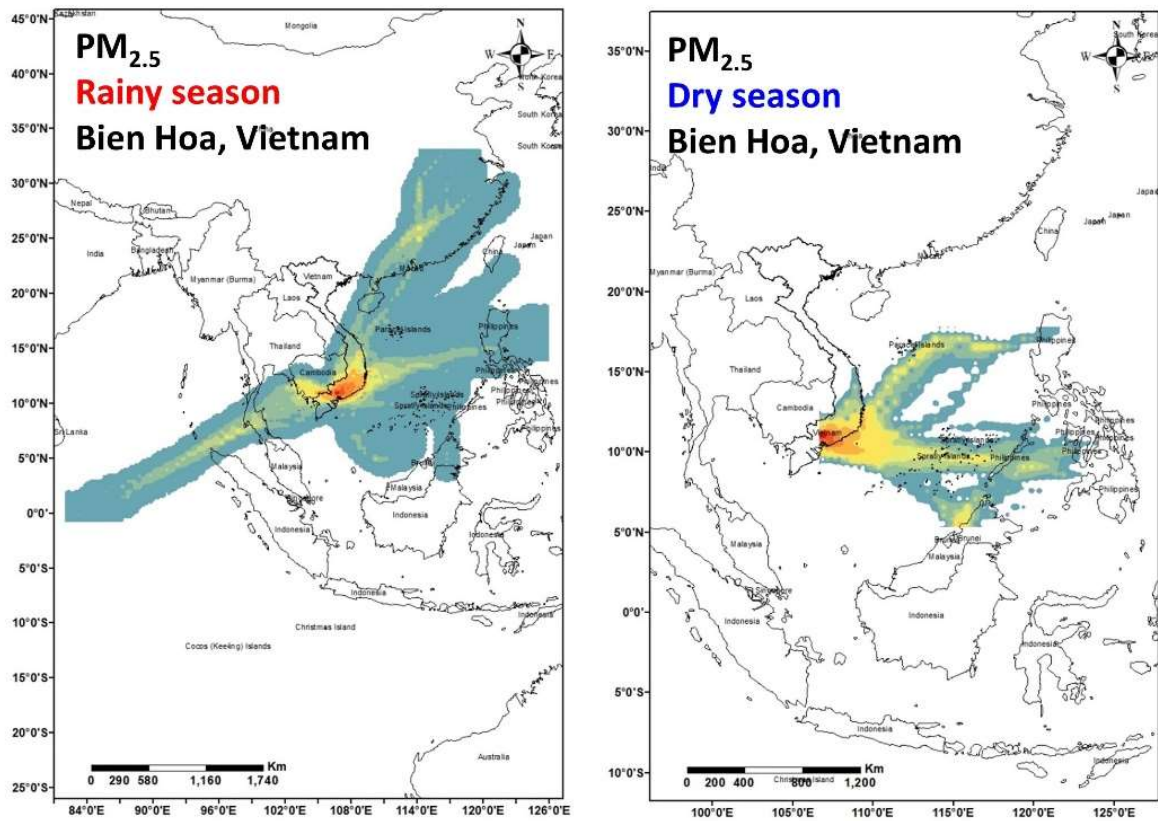


Fig. 1. Spatial distribution of PSCF values of PM_{2.5} in BHC: rainy season (left side), and dry season (right side).

SHORT-TERM IMPACT OF FINE PARTICULATE MATTER ON HOSPITAL ADMISSIONS IN NORTHERN VIETNAM IN 2019

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Abstract

Background: Fine particulate matter (PM_{2.5}) can affect the number of admissions for respiratory and cardiovascular diseases among children and adult. Meanwhile, the atmosphere in the northern Vietnam has been severely contaminated by PM_{2.5} from various sources such as industrial activities, traffic, and craft villages. Therefore, the aim of this study is to estimate the short-term impact of ambient PM_{2.5} on adult and pediatric cardiovascular and respiratory admissions in the northern provinces of Vietnam in 2019.

Methods: This study applied the health risk assessment approach recommended by the World Health Organization (WHO) to estimate the percentage of admissions attributed to ambient PM_{2.5}. Daily PM_{2.5} mean concentration was provided by the Center for Interdisciplinary Integrated Technology Field Monitoring (FIMO). For the health data, daily number of admissions were extracted from hospitals in several provinces in Northern Vietnam. We conducted the calculations using the health function as suggested by the WHO.

Results: Exposure to ambient PM_{2.5} contributed a substantial proportion of the admissions among children and adult in Northern Vietnam in 2019. For instance, approximately 2.3% of childhood respiratory admissions and 1.3% of adulthood cardiovascular admission were attributed to ambient PM_{2.5} in Ha Noi in 2019. The corresponding results in Thai Binh were 1.1% and 0.5%, respectively. While the number of admissions in Hanoi were promptly distributed in the central area of the city, the hospitalizations in Thai Binh were disproportionally allocated to the western districts of the province.

Conclusions: The PM_{2.5} pollution has contributed to the hospitalizations in northern provinces of Vietnam. The highest impact can be observed in the most polluted areas. Drastic measures to control the air pollution northern Vietnam is needed to improve the quality of life for this community.

Keywords: *particulate matter, respiratory, cardiovascular, Vietnam*

PRELIMINARY INVESTIGATION ON THE OCCURRENCES OF PCNS IN AMBIENT AIR OF HO CHI MINH CITY, VIETNAM

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1. Introduction:

In May 2015, 75 congeners of Polychlorinated Naphthalenes (PCNs) were included as new POPs under Stockholm Convention. PCNs were started to produce in the early 1900s and widely adopted in a variety of industrial applications such as dye-making, fungicides in the wood, textile, and paper industries, plasticizers, oil additives, casting materials for alloys and lubricants for graphite electrodes. Although the production of PCNs was terminated at the end of the 20th century due to the recognition of their damage to the environment and adverse effects on human health, these compounds are still released into the environment by common sources such as historical use of PCNs, historical and present use of PCBs (PCNs are byproducts in the production of PCBs), combustion and other thermal processes. The level of PCNs in the environment of Vietnam has been not reported. As a very first study on PCNs in Vietnam, investigating the level and exploring potential sources of PCNs in ambient air in Ho Chi Minh City (HCMC) which is one of the densest populations with many potential sources of PCNs within and around the city is deemed necessary.

2. Materials and method:

In this study, ambient air samples were collected using high-volume air samplers (PS1, USA) at five urban sites located in the city. Each sample was collected for 2 days with a total volume of 650 m³. Gas-phase PCNs were adsorbed by a pre-cleaned sandwich cartridge of PUF/XAD-2/PUF containing 15 g XAD-2 and a PUF (Tisch Environmental), while particulate-phase PCNs were collected by quartz fiber filter (QFF, Whatman). Three samples were collected from each site and 75 PCNs in gas and particulate phases were analyzed using GC/MS following isotope dilution method[1],[2].

3. Result and discussion:

Total PCN concentrations measured at five sites range from 60.4 pg/m³ to 264 pg/m³ (134 pg/m³ on average), which is significantly higher than that measured at urban sites in northern Taiwan. Gas-phase PCNs are significantly higher than solid-phase PCNs. Two groups of homologue distribution are found, the first group consisting of all samples collected from three sampling sites is characterized by the dominance of low chlorinated CN including Mono- and Di-CNs, accounting for 81-89%, while the second group including all samples collected from two other sites which are characterized by TetraCN (56-65%), followed by TriCN (13-21%).

4. Conclusion:

The results indicate that different sources may contribute to PCNs collected from two groups of sampling sites. Diagnostic ratios indicate that mix-source contributes to the PCNs collected, however, more influence of thermal processes is found at three sampling sites of the first group.

Acknowledgements: *The authors gratefully acknowledge the financial supports provided by Vietnam National Foundation for Science and Technology Development (NAFOSTED 104.04-2019.35).*

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ENHANCING DENGUE OUTBREAK FORECASTING WITH HIGH-RESOLUTION WRF MODELING IN THE DART FRAMEWORK

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Abstract

Within the Dengue Advanced Readiness Tools (DART) framework, an international initiative aimed at developing a dengue outbreak forecasting system for Hanoi and Ho Chi Minh City, this research attempts to deploy the Weather Research Forecasting (WRF) model for very high spatial and temporal resolution weather forecasting. Given its pivotal role as a foundational input for the DART system, precise forecasting of temperature and precipitation is paramount. In the initial phase, we scrutinize the performance of WRF across 24 configurations, incorporating diverse physical parameterizations, at spatial resolutions of 6km and 2km. This sensitivity evaluation centers on a representative case study spanning from June to November 2019. Compared to meteorological station data, our preliminary findings indicate that the modeling system demonstrates reasonable performance, with simulated temperature and precipitation patterns exhibiting smaller biases and better statistical skills than the driven global forecasts. Notably, absolute biases in simulated temperature are predominantly less than 1 degree Celsius, with configuration choices exhibiting minimal sensitivity. In contrast, precipitation simulations exhibit higher uncertainty across settings, possibly attributed to the distinctive geographical and meteorological features of each city. This underscores the need for a thorough analysis and fine-tuning of the WRF model to meet the requirements of the DART project. Nonetheless, our results offer crucial insights for subsequent modeling endeavors in Vietnam and contribute to the broader knowledge base of the WRF community, a widely utilized weather model globally.

Keywords: Dengue; WRF; temperature; precipitation; parameterization.

SENSITIVITY OF WRF-SOLAR FORECASTS TO SHORTWAVE RADIATION AND MICROPHYSICS SCHEMES OVER THE MANILA OBSERVATORY, PHILIPPINES

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Abstract

Due to the intermittent nature of solar energy, solar forecasting is crucial to the proper operation, balancing, and scheduling of electricity production of solar power plants. One forecasting method is through the use of Numerical Weather Prediction (NWP). NWP models are mathematical models that process current weather observations to predict future weather conditions. Among these NWP Models, WRF-Solar, a special configuration of the Weather Research and Forecasting (WRF) Model, is used to forecast Solar Energy. This study tests the sensitivity of Global Horizontal Irradiance (GHI) forecasts produced by the WRF-Solar on the Short Wave and Microphysics schemes. Six microphysics schemes (Kessler, Purdue Lin, WRF Single-Moment 6-Class, Goddard, Thompson, Aerosol-aware Thompson), and three shortwave schemes (Dudhia, Goddard, RRTMG) giving a total of 18 different combinations of these Physics schemes were examined. The forecast GHI were compared with the observed GHI from a solar pyranometer installed at the Manila Observatory, Philippines. To assess the performance of the forecast, error metrics, namely root mean square error (RMSE), relative RMSE (rRMSE), mean bias error (MBE), relative MBE (rMBE), mean absolute error (MAE), relative MAE (rMAE) and the Pearson correlation coefficient (r) were determined. The results show that the WRF-Solar predicts GHI with RMSE (rRMSE) ranging from 162.4 W/m² (27.3%) to 266.4 W/m² (44.8%). The accuracy of the forecasts highly depends on the shortwave and microphysics schemes used. The best-performing combination of schemes was the RRTMG Shortwave and Thompson Aerosol Aware Scheme with an RMSE (rRMSE) of 162.4 W/m² (27.3%), an MBE (rMBE) of -9.5 W/m² (1.6%), an MAE (rMAE) of 94.34 W/m² (15.9%) and an r of 0.89. It also showed an RMSE improvement of 39% compared to the worst-performing scheme (Dudhia Shortwave and Kessler Microphysics) and an RMSE improvement of 19.9% from the base case (Dudhia Shortwave and Goddard Microphysics). For the first time, we have explored the performance of WRF-Solar Forecasts over Metro Manila. This pioneering study showed that WRF-Solar can adequately predict the amount of solar irradiance and thus will be critical as the country transitions to a more renewable future.

FLASH DROUGHT IN VIETNAM AND SOME OF ITS CHARACTERISTICS DURING THE PERIOD OF 1961-2020

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1. Introduction

Drought, conventionally, is often classified into four types including meteorological, agricultural, hydrological and socio-economic ones. By the early 2000s, a new type of drought emerged, called Flash drought (FD), and quickly got special interest of scientific community. FD is also caused by a lack of rainfall, but can also be accompanied by increased evaporation due to high temperatures, low humidity, strong winds and sunny weather. At that time, drought conditions that have negative impacts on agriculture and ecosystems can quickly appear, manifested by soil moisture deficit and vegetation-health decline.

In Vietnam, FD is a new research topic. In this study, we will investigate the FD situation, evaluate the spatial and temporal variations of FD characteristics and their variation trends on the main land of Vietnam in the period of 1961-2020.

2. Data and Method

FD events were identified using mean root zone soil moisture (RZSM; 0-100cm), the data was extracted from ERA5 reanalysis, at the resolution 0.25° during 1961-2020, at the coordinates from 101.125E - 110.875E and 7.625N - 24.375N. Soil moisture (SM) values were converted from the actual unit of m³/m³ to percentiles (%) to determine the FD events and calculate their characteristics.

The approach proposed by Yuan et al., (2019), that was adopted and extended by Mukherjee & Mishra, (2022), was applied with some adjustments to get more detailed and suitable calculation.

Firstly, we identified FD events with three following criteria:

- Daily soil moisture values decrease from 40th percentile to below 20th percentile, with an average decline rate of no less than 5% per pentad (5 days);
- If the declined soil moisture values rise to 20th percentile again and exceeds 40th percentile, the FD is considered to be terminated;
- The drought should last for at least 15 days.

On the basis of identified FD events, a number of FD characteristics, including frequency, speed of soil moisture decline under the onset stage (SPD), drought duration (DD), drought severity (DS), drought intensity (DI), intensification rate (rate of depletion - RD), and their variation trends have been calculated.

