



MARINE SCIENCE 2-

SUSTAINABLE DEVELOPMENT



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14 November, 2025

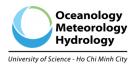
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WORKSHOP ON

MARINE SCIENCE AND SUSTAINABLE DEVELOPMENT

Workshop Date: November 14-15, 2025

Location: University of Science, VNU-HCM

No. 227 Nguyen Van Cu Street, Cho Quan Ward, Ho Chi Minh City, Vietnam

SESSION 1: MARINE SCIENCE AND SUSTAINABLE DEVELOPMENT

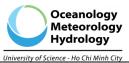
Chairman: Prof. Piotr Zieliński, Dr. Le Dinh Mau

Time	Title
08:00 - 08:45	REGISTRATION
08:45 - 09:00	OPENING CEREMONY
	Tran Minh Triet
	Vice President, University of Science, VNU.HCM, Vietnam
09:00 - 09:15	SAILING THROUGH SCIENCE: THE 20-YEAR JOURNEY OF OMH@HCMUS
	Vo Luong Hong Phuoc
	University of Science, VNU.HCM, Vietnam
09:15 - 09:30	FROM TAIWAN TO VIETNAM: ADVANCING COASTAL MONITORING
	WITH INDIGENOUS HF RADAR DEVELOPMENT
	Hwa Chien
	National Central University, Taiwan
09:30 - 09:45	GLOBAL TRENDS IN OCEANIC FRONTS: IMPLICATIONS FOR MARINE
	ECOSYSTEMS
	Andrew Fischer 1,2, Kai Yang 1,2, Phuc TD. Le 1,2
	¹ Institute for Marine and Antarctic Studies, University of Tasmania, Australia
	² AMCSearch, University of Tasmania, Australia









09:45 - 10:00	NO DATA, NO STORY: HIGH-PRECISION MEASUREMENTS IN MARINE
	CHEMISTRY (DMS AS EXAMPLE) ~ SURVIVE AND ADVANCE IN ANY
	ENVIRONMENT
	Sohiko Kameyama
	Faculty of Environmental Earth Science, Hokkaido University, Japan
10:00 - 10:15	MACHINE LEARNING APPLICATIONS: CLASSIFICATION AND REGRESSION
	Quoc Pham
	Faculty of Natural Sciences, University of Silesia in Katowice, Poland
10:15 - 10:45	GROUP PHOTO
	TEABREAK

SESSION 2: MICROPLASTICS: FROM RESEARCH TO PREDICTION

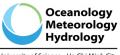
Chairman: Prof. Sohiko Kameyama, Dr. Bui Thi Ngoc Oanh

Time	Title				
10:45 - 11:00	CHEMICALDRIFT - A NEW OPEN SOURCE OCEAN POLLUTION MODEL				
	Lars R. Hole ¹ , Manuel Aghito ¹ , Øyvind Breivik ^{1,2}				
	¹ Norwegian Meteorological Institute				
	² Geophysical Institute, University of Bergen, Norway				
11:00 - 11:15	SURFACE WATER CONTAMINATION WITH MICROPLASTICS IN POLAND:				
	TRENDS AND CHALLENGES				
	<u>Piotr Zieliński</u> , Karolina Mierzyńska				
	Department of Environmental Protection, Faculty of Biology, University of				
	Białystok, Poland				







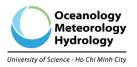


V	*	вноснсм ₹ University of S	Science	OMH@HCN	1US	University of Scienc	e - Ho Chi Minh City
11:15 - 11:30	MICRO	PLASTICS: C	LASSIFICAT	ION and	PREDICTIO	V	
	Vo Lu	ong Hong	Phuoc¹,	Piotr	Zieliński²,	Sohiko	Kameyama ³ ,
	Lars R. I	Hole ⁴ , OMH	group¹				
	¹ Univers	ity of Science	, VNU.HCM,	Vietnam			
	² Univers	ity of Białysto	ok, Poland				
	³ Hokkaid	do University,	Japan				
	⁴ Norweg	jian Meteoro	logical Instit	ute, Norw	ay		
11:30 - 11:45	.1:45 DETECTION AND CLASSIFICATION OF MICROPLASTICS USING ARTIFICIA					G ARTIFICIAL	
	INTELLI	GENCE: CHA	LLENGES A	ND OPPO	RTUNITIES		
	Pham T	he Bao¹, Le	nhi Lam The	uy¹, Vu N	goc Thanh	Sang¹, Da	at Trinh¹, Tran
	Quang	Vinh¹, Dang	Nguyen Qu	oc Duong	¹ , Tran Thi	Chung², L	e Nguyen Hoa
	Tien ² , Vo Luong Hong Phuoc ²						
	¹ Saigon University, Vietnam						
	² Univers	ity of Science	, VNU.HCM,	Vietnam			
11.45 12.00							
11:45 - 12:00	INTEGR	ATING AI AI	ND GIS FOR	FORECAS	STING SALT	WATER I	NTRUSION IN
	но сні	MINH CITY,	VIETNAM (JNDER C	LIMATE CH	ANGE	
	Vo Thi Kim Kieu, Pham Thi Tuyet Huyen, <u>Nguyen Kim Loi</u>						
	Research	center for o	climate chan	ige - Non	g Lam unive	ersity, Ho	Chi Minh City,
	Vietnam						
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SESSION 3: FLUVIAL AND COASTAL PROCESSES

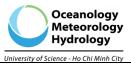
Chairman: Prof. Andrew M. Fischer, Assoc. Prof. Dang Truong An

Time	Title
13:00 – 13:30	POSTER DISCUSSION
	Prof. Ewa Łupikasza, Institute of Earth Sciences, University of Silesia in
	Katowice, Poland
	Dr. Vu Tuan Anh, Institute of Oceanography, VAST, Vietnam
13:30 - 13:45	FORMATION MECHANISM OF SAND BAR IN CUA DAI - THU BON RIVER
	MOUTH
	<u>Vu Tuan Anh</u> , Nguyen Thi Thuy Dung
	Institute of Oceanography, VAST, Vietnam
13:45 - 14:00	SUB-MESOSCALE FLOWS AND NEAR-INERTIAL MOTIONS IN THE
	MISSISSIPPI-ATCHAFALAYA RIVER PLUME IN THE GULF OF MEXICO
	Pat Welch
	Oregon State University, United States
14:00 - 14:15	WATER RESOURCE CHARACTERISTICS OF THE MEKONG DELTA: CURRENT
	STATUS, CHALLENGES, AND SUSTAINABLE MANAGEMENT SOLUTIONS
	Tran Dang An
	Thuyloi University, Vietnam
14:15 - 14:30	THE USE OF SAND ON A GLOBAL SCALE AND THE IMPACT TO THE MARINE
	ENVIRONMENT
	Klaus Schwarzer
	Kiel University, Germany







