



Report

International Conference

“Marine Geology: Marginal Seas - Past and Future”

November 27 - December 1, 2023

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Base for International Science & Technology Cooperation of Deepsea Geoscience, MOST, China.

Key Laboratory of Marine Mineral Resources, Ministry of Natural Resources, China.

Southern Marine Science and Engineering Guangdong Laboratory (Guangzhou), China.

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DDE Marginal Seas Task Group



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1. Introduction

Marginal seas as zones of transition between continents and oceans are increasingly becoming the focus of international marine research. The reason lies in their importance as buffer zones for the natural transfer of matter and energy between the mainland and the marine areas and thus as a source of marine raw materials, for energy production, as trade routes and the socio-economic networking of society. In addition, the coastal zones and the people living there are increasingly threatened by sea-level rise and extreme weather phenomena, so that effective coastal zone management is of vital importance.

To contribute to the demands of the society on marine geosciences, and to foster international cooperation we established a network of marine scientists and launched a scientific research initiative focused on marginal seas research. Our special research approach consists in the integration of the new possibilities of big data analysis and modeling techniques including AI and machine learning. On 28th November, 2019, the 1st Marginal Seas Expert Meeting took place at Guangzhou, China titled “Eurasian Marginal Seas: Past and Future”, hosted by the Guangzhou Marine Geological Survey (GMGS), China Geology Survey (CGS), and attended by 18 overseas experts from seven countries, together with 50 Chinese colleagues. During the COVID-19 pandemic, the conference “Marginal seas: Past and Future”, was held on-line as 2nd Marginal Seas Expert Meeting hosted by the University of Szczecin (USZ), Poland and the Baltic Earth scientific network, on 16-17th December, 2020. In 2021 the Marginal Seas Task Group has been established in the frame of the Deep-Time Digital Earth (DDE) Big Sciences Program of the International Union of Geological Sciences (IUGS) and co-organized later scientific events such as the GMGS/CGS hosted a hybrid online / onsite 3rd Expert Meeting “Marine Geology: Marginal Seas - Past and Future” on 14-17th December, 2021, at Guangzhou, China. The 4th Marginal Seas Expert Meeting: hybrid online / face-to-face Conference Session “Comparing Marginal Seas”, was integrated into the 4th Baltic Earth Conference, May 31-June 2, 2022 in Jastarnia, Poland, hosted by the DDE Marginal Seas Task Group, University of Szczecin, Poland and Baltic Earth scientific network. The 5th Marginal Seas Expert Meeting was an on-line event hosted by USZ, Poland and Baltic Earth on 5-7th December, 2022, with a

major theme of “River Mouth Systems - Natural Drivers and Human Impacts”.

The chain of events was continued via the 6th Marginal Seas Expert Meeting, which was integrated into the hybrid online/onsite IAMG2023 Conference in Trondheim, Norway, August 5-12, 2023, with a topical Session of “Marginal Seas - Dynamics and Modeling”. This meeting was specifically undertaken to strengthen young scientists’ participation in the DDE Marginal Seas activities.

The IUGS and International Association for Mathematical Geosciences (IAMG) provided promotion of the Marginal Seas initiative network, not only for the organization of scientific meetings, but also for research, in particular by supporting the R&D Project “Morphological Evolution of Coastal Seas - Past and Future” undertaken from 2021 to 2024.

To continue pushing the Marginal Seas initiative forward, the International Conference “Marine Geology: Marginal Seas - Past and Future” was held in Guangzhou, November 27 to December 1, 2023. As the 7th Marginal Seas Expert Meeting, it was to support communication in marine geoscience and technology between Chinese scientists and their international partners that are active in marine geosciences, including the coastal and marine environmental research, fundamental geology, mathematical geosciences, marginal sea future projections, and management for the upcoming decades.

The conference was organized and hosted by the GMGS/CGS, Guangzhou, China that have carried out numerous successful marine geological surveys and scientific research work in the marginal sea areas of the South China Sea, as well as the deep sea and polar sea areas in the past 60 years. In this field of science, the GMGS has successfully cooperated during the last 40 years with colleagues and organizations from the American and European Continents, as well as from East and South Asia.