3. Results

The results show that, on average, there were 1 – 4 FD events per year across the country, the number of events varied by regions and time periods. The FD frequency in regions and months of the year also varied. FD occurred more often in the period from April to October (the rainy-season months) and less

often from November to March of the next year (the dry-season months). September and October were the period of highest occurrence, in which, most of the Northern Delta (B3) region, some provinces of the North-East (B2) and North Central (B4) recorded the highest rate. These two months was the transiting time between the rainy and dry seasons, it might have led to soil moisture deficits and created favorable conditions to trigger FDs during this period.

The speed of soil moisture decline under the onset stage (SPD) is one of the important characteristics, reflecting the "flash" of the drought. The greater this speed is, the greater the danger of FD might have. Our calculations show that, mean SPD in the research area was quite stable at high rate, from 16% to around 25%/pentad, leading to rapid onset of FD.

Drought duration (DD) lasted from 15-70 days, most commonly around 30-40 days. The mean duration of these events across the country was about 35 days per event, however, there was considerable variation among regions and time periods.

About the drought severity (DS), noting that DS is the cumulative sum of soil moisture percentiles in each FD event, so longer DD leads to larger DS. The calculation present that DS varied significantly over time in the North, Central Highlands, South and South Central regions, only the North Central region recorded insignificant variation. The mean DS over the country was seen at 810%.

Though the DS varied widely across the country, the drought intensity (DI) was fairly uniform across regions. The mean DI ranged from 20%-25%/day. While the mean intensification rate (rate of depletion – RD) recorded at 10.7%/event. This characteristic did not differ much among regions, however, it increased quite suddenly in the South during 1971-1980 period and in the Northeast during 1981-1990 period, at 17%/event. The larger the RD is, the faster the FD occurs and then the faster the soil moisture drops to the lowest point. In such conditions, which crops that cannot adapt to the rapid decline speed and soil moisture deficit will be seriously affected.

For the variation trend of the flash drought characteristics, it was recorded an increase in the South and Northwest regions for almost characteristics, while other regions had a constant trend or very slight downtrend.

4. Conclusions and recommendations

In this study, we used ERA5 soil moisture data to identify the flash drought events, calculate their characteristics and variation trends on the mainland of Vietnam during the period of 1961-2020. The results showed that in Vietnam during the study period, FD characteristics such as number of events, drought duration and severity varied greatly over time and space. The Southern regions had fewer FD events than the North did, but the FD duration was longer, leading to greater severity. The South and North West regions also recorded an increasing trend in almost FD characteristics.

Notably, the study found that flash droughts often occurred in the rainy season. This finding could have implications for the agricultural industry, producers, farmers. Because people usually do not think about drought during this time of the year, they may pay less attention to water storage and proactive irrigation for the crops. Therefore, this can be important information for warning, prevention and response activities to FD.

Further researches, especially on the prediction, forecasting, early warning, etc., should be conducted to provide better understandings, tools, etc., and then action plans to mitigate the impacts that flash droughts might cause.

Keywords: Flash drought; Variability; Trend; Vietnam.

THE FUTURE OF DROUGHT IN VIETNAM: A MULTI-SCENARIO ANALYSIS USING CMIP6 DOWNSCALED PRODUCTS.

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Abstract

Understanding future drought threats is crucial for Vietnam, a country highly susceptible to water scarcity due to its economic dependency. This study utilizes state-of-the-art high-resolution downscaling products from various Coupled Model Intercomparison Project Phase 6 (CMIP6) scenarios to assess future drought conditions across six socio-economic regions. Precipitation and temperature datasets projected under SSP1-2.6, SSP2-4.5, and SSP5-8.5 scenarios, encompassing over 20 models each, are employed to compute the Standardized Precipitation-Evapotranspiration Index (SPEI) for evaluating drought and wetness conditions, as well as their variability. While Mann-Kendall tests reveal relatively high uncertainty in SPEI trends towards the end of the century across all CMIP6 scenarios, our contribution tests confirm that the differences between the three scenarios are mostly contributed by their differences in temperature changes. Nevertheless, the regions of Northern Midland (R1), Central Highlands (R4), and the Southeast (R5) consistently exhibit intensified severe drought characteristics, especially under SSP5-8.5, where a dramatic temperature increase induces greater water loss through enhanced evapotranspiration. Additionally, a copula-based bivariate joint distribution analysis is employed to model the combined distribution of drought duration and severity, facilitating the calculation of joint return periods to estimate critical event occurrences. In the most severe cases of the SSP5-8.5 scenario, Vietnam, particularly regions R1, R4, and R5, is projected to experience more frequent and intense drought events in the future. Furthermore, the anticipated expansion of drought-affected areas by the end of the century underscores the heightened exposure of many regions within the country to this natural hazard. The insights gleaned from this study hold significant implications for decision-makers and researchers in Vietnam and contribute globally to understanding and managing the risks associated with drought in the context of climate change.

Keywords: Drought; SPEI; CMIP6; Copula.

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PROBABILISTIC PROJECTIONS OF FUTURE TEMPERATURE AND PRECIPITATION FOR CLIMATE RISK ASSESSMENT IN VIETNAM

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Abstract

Extreme climate events are rare but can have serious consequences. Assessing the quantitative likelihood of such events is crucial, but it is challenging due to the inaccuracy of commonly used GCM models in representing them, as well as their high uncertainty. In this study, a probabilistic model for extreme climate events in Vietnam called SMME-VN was developed using the Surrogate Mixed Model Ensemble method to predict temperature and rainfall under the SSP2-4.5 and SSP5-8.5 scenarios. SMME-VN is a joint probabilistic model derived from the weighted patterns of 35 GCM models and surrogate models taken from the CMIP6-VN dataset. Independent testing of the probabilistic model showed that it is highly accurate. Consistent with previous research, the SMME model predicts that higher latitudes will experience more warming than lower latitudes, with the northern mountainous provinces seeing the highest temperature increases and the South Central region experiencing the lowest. Under the SSP5-8.5 scenario, there is a 5% chance that the national average temperature will exceed 6.29°C. At the 95% probability level, the minimum temperature increase is 2.21°C. Rainfall is expected to slightly increase at the end of the century, with an average increase of 6.12% at the 5% probability level. The study also found that natural climate variability contributes significantly to the uncertainty in prediction results. However, as the century progresses, the uncertainty of extreme climate event predictions depends on the uncertainty of future greenhouse gas emission scenarios.

Keywords: *probabilistic projection, climate risk, SMME, Vietnam, CMIP6-VN*

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SPATIOTEMPORAL PROJECTIONS OF PRECIPITATION IN THE MEKONG RIVER BASIN BASED ON REGIONAL CLIMATE MODEL

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Abstract

The Mekong River Basin (MRB), the largest international river in Southeast Asia, supports a population of approximately 70 million people. Precipitation serves as the primary source of water resources in the basin, exerting significant influences on the ecology, production, and livelihoods within the region. In this study, future precipitation was projected using the Regional Climate Model (RegCM) driven by CNRM-ESM2-1, a Coupled Model Intercomparison Project Phase 6 (CMIP6) climate model. To address biases in the simulated precipitation over the MRB from the Regional Climate Model products, we applied the Quantile Mapping (QM) bias correction technique. The QM process was implemented for both the baseline period (1995-2014) and the subsequent future period (2070-2099) under two Shared Socioeconomic Pathway scenarios (SSP245 and SSP585). When compared to the original model outputs during the independent validation period, the QM technique resulted in a substantial reduction in bias and noteworthy improvements in representing precipitation indices.

Across both future scenarios, there was an observable increasing trend in precipitation throughout the MRB. In particular, annual precipitation anomalies for 2070-2099 were 96 mm and 137 mm for the SSP245 and SSP585 scenarios, respectively. During spring and winter, precipitation exhibited a slight increase in the northern MRB but decreased in the southern MRB. Conversely, during summer and autumn, there was a significant and widespread increase in precipitation across almost the entire basin. The trend shows an increase in rainfall during the wet season and a decrease during the dry season for both scenarios, indicating that droughts and heavy rainfall events may occur more frequently in the future. Regarding daily rainfall, there is a significant increase of 5-10% in the number of days with precipitation exceeding 20 mm/day under the SSP585 scenario in the period from 2070 to 2099. Furthermore, we observed significant alterations in the spatial distribution of future precipitation. Areas with annual precipitation exceeding 2400 mm and 1800 mm (westside of Annamite range) exhibited outward expansion in a circular pattern. Additionally, the central region with annual precipitation exceeding 1500 mm shifted westward, indicating an expansion of areas with annual precipitation exceeding 2400 mm and 1800 mm. In contrast, dry-season precipitation, as represented by the 400 mm isohyet, contracted primarily in a circular pattern toward the center. These changes suggest a contraction of areas with dry-season precipitation.

BUILDING A LOCAL SUSTAINABLE SUPPLY CHAIN NETWORK FOR RECYCLABLE MATERIALS FOR MEDIUM-SIZED CITIES IN SE ASIA (INDONESIA)

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Abstract

Innovative strategies in solid waste management are crucial to achieving global sustainability goals and enhancing local livelihoods. This challenge is particularly significant in rapidly growing urban areas. One promising approach to address this challenge is to redirect recyclable materials away from centralized landfill disposal through the implementation of local supply chain networks that directly connect households with the recycling industry. App-based technologies have significant potential to facilitate the flow of valuable materials, thereby providing efficient and flexible incentives as the foundation of an innovative and decentralized circular economy model.

We present initial results from a medium-sized city in Indonesia showing that implementation of app-based technology with a community-based recycling approach attracts customers (households) and local waste banks. Research results indicate that the application of this technology to recycling simplifies, accelerates, and makes local recycling systems more attractive and transparent.

Some challenges remain but they can be overcome through continued community and stakeholder outreach and education, as the use of App-technology offers significant benefits at the city level for waste management and improved local circular economy. To this end we developed and operate an International Recyclable Lectureship Series (<https://go.hw.ac.uk/GRLPSWAY>) bringing experts views from different countries to diverse audiences.

Our project builds on a strong partnership between universities in the UK, Indonesia, and Vietnam (Phenikaa University Hanoi) and their non-academic networks. We aim to use a newly developed mobile App, currently tested in Indonesia, and test it in other mid-size cities in Vietnam, and beyond.

EVALUATION OF THE MICROPLASTIC PRESENCE AND THEIR POTENTIAL RISKS: A PRELIMINARY STUDY IN PHU LY, HA NAM

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Abstract

Nowadays, due to the possible environmental concerns they pose, microplastics are a major problem worldwide. Data on the prevalence and health consequences of microplastics in Southeast Asia, particularly in Vietnam, are currently lacking. This study examined the concentrations of microplastics (MPs) in the sediments and surface waters of Phu Ly, Ha Nam, Vietnam. MP concentrations in surface water range from 0.17 to 6.2 g L⁻¹, and in sediment, they range from 3.74 to 31.23 mg kg⁻¹ wet weight. Nine trace metals (TMs), with concentrations ranging from 0.0004 to 42.75 mg/g in surface water, including Cd, Pb, Co, Ni, Mn, Cr, As, Cu, and Zn, were found to be associated with MPs. We predicted that there would be a high correlation between the levels of environmental contamination and the TMs absorbed on the surface of MPs. Although there is a tenuous connection between MPs and (antimicrobial resistant) AMR bacteria/genes, the importance of MPs in the transfer of those hazards cannot be understated. Although the hazard quotients (HQs) of TMs associated with MPs in this study were less than 1, indicating low health risks from the pollutants, regular monitoring of MPs and other environmental concerns such as TMs and AMR are needed due to the high mobility of MPs in the ecological system.

Keywords: *Microplastics, Trace metals, antimicrobial resistance, health risk, transportation vehicle.*

YOUTH ENGAGEMENT IN PLASTICS RESEARCH: LESSONS, LIMITATIONS AND OPPORTUNITIES IN APPLYING MULTIDISCIPLINARY ENGAGEMENT METHODS TO CULTIVATE INTERGENERATIONAL KNOWLEDGE EXCHANGE AND ACTION FOR PLASTICS SOLUTIONS IN VIETNAM

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Abstract

Engagement of citizens in solution-based approaches to the plastic challenge has become a popular approach in plastics research. Despite their widespread application engagement activities make little effort to connect youth and older generations in knowledge exchange and collective action. This paper explores the series of engagement activities for youths carried out by the ‘Sources, Sinks, and Solutions for the Impacts of Plastics on Coastal Communities in Viet Nam’ (3SIP2C) Project. Our research revealed that while there is a proliferation of plastics awareness programs run by governmental and non-governmental organisations in Viet Nam, most of these focus on establishing communal clean-up initiatives (locally known as Green Sundays) or on educational competitions around the reuse and recycling of plastics. While such activities raise some awareness for the participants, they appear to have little effect in motivating future individual or collective actions beyond the confines of that specific activity.

As part of our project, we designed a series of research activities aimed to engage youths (14-16 years old) in understanding the impacts of marine plastics on coastal Viet Nam. We carried out these activities over the course of 7 months working with Grade 9 Geography pupils from the High School for Gifted Students in Social Sciences and Humanities in Hanoi. Implementing different methods such as map-building, team project, storytelling, youth-led research, and workshop discussions the engagement offered multiple ways for the students to develop new skills, acquire environmental, social, and geographical knowledge around the plastics issue, and engage in intergenerational knowledge exchange with Cat Ba local communities.

Storytelling offered valuable insights about youth perceptions about the pathways of plastics from their production to their end in the landfills or recycling factories and helped us identify gaps in their knowledge about the trajectories and impacts of marine plastics. Through the team projects and map building exercise the students were able to learn how the flows of plastics that leak to the environment and move through the waterways connect different geographical places such as Hanoi and Cat Ba. Finally, the youth-led research they carried with Cat Ba local communities provided both the pupils and our researchers with new insights into plastics use and disposal practices on the island, as well as offered an entry point for intergenerational knowledge exchange in our Cat Ba community workshop. Evaluation surveys and feedback from all participants and involved stakeholders revealed very positive attitudes and changes in perception as result of these activities. More importantly, it suggested that over 90% of the participants felt strongly motivated to keep partaking in various activities and individual practices to reduce, reuse and recycle plastics.