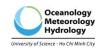


14:30 - 14:45	COASTAL PROTECTION STRATEGIES WITH NATURE-BASED SOLUTION					
	FOR CLIMATE CHANGE ADAPTATION IN COASTAL MEKONG DELTA					
	Le Xuan Tu					
	Southern Institute of Water Resources Research, Vietnam					
14:45 - 15:00	SHIFTING TIDAL DYNAMICS IN THE MEKONG DELTA: UNRAVELING THE					
	ACCELERATION OF TIDAL AMPLIFICATION AND ITS ANTHROPOGENIC					
	ROOTS					
	Nguyen Cong Thanh ^{1,2} , Tran Van Xuan ^{2,3} , Nguyen Nghia Hung ⁴ , Dang					
	Truong An ^{1,2}					
	¹ Department of Oceanology, Meteorology and Hydrology, University of					
	Science, HCM City, Vietnam					
	² Vietnam National University, HCM City, Vietnam					
	³ Department Petroleum Geology, Faculty of Geology and Petroleum					
	Engineering, University of Technology, HCM City, Vietnam					
	⁴ Center of Rural Technical Infrastructure Development, Southern Institute of					
	Water Resources Research, HCM City, Vietnam					
TEABREAK						
15:30 - 18:00	CELEBRATING THE 20TH ANNIVERSARY					
	OF OCEANOLOGY, METEOROLOGY AND HYDROLOGY DEPT					

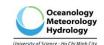


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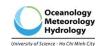
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SESSION 1:

MARINE SCIENCE AND SUSTAINABLE DEVELOPMENT



SAILING THROUGH SCIENCE: THE 20-YEAR JOURNEY OF OMH@HCMUS

Vo Luong Hong Phuoc^{1, 2}

¹University of Science-Ho Chi Minh City, Vietnam ²Vietnam National University, Ho Chi Minh City, Vietnam

Abstract

Over the past two decades, the Department of Oceanology, Meteorology and Hydrology (OMH) at the University of Science, VNU–HCM has made significant strides in advancing marine, atmospheric, and hydrological sciences in Vietnam and beyond. OMH's research has focused on key themes, including ocean-atmosphere and land-sea interactions, climate variability and change, hydrology, and environmental water quality.

With a growing network of national and international partners, OMH has led and codeveloped collaborative projects addressing sediment transport, coastal dynamics, offshore wind energy, and microplastics pollution. These efforts have resulted in over 100 publications and have strengthened scientific capacity through student and staff exchanges, workshops, and field training programs.

As it celebrates its 20-year milestone, OMH continues to expand its horizons toward integrated ocean-climate research and sustainable water-resource management, reaffirming its commitment to scientific excellence and international cooperation in understanding and protecting our changing environment.

Keywords: Coastal dynamics, sediment transport, Microplastics, environmental water quality, Ocean-atmosphere



FROM TAIWAN TO VIETNAM: ADVANCING COASTAL MONITORING WITH INDIGENOUS HF RADAR DEVELOPMENT

Hwa Chien

National Central University, Taiwan

ABSTRACT

Taiwan and Vietnam both face urgent coastal challenges from typhoons, storm surges, and rapid environmental change. To address these needs, Taiwan has developed an open-architecture high-frequency (HF) radar network in collaboration with international partner the University of Hawai'i, while advancing indigenous capabilities in hardware design, operations, and data management. Unlike black-box commercial systems, this open framework ensures transparency and adaptability, encouraging technological progress and wider collaboration.

Key achievements include robust radar hardware suited to typhoon-prone coasts, automated data quality control integrated into national platforms, and algorithmic advances such as bistatic configurations and exploratory tsunami detection. These systems now support applications in disaster early warning, offshore wind energy, and maritime safety.

Taiwan's experience highlights the importance of openness, data quality, and inter-agency cooperation. The keynote will conclude with opportunities for Taiwan–Vietnam collaboration through demonstration sites, data sharing, and capacity building, toward a regional HF radar network.

Keywords: High-frequency (HF) radar, disaster early warning, open-architecture coastal observing system



GLOBAL TRENDS IN OCEANIC FRONTS: IMPLICATIONS FOR MARINE ECOSYSTEMS

Andrew M. Fischer 1,2, Kai Yang 1,2, Phuc TD. Le 1,2

¹Institute for Marine and Antarctic Studies, University of Tasmania, Australia ²AMC Search, University of Tasmania, Australia

ABSTRACT

Climate change is altering the physics of the world's ocean. Fronts, where water masses of different properties meet, are important features responsible for global regulation of heat, ocean-atmosphere CO₂ exchange, and are also accumulators of floating marine debris (FMD). Utilizing a long-term record of satellite sea surface temperature for frontal detection and satellite records of ocean currents and finite-sized Lyapunov exponents, trends of frontal frequency over the last two decades have been declining in global marine hotspots, and this decline is associated with declines in chlorophyll concentrations. Global regions of frontal decline show a decrease in chlorophyll concentration and atmospheric CO₂ drawdown. Lastly, a statistical model of floating marine debris (FMD) hotspots was developed to highlight areas vulnerable to increased probability of FMD accumulation. Global declines in fronts and associated declines in productivity, coupled with increased probability of FMD accumulations, will be a future challenge for fisheries sustainability and marine conservation.

Keywords: Oceanic fronts, CO₂ exchange, floating marine debris (FMD), fisheries sustainability



NO DATA, NO STORY: HIGH-PRECISION MEASUREMENTS IN MARINE CHEMISTRY (DMS AS EXAMPLE) ~ SURVIVE AND ADVANCE IN ANY ENVIRONMENT

Sohiko KAMEYAMA

Faculty of Environmental Earth Science, Hokkaido University, Japan

ABSTRACT

In the field of geochemistry including marine chemistry, which I specialize in, chemical analysis is indispensable. Geochemists compare analytical data with related information from chemistry, biology, physics, and earth sciences, apply statistical methods, and sometimes use numerical models to understand the behavior of chemical substances and their controlling factors. I believe this act of "contemplation" lies at the core of research, while sampling and laboratory analysis themselves are not "research" but just routine "work".

Nevertheless, the foundation of my work has been the development of analytical techniques that enable easier, more frequent, smaller-scale, lower-cost, and more accurate measurements. This approach is closer to engineering, akin to being a primary producer within research. Much of my work has relied on extracting data through technical ingenuity rather than elegant hypothesis-driven design. Yet, such efforts occasionally yield elegant results, as in a study published in Geophysical Research Letters in 2013.

That study demonstrated a strong positive correlation between dimethyl sulfide (DMS), a volatile sulfur compound in surface seawater, and net community production (NCP), an indicator of biological productivity. DMS, produced by marine biota, contributes to atmospheric cloud condensation nuclei, linking marine biological changes under global warming to radiative forcing. While many studies normalized DMS using multiple variables, ours showed that a single variable—NCP—was sufficient.

This presentation will introduce the analytical approaches and motivations behind such work, and I hope that integrating them with the strong tradition of physical oceanography fostered by the Department of Oceanology, Meteorology and Hydrology—now celebrating its 20th anniversary—will further advance research on aquatic biogeochemical cycles.

Keywords: Marine geochemistry, dimethyl sulfide, climate forcing



MACHINE LEARNING APPLICATIONS: CLASSIFICATION AND REGRESSION Quoc PHAM

Faculty of Natural Sciences, University of Silesia in Katowice, Poland

ABSTRACT

In recent years, machine learning has gained significant traction in the field of earth science, particularly in hazard susceptibility mapping. This seminar will delve into various aspects of machine learning's applications in hazard susceptibility mapping, including the selection of suitable machine learning algorithms for specific applications and the optimization processes involved. Case studies will be presented, highlighting the successful use of machine learning in flood, landslide, and nitrate pollution susceptibility mapping. Additionally, the seminar will explore the untapped potential of machine learning in addressing challenges within other earth science domains.