ECONOMIC AND SOCIAL COST OF PLASTIC WASTE ON THE FISHERIES INDUSTRY IN VIET NAM

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Abstract

Plastic pollution is a global challenge. It is a transboundary issue with serious environmental, health, social, and economic effects across territories. The occurrence, source, transport, and fate of plastics from macro to nano sizes has been widely quantified, characterised, and modelled on a global scale. While a lot of work has been done on the spatiotemporal magnitude of plastic pollution, little is known about the actual impacts of plastic litter on maritime economies, coastal and riverine communities in Vietnam. Nearshore capture fisheries in Vietnam are impacted by plastic litter from both coastal and inland sources, causing losses in revenues, threatening livelihoods, and increasing occupational risks for fishers. Understanding the tangible and quantifiable socio-economic cost of plastic pollution on the fishing industry of Vietnam could provide valuable insights for effective policy interventions and stakeholder innovations to address this issue.

In this research, we quantified fishers' and coastal communities' perspectives on the socio-economic impacts of plastic debris on the operation of nearshore fishing vessels in Hai Phong City, Nam Dinh, and Ben Tre provinces. We carried out semi-structured questionnaires (N=529, with 199 fishers and 330 coastal aquaculture farmers), focus group discussions, and in-depth interviews with related stakeholders. The direct cost of plastic pollution incurred by fishers includes the cost of time (hours) lost when sorting plastic from catch, dealing with entanglements and downtime when the vessel is damaged. Directly incurred costs are associated with expenditure arising from repairs resulting from the entanglement of plastic waste in fishing gear, boat propellers, and cooling systems, which is reported at an average of 22.6 million VND/boat/year, which is equivalent to $2.5 \pm 2.8\%$ of each fishing boat's annual revenue. Adding the indirect cost of reducing catch efficiency and increasing time otherwise spent fishing, the total impact of plastic on local capture fishery is estimated at $17.3 \pm 19.2\%$ of annual revenue (Table 1). Moreover, fishers reported the serious health and safety risks associated with accidents and loss of health or life while untangling plastic ropes stuck in propellers.

Most fishers displayed extensive knowledge about the spatiotemporal hotspots of plastic debris in their fishing areas. They reported estuaries and sluice gates as hotspots, particularly during high fluxes in Southeastern wind and storm seasons (May-Oct). They described what they observed in these hotspots and that plastic bags were the most common type of visible plastic waste. The study also explored fishers' perspectives on sustainable solutions for plastic pollution in the research locations. Understanding the challenges, costs, and limitations to deal with marine plastics experienced by coastal fisheries communities offer important insights for co-designing sustainable interventions for plastic pollution mitigations in Vietnam.

Table 1: Economic impacts of marine plastic debris on the fishing industry in Vietnam.

Type of fishing boats	Provinces	Direct plastic waste cost (million VND /boat/year)	Total direct plastic waste cost and revenue loss (million VND /boat/year)	Direct plastic waste cost (% revenue /boat/year)	Total direct plastic waste cost and revenue loss (% revenue /boat/year)
Trawl (LOA<15m)	Ben Tre	24.5±22.2	117.1±89.6	4.6±4.2	22.2±16.9
	Hai Phong	18.0±29.7	142.9±230.4	2.0±3.3	15.9±25.7
	Nam Dinh	17.8±18.9	176.8±165.9	1.3±1.4	13.6±12.8
Gillnet (LOA<12m)	Ben Tre	27.0±22.9	119.2±148.9	5.4±4.6	24.1±30.2
	Hai Phong	21.7±4.29	145.1±69.7	2.3±0.4	15.7±7.5
	Nam Dinh	57.7±54.8	203.1±215.9	10.2±9.7	36.1±38.4
Gillnet (12m<LOA<15m)	Ben Tre	35.8±11.5	206.4±108.6	5.5±1.7	31.9±16.8
	Hai Phong	15.7±15.7	119.8±119.8	2.6±2.6	20.1±20.1
	Nam Dinh	44.6±11.3	353.0±143.2	3.4±0.8	27.6±11.2
Average		22.6±25.5	154.7±172.1	2.5±2.8	17.3±19.2

Note: LOA: Length Overall. Data are presented as Mean ± Standard Deviation

FROM NATIONAL TARGETS TO LOCAL ACTIONS IN REDUCING MARINE PLASTIC WASTES: A CASE STUDY OF VIET NAM

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Abstract

Marine debris management generally and reducing plastic wastes in specific is considered to be a relatively emerging concept and still need a common understanding among management agencies. It is stated that there is around 3.7 million tons of plastic waste are generated in Viet Nam annually and this figure is projected to increase by 36% between 2018 and 2030. However, only 10-15 percent of plastic wastes generated is collected for recycling. Recognise the important of collective effort in December 2019, Viet Nam approved the National Action Plan (NAP) on marine plastic wastes management to the year 2030 with targets of reducing 75% of plastic waste in marine bodies and 100% of fishing nets loss or dispatch be collected; 100% of tourism areas and holiday accommodation business along the coastal lines will not use single use and non-biodegradable plastic bags, and 100 marine protected areas will be free from plastic wastes. In order to achieve NAP's targets, it requires collective effort from various stakeholders, particularly from local authorities. This paper aimed to explore how these national targets were transformed into provincial actions of localities along the coastal lines in Viet Nam using a content analysis methodology with the multi-level governance lens in the central-oriented policy making context. Among 28 provinces along the coastal line in Viet Nam, 22 local action plans for marine plastic wastes management to the year 2030 were approved and used in this study. The findings from content analysis of the 22 action plans developed and approved by provincial authorities indicate that even in the central-oriented policy making system like in Viet Nam not all proposed action plans have targets in reducing plastic wastes on ocean but having more or less the same implementation arrangement. Interestingly, 2/22 provinces developed their action plans to implement NAP having specific targets beyond the types of targets stated in the NAP's NAP's scopes and targets. It concludes that at the provincial level, due to limited resources (both technical and financial resources), action planning to achieve targets of reducing plastic wastes on marine waters in NAP the action plan proposed still generalization and lack of budget estimation for the implementation. This means that, in order to implement the local action plans, these provinces have to detail interventions and budget planning.

Keywords: NAP; marine debris; plastic wastes; multi-governance

EVALUATING THE RELATIONSHIP BETWEEN ANTIBIOTICS RESISTANCE MICROBES AND MICROPLASTICS COLLECTED IN THE RED RIVER DELTA, VIETNAM.

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Abstract

Due to rapid industrialization and urbanization in Vietnam, the daily production activities cause plastic waste pollution. Over time, under the influence of different environmental factors, plastic wastes decompose into microplastics, which are then released into different ecosystems. Microplastics in aquatic environments act as reservoirs for pathogenic microorganisms and perhaps also antibiotic-resistant genes, spreading them to different ecosystems and causing negative effects on the environment and humans. In particular, infections caused by microbes resisting broad-spectrum β -lactam antibiotics are increasing, and it resulted in increased morbidity and mortality.

The objective of this study was to investigate the prevalence of antibiotic microbial strains and β -lactam resistance genes on the surface of microplastics collected from several rivers of the Red River Delta. Using traditional culture techniques on Mackonkey agar plates containing cefotaxime, we found several strains resistant to β -lactam antibiotics from microplastics and water samples. These colonies were amplified with the target genes TEM, SHV, CTX-M-1, CTX-M-2, CTX-M-8, CTX-M-9, and CTX-M-25 using molecular techniques. Our first results showed the appearance of TEM and CXT-M genes.

These findings demonstrated that microplastics and water of contaminated areas act as sources of exposure and dissemination of β -lactam antibiotic-resistant strains as well as the emergence of antibiotic-resistant genotypes. As a consequence, this can have negative impacts on environmental and human health since it raises the risk of antibiotic resistance spreading throughout the ambient microbial community.

Keywords: Microplastics, antibiotic-resistant, β -lactam, health.

ANAEROBIC MEMBRANE BIOREACTOR FOR SEAFOOD PROCESSING WASTEWATER TREATMENT: A COMPARISON BETWEEN FLATSHEET AND HOLLOW FIBER MEMBRANES FOR REUSE PURPOSE

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Abstract

Seafood wastewater contains many organic compounds and nutrients that harmful to the environment and human health. Thus it is urgent need a suitable method to treat the seafood processing wastewater. This study examines the performances of flatsheet and hollow fiber membranes for seafood wastewater, focusing on their ability to reduce pollutants and increase water reuse possibility in anaerobic membrane bioreactor system (AnMBR). The results show that the pattern of membranes impact on trans-membrane pressure (TMP) stability and flux rates using flat sheet and hollow fiber membranes. Flatsheet membranes had an average TMP of 0.65 bar as well as an average flux of 18.2 m².h. The hollow fiber membranes recorded an average TMP of 0.64 bar with an average flux of 18.1 L/m².h. After a 60-day screening period, the removal efficiencies of COD (43.17-91.5%), NH₄⁺ (58.5-84.7%), TDS (9-10.82%), TSS (89.0-99.7%), and TN (4.9-18.9%). The potential uses of the treated effluent include non-food crop irrigation, landscaping, surface water recharge, and industrial processes that do not require potable water quality. Further study is the fabrication of novel ultrafiltration (UF) membrane for the AnMBR process with antifouling property for the treatment of seafood wastewater.

Keywords: AnMBR, seafood processing wastewater, flatsheet, hollow fiber.

VARIABILITY OF ARSENIC SPECIATION IN RICE GRAIN, LEAF, AND PADDY SOIL ACROSS DIFFERENT GROWING CONDITIONS IN CAMBODIA

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Abstract

Rice provides an average of 20% of globally consumed calories and employs millions of rice farmers. Rice is commonly grown in paddy soils, where anaerobic respiration reduces ferric iron (III) oxyhydroxides, sulfate (SO_4^{2-}) and arsenate (AsO_4^{3-}), increasing dissolved Fe (II) and As (III) concentrations in soil pore water. Rice commonly accumulates this soluble As, potentially posing environmental and health concerns. Understanding how that As accumulates in the grain, and its toxicity to humans and plants, requires detailed knowledge of the oxidation state and coordination environment, collectively called the speciation, of the arsenic in each material. Most previous research examining As speciation in rice chemically extracts As from the soil, plant or grain, then determines speciation using a combination of chromatography to separate species and inductively coupled plasma-mass spectroscopy (ICP-MS) to detect species containing metals. These methods have found that a portion of the As in rice grain is methylated, but it appears to oxidize As, and it removes the As from its coordination environment, making it hard to see how the As is bound in the grain. Here, we establish the utility of synchrotron-based X-ray absorption spectroscopy for As speciation in rice grain, leaf and paddy soils. Arsenic speciation was determined at the National Synchrotron Light Source-II in Brookhaven, NY, USA for collocated rice and paddy soil samples collected from a wide range of small stakeholder farms in January 2023 in Kandal and Kampong Chhnang provinces of Cambodia. The total arsenic concentration of plant samples was determined by digestion and ICP-MS, while soil As was measured by X-ray fluorescence (XRF). Methylated As was found in soils, leaves and grain. In grain, this method is uniquely able to show that both inorganic As and methylated As species are coordinated to protein. Soil, in contrast, contains primarily arsenate unless collected from fields under sustained flooding. Neither speciation or grain concentration was correlated to soil or leaf As concentrations. Arsenic XANES spectra were collected successfully without sample preparation other than sample homogenization for grains and leaves with less than 50 μg As/kg and soils with as little as 1 mg As/kg. Thus, we demonstrate that As XANES analysis serves as a useful tool to determine the speciation of the arsenic and other elements and provides important information about the oxidation state and coordination environment of As in impacted agricultural systems. Understanding the speciation of rice arsenic will allow for more productive rice growing methods while mitigating rice as a major risk to public health and food security.

Keywords: Arsenic, Rice, Soil Chemistry, Spectroscopy, Speciation

PALEOCLIMATOLOGY OF HOLOCENE AND PLEISTOCENE SEDIMENT FROM BIỂN HỒ MAAR LAKE, CENTRAL HIGHLANDS OF VIETNAM

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Abstract

Current trends in global warming will likely increase atmospheric humidity and affect the East-Asian monsoon system across Vietnam. It is essential for evaluating current and potential future trends in global climate change to properly understand the past climatic variability at the regional to local scale. In the absence of a historical climate narrative and long instrumental records in Vietnam, we must rely on geoarchives that recorded the paleo-environmental history. Biển Hồ (pronounced “bee en hoe”) is a volcanic crater lake (i.e. maar, 14° 03’ N, 108° 00’ E) in the Central Highlands of Vietnam that has been accumulating sediment for tens of thousands of years. Biển Hồ was largely spared from the ravages of the Vietnam war because a U.S. base was located nearby. Today, the maar holds a ca. 21 m deep, environmentally protected lake and provides water for the nearby city of Pleiku. In field campaigns between 2016 and 2021, numerous gravity and piston cores were recovered with lengths of up to ~25 m. Paleomagnetic measurements and radiocarbon ages of fossilized terrestrial plant fragments and bulk organic carbon in sediment document continuous sedimentation, with sediment at a depth of 25 m corresponding to an age of 57 kyr. Multiproxy analyses, including sedimentological and geochemical characteristics of the lake sediment records, help reconstruct the local and regional environmental history with respect to both long-term trends and extreme weather events and anthropogenic changes in hydrology across several millennia. XRF-based elemental abundance records document significant changes in the chemical composition of the sediment. Bulk isotopic analyses reveal a shift of $\delta^{13}\text{C}$ ratio around the Pleistocene/Holocene boundary that suggest a vegetation change after the Last Glacial Maximum. Interpretation of these geochemical data for Biển Hồ sediment will be aided by evidence from pollen, and diatom data expected for late 2024. More advanced coring in the future may reach basaltic bedrock in the center of Biển Hồ and extend the record to more than 200 ka BP, since the last regional volcanism and the age of the maar are believed to date back at least 0.2 Myr. This estimate would potentially allow a paleoclimate record reaching at least back to the Eemian, i.e. MIS 5e (approx. 125 ka BP).

Keywords: *sediment coring, maar lake, paleoclimate, Asian monsoon, Pleistocene, Holocene*

APPLICATION OF THE CUMNOX/GAC CATALYST FOR REMOVING VOCs IN THE ADSORPTION-OXIDATION PROCESS

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Abstract

With the vigorous development of industry and technology, air pollution is becoming more and more serious. Most VOCs are toxic, or the potential substances cause cancer that harms human health. Besides, VOCs contribute to environmental phenomena such as ozone depletion, acid rain, and photochemical smog. Therefore, removing VOCs has been a concern and has been researched for a long time.

Compared to the different technologies, adsorption is the most common technology because of its high adsorption capacity and low-temperature process advantages. However, it is not suitable to apply for removing VOCs with a small amount or unvalued VOCs, which are not worth recovering. Besides, the polluted substances must be desorbed and treated secondary after the adsorption process. Whereas, catalytic oxidation has the advantages of low concentration of organic waste gas, energy-saving, simple operation, high efficiency of pollutant removal, low auxiliary cost, and less secondary pollution. Therefore, combining adsorption and catalytic oxidation is proposed to have many advantages in the two processes.

The optimization of the composition and the synthesis method is the most important issue in the improvement process of the activity of catalysts. Following many previous studies, noble metals (Pt, Au, and Pd) have had high performance in toluene oxidation at a low temperature. However, the scale application has been limited by the high price of the catalysts. Transition metals have been used to solve this problem. Among them, manganese oxide is one of the high-activity catalysts for the oxidation of CO and VOCs, e.g., toluene and benzene, at a relatively low cost. Therefore, it has recently attracted considerable scientific research and application. The structure of manganese-based oxide contains many lattice oxygens instability.

Consequently, it is possible to store oxygen in the crystal lattice and improve CO and VOCs oxidation process. Furthermore, the catalytic activity of manganese base catalysts depends on the oxidation states of manganese, and composite metal oxides usually show better catalytic activity than single oxides.

Our research showed that CuMnOx powder (with a molar Cu/Mn ratio of 0.515) has a high catalytic activity in the benzene and toluene oxidation process at 250°C. In contrast, granular activated carbon

(GAC) has a high surface area, high adsorption capacity, and good thermostability at high temperatures. Moreover, the powder catalysts could cause clogged pipe entirely, so applying the kind of catalyst in the industry was difficult. Thus, the CuMnOx/GAC catalyst was studied for application in gaseous treatment systems. In this study, the CoMnOx/GAC catalyst for the adsorption oxidation process of benzene was prepared by the impregnation method and characterized by modern techniques. This work evaluated the catalytic activity of the CuMnOx/GAC catalyst with the active phase in the region from 4% to 25% at 150°C, 180°C, and 250°C in the adsorption–oxidation process. It was found that CuMnOx/GAC with a 25% active phase has a large adsorption capacity, desorption capacity, and 100% benzene conversion into CO₂ at 250°C. Therefore, the CuMnOx/GAC catalyst can be applied in the adsorption-oxidation system to remove VOCs before releasing the environment.

Key words: Manganese copper oxides catalyst, Granular activated carbon (GAC), the adsorption – oxidation process

DYNAMIC OF MICROBIAL DEVELOPMENT AND MEMBRANE FOULING BEHAVIORS IN ANAEROBIC MEMBRANE BIOREACTOR (ANMBR) SYSTEM FOR SEAFOOD PROCESSING WASTEWATER TREATMENT

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Abstract

The seafood processing industry in Vietnam has experienced substantial growth, driven by increasing market demand and consumption. This growth, however, has resulted in several environmental impacts. In response to these environmental concerns, the use of Anaerobic Membrane Bioreactors (AnMBRs) has gained popularity. AnMBRs combine microbial organisms present in sludge with filter membranes for wastewater treatment. They are known for their high efficiency and versatility in treating various types of wastewater. Nonetheless, a common issue in AnMBR systems is membrane fouling, which can significantly reduce overall treatment efficiency. In this study, granular sludge was collected from a wastewater treatment plant and cultivated in a lab-scale wastewater treatment system to evaluate its growth. Additionally, membrane fouling behaviors will be investigated by testing Polyethersulfone (PES) Ultrafiltration (UF) membranes efficiency in treating seafood wastewater. The AnMBR systems were operated continuously, with samples collected at various intervals to measure parameters such as COD, TSS, NH_4^+ , NO_2 , NO_3 , TN, TP, and PO_4^{3-} . The results demonstrated that the sludge exhibited favorable characteristics, with MLSS ranging from 2500-7000 mg/L and SVI from 30-50, indicating good adaptability of microbial development. Regarding contaminant removal, AnMBR system achieved over 70% COD removal efficiency, and notably, nearly 97% TSS removal efficiency. However, certain parameters such as TP and TN showed lower removal efficiency, averaging around 20-30%. This can be explained by membrane fouling caused by the accumulation of contaminants and sludge on the surface and inside pores of membrane, which limits the membrane process. In summary, this study provides valuable insights into the membrane fouling and the potential of microbial development of granular sludge in laboratory-scale AnMBR systems for seafood wastewater treatment. These findings have the potential to benefit the seafood industry by helping it meet the allowable standards outlined in QCVN 11-MT:2015/BTNMT.

Keyword: *Seafood wastewater, anaerobic membrane bioreactor, microbial communities, membrane fouling.*

PREDICTING *CHLOROPHYLL-A* CONCENTRATION IN THE MEKONG RIVER OF VIETNAM USING PHYSICOCHEMICAL PARAMETERS AND REMOTE SENSING DATA

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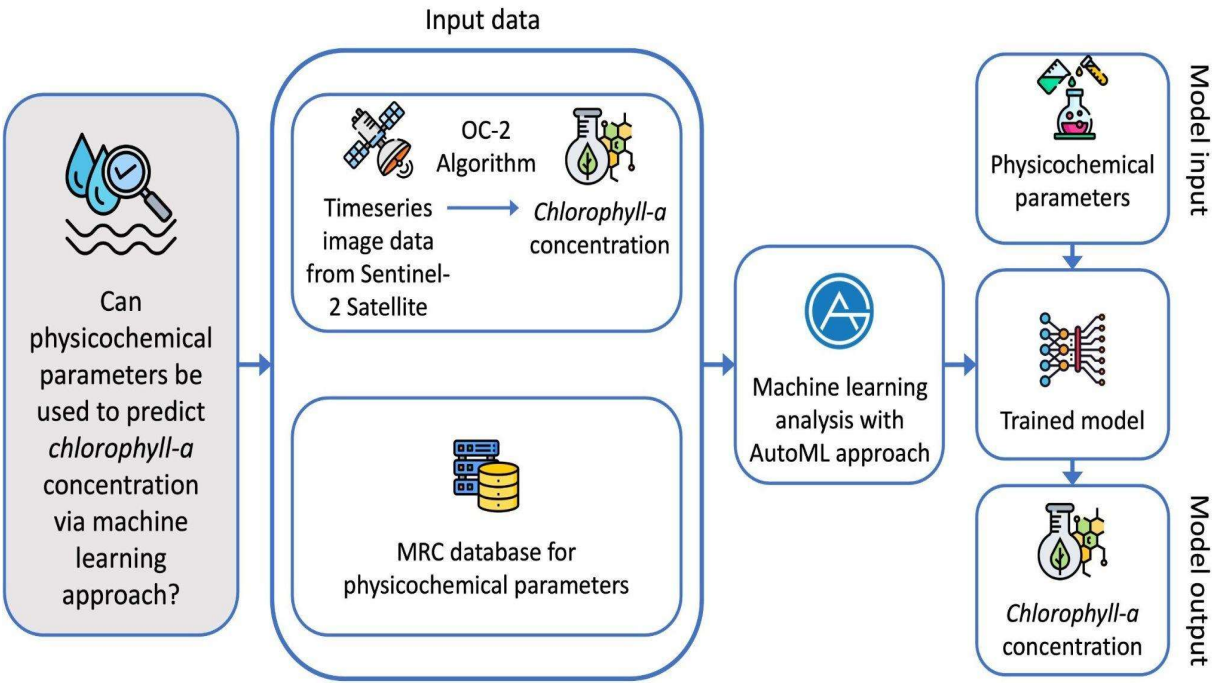
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Abstract

Eutrophication, known as excessive algal growth in aquatic environments due to enriched nutrients and minerals, has a negative impact on the quality of freshwater. The Mekong River in Vietnam, a crucial home for aquaculture industries, lends heightened weight to the eutrophication issue. Predicting eutrophication, indicated here as the concentration of *chlorophyll-a* (a pigment produced by photosynthetic organisms), using environmental physicochemical parameters and remote sensing data, is essential to inform the health of the aquatic environments, hence providing better support to the aquaculture practices in the Mekong, especially in the absence of in-situ and real-time monitoring data. In this study, we use nine environmental physicochemical parameters of water quality obtained between 1985 and 2021 from 121 sampling sites in Mekong River, Vietnam including pH, water temperature, conductivity, total suspended solids, chemical oxygen demand, dissolved oxygen, sulfate, nitrite-nitrate, and phosphate (data from the Mekong River Commission database). The development of a unique machine learning framework targeted at forecasting *chlorophyll-a* concentration based on the aforementioned environmental parameters is validated by Sentinel-2 Multispectral Instrument (MSI) image data. Our methodology includes the integration of geospatial coordinates (latitude and longitude) associated with satellite image data obtained from Google Earth Engine, subsequently undergone a transformation into a comprehensive training dataset for *chlorophyll-a* concentration estimation using the OC2 algorithm. This enriched combined dataset is employed as the foundation for AutoML-based approach with a 70% training set and 30% test set, facilitating the prediction of the *chlorophyll-a* concentration index based on environmental physicochemical data. Standard statistical metrics like the Coefficient of Determination (R^2), Root Mean Square Error (RMSE), and Mean Absolute Error (MAE) are used to evaluate the effectiveness of our model. The preliminary findings show that our model performs efficiently ($R^2 > 0.9$) in predicting the concentration of *chlorophyll-a* in the studied area. The findings from this study initiate the first step toward developing an effective tool for tracking and combating eutrophication in the Mekong Delta.

Graphical Abstract



HEALTH RISKS AND POTENTIAL SOLUTIONS FOR REMOVING MICROPLASTICS AND CO-CONTAMINANTS IN WATER SUPPLY SYSTEMS: A REVIEW

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Abstract

Microplastics (MPs), which are globally detected across various environments, have attracted significant attention due to their potential threat to water quality, especially water supply systems. MPs serve as transport vectors for toxic chemicals within ecosystems; however, they also contain intentionally added hazardous ingredients to enhance polymer properties and lifetime. This review attempts to shed light on the existence of harmful chemicals within MPs as well as their ability to adhere to emerging pollutants and organisms. Furthermore, the effects of MPs on human health and several viable solutions to co-treat these interactions are also discussed. The results show that MPs not only contain harmful chemicals like phthalates or polybrominated diphenyl ethers but can also adsorb, absorb, and release persistent organic pollutants (POPs) such as per- and polyfluoroalkyl substances (PFASs). In addition, long-term exposure to microplastics can have detrimental effects on human health, including the digestive, respiratory, endocrine, reproductive, and immune systems. To address these issues, ion exchange resins, synthetic adsorbent materials, coagulation, and advanced technologies like electrochemical oxidation can effectively eliminate these contaminants with treatment efficiencies exceeding 90%. In contrast, biological processes are less commonly employed, primarily due to their lower treatment efficiency, typically around 40%. Thus, understanding the negative impacts of MPs and co-contaminants on human health as well as proposing feasible solutions for mitigating these emerging pollutants are necessary to protect both the environment and public health.

Keywords: *Microplastics, Co-contaminants, Health risks, Potential solutions, POPs.*

POPULATION STATUS OF THE RED-SHANKED DOUC IN SON TRA NATURE RESERVE, DA NANG

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Abstract

The Red-shanked Douc (*Pygathrix nemaeus*) is an endangered primate found in Vietnam, Laos, and Cambodia. The largest populations of the Red-shanked Douc are reported to be in Laos, while the doucs's record in Cambodia is in a restricted region close to the border with Vietnam and Laos. In Vietnam, the douc is documented to be from Pu Mat National Park, Nghe An to Ba Na Nui Chua Nature Reserve, Da Nang. *P. nemaeus* is classified as Critically Endangered by IUCN throughout its entire range, and is believed to have experienced a major decline of more than 80% of its population over the last 40 years due to a combination of habitat loss, and illegal hunting. Hunting is currently the main threat to the Red-shanked Douc, mostly for subsistence use and traditional medicine. Destruction of its natural habitat is the second major threat to *P. nemaeus*, as many areas in Central Vietnam have been cleared and shifted to anthropogenic land uses due to the rapid growth of Vietnam's population and economy. As often the case with endangered species, laws and regulations created to protect them are difficult to enforce – even though the country has granted the Red-shanked Douc the highest protection status. To ensure the survival of this species, it is important to have accurate and up-to-date information on the population status, distribution and conservation needs for the doucs.

In Vietnam, the largest population of the Red-shanked Douc is found in Phong Nha – Ke Bang National Park, Quang Binh, with about 445 to 2,187 individuals. The second largest population exists in Son Tra Nature Reserve, Da Nang, with around 171 individuals in 12 groups from the most recent survey in 2008. Since then, no updated published data is available for the population size and distribution of the doucs in Son Tra, and hence population trends of those critical groups remain unknown. Given that there has been an intense pressure from many economic sectors to have more infrastructure developments in Son Tra, having regularly updated information on the *P. nemaeus* population in Son Tra is crucial in protecting remaining available habitats. Therefore, to address this information gap, we conducted the field survey in March 2023 to collect data on the current status of the Red-shanked Douc Langur population in Son Tra.