Keywords: Machine learning, hazard susceptibility mapping.



SESSION 2: MICROPLASTICS:

FROM RESEARCH TO PREDICTION



CHEMICALDRIFT - A NEW OPEN SOURCE OCEAN POLLUTION MODEL

Lars R. Hole¹, Manuel Aghito¹, Øyvind Breivik^{1,2}

¹Norwegian Meteorological Institute, Norway

²Geophysical Institute, University of Bergen, Norway

ABSTRACT

A novel, open source numerical model, ChemicalDrift, has been designed to simulate the transport and fate of chemicals in the marine environment from coastal waters to the global ocean. ChemicalDrift is implemented as a module within the Lagrangian framework OpenDrift. In the context of increasing marine resource exploitation and mounting environmental pressures, sustainable management and planning are imperative. Numerical models, especially when integrated with data from monitoring surveys, play a crucial role in assessing the state and trends of chemical pollution. ChemicalDrift captures the complex interplay of oceanic physical processes and chemical transformations, including advection, diffusion, sedimentation, resuspension, particle adsorption, degradation, and volatilization. These processes are modelled to account for the distinct properties of metals and organic compounds, as well as changes in environmental parameters such as temperature and salinity. ChemicalDrift has been used to assess the impacts of shipping activities in European seas. The study compared baseline conditions from 2018 with projections for future scenarios in 2050. The modelling results, supported by toxicological studies, highlighted the potential negative impacts of exhaust gas cleaning systems (EGCSs), commonly known as scrubbers.

Additionally, copper and zinc from antifouling paints were projected to exceed recommended thresholds, particularly along the southern North Sea coast. The proposed model is aimed at being a versatile tool for environmental assessment studies. Integrated into the open-source Python package OpenDrift, the model's modular architecture enables distinct physical and chemical sub-processes to be implemented as separate algorithms, facilitating enhancements and the implementation of new features. Future uses may include global studies of shipping related pollution and high-resolution modelling of sensitive coastal regions affected by multiple sources, such as aquaculture and land-based discharges from water treatment plants, agriculture, industry, and rivers. ChemicalDrift also has the potential to be integrated into more comprehensive tools for spatial planning and the sustainable management of marine resources.

Keywords: Chemical Drift numerical model, marine chemical pollution, contaminants

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SURFACE WATER CONTAMINATION WITH MICROPLASTICS IN POLAND: TRENDS AND CHALLENGES

Piotr Zieliński, Karolina Mierzyńska

Department of Environmental Protection, Faculty of Biology, University of Białystok, Poland

ABSTRACT

Plastics, due to their properties, are widely used in the modern world. The degradation of plastic materials leads to the formation of microplastics (MP) – particles smaller than 5 mm, which have been detected in various environments, including freshwater, since the 1970s. The aim of this review was to collect and compare data on the occurrence of microplastics in Poland's surface waters, based on studies published up to the end of 2024. A total of 65 aquatic ecosystems were covered: 47 lakes, 13 rivers, and 5 reservoirs. Most studies focused on MP in water (68.4%), while fewer addressed bottom sediments (15.8%) and shoreline sediments (10.5%). MP contamination showed high variability, ranging from 0.00 to 245,000 MP/m³ in water and from 4 to 120,000 MP/kg dry weight in bottom sediments. The highest levels of MP were recorded in rivers, including the Nida and the Vistula. MP particles varied in shape (mainly fragments and fibers), color (predominantly red, blue, and black), and size (most often <1 mm). The studies revealed a wide diversity of analytical methods, which hindered the comparability of results. The review emphasizes the need for methodological standardization. Given its wide diversity of surface waters, resulting from differences in anthropogenic pressure, ecological status, and trophic conditions, Poland represents a valuable setting for comparative research on the increasing problem of plastic pollution in aquatic environments.

Keywords: Microplastic contamination, aquatic environments, particles characteristic



MICRO PLASTICS: CLASSIFICATION and PREDICTION

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Abstract

Microplastic (MP) contamination in the lower Mekong River and Can Gio estuarine system has become a critical environmental issue affecting aquatic ecosystems and coastal livelihoods. This study integrates field investigations and numerical modeling to classify and predict the spatial–temporal distribution of microplastics under hydrodynamic influences. Surface water and sediment samples collected along the Tien, Hau (Mekong river), and Can Gio (HCMC) regions were analyzed to determine microplastic abundance, and polymer composition. Fragments and fibers were found to be the dominant forms, with polyethylene (PE) and polypropylene (PP) as the most common polymers. Higher concentrations occurred during the dry season and near river mouths, where hydrodynamic retention and human activities are strongest.

To complement field data, the OpenDrift Lagrangian particle-tracking model was applied to simulate microplastic transport pathways under varying tidal, wind, and discharge conditions. Modeling results revealed that hydrodynamic dynamics and seasonal flow variations significantly influence dispersion and accumulation zones. Results indicate that microplastics exhibit stronger retention and re-suspension patterns in the estuary, while offshore zones are more affected by wind-driven transport.

This integrated approach demonstrates the potential of combining classification and predictive modeling to understand microplastic behavior in estuarine–coastal environments. The findings provide a scientific foundation for risk assessment, pollution management, and sustainable development strategies in the Mekong Delta and Ho Chi Minh City region.

Keywords: Microplastics, Hydrodynamics, Classification, OpenDrift, Mekong River, Can Gio Estuary, Modeling



DETECTION AND CLASSIFICATION OF MICROPLASTICS USING ARTIFICIAL INTELLIGENCE: CHALLENGES AND OPPORTUNITIES

Pham The Bao¹, Le nhi Lam Thuy¹, Vu Ngoc Thanh Sang¹, Dat Trinh¹, Tran Quang Vinh¹, Dang Nguyen Quoc Duong¹, Tran Thi Chun,^{2,3}, Le Nguyen Hoa Tien^{2,3}, Vo Luong Hong Phuoc^{2,3}

¹Saigon University, Ho Chi Minh City, Vietnam

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ABSTRACT

The widespread presence of microplastics poses a growing threat to ecosystems and human health, necessitating efficient detection and classification methods. Traditional analytical techniques are often time-consuming, costly, and limited in scalability. Recent advancements in artificial intelligence (AI) have introduced powerful tools for automating microplastic identification through image analysis and spectral data interpretation. This review examines the current progress in applying Al—particularly deep learning models such as convolutional neural networks (CNNs)—to the detection and classification of microplastics. It also highlights key challenges, including limited datasets, variations in particle morphology, and spectral overlap between polymer types. Opportunities for improvement are further discussed, emphasizing the integration of AI with advanced imaging, open-access datasets, and standardized protocols. The findings underscore Al's potential to accelerate environmental monitoring, enhance analytical precision, and support global efforts to mitigate plastic pollution.