In this study, two main methods for collecting data on the population status of the Red-shanked Douc were line transect survey and observation point survey. If the doucs were spotted, we used long-range observation devices including binoculars and cameras to search, detect, observe, record, and count the douc group. Simultaneously, information about the group, including observation time, observation coordinates, distance from observers, group structure, group characteristics, etc., was recorded in the field form. Due to the social structure and migratory behavior of doucs, different douc groups were

distinguished based on the number of adult males/females and the number of juveniles, as well as the location where the group was found. Groups that could not be clearly distinguished were treated as a single group.

The results showed that in March 2023, there were 16 groups with about 114 – 118 observable individuals of the Red-shanked Douc in Son Tra (Fig 1). However, one problem of field primate survey is imperfect detection, in which only a few individuals of a much larger group were observed and recorded. In this study, there were many groups that had only 1-2 adult females, which were much lower than the natural size. Therefore, the population size of the doucs in our study might be underestimated. The actual size of the Red-shanked Douc population in Son Tra may be much higher than the observed number. Previous studies have calculated the average group size of *P. nemaeus* in Son Tra at 14-18 individuals per group. Hence, for 16 recorded groups, the upper bound limit for the doucs may be around 224 – 288 individuals.

In addition, according to our observations during field surveys, the Red-shanked Douc often occurs in evergreen forest habitats that have not endured significant human impacts. We did not record any douc group in the grassland/shrubland areas, or forest areas that are subjected to heavy human disturbances. *P. nemaeus* usually only lives and moves along the canopy and sub-canopy of the forest structure, and they are often recorded in the Northern side of Son Tra. In the Southern part of the peninsula, there are many human activities, including very busy shipping and transportation activities in a major seaport of Da Nang. Therefore, the remaining habitat of the doucs is under constant threats from various human activities, such as logging, land conversion, transportation, and tourism development. Hence, our results emphasize the urgent need for conservation measures to protect the remaining habitat of the Red-shanked Douc in Son Tra and to ensure the long-term survival of this critically endangered species.

In conclusion, our study provides updated information about the current status of the Red-shanked Douc population in Son Tra Nature Reserve, Da Nang. This study was carried out in March 2023 in Son Tra, with line transect and observation point survey methods. We recorded 16 groups of *P. nemaeus* in Son Tra with about 114 - 118 observable individuals. However, based on previous studies, the total population size of the doucs in Son Tra may be as high as 224 – 288 individuals. The study identified the main threats to *P. nemaeus* in Son Tra as habitat loss due to economic activities and development projects. Hence, continuous law enforcements and conservation activities are essential in protecting this second most important population of the Red-shanked Douc in Vietnam.

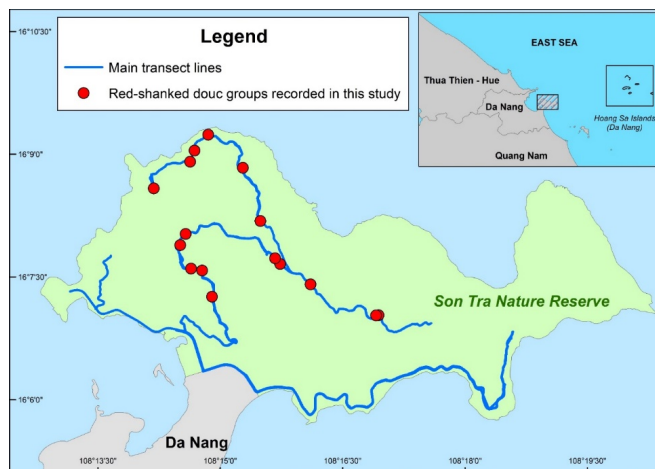


Fig 1. Red-shanked douc groups recorded in our field survey

HIGH-THROUGHPUT ANALYSIS USING 16S rRNA GENE OF BACTERIAL COMMUNITIES PRESENT IN SELECTED BIVALVES AND GASTROPODS SPECIES FROM BAYUG ISLAND, ILIGAN CITY, PHILIPPINES

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Abstract

Seashells, including bivalves and gastropods, are known worldwide due to their significant contributions in terms of economy, ecology, and medicine. This is evident as they serve as a source of food and are valued as excellent biological indicators. This study aims to identify the bacterial communities present in selected edible species of bivalves (*Pinctada margaritifera* and *Anadara granosa*) and gastropods (*Canarium urceus* and *Conus stercusmuscarum*), and diversity through eDNA metabarcoding. Water samples were collected from the selected species of bivalves and gastropods using a swabbing technique. The samples were subjected to genomic DNA isolation, followed by amplification and sequencing of the V3-V4 region of the 16S rRNA gene using the Illumina MiSeq platform. Data analysis was done through Parallel meta suite software. Four amplicon libraries were created representing two species of Bivalves and two species of gastropods in the study area. 173,489 amplicon sequence variants (ASVs) were obtained after quality control and processing. Among the bacterial community, the genera *Stenotrophomonas*, *Vibrio*, *Serratia*, *Photobacterium*, and *Shewanella* were found to be the most abundant. The analysis of Shannon index, which indicates the alpha diversity of the bacterial community, revealed higher diversity in *Anadara granosa*. Also, the analysis using PICRUST algorithm within the Parallel Meta Suite, revealed that specific bacteria found in selected species of gastropods and bivalves are involved in various functions such as protein production, xenobiotic metabolism, biodegradation, and other metabolism-related processes, that can be utilized to support their ecological and physiological functions.

Keywords: Bacteria, Bivalves, Gastropods, Parallel meta suite, Seashells

HIGH-THROUGHPUT 16S RRNA GENE SEQUENCING ANALYSIS OF BACTERIAL COMMUNITIES ASSOCIATED WITH SELECTED MANGROVE SPECIES FROM BAYUG ISLAND, ILIGAN CITY, PHILIPPINES

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Abstract

Mangrove ecosystems have significant ecological and economic importance due to their valuable services. These ecosystems act as protective barriers, safeguarding coastlines from storms and erosion. Additionally, they can break down pollutants and serve as essential nurseries for various aquatic organisms. The dynamic nature of mangrove environments offers specialized ecological niches, accommodating a diverse range of organisms, including bacterial communities. This particular study aimed to investigate the bacterial communities inhabiting five mangrove species (*Rhizophora stylosa*, *Rhizophora apiculata*, *Rhizophora mucronata*, *Sonneratia alba*, and *Ceriops tagal*), as well as one associate mangrove species (*Nypa fruticans*). Assessing bacterial diversity and abundance unravel the functional roles of these communities within the productive mangrove ecosystem. Soil samples from the rhizosphere of mangroves were collected from Bayug Island in Iligan City, Philippines. Genomic DNA was subsequently isolated from the samples and the V3-V4 region of the 16S rRNA gene was amplified and sequenced using the Illumina MiSeq platform. Six amplicon libraries were created, each representing one of the six mangrove species in the study area. Data analysis was performed using the Parallel Meta Suite software. Following quality control and processing, 173,270 amplicon sequence variants (ASVs) were obtained. The top five most abundant ASVs were identified as belonging to the genera *Vibrio*, *Stenotrophomonas*, *Serratia*, *Pseudoalteromonas*, and *Achromobacter*. The Shannon index, a measure of bacterial community's alpha diversity, revealed a higher diversity in *Sonneratia alba*. Utilizing the PICRUST algorithm within the Parallel Meta Suite, the analysis discovered that certain bacteria play roles in biodegradation, xenobiotic metabolism, and metabolism-related processes. The presence of these bacteria suggests their potential utilization in various applications such as environmental cleanup, bioremediation, waste treatment, biotechnology, industrial processes, agriculture, and soil health improvement.

Keywords: Mangrove, Bacterial Community, Abundance, Diversity

ANTIBACTERIAL ACTIVITY OF SEA HARE (*DOLABELLA AURICULARIA*) EGG STRING EXTRACTS AGAINST POTENTIALLY PATHOGENIC BACTERIA USING BROTH MICRODILUTION METHOD

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Abstract

Pharmaceutical industries now recognize the vast variety of ocean organisms, each possessing distinct biological characteristics. Sea hares, for example, are marine organisms that utilize bioactive chemicals as a defense mechanism against predators, including their eggs. To explore the potential antibacterial properties of sea hare species (*Dolabella auricularia*) found in Pujada Bay, Philippines, egg strings were collected and extracted using hexane and methanol solvents. The antibacterial activity of each fraction was determined through minimum inhibitory concentration (MIC) testing against four potentially pathogenic bacteria, *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli*, and *Pseudomonas aeruginosa*. The broth microdilution method was employed to assess the antibacterial activity of *Dolabella auricularia* egg strings. Results revealed the MIC values for hexane extracts which exhibited 0.23 mg/ml, and 0.33 mg/ml against *E. coli*, and *P. aeruginosa*, respectively. While methanolic extracts displayed an MIC of 1.46 mg/ml against *E. coli* and an even more potent MIC of 0.79 mg/ml against *P. aeruginosa*. In the case of *B. subtilis*, the hexane extract had an MIC of 1.5 mg/ml, while the methanolic extract exhibited an MIC of 0.83 mg/ml. Lastly, against *S. aureus*, hexane extracts suppressed the growth with an MIC of 0.77 mg/ml, while methanolic extracts demonstrated an MIC of 3.33 mg/ml. These findings showcase the promising antibacterial activity of *Dolabella auricularia* egg string extracts and highlight their potential for further investigation and development in the pharmaceutical field.

Keywords: sea hare, broth microdilution method, antibacterial, Pujada Bay, biological characteristics

HIGH-THROUGHPUT SEQUENCING OF DIATOMS USING V4 REGION OF 18S RRNA GENE IN BAYUG ISLAND, ILIGAN CITY, PHILIPPINES

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Abstract

Diatoms are the primary contributors to aquatic primary production and are the most dominant phytoplankton. Their adaptability and growth in diverse natural resources enable them to thrive in various climates and geographical areas, making them suitable for various applications. This study aimed to analyze the diatom composition in two study sites, namely the sanctuary mangrove area and the estuary, located in Bayug Island. The analysis was conducted using metabarcoding of the V4 region of the 18S rRNA gene, amplified and sequenced on the Illumina MiSeq platform. Four amplicon libraries were generated, representing the diatom composition at the two study sites. Data processing was performed using the Parallel-Meta-Suite software. Following quality control and processing, 20,433 amplicon sequence variants (ASVs) were obtained. Among these, the genera *Navicula*, *Thalassiosira*, *Chaetoceros*, *Guinardia*, *Amphora*, and *Minidiscus* were the most abundant ASVs. The assessment of diatom alpha diversity using the Shannon index indicated a higher diversity in the estuary site. Furthermore, the analysis using the PICRUST algorithm within the Parallel Meta Suite suggested that the presence of these specific diatom species exhibited a significant response to salinity levels, potentially indicating environmental disturbances such as water pollution. The presence of these diatoms has the potential to be utilized in environmental treatments, disease prevention, biotechnology, and as nutrient indicators for other marine organisms.

Keyword: diatoms, abundance, diversity, parallel-meta-suite

MEDIUM-RANGE WEATHER FORECAST USING PREDICTIVE RECURRENT NEURAL NETWORKS

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Abstract

Numerical Weather Prediction (NWP) models provide reliable global forecasts but require high computational cost. Deep Learning (DL) emulators trained on NWP outputs offer cost-effective and reliable forecasts. However, current DL models oversimplify the temporal component leading to prediction errors accumulated quickly as the lead time increase.

We propose a DL architecture with more focus on weather variables' dynamics through time. Our Predictive Recurrent Neural Network (PredRNN), previously used for modeling video dynamics, was trained on outputs of the European Centre for Medium-Range Weather Forecasts (ECMWF). Furthermore, we incorporated two physical constraints, namely, mass conservation and dry static energy, into our DL architecture for sustaining reliable forecasts of up to 2 weeks.

Our results show that the PredRNN has excellent performance in forecasting wind speed, precipitation, sea surface pressure, temperature, specific humidity and geopotential height. Our findings suggest that incorporating temporal dynamics and physical constraints in DL weather forecasting models can improve their accuracy.

APPLICATION OF LONG SHORT-TERM MEMORY (LSTM) NETWORK IN SEASONAL WEATHER FORECASTING FOR VIETNAM

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Abstract

Seasonal temperature and rainfall forecasting are in growing demand across various socio-economic sectors, including water resource management, agricultural production, and natural disaster prevention. This study aims to assess the effectiveness of applying an LSTM network to predict monthly rainfall and temperature in seven climatic sub-regions of Vietnam, considering lead times of 1, 3, and 6 months. We utilize climate indices and observed stationary data spanning from 1980 to 2020 as input. In our investigation, we employ both climate indices and neighboring station data as potential predictors. Our results indicate that across all stages, including training, validation, and testing, the mean absolute errors (MAE) and root mean square errors (RMSE) are notably low, with correspondingly high correlation values. For lead times of 1-3 months, the results demonstrate improved performance when incorporating additional station data as predictors. Conversely, for longer lead times, the use of climate indices alone enhances predictive accuracy. With positive MAE skill scores surpassing climatology forecasts, our findings underscore the potential of this method for operational forecasting.

Keywords: Seasonal weather forecasting, LSTM, rainfall, temperature, Vietnam.

NUMERICAL INVESTIGATIONS ON SEASONAL VARIATION OF WAVES IN THE CAT BA – HA LONG COASTAL AREA

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Abstract

Based on the reanalysis of meteorology data NCEP CFSV2, the third-generation wave model SWAN (Delft3D model) was used to simulate waves in the Cat Ba– Ha Long coastal area for one year (2021). The model accuracy was compared with measure data at Hon Dau and Co To stations. The results showed that: (1) there was a good agreement between observation data and calculation. (2) In the study area, the northeasterly waves prevailed in the Northeast monsoon, the southerly waves reigned in the Southwest monsoon, and the east-southeast waves predominated during the periods of the transitional seasons. Waves were stronger in monsoons than in the transitional seasons, up to the strongest in Northeast monsoons and down to the weakest when changing from winter to summer. (3) While wave heights ranged from 0.6-1.0m in the South, Southwest of Cat Ba, and South of Ha Long Bay during the Southwest monsoon, they reached 0.8-1.5m in the Southeast of Cat Ba-Ha Long during the Northeast monsoon.

Keywords: Delft3D, SWAN, Hai Phong-Ha Long, waves

APPLYING A MACHINE LEARNING-BASED METHOD FOR THE PREDICTION OF SUSPENDED SEDIMENT CONCENTRATION IN THE RED RIVER BASIN

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Abstract

Knowledge of sediment transport is important to understand the transportation and recycling of elements and matter in the Earth system. However, SSC measurements are often inadequate in river systems. In this study, we performed a Tributary-based Downstream gauge Estimation (TDE) machine learning (ML) approach to estimate suspended sediment concentration (SSC) at Son Tay hydrological station based on SSC and river discharge (Q) data from three upstream stations, one per tributary of the Red River. A comparative analysis of four ML algorithms, including Multiple Linear Regression (MLR), Elastic Net (EN), Random Forest (RF), and Support Vector Machines (SVM) was conducted. Results showed that the SVM algorithm with linear kernel exhibited the highest accuracy ($r^2 = 0.87$ and RMSE = 64.7 mg L⁻¹). The performance of the TDE-ML was better in the high-flow period. This approach also revealed the role of SSC contribution of each upstream station to the downstream station.

Keywords: Machine learning, Red River, tributary-based approach, sediment transport, modelling

SINGLE VS. COMBINED MODELS: A REVIEW OF CURRENT TRENDS IN FLOOD MODELING AND DRIVERS FOR PREDICTION MODELS SELECTION

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Abstract

Flood is a major destructive natural disaster that causes losses of human life and disruption to economic and social development. Therefore, flood forecasting, as a non-structural measure, plays a crucial role in flood management to help countries come up with mitigation and prevention strategies. There have been a great number of studies done on flood prediction using hydrological, hydraulic, remote sensing, and machine learning (ML) techniques. While most of the published studies focused on the models' strengths and weaknesses and applications in studying flood behaviors, comparison of advancements between single and combined models and the driving factors behind decisions to choose particular models were rarely explored. Therefore, the purpose of this study is to review current trends in using combined models - models that applied more than one technique mentioned above - compared to single models that applied only one technique, in flood forecasting for three types of floods, namely fluvial, pluvial, and coastal flooding. Using a Scopus search, we found 227 papers on single and combined flood modeling techniques published between 2017 and 2023. We then chose 103 articles that fit the study objectives for further analysis. We found that most of the flood modeling studies were done in Asia with 60 articles (Figure 2). America came in second with 22 articles, while 16 articles were conducted in North America. Although single models still dominated flood modeling research, the ratio between single and combined model articles was quite balanced at 53% and 47% respectively. Hydrological models (25 articles) were studied as often as ML models (24 articles) in single-model research. However, this trend was observed only in Asia, whereas in America, ML models (7 articles) were studied more than hydrological (3 articles) and hydraulic (3 articles) models. No single ML application in flood study was found in Europe and Africa. ML was preferred in combined models during the study period, accounting for 56% of the total 48 articles. The most common combination was hydrological and ML models where most of the studies showed that using these two approaches improved forecast accuracy compared to using either one of them exclusively. The results of the review provide valuable insights for researchers in selecting the most suitable flood forecast techniques depending on the type of floods and the study catchment's characteristics.

Keywords: Flood modeling, remote sensing, machine learning, combined model, single model

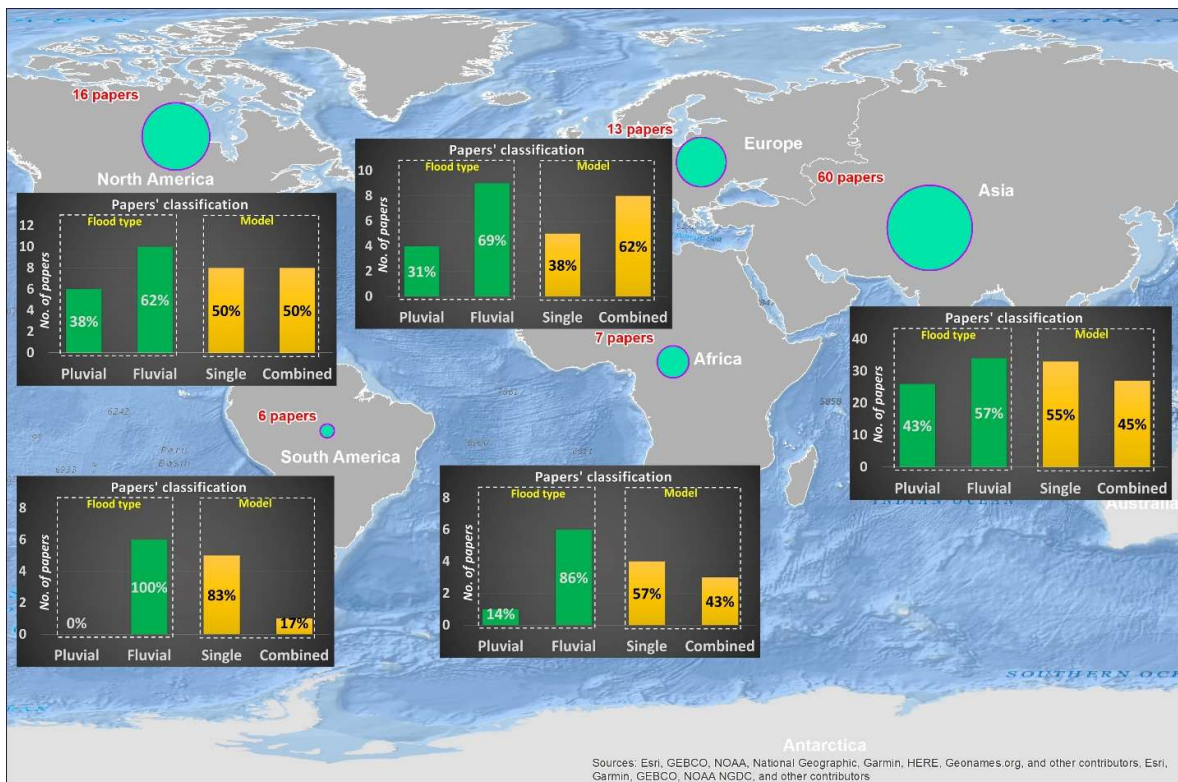


Figure 2: Distribution of single and combined flood forecast model studies between 2017 - 2023.

NUMERICAL MODELING OF TURBIDITY MAXIMUM DYNAMICS IN THE CAM -NAM TRIEU ESTUARY (VIETNAM)

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Abstract

The turbidity maximum dynamics in the Cam -Nam trieu estuary were replicated successfully by applying Delft3D model. Observation data of water level, salinity, turbidity and Suspended Sediment Concentration (SSC) in May and September 2015 were used to calibrate and validate the model. Nash-Sutcliffe Efficiency (NSE) between observed and simulated water level ranges from 0.845 to 0.972, showing a very good simulation. Simulated salinity and SSC follow a similar trend with that observed. The model successfully reproduces 2 types of Estuarine Turbidity Maximums (ETMs) along the Cam-Nam Trieu estuary in 2015: an upper well-mixed ETM with high SSC up to the surface at low salinity (from 0.1 psu), and a lower ETM confined in the bottom layer (salt wedge) at salinities between 12 psu and 20 psu in stratified waters. Their length depended on the longitudinal salinity gradient and was highest at low tide than at high tide. Turbidity was higher in the upper section of ETM in dry season and in the lower part during wet season. Both ETM components show seasonal movements in their locations, moving upstream during dry season and downstream during wet season.

Key words: *Cam-Nam Trieu Estuary, Delft3D, Estuarine turbidity maximum, Suspended Particulate Matter*

LARGE DAM IMPACT RECORDED IN TIEN HAI WETLAND SEDIMENT CORE, THE RED RIVER DELTA, VIETNAM

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Abstract

The Da River is one of the main tributaries of the Red River system in northern Vietnam. Hoa Binh reservoir-dam in the Da River came into operation in 1989 which caused a decrease in the sediment supply and resulted in a reduction of annual suspended particulate matter delivery to the Red River delta (Dang et al., 2014; 10.1016/j.scitotenv.2010.07.007). Other large dams have been subsequently constructed and operated within the Red River watershed over the last 30 years. The Tien Hai Wetland Nature Reserve (Tien Hai WNR) is a coastal wetland area located north of the Ba Lat estuary - the largest mouth of the Red River in Thai Binh province. In the Tien Hai WNR, there is a system of tidal channels, tidal flats where mangrove forests grow, and barrier bars that are separated from the tidal flats by a shallow lagoon (Anh, 2022; 10.1016/j.marpolbul.2022.114278). Back-bar sediment cores with a total thickness of 240 cm were retrieved in 2020 and 2023 in a tidal channel near the boundary between a current mangrove forest and the lagoon. The cores have been photographed, subsampled, and analyzed for sediment physical characteristics including grain size, loss on ignition and susceptibility, and ¹³⁷Cs chronology to learn how the sedimentation rate changed after 1989. Below sediment depth of 100 cm, visible laminations of sand-dominant and silt/clay-dominant sediments can be observed downcore. Carbonate shell fragments are abundant only at 0-60 cm intervals. ¹³⁷Cs chronology reveals that the topmost 80 cm of the sediment cores provide a record of the last ~80 years of sedimentation history. The average sedimentation rate of the pre-1989 period is ~1.22 cm/year, whereas the post-1989 average rate is ~0.88 cm/year. Data of sediment grain size, sand and clay fractions, organic matter content, and magnetic susceptibility indicate a relatively stable trend over time with the exception of some short intervals with intermittent lows or highs. Our sediment cores at the Tien Hai WNR have the potential to record the impact of large dam-reservoir constructions, including the Hoa Binh dam-reservoir on reducing the sedimentation rate at the Red River delta, thus increasing understanding of modern sediment budget for the Red River subaqueous delta in the Gulf of Tonkin.

Keywords: Tien Hai, sediment core, mangrove, back-bar, dam, reservoir, Red River delta

PRELIMINARY INSIGHT INTO DISTRIBUTION AND SOURCE OF CLASTIC MATERIALS IN SURFACE SEDIMENTS IN THE BA BE LAKE, VIETNAM

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Abstract

The Ba Be lake, the largest natural fresh water lake in Vietnam, is a prominent geographical-geological landscape containing an abundant bio-diversity system. Currently, the Ba Bể lake has been sustainably explored for tourism since it was respectively recognized as one of twenty special lakes in the world in 1995, the ASEAN Heritage Park in 2003, and the National Special Relic Area in 2012. Three rivers, including the Ta Han, Bo Lu, and Leng rivers feed into the Ba Be lake from the south and west. And the Nang river in the north is acting as a buffer regulating flooding of the lake when water is drained from the lake in the dry season, but is reversed in the wet season. The rivers flowing into the lake are important water resources and deliver large amounts of sediment to regional and catchment ecosystems. In this present study, the preliminary analysis of grain size and geochemistry of surface sediments, collected along the lake and at junctions of the lake with inflow rivers, is used to investigate the distribution and potential sources of clastic materials accessing the lake. The results show that the distribution of clastic sediments is insignificant spatial differences between in the junctions and along the Ba Be lake, but the silt content displayed higher values in the junctions. Principal component analysis integrated with correlation analysis revealed that weathering products formed on different parent rocks were the biggest contributor to the fine size of clastic grains, mainly ranging from silt to clay, while metal elements were primarily derived from both natural and anthropogenic sources. The findings could provide a scientific basis for environmental protection authorities to prevent and control the metal-containing sediment inflow. The geochemistry of surface sediments is a useful indicator of the impacts of intensified climate change and human activities in the Ba Be lake.

Keywords: surface sediment, junction, clastic materials, distribution, geochemistry

MANGROVE RESTORATION ELEVATES LOCAL CARBON STORAGE BUT CHANGES CENTENNIAL-SCALE CARBON BURIAL DYNAMICS

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Abstract

Mangrove forests are some of the most effective carbon sinks on Earth and have received growing interest in recent years as a nature-based solution to offset carbon emissions and mitigate climate change (blue carbon). Unfortunately, mangroves are globally threatened due to anthropogenic pressure, accelerating environmental change and disease. New approaches are therefore required to enable their long-term sustainable management. To achieve this, understanding the effects of active restoration efforts on mangrove blue carbon dynamics have become a conservation priority. Here, we investigated mangrove carbon storage over the past 120 years in and around the Xuan Thuy National Park in the Red River delta, northern Vietnam. We compared carbon storage over time in three contrasting mangrove systems: old-growth forest associated with intermediate-intensity shrimp farms, areas of artificial restoration, and areas of natural spontaneous regeneration. We found that the amount of carbon in the old-growth forest sediments has been higher than the restored or regenerated areas since the 1960s, peaking in the 1990s. This coincided with maximum sedimentation rates in the old-growth forests, which have been elevated since the 1990s – highlighting an interaction between the high sedimentation loads of shrimp farms and high entrainment capacity of mangrove prop roots. Using stable isotopes to characterise the source of the sediment carbon, we found that old-growth and naturally regenerated mangrove sediment carbon has been consistently dominated by marine plants and algae throughout our time record. Until the 1960s, the restored mangrove sediment carbon was also dominated by marine plants and algae. However, since then we have identified a shift in the carbon source, to a dominance of mangrove-derived organic matter. This suggests that restoration activities may change the carbon cycling of mangrove forests, creating a ‘closed’ system of autochthonous carbon fixation and storage, with reduced interaction with marine-derived carbon. Mangrove restoration therefore holds potential for promoting blue carbon storage, but this may coincide with a loss in external linkages – which may have cascading impacts on wider ecosystem functioning.