Keywords: Artificial intelligence (AI), microplastic detection and classification



INTEGRATING AI AND GIS FOR FORECASTING SALTWATER INTRUSION IN HO CHI MINH CITY, VIETNAM UNDER CLIMATE CHANGE

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ABSTRACT

This study applied machine learning/ deep learning, and geographic information systems to predict saltwater intrusion in Ho Chi Minh City, Vietnam using monthly salinity, temperature, rainfall, and tide datasets between 2008 and 2024. The results indicated that the Long Short-Term Memory outperformed the Random Forest model with higher accuracy across almost stations – five out of six stations, particularly at An Ha station (NSE = 0.92 and PBIAS = -2.12%). In the future, the forecasting results show that serious salinity intrusion in coastal areas such as Can Gio district, and there is a risk of spreading deep into the area around Nha.Be, and Ong.Thin stations. Specifically, salinity peaks in 2029 (spread fast and deep with peak value of 13.84‰) and 2033 (spread slowly with peak value of 14.16‰), following by a slight decline in 2035. Moreover, using geographic information systems to spatial analysis highlights high-risk zones, contributing to support the management of water resources, sustainable urban planning orientation and promoting adaptive solutions to protect the ecosystem and livelihoods of the coastal residential community affected.

Keywords: Al-GIS, Salinity Intrusion, Ho Chi Minh City, Vietnam



SESSION 3:

FLUVIAL AND COASTAL PROCESSES



FORMATION MECHANISM OF SAND BAR IN CUA DAI - THU BON RIVER MOUTH

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ABSTRACT

Between November 4 and November 11, 2017, flood events resulted in average daily discharge rates at the Nong Son hydrological station ranging from 1,490 to 8,880 m³s⁻¹, with a peak value reaching 9,790 m³s⁻¹. These flood currents not only transported sediments within the river channel but also entrained, transported, and deposited sediments beyond the river mouth, thereby contributing to both erosion and accumulation processes. Sediment entrainment and transport primarily occurred along the mid-river channel and the upstream face of the sand bar. At the bar top, sediment transport and accumulation were active, while the back side of the bar exhibited dominant depositional patterns, resulting in a broader and flatter bar top morphology. Following the flood, a subaqueous sand bar developed directly opposite the river axis. The bar top displayed an oval geometry, with a major axis of approximately 1,150 meters, a minor axis of around 420 meters, and an overall surface area of 0.346 square kilometers. Wave propagation across the bar top was substantially dampened, with significant wave heights commonly reduced to below 1 meter. Hydrodynamic interactions among fluvial discharge, tidal currents, and wave-induced currents generated a flow convergence zone covering the bar top, characterized by velocities below 0.25 ms⁻¹ and water depths less than 2.5 meters - conditions conducive to sediment deposition. Sediment accumulation during the northeast monsoon season was especially pronounced, totaling approximately 1.31×10^5 cubic meters, which represented 76.6% of the total sediment deposition over the annual period from November 11, 2017, to November 11, 2018. This accumulation led to the transformation of the subaqueous sand bar into a subaerial sand bar on March 29, 2018. Continued accumulation during subsequent months enabled further growth of the sand bar, which expanded to an area of 35,650 square meters and attained an average elevation of 0.23 meters by the conclusion of the southwest monsoon season.

Keywords: flood, currents, waves, sediments, erosion, accumulation process, sand bar



SUB-MESOSCALE FLOWS AND NEAR-INERTIAL MOTIONS IN THE MISSISSIPPI-ATCHAFALAYA RIVER PLUME IN THE GULF OF MEXICO

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ABSTRACT

The Mississippi-Atchafalaya river system delivers substantial freshwater and sediment to the northern Gulf of Mexico, creating a buoyant plume that exhibits complex sub-mesoscale dynamics and energetic wave motions. Understanding the interaction between river plume fronts and inertial oscillations is crucial for predicting mixing, sediment transport, and ecosystem dynamics in this economically important region.

Over three field seasons from 2019 through 2022, we performed multi-platform observations of the time evolution of full water column frontal structures in the 15 to 80 m depth range south of the Louisiana-Texas border.

The diurnal wind forcing, with periods comparable to the local inertial period (~25 hours at 28°N), introduced energetic near-inertial waves throughout the entire water column. These near-inertial oscillations were found to be strongly influenced by the sub-mesoscale frontal structures, with enhanced vertical velocities and mixing observed at frontal boundaries. Sub-mesoscale instabilities within the plume front create overturning cells spanning the water-column, leading to the resuspension of sediment and ventilation of the bottom boundary layer.

Our results demonstrate that the interaction between diurnal wind forcing and submesoscale frontal dynamics creates efficient pathways for energy transfer to small scales and enhanced vertical mixing in river plume environments. These findings have important implications for understanding sediment transport to offshore waters and the biological productivity of the northern Gulf of Mexico shelf.

Keywords: sub-mesoscale dynamics, frontal dynamics, sediment resuspension, diurnal wind forcing, biological productivity.



WATER RESOURCE CHARACTERISTICS OF THE MEKONG DELTA: CURRENT STATUS, CHALLENGES, AND SUSTAINABLE MANAGEMENT SOLUTIONS

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ABSTRACT

The Mekong Delta represents the downstream terminus of the Mekong River system and serves as a critical region for Vietnam's water security, food production, and socio-economic development. However, its water resources are increasingly threatened by climate change, upstream hydropower regulation, saltwater intrusion, and excessive groundwater abstraction. This study investigates the hydrochemical and isotopic characteristics (δ^{18} O, δ^{2} H, ³H) of surface water, rainfall, and groundwater across the Delta to elucidate the dominant processes governing the regional hydrological system. Results reveal distinct isotopic and hydrochemical gradients among the upper, middle, and coastal subregions, reflecting the combined influences of evaporation, mixing, and river-aquifer exchange. Surface water isotopic compositions are largely controlled by seasonal flow regimes from Kratie and the Tonle Sap flood pulse, while groundwater shows evidence of progressive depletion and salinization, particularly in the qp1, qp3, and n22 aquifers. Key challenges include land subsidence induced by over-extraction, inland salinity encroachment, and the decline of natural recharge and water quality. To address these challenges, the study proposes an integrated, multi-source water management framework emphasizing conjunctive use of rainfall, surface, and groundwater, as well as reclaimed water. It further recommends restricting deep-aguifer exploitation, strengthening isotope-based and water-quality monitoring networks, and developing digital-twin models to support adaptive water governance under changing climatic and hydrological conditions. The findings provide a scientific foundation for sustainable water resource management and climate-resilient development strategies across the Mekong Delta.

Keywords: isotopic characterization, land subsidence, salinization, groundwater depletion



THE USE OF SAND ON A GLOBAL SCALE AND THE IMPACT TO THE MARINE ENVIRONMENT

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ABSTRACT

On a global scale, sand is - behind water - is the most used natural resource. Its demand is booming and has increased threefold over the last 20 years and currently the use is higher than its natural production. This is due to the use of sand in many different areas not only for construction as part of concrete or for land reclamation project and coastal protection, as a source for glass, but as well in the IT technology, food production, cosmetics, etc. Sand is present in all areas of our life. Despite the strategic importance of sand, its extraction, sourcing, use, and management remain largely ungoverned in many regions of the world, leading to numerous environmental and social consequences that have been largely overlooked (Peduzzi 2014).

In the marine environment, today the most mined minerals are sand and gravel. On land potential areas for sand mining will be deforested and the impacts on areas that have been mined are going to be contained only to that space. Those areas are static and are considered as "inactive sand deposits". Opposite to those areas are rivers and beaches, where the sand resources "are active and dynamic deposits", as they are moving all the time. These dynamics of sand can have crucial importance not only just at the mining spot but for land areas downstream of rivers, for deltas or adjacent coastal areas with their infrastructure, ecosystems and communities depending on them.