RIVERBANK EVOLUTION ASSESSMENT USING REMOTE SENSING AND GIS-DSAS: A STUDY ON THE HAM LUONG RIVER, VIETNAMESE MEKONG DELTA

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Abstract

Riverbank erosion is a long-term natural disaster occurring in almost all deltas worldwide. This study aims to assess the riverbank variations for the Ham Luong River, in the Vietnamese Mekong Delta from 1998 to 2020. Riverbanks were extracted from the Landsat satellite images using remote sensing combined with machine learning algorithms. Afterward, the riverbank change rate was analyzed using the Digital Shoreline Analysis System (DSAS 5.1) integrated with ArcGIS software. The results show that from 1998 to 2020, riverbank erosion was dominant over the accretion, with a total erosion length of 73 km (57.6% of the entire length of two banks) and an erosion area of 175 ha, compared to those from accretion, i.e., 56 km (44.2% of the entire length of two banks, which is 76.7% of the total erosion length) and 138 ha respectively. The erosion rates were mainly in low (-1.0 to -0.5 m/year) and medium levels (-3.0 to -1.0 m/year) categories, which occupied 10.35% and 9.5% of the total calculated transects respectively. Importantly, erosion mainly occurred along the right bank, with a mean net bank line erosion of -11.34 m/year. Considering the riverbank erosion in three temporal periods (i.e., 1998–2005, 2005–2017, and 2017–2020), we concluded that it tends to increase in both rate and scope. The period 1998–2005 had a net accretion area of 46.92 m²/year, and accretion occurred in both bank lines. However, riverbanks were predominantly eroded from 2005 to 2017, with a net erosion area of -9.34 m²/year, mainly on the right bank. That figure dramatically increased from 2017 to 2020 at -98.06 m²/year (more than ten times compared to that in 2005–2017), and erosion occurred in both left and right banks. Significantly, the riverbank was marginally eroded by the protection of the vegetation belt (e.g., in 1998–2005); however, it became rapid when the vegetation belt disappeared (e.g., in 2017–2020). The study recommends implementing effective measures to protect the Ham Luong riverbanks, especially protecting and restoring the vegetation belts. Integrating remote sensing and machine learning combined with GIS-DSAS is highly transferable for riverbank change analysis for the whole Mekong Delta and other river systems in Vietnam and the globe.

Keywords: Vietnamese Mekong Delta, erosion, accretion, remote sensing, machine learning, riverbank, DSAS

Graphical abstract:

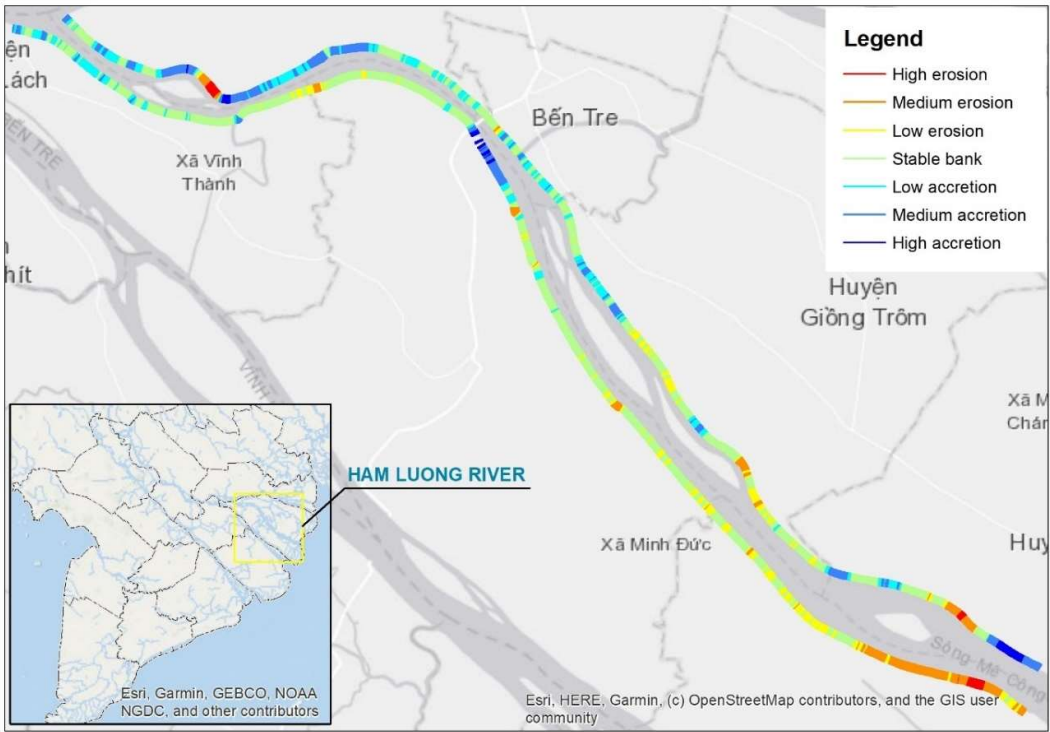


Figure 3. Morphological changes in the Ham Luong River from 1998 to 2020

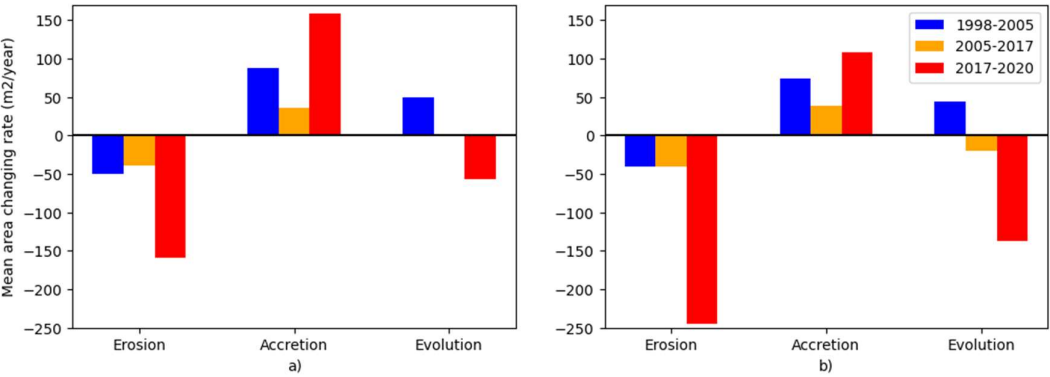


Figure 4. Mean area changing rate through three temporal periods in a) The left bank and b) The right bank

BUILDING A NEAR REAL-TIME BIOMASS BURNING AND WILDFIRE MONITORING SYSTEM IN SOUTHEAST ASIA COUNTRIES WITH GOOGLE EARTH ENGINE'S DYNAMIC WORLD DATABASE.

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Abstract

Dynamic World (DW) Database is Global 10m resolution near real-time land cover dataset, producing probabilities per pixel for 9 land types, useful for change-detection products and derivative maps from Google Earth Engine. This database classify landscape into 9 classes of landuse landcover (LULC): 'built', 'bare', 'grass', 'snow_and_ice', 'flooded_vegetation', 'trees', 'water', 'shrub_and_scrub', 'crops'. The classification is done by Fully Convolutional Neural Network (FCNN) classification model based on Sentinel-2 Top of Atmosphere, Dynamic World offers global land cover updating every 2-5 days depending on location.

In Southeast Asia, biomass burning activities (high season from December - February) and wildfires (high season from February - May) pose significant environmental and socio-economic challenges, including air quality deterioration, habitat destruction, and health hazards.

Previous monitoring systems on the issue, such as NASA's Fire Information for Resource Management System (FIRMS), primarily rely on satellite-based radiation detection of wildfire hotspots. Dynamic World's approach focuses on post-fire landscape change monitoring in near real-time. Specifically, it tracks alterations in land cover such as forestland depletion, crop loss, and grassland transformations following fire events in Southeast Asian countries. The system is built on a cloud-based server, providing automatic calculation of changes of forest, crop, grassland and providing visualization of events.

This research underscores the potential of Google Earth Engine's Dynamic World Database in addressing critical environmental challenges in Southeast Asia and serves as a model for enhancing landscape monitoring and disaster management worldwide.

Graphic abstract:

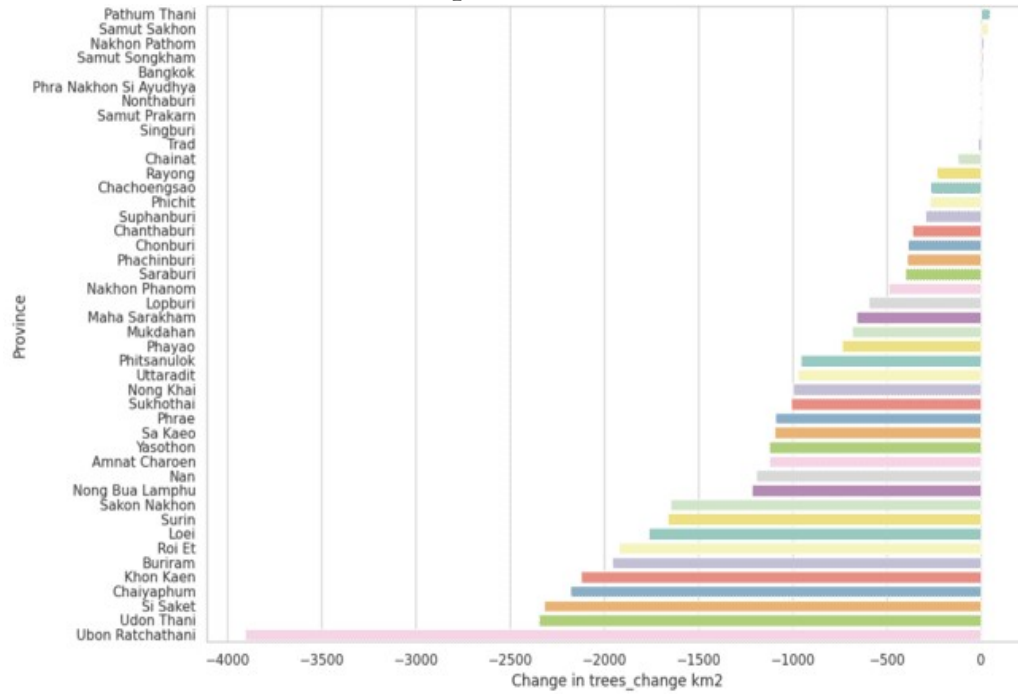


Fig.1: Change of 'trees' class of 59 provinces in Thailand, comparing from data of June - December 2022 to January - May 2023

(a) Brazil, 05 April 2021 (latitude: -22.193, longitude: -52.407)



(b) Poland, 02 April 2021 (latitude: 52.754, longitude: 20.331)

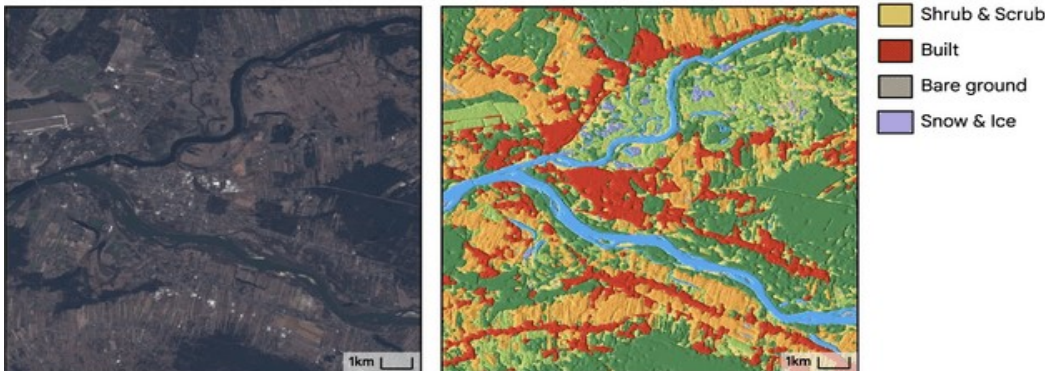


Fig.2: Examples of Sentinel-2 imagery (RGB) and corresponding Dynamic World NRT products for April 2021.

Location coordinates reported for image centroid.

(a) Brazil, *ee.Image('GOOGLE/DYNAMICWORLD/V1/20210405T134209_20210405T134208_T22KCA')* and corresponding Dynamic World labels.

(b) Poland, zoomed view of *ee.Image('GOOGLE/DYNAMICWORLD/V1/20210402T095029_20210402T095027_T34UDD')* and corresponding Dynamic World product with a hillshade on the Top-1 confidence class applied to the categorical labels, revealing features not normally visible with discrete valued LULC maps. (Brown et al, 2021, Figure 6)

COMPARISON OF MULTI-SOURCE SATELLITE REMOTE SENSING OBSERVATIONS FOR MONITORING THE VARIATIONS OF SMALL LAKES: A CASE STUDY OF DAI LAI LAKE (VIETNAM)

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Abstract

This study compares the capabilities of three satellites (i.e. Sentinel-1, Sentinel-2, and PlanetScope (PS)) for mapping and monitoring the variations of Dai Lai Lake, a small lake located in North Vietnam, for the 2018-2023 period. The analysis involves the utilization of Google Earth Engine to partially process Sentinel-1 and Sentinel-2 observations to extract the backscatter coefficient of VH polarization, and the NDWI and MNDWI maps. In contrast, PS observations are processed using local computers to generate the NDWI maps. The method for making the binary water/non-water maps primarily employs the Otsu threshold selection algorithm on each single map derived from the previous step. The findings reveal that Dai Lai Lake's surface water extent remains relatively stable over the six-year period, and is not strongly affected by the seasonal cycle. Depending on each satellite sensor, the difference between the minimal and maximal extent of the lake ranging from 15 to 20 ha. Although the spatial distribution patterns of the lake exhibit significant similarity, the estimated average water extent of the lake derived from 3m resolution PS imagery surpasses that obtained from 10m resolution Sentinel-2 and Sentinel-1 imagery by 2.17% and 5.60%, respectively. PS observations are effective for mapping and monitoring small lakes due to its high spatial resolution and daily revisiting frequency. However, scholars are advised to thorough testing the quality of the PS NIR band before incorporating it into their future research. Meanwhile, Sentinel-2 observations prove great effectiveness for lake monitoring, using both the NDWI and MNDWI. The main strength of Sentinel-1 satellite lies in its ability to operate under all weather conditions; however, potential misclassifications could arise due to similarities in backscatter coefficients of VH polarization between water surfaces and other flat surfaces. Each satellite platform exhibits distinct advances and limitations; therefore, to comprehensively monitor spatial-temporal variations of small lakes over extended period, scholars should collect observations from all available satellites.