Mining of sand bodies requires an understanding of their geological origin and their natural development in time and space. Extraction from active sand bodies can result in changing rates of sand transport (e.g., in rivers or in coastal environments), leading to erosion and threatening communities and livelihoods far away from the area of extraction.

Keywords: sand demand, sand mining, coastal and riverine erosion impacts



COASTAL PROTECTION STRATEGIES WITH NATURE-BASED SOLUTION FOR CLIMATE CHANGE ADAPTATION IN COASTAL MEKONG DELTA

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ABSTRACT

The article presents coastal protection strategies for the Mekong Delta region in response to the impacts of climate change and rising sea levels. The study proposes a multi-layered coastal protection approach that combines nature-based solutions, including various engineered structures such as breakwaters, beach nourishment, bamboo fences, mangrove forests, and revetments. The research presents a design perspective for breakwaters and proposes a phased seaward expansion of mangrove forests over time. The article also introduces a planning for the arrangement of coastal protection structures in the Mekong Delta, based on successful case studies in the research area and worldwide.

Keywords: coastal protection, multi-layered defensed approach, nature-based solution, climate change, sea-level rise adaptation



SHIFTING TIDAL DYNAMICS IN THE MEKONG DELTA: UNRAVELING THE ACCELERATION OF TIDAL AMPLIFICATION AND ITS ANTHROPOGENIC ROOTS

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ABSTRACT

The Vietnamese Mekong Delta (VMD), a vast and densely populated low-lying plain of approximately 40,000 km², is exceptionally vulnerable to interact in fluvial and oceanic processes. While past research has identified alterations in the delta's tidal regime, these studies were often constrained by limited temporal data, making it difficult to isolate persistent human-induced trends from inherent fluctuations. This research addresses this knowledge gap by delivering a thorough, contemporary assessment of accelerating tidal amplification using an extensive 45-year (1980–2024) dataset. Through stationary harmonic analysis of water level records from six strategic hydrological sites and a coastal benchmark, we examined key tidal components. The analysis reveals a marked reduction in the solar annual (SA) amplitude at inland stations, signaling a diminished influence of river flow after the year 2000. In contrast, the amplitudes of primary tidal constituents (M2, K1) have significantly intensified in the central and upper delta regions during the same period, while phase shifts in the M2 component indicate more rapid tidal wave propagation. Furthermore, the amplification of the shallow-water (M4) constituent inland strongly points to river channel deepening—caused by in-delta sand extraction and sediment trapping by upstream dams as the principal mechanism driving these transformations. These hydrodynamic alterations carry severe consequences, including heightened high-tide inundation and increased saltwater intrusion, which jeopardize the delta's long-term viability.

Keywords: tidal amplification, tidal propagation, anthropogenic impact, water level, reduced river discharge



POSTER SESSION



APPLICATION OF HYDRODYNAMIC MODELING IN MANGROVE FORESTS

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ABSTRACT

Mangrove forests are essential coastal ecosystems that function as biological wave barriers, reducing wave energy and current velocity, thereby protecting shorelines from erosion and natural disasters. In addition, mangroves act as natural sediment traps, retaining suspended organic and inorganic particles, and serve as important blue carbon reservoirs.

Hydrodynamic modeling is an indispensable scientific tool for quantifying these crucial roles of mangrove ecosystems. Such models simulate water motion and material transport, with a key challenge being the accurate incorporation of vegetation-induced drag forces into flow equations. Successfully simulating these interactions enables the prediction of wave attenuation and sediment transport processes, thereby supporting effective integrated coastal management under climate change.

Keywords: mangrove wave attenuation, hydrodynamic modeling, vegetation-induced drag forces, coastal management



ANALYSIS OF SHORELINE CHANGE IN VINH LONG PROVINCE IN THE PERIOD 1989-2025 USING REMOTE SENSING AND GIS

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ABSTRACT

This study aims to assess the shoreline changes in Vinh Long province from 1989 to 2025. The research utilized the AWEI index to extract land-water boundaries from satellite images captured by Landsat 5, 7, 8, and Sentinel-1. Following this, the QSCAT tool integrated into the QGIS software was employed to analyze and evaluate the results of shoreline accretion and erosion. The findings indicate that the shoreline has experienced significant fluctuations, with 50% of the shoreline accreting and 49.3% eroding. The period from 1995 to 2001 recorded the most pronounced erosion rate at 61%, while the period from 2006 to 2014 showed the least erosion at 35.7%. In Area 1, the shoreline is predominantly accretive, with 78.8% of the area experiencing a net gain at a rate of 4.1 m/year. Area 2 exhibited complex fluctuations, showing the highest erosion rate at -3.5 m/year. In Area 3, erosion was dominant, affecting 83.3% of the area, albeit at a very low rate of -0.8 m/year

Keywords: shoreline changes, AWEI index, QSCAT tool, satellite images, Vinh Long province



CLIMATE VARIABILITY IMPACTS ON IRRIGATION WATER POTENTIAL FOR VIETNAMESE MEKONG DELTA

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ABSTRACT

The Vietnamese Mekong Delta (VMD), a crucial delta for rice cultivation, faces challenges from climate variability, including altered rainfall, rising temperatures, and droughts, posing risks of rain-fed water deficits due to global climate change. This study investigated the impacts of global climate change on irrigation water potential and irrigation water demand for rice paddies in the Plain of Reeds. The study applied the FAO-AquaCrop model to simulate irrigation water potential and irrigation water demand for winter-spring, summer-fall, and fall-winter seasons under current climatic conditions and future RCP4.5 and RCP8.5 scenarios for 2011-2040, 2041-2070, and 2071-2099. The model was calibrated and validated against observed yield data from 2002-2023. Results indicate a general irrigation water potential increase across seasons and sub-areas, with the winter-spring crop showing the most substantial rise (up to 65.7% by 2071-2099 under RCP8.5). Irrigation water demand also generally increased, particularly for the winter-spring crop, though RCP8.5 did not always yield higher demand than RCP4.5, suggesting complex climate-irrigation interactions. These findings highlight the need for adaptive water management and the potential of adjusting sowing schedules to mitigate increased irrigation water demand.

Keywords: Climate change, water potential, AquaCrop, *Oryza sativa*, RCP scenarios



ADVANCING HOURLY WATER LEVEL PREDICTION IN THE VIETNAMESE MEKONG DELTA: A COMPARATIVE ANALYSIS OF LSTM AND HARMONIC MODELS

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ABSTRACT

Accurate hourly water level prediction (HWLP) is critical for effective flood control and risk reduction in intricate hydrodynamic systems such as the Vietnamese Mekong Delta (VMD). This study evaluates the performance of a Long Short-Term Memory (LSTM) network for HWLP at the My Thuan station on the Tien River, a site characterized by the interplay of fluvial and tidal forces. Utilizing a comprehensive hourly dataset spanning from 1978 to 2022, we benchmarked the LSTM model's predictive capabilities against the conventional harmonic analysis approach across various forecast horizons, from 1 to 168 hours. An optimal input length of 360 preceding hourly data points (15 days) was identified through a sensitivity assessment. The LSTM model demonstrated high proficiency in short-term predictions, achieving a Nash-Sutcliffe Efficiency (NSE) of 0.98 and a Root Mean Square Error (RMSE) of 9.25 cm for a 1-hour lead time. However, its predictive power diminished substantially over extended horizons, with the NSE falling to 0.59 and the RMSE surpassing 48 cm at the 168hour mark. Nevertheless, the LSTM model consistently surpassed the harmonic method, particularly in its ability to represent the non-linear dynamics between river flow and tidal effects. This research establishes a definitive performance benchmark for a univariate deep learning model in this specific environment and delineates its practical operational constraints. Our results suggest that while LSTM holds significant potential for near-term forecasting, incorporating external physical variables is essential for enhancing its long-range predictive reliability.

Keywords: Deep learning, Tien River, Harmonic analysis, Time-series analysis, Water level forecast.



ANALYSIS OF CHLOROPHYLL CONCENTRATIONS, PHYSICAL FACTORS, AND DYNAMICS FACTORS IN THE COASTAL AREA OF CAN GIO, HCM CITY

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ABSTRACT

The study aims to study the relationships of Chlorophyll concentration and physical factors (temperature, salinity, turbidity, dissolved oxygen - DO) and hydrodynamic factors (flow, water fluctuation) in the coastal Can Gio area (HCMC) during the northeast (Jan 2025) and southwest (Aug 2024) monsoons. Some methods are used, such as data analysis and processing, VBA for coordinate transfer, Surfer for interpolation, and Grapher for graphical analysis. The results show that Chlorophyll has a strong correlation with turbidity, DO, and water fluctuation, but a weak correlation with salinity, temperature, and flow. Chlorophyll, turbidity, and temperature in the river areas are generally higher than those in coastal areas, whereas flow and salinity are higher in coastal areas. Generally, most physical factors (excluding temperature), hydrodynamics, as well as Chlorophyll concentrations, are stronger during the northeast monsoon compared to the southwest monsoon. The study results reveal a close relationship between Chlorophyll, physical and hydrodynamic factors, supporting the prediction of impacts on aquatic organisms and applications in ecology/biology.

Keywords: tidal



PREDICTING COASTAL WATER LEVELS USING MACHINE LEARNING: A CASE STUDY IN VUNG TAU, VIETNAM

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ABSTRACT

Accurate water level forecasting enables early prediction of tidal surges and flooding, supporting coastal management, operational planning, and risk reduction under the impacts of climate change. This study aims to develop and evaluate machine learning models for predicting water levels at the Vung Tau station using 44 years of daily observations, with the goal of improving the accuracy of long-term forecasts. Two machine learning techniques, bagging (Random Forest) and boosting (Gradient Boosting Machine), were applied to predict water levels for the following year. Model performance was evaluated using the MAE, RMSE, and R^2 metrics. The results show that both models achieved high accuracy in forecasting water levels at Vung Tau station. Among them, the Gradient Boosting Machine achieved superior performance (MAE = 0.0041, RMSE = 0.0080, R^2 = 0.9986) compared to the Random Forest (MAE = 0.0071, RMSE = 0.0134, R^2 = 0.9961), indicating that the boosting method outperforms bagging for this task. These findings demonstrate that the boosting model can significantly enhance water level prediction accuracy compared to traditional approaches, highlighting the growing importance of artificial intelligence in water resource management and climate change adaptation in coastal regions.

Keywords: Water level forecasting, Machine learning, Vung Tau (Vietnam)



CHARACTERISTICS AND DISTRIBUTION OF MICROPLASTICS IN SURFACE WATER AND SEDIMENTS IN THE DOWNSTREAM MEKONG RIVER REGION (VIETNAM)

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ABSTRACT

Microplastic pollution (MP) in the lower Mekong River region (Mekong Delta, Vietnam) has become an emerging environmental issue, threatening aquatic ecosystems and local livelihoods. This study investigates the spatial and temporal distribution, abundance, and morphological characteristics of microplastics in surface water and sediment samples collected from 19 sites along the Tien and Hau Rivers. Oil separation and density-based techniques were applied to extract microplastics, followed by microscopic observation to classify their shapes (fragment, fiber, film, bead) and Fourier Transform Infrared Spectroscopy (FTIR) to identify polymer composition. Results show that microplastics are widely distributed across both surface water and sediment environments, with higher concentrations detected during the dry season, particularly in the downstream areas (ST10 and ST16). Fragments and fibers were the dominant forms. FTIR analysis revealed that polyethylene (PE) and polypropylene (PP) were the most common polymers. These findings highlight that microplastic pollution in the lower Mekong River is influenced by hydrodynamic conditions and human activities. The study provides essential baseline data for future environmental management and pollution control strategies in the Mekong Delta.

Keywords: Microplastics, Can Gio mangroves, seasonal variation, FTIR spectroscopy, optical microscopy, sediment, water samples.

Proceedings of Marince Science and Sustainable Development | 14 November, 2025



MODELING THE DISTRIBUTION OF MICROPLASTICS UNDER HYDRODYNAMIC IMPACTS IN MEKONG RIVER ESTUARY USING THE OPENDRIFT MODEL

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ABSTRACT

Microplastics have emerged as a major environmental concern due to their persistence, transport potential, and ecological risks. This study aims to model the distribution and transport pathways of microplastics in the Mekong River estuary under the influence of hydrodynamic conditions. Using the OpenDrift Lagrangian particle-tracking model, we simulated the dispersion and accumulation of microplastic particles in response to tidal currents, wind forcing, and freshwater discharge. Hydrodynamic inputs were obtained from regional circulation models representing both dry and wet seasons. The results reveal significant spatial and temporal variations in microplastic transport, with strong retention zones near river mouths and tidal flats. Seasonal flow dynamics and wind patterns play crucial roles in determining the dispersion and deposition behavior of microplastics. The study highlights the applicability of OpenDrift for predicting microplastic fate in complex estuarine systems and provides a scientific basis for pollution mitigation and management strategies in the Mekong Delta.

Keywords: Microplastics, Hydrodynamics, OpenDrift, Mekong River Estuary, Modeling

Proceedings of Marince Science and Sustainable Development 14 November, 2025



CORRELATION BETWEEN LA NIÑA MODOKI AND RAINFALL AND MOISTURE TRANSPORT OVER SOUTHERN VIETNAM DURING 2020–2024

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ABSTRACT

In this study, the relationship between the ENSO Modoki and variations in rainfall and moisture transport over Southern Vietnam is examined. Using the El Niño Modoki Index (EMI) recalculated from OISST dataset, the 14-month period from March 2022 to May 2023 is identified as a La Nina Modoki phase. Anomalies of various fields including precipitation, wind, surface pressure, and moisture flux from GPCC and ERA5 reanalysis datasets are analyzed. Results show a correlation between EMI and these anomalies over Southern Vietnam, especially at a 2-month timelag. Moreover, the study also shows a reduction in rainfall, surface wind, and moisture flux over Southern Vietnam during summer monsoon in 2022. Correlative reponses among changes of these fields suggest that ENSO Modoki may influence structure of moisture transport, and therefore rainfall distribution over the region.

Keywords: La Niña Modoki, EMI, rainfall variability, moisture transport, Southern Vietnam.