Keywords: *Lake mapping; Lake monitoring; Sentinel-1; Sentinel-2; PlanetScope; Dai Lai Lake.*

Acknowledgements: *The author gratefully acknowledge the financial supports provided by Vietnam Academy of Science and Technology (THTEXS.03/22-24).*

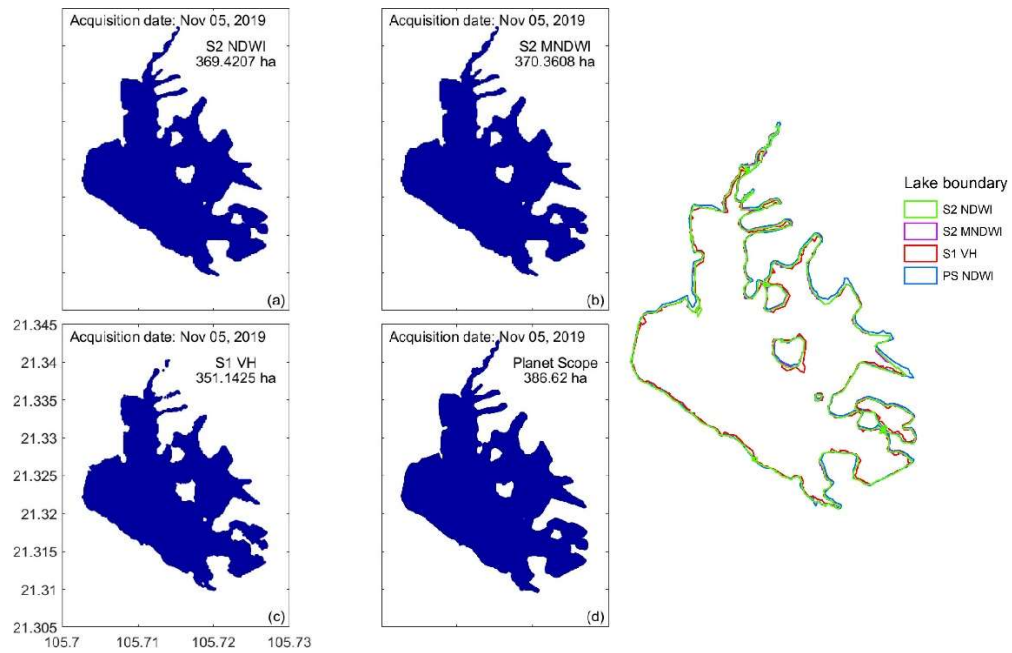


Fig 1. Surface water extent maps of Dai Lai Lake and its boundary, derived from different satellite sensors. All observations were acquired on November 5, 2019.

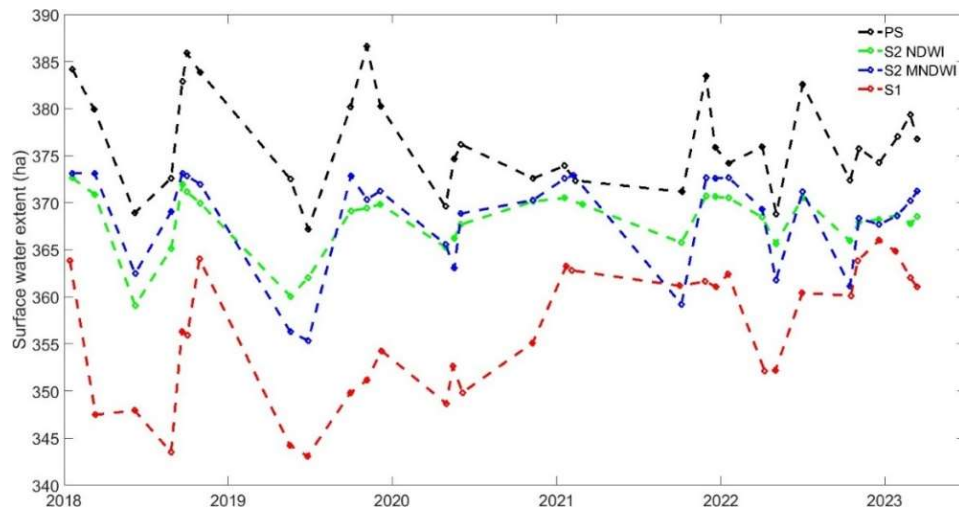


Fig 2. Time series of water extent of Dai Lai Lake during the 2018-2023 period, estimated from different satellite sensors

INNOVATIVE YOUTH-LED SOLUTIONS TO LOCALIZED CLIMATE-RELATED ISSUES IN THE RED RIVER CATCHMENT OF VIETNAM

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Abstract

The provinces in the Red River Catchment (RRC) have witnessed increasingly severe impacts of natural disasters and climate change. The government, policy makers and local people of Vietnam are facing challenges related to disasters and climate change. Indigenous knowledge or 'traditional science' plays an important role in sustainable development, environmental protection and disaster reduction. The role of young people in mitigating the impacts of climate change is increasingly being appreciated. Findings are presented of a research project on Youth-led adaptation for climate change challenges in Vietnam: social action, inter-generational and inter-cultural learning in Vietnam. This paper shows that young people working together in partnership, were supported in seeking to identify imaginative ways to mitigate climate change challenges in the Red River basin. Youth-led work explored how local, traditional and indigenous knowledges could develop understandings and strengthen local and societal resilience through an innovative partnership approach. Participatory action research approach and innovative story telling methods were employed to enable youth-led solutions to localized climate-related issues in the region.

Key words: Red River Catchment, climate change, disaster risk reduction, innovative solution, youth

DISTRIBUTION AND CHARACTERISTICS OF MICROPLASTICS ACROSS A LARGE RIVER BASIN: A FIRST COMPREHENSIVE STUDY IN THE RED RIVER DELTA AND CAT BA ISLAND

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Abstract

Microplastics (MiPs) have been discovered in aquatic environments worldwide, but it still needs to be determined what causes and controls their occurrence and dispersion. Notably, there is limited evidence about their transportation and fate in river catchments and networks. In this study, we identified MiPs distribution in different water layers (surface, middle, and bottom) and sediments from thirteen (13) locations across the Red River Delta (RR) and Cat Ba Island (CB). Water samples were collected on a pump system with plankton nets (mesh size ~80 μm). MiPs were found in all the water samples, with concentrations ranging from 0.33 to 15.5 mg dry weight/ m^3 . In the Red River Delta, MiPs were mainly detected as fibres, but on Cat Ba Island, they were observed as both fibres and plastic flakes. The MiPs composition in RR samples was mostly PET, PE, PVC and nylon. Aside from those typical categories, the findings in CB revealed the presence of various coating compounds emitted from painted ship covers and PS from aquaculture farms. In addition, the results indicated that in the Red River Delta, higher MiP concentrations were observed in the upper locations of the downstream, such as Hanoi and Ha Nam, and fewer MiPs were found in river mouths, such as Ba Lat and Day river mouth. Cat Ba Island had a 2–5 times greater concentration of MiPs than the Red River Delta. It could be due to complex human activities, including aquaculture, tourism, transportation and fishing, and other sources from the open sea. Additionally, salinity, tide, and water flow greatly impacted how MiPs were distributed across different water layers. In summary, the results of this study contribute to a better understanding of how MiP concentrations are affected by human activities, hydrology, and sampling techniques, as well as how MiPs are spatially distributed and transported through a river basin.

Keywords: *Microplastic, Red River, Cat Ba Island, Distribution, Sources*

UAV, A CLOSE-RANGE REMOTE SENSING SYSTEM, EXAMPLES FROM THE DEPARTMENT OF SPACE AND APPLICATIONS, USTH

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Abstract

Unmanned Aerial Vehicle (UAV), a platform in the term of close-range remote sensing is employed to solve environmental problems at a very detailed levels, minimizing effects of cloud covers, flexibly acquiring data compared to satellite observations. Various sensors have been integrated into UAVs to build remote sensing systems as the RGB image UAV, Multispectral UAV, Hyperspectral UAV, Lidar UAV. This presentation briefly illustrates three research examples of UAV applications which have been carried out in the department of Space and Applications, USTH.

In the first study, a push-broom hyper spectral camera with 122 bands in the visible and near infrared (400-1000nm) wavelength range is integrated in a hexagonal drone to take photos of a testing rice field to estimate the nutrient concentration in rice leaves. The Normalized Difference Red Edge, a vegetation index composed from hyperspectral bands, produces a moderately accuracy of nitrogen and phosphorus estimation but a saturation of the potassium concentration.

The second application focuses on the use of UAV-RGB images acquired in June 2014 and July 2020 to clarify the effect of topography changes on the vertical growth of mangroves. The experiment implemented in Xuan Thuy national park indicates that although the erosion or deposition happened in intertidal flats, no relationship with the vertical growth of mangroves is found.

The third study is an example of coupling multitemporal satellite images and UAV-RGB images acquired in 2019 and 2020 to investigate the exploitation of open-pit mine. The classification of multitemporal satellite images provides the information of the dynamic changes of land covers caused by the exploitation. The comparison of digital terrain models generated from UAV images provides the volume changes of the mine exploitation.

Consequently, equipment and experiment gained from various applications of UAV data may open the cooperations between the department of Space and Applications with scientists in the future.

Acknowledgement

This presentation is within the framework of the project “Integrating remote sensing and deep learning for assessing the health of rice”, No. CN4000.01/22-24.

Graphic abstract

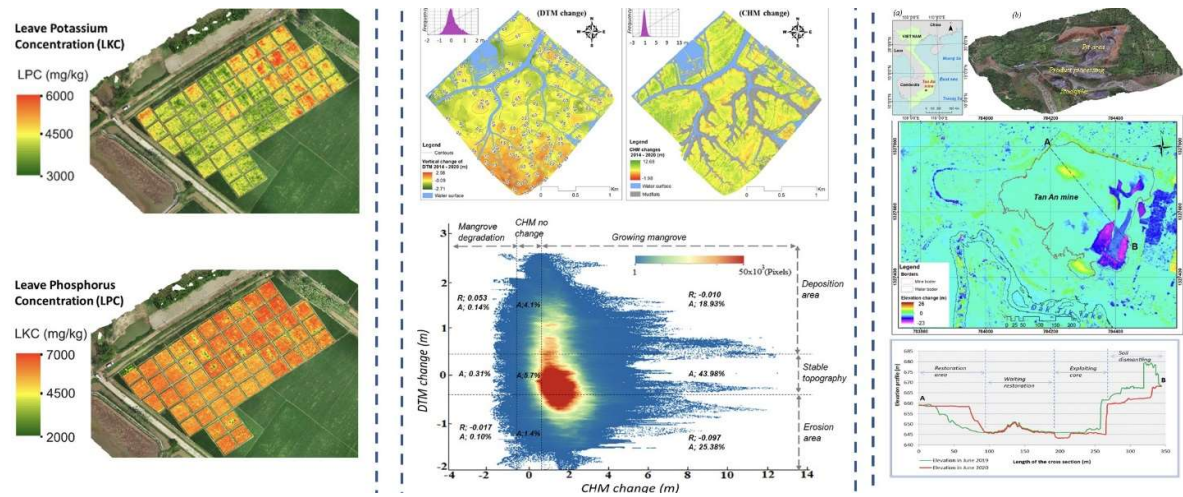


Fig 1. Ex.1 Extraction of nutrient concentration in leaves using hyperspectral UAV data (left images), Ex.2 Investigation of topographical changes and vertical variation of mangroves using RGB-UAV data (center images), EX.3 Volume changes of topography caused by mine exploitation using RGB-UAV images and satellite images (right images).

VALUATION OF FOOD SECURITY AND CULTURAL LANDSCAPE SERVICES FOR PADDY ECOSYSTEMS IN DEVELOPING COUNTRIES: A CASE STUDY IN VIETNAM

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Abstract

In recent times, the assessment of ecosystem services has gained increased importance, as the disappearance of numerous ecosystems worldwide directly impacts human well-being and the quality of the living environment, especially in developing countries where many environmental issues are increasingly concerned. This study was conducted to evaluate food security and cultural landscape services for paddy ecosystems for ecotourism development in developing countries with case study in Hongthai, Vietnam. The results of the evaluation show that the total value of paddy eco-services in Hongthai is about 579,585.1USD, in which, the use value is 94,50.5 USD (29,146.9 USD of food security value, 65,353.6 of tourist landscape value); the non-use value is 485,084.6 USD (46,223.9USD of option value; 61,549.0USD of value left; 377,311.7 USD of value exists). Based on the findings, this study proposes some policy implications for Vietnam, and for similar low-living provinces in developong countries, helps them to promote poverty reduction methods and develop sustainable tourism base on paddy ecosystems services.

Keywords: *valuation, food security services, cultural landscape services, paddy ecosystem services, developing countries.*