Proceedings of Marince Science and Sustainable Development 14 November, 2025



DETERMINATION OF MICROPLASTICS IN SURFACE SEDIMENT SAMPLES AT CAN GIO, HO CHI MINH CITY

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ABSTRACT

The aim of this study is to identify the characteristics of microplastics, such as their abundance and shapes, in surface sediment samples collected at Can Gio Beach, Ho Chi Minh City. Established methodological approaches, including organic matter digestion, density separation, sample filtration, and microscopic observation, were applied. Surface sediment samples were collected in April 2023 along two transects: one perpendicular to the shoreline (from sample CG-1 at low tide to CG-5 at the highest tide) and one parallel to the shoreline (from sample CG-6 to CG-9). Results indicate that, along the transect perpendicular to the shoreline, the average microplastic abundance was 6.28 \pm 0.16 particles per gram of sediment. Microplastic abundance tended to increase towards the shore, with the highest value observed at sample CG-5 (17.97 particles per gram) and the lowest at CG-1 (0.46 particles per gram). The observed microplastic shapes included fragments, fibers, foams, and films, with fragments comprising the highest proportion at 74.46%. Along the transect parallel to the shoreline, the average microplastic abundance reached 21.60 particles per gram of sediment. Analysis of the relationship between microplastics and sediment particle size revealed that microplastics were predominantly concentrated in the "medium sand," "coarse sand," and "very coarse sand" fractions.

Keywords: microplastics, surface sediment, density separation method, sediment particle size, Can Gio



PROCESSING WAVE DATA FROM DATAWELL BUOYS

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ABSTRACT

The objective of the thesis is to study and build a program to calculate and process data from Datawell wave buoys (DWR-MkIII and DWR4) at some stations on the West Coast of the United States, the East Coast of the United States and the Hawaiian Islands. The wave energy spectrum is calculated by FFT according to two methods: (1) the Massel method with L=128, 256, 512; and (2) the Datawell method. Wave characteristics are calculated based on the wave spectrum. The comparison results with CDIP (Coastal Data Information Program) data show that the Massel method is suitable with L=256 for the DWR-MkIII buoy and L=512 for the DWR4 buoy. Compared with Massel, the Datawell method gives better correlation results. The calculation method is applied in normal and stormy conditions. The thesis also initially studies how to calculate the wave direction spectrum. The results show that the wave direction is consistent with the CDIP data, but the energy is significantly lower.

Keywords: Datawell wave buoys, wave energy spectrum, FFT, CDIP, wave direction spectrum

Proceedings of Marince Science and Sustainable Development 14 November, 2025



INTRASEASONAL VARIABILITY OF RAINFALL AND ZONAL WIND OVER SOUTHERN **VIETNAM IN SUMMER MONSOON 2020**

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ABSTRACT

This study investigates intraseasonal variability of rainfall in Southern Vietnam during the summer monsoon 2020. The study uses data from ERA5 reanalysis dataset, along with outgoing longwave radiation (OLR) from NOAA. A Lanczos filter is constructed and applied to extract intraseasonal signals with 20-100-day cycles. Results indicate three strong MJO events during May-June, July-August, and November-December 2020, through precipitation and OLR fields. Intraseasonal OLR exhibits strong signal in coastal regions and relatively weaker over land. Zonal wind at 850 hPa level shows strong intraseasonal component in areas directly influenced by the monsoon. VIMD has a heterogeneous distribution, with strong moisture convergence over active MJO phase areas. In general, the MJO exhibit a significant role to regional rainfall and lower zonal wind variation over the study region.

Keywords: Intraseasonal, summer monsoon, MJO, rainfall, zonal wind, VIMD



ASSESSMENT OF POLLUTION LEVELS OF URBAN CANAL BASED ON PHYSICOCHEMICAL PARAMETERS AND NUTRIENT CONCENTRATIONS

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ABSTRACT

The Tau Hu Canal was once a major trade route in Ho Chi Minh City, and the increasing population along the canal will likely lead to an increase in pollution over time. We conducted sampling along the canal during two periods, one of high tide and one of low tide, during the dry season (November 2024). Quartile statistics and principal component analysis (PCA) were used to analyze the results. The parameters analyzed include: Temperature, pH, Oxidation-Reduction Potential (ORP), Electricity Conductivity (EC), Total Dissolved Solids (TDS), Salinity (S), Nutrients (NO3-, NH4+, PO43-). The results showed that the water quality at low tide was more polluted than at high tide. The lower concentrations of the analyzed parameters at high tide were due to the change in water during high tide in the afternoon. Redfield ratio analysis results showed that the area was severely deficient in nitrogen relative to phosphorus. The quartile results show that factors such as pH, NO3-, PO43- tend to disperse during low tide, while factors such as Temperature, ORP, TDS, salinity, NH4+ tend to disperse during high tide. The results of the PCA showed that the first four principal components explained 82% of the variance in the data, with the first principal component accounting for 44.4% of the variance and the second principal component accounting for 23.2% of the variance. The cause of pollution in the area may be due to human waste discharge and traffic. Additionally, there is a sampling station with relatively good water quality, thanks to a tidal gate that helps prevent certain pollutants from passing through.

Keywords: urban canal, nutrients, PCA, Quartile statistics



TEMPERATURE CHANGE TRENDS IN HO CHI MINH CITY DURING THE PERIOD 1993-2023

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ABSTRACT

Based on a series of temperature data from 1993 to 2023 at Tan Son Hoa station, Ho Chi Minh City (HCMC), this study has statistically analyzed the characteristics related to temperature changes in HCMC. During the period 1993 - 2023, the average temperature tended to increase by about 1.3°C/year. January has the lowest average temperature (27.1°C), while April has the highest average temperature (29.8°C). The average temperature change trend of Ho Chi Minh City follows the general global trend. Additionally, the analysis results show the impact of El Niño and La Niña phenomena on temperatures in HCMC. During El Niño phases, temperatures tend to be higher than the average, whereas during La Niña phases, temperatures tend to be lower than the average. The results indicate that temperature anomaly peaks often appear during El Niño phases or the transition phase from El Niño to La Niña.

Keywords: temperature trends, El Niño, La Niña, climate change signal



SALTWATER INTRUSION IN THE MEKONG DELTA (VIETNAM)

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ABSTRACT

This study focuses on saltwater intrusion in the Mekong Delta during the period 2019 – 2023. Salinity data collected from monitoring stations along the river system indicate that the 4‰ salinity boundary fluctuated between years, with 2020 being the most severe year, showing intrusion depths reaching 65–66 km at some estuaries. In comparison, 2023 showed an increase in intrusion compared to 2022 but remained lower than extreme events in previous years. The study also preliminarily applied the DELFT3D model to simulate the saltwater intrusion process using meteorological and hydrological conditions of 2023. The results demonstrated a relatively good agreement with observed data, with the 4% boundary ranging from 41 to 52 km at major estuaries. Although some minor discrepancies were observed compared to measurements, the model shows potential for application in forecasting and managing saltwater intrusion in the Mekong Delta under increasing climate change impacts.

Keywords: Mekong Delta, saltwater intrusion, DELFT3D model



DUAL IMPACT OF SEDIMENT DEFICIT AND COASTAL ENGINEERING ON SHORELINE **EVOLUTION: A CASE STUDY OF VIETNAM'S VINH LONG COAST**

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ABSTRACT

The Vietnamese Mekong Delta (VMD), a vital hub of ecological and economic activity, is currently confronting severe environmental challenges. This paper presents an in-depth assessment of shoreline evolution along the Vinh Long coast, over the period from 2009 to 2023. By utilizing a multitemporal remote sensing framework incorporating Landsat and Sentinel-1 data, we quantified coastal transformations and examined the combined effects of natural processes and human activities. Shoreline positions were delineated via an automated histogram-based thresholding technique and normalized to the mean sea level (MSL) using a precise tidal adjustment, ensuring reliable year-to-year analysis. Results indicate a prevailing pattern of erosion, with approximately 72.6% of the shoreline receding at an average velocity of -5.7 \pm 6.9 m/yr. The study was partitioned into discrete timeframes to differentiate the effects of significant human interventions. Before 2014, the coastline was defined by extensive erosion, largely driven by a major decrease in sediment delivery from the Mekong River linked to upstream damming and sand extraction. The subsequent period, post-2014, was distinguished by the influence of a large coastal groin system, which triggered a typical geomorphic reaction: significant sediment accumulation on the northern side and intensified, spreading erosion on the southern side. This process is heavily influenced by seasonal weather patterns, as the powerful Northeast monsoon facilitates a dominant southwestward littoral drift. The study highlights the acute susceptibility of the Vinh Long coast to a systemic sediment shortage, a problem that is compounded locally by engineering structures. The quantitative findings offer a crucial scientific foundation for formulating sustainable coastal defense and sediment management policies for the wider Mekong Delta.

Keywords: Coastal erosion, Mekong Delta, Remote sensing, Sediment transport, Coastal structures.



APPLYING OPERATIONAL STANDARDS FOR FORECASTING UV AND THERMAL EXTREMES IN HO CHI MINH CITY

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ABSTRACT

In the context of rapid urbanization and climate change, Ho Chi Minh City frequently experiences extreme ultraviolet (UV) radiation and high thermal conditions that significantly affect public health, the urban environment, and socio-economic activities. This study focuses on applying operational standards for identifying and forecasting UV and thermal extremes (Heat Index), aiming to standardize urban meteorological operations in Vietnam in accordance with World Meteorological Organization (WMO) and World Health Organization (WHO) guidelines. The methodology includes: (i) reviewing and harmonizing national and international standards for identifying weather extremes; (ii) calculating UVA, UVB, UV Index, and Heat Index using data from ERA5 reanalysis, ozone and UV measurements at Tan Son Hoa Station, and local meteorological observations; (iii) analyzing temporal, spatial, and frequency variations to identify the timing, location, and intensity of extremes. Results indicate that the period from March to May shows the highest frequency of UV and heat extremes. The urban core and high-density built-up areas record the most frequent exceedances of UV Index ≥11 and Heat Index ≥41°C. Based on these findings, a **four-step operational framework identification, classification, warning, and communication—**is proposed, applying existing operational standards to enhance early warning capacity and integrate UV-thermal risk information into urban climate monitoring systems. This research contributes to improving forecasting efficiency and climate risk communication in Vietnam, while establishing a foundation for international collaboration on operational applications of urban climate forecasting under the challenges of global climate change.

Keywords: UV Index; Heat Index; Thermal potential; Operational standards application; Urban forecasting; Ho Chi Minh City; Climate change



ASSESSMENT OF SHORELINE PROTECTION EFFICIENCY OF TWO BREAKWATER OPTIONS IN LONG VINH COMMUNE, VINH LONG PROVINCE

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ABSTRACT

The impact of upstream development, climate change, and sea level rise on the Mekong Delta is becoming increasingly evident. The coast in Long Vinh commune, located near Dinh An estuary, has been seriously eroded recently. This paper utilizes the MIKE 21/3 Coupled Model FM to simulate seasonal current regimes, wave height for two shoreline protection solutions. The two compared solutions include a revetment with two rows of prestressed centrifugal concrete piles filled with rubble stone (Solution 1) and a revetment using perforated precast concrete blocks (Solution 2). The model is calibrated and verified with data on water level, flow, wave height from national stations and actual measurements in the area. The reliability of the model is assessed through the RMSE and NSE indices. The results show that both solutions provide effective shoreline protection; however, Solution 1 demonstrates better performance. This study serves as a scientific basis to assist local authorities in selecting appropriate shoreline protection measures for the area

Keywords: erosion, numerical simulation, hydrodynamics, Vinh Long, wave-reducing revetment.

Proceedings of Marince Science and Sustainable Development | 14 November, 2025



PREDICTING SEA-AIR METHANE POTENTIAL FROM DISSOLVED OXYGEN (DO) AND FIXED NITROGEN (N*) IN CAN GIO MANGROVE (HCMC)

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ABSTRACT

Mangrove forests export organic-rich, reducing porewaters that foster methanogenesis in micro-anoxic niches despite high seawater sulfate. Two readily observed biogeochemical indicators—dissolved oxygen (DO) and the fixed-nitrogen anomaly (N*)—can help predict dissolved methane (CH₄) in adjacent waters. Therefore, an inverse DO–CH₄ relationship is expected, often non-linear with thresholds near hypoxia ($< 2 \text{ mg L}^{-1}$). N* diagnoses nitrogen gain/loss relative to Redfield stoichiometry, typically computed as $\mathbf{N}^* = [\mathrm{NO_3}^-] - 16[\mathrm{PO_4}^{3-}] + 2.9$. Negative N* implies fixed-N removal by denitrification/anammox in reducing environments that also favor CH₄ buildup; positive N* reflects N fixation or external NO₃⁻ inputs, usually linked to better ventilation and lower CH₄. Thus, CH₄ tends to covary negatively with N* (more negative N*, more CH₄).

Keywords: fixed nitrogen, dissolved oxygen, methane



MANGROVE LIVING LAB

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ABSTRACT

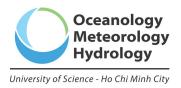
The Mekong Delta in Vietnam is facing a dire threat of near-complete submersion by the end of the century unless urgent actions are taken throughout the river basin. Without intervention, this delta, home to nearly 20 million people, could see up to 90% of its land underwater, with profound local and global consequences. Land subsidence, accelerated by human activities like excessive groundwater extraction and aggravated by sea level rise, is causing the delta to sink below sea level. To address this crisis, it is essential to implement measures that harness natural processes to protect against devastating and recurrent flooding. Collaboration from national governments, international organizations, the private sector, and civil society is crucial. The submersion of the Mekong Delta is threatening the vulnerable communities, particularly those situated near the six estuarine river mouths. Historically, these coastal and estuarine mangrove habitats have served as natural shields, dissipating wave energy and capturing sediment. They have been indispensable in safeguarding the provinces' inhabitants. Furthermore, these mangrove ecosystems have nurtured rich ecological diversity and supported lucrative tourist and fishery industries. However, the ongoing degradation of Mekong coastal habitats raises significant concerns regarding their continued ability to provide these vital services in the future. Urgent action is needed to preserve these critical ecosystems for future generations. Mangrove restoration and planting is a complex undertaking that requires political, social, economic and biophysical enabling conditions. Therefore, the implementation of these types of naturebased solutions should be conducted on the basis of local knowledge and expertise and involve participatory decision-making and longterm monitoring and data collection. A longterm physical living lab in the Mekong Delta will be able to validate these conditions and strengthen this with actual data and evidence-based understanding. Living labs serve as a crucial link between knowledge developers and innovation users, facilitating the development of research projects, pilot initiatives, and field experiments. This dynamic involvement in practical projects helps raise awareness of innovative practices. As a result, universities become more integrated with society and have greater influence when providing advice to various partners.

Keywords: submersion risk, land subsidence, nature-based solution, living lab











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