This hybrid online / onsite international conference was one of the important scientific activities to celebrate the 60th anniversary of GMGS in 2023. The conference was structured into an opening ceremony, four topical sessions, discussion and conclusion parts covering three days with English language speech and presentations.

Four main targets of the conference are to be mentioned:

- Extension of the international Marginal Seas Research Network,
- Further development of fundamental and applied fields in marginal sea research,
- Scientific support of the current and future DDE Marginal Seas research projects,
- Definition of the grand challenges of marginal seas research as basis for the preparation of future research projects.

2. The conference

The main venue sets in GMGS Nansha Base in Guangzhou. After several months' preparation, the conference has received 62 abstracts.

Opening ceremony:

During the opening session the participants of the conference were welcomed by Lixia Xing, vice director general of GMGS and Guangsheng Yan, Leading Team of GCS;

Jennifer McKinley, IUGS Executive Committee councilor IAMG, Committee councilor/Past President, DDE Governing Council chairman, Queen's University Belfast, UK, and Andrzej Skrendo, vice rector of the University of Szczecin attended the opening ceremony and delivered welcome speeches. Gaowen He, GMGS, chaired the opening ceremony on behalf of conference host and sponsors.

Representatives from Division of Fundamental Geology of CGS, and Representatives from Guangzhou Municipal Science and Technology Bureau did attend the opening ceremony.

Scientific part:

The scientific part of the conference was introduced by 3 plenary keynote lectures. During the topical sessions, 4 keynotes lectures and 41 regular lectures were delivered, and 11 poster lectures were presented.

Extended discussions summarized the results of each topical session and a final discussion session was held to conclude the general outcomes of the conference. which was attended by more than 100 participants from 11 countries.

3. Key note lectures

H. Gary Greene (Moss Landing Marine Labs, San Jose State University, USA) in his key note lecture that he had prepared together with John R. Delaney (School of Oceanography, University of Washington, Seattle, USA) gave an introduction into the concept of Urban Seas and exemplified the concept by the Salish Seas. This concept is initiating a general discussion of the marginal seas research as a new direction in marine sciences to integrate of basic and applied concepts in the view of the UN Sustainable Development Goals.

The second key note lecture was devoted to river mouth systems as interfaces between the terrestrial and marine realm. **Snigdha Ghatak** (Geological Survey of India, Kolkata, India) explained spatio-temporal evolution of Ganges-Brahmaputra-Meghna Mega Delta System, delivering one of the world's largest tropical riverine sediments loads to receiving marine basins. The general agreement of the projected model output with the observed coastal morphological configuration suggest that empirical data analyzes together with modeling approaches open up new perspectives for coastal zone management in line with the UN Sustainable Development Goals.

In his key note lecture **Gaowen He** (Guangzhou Marine Geological Survey, China) described the importance of targeted theoretical and applied research for the practical use of marginal seas natural resources and its environmental protection. He explained the chain of “International Marginal Seas Expert Meetings” that have been organized by co-operating research institutes since 2019 taking into account theoretical base line studies in geosciences and modern data sciences as well as case studies in applied marine and coastal sciences.

4. Topical Sessions

The conference was structured into four topical sessions. The first session focusses on **river impacted continental shelves - sediments and environment** continuing the discussion of methodologies, societal demands and future regional target areas. The second session on **coastal processes** is aiming to foster the discussion related to the research R&D Project of the DDE Marginal Seas Task Group which aims to compare coastal developments of coastal seas.

The third session on **ecosystem dynamics** shall contribute to integrate environmental data into the general concept of interdisciplinary marginal seas research. The fourth session on **Methodological approaches and Geodata management, including Machine Learning and Artificial Intelligence** is devoted mainly to formatting, harmonizing, processing and mapping marginal sea data to manage geodata and to make the spatial database FAIR (Findable, Accessible, Interoperable and Reusable) through the implementation of dedicated Marine Spatial Data Infrastructure at different scales.

4.1. Session 1.

River impacted continental shelves - sediments and environment

Conveners: Peter Clift (University College London, UK), Gary Greene (Moss Landing Marine Laboratories, California, USA), Jan Harff (University of Szczecin, Poland), Joanna Waniek (Leibniz Institute for Baltic Sea Research, Warnemünde, Germany)

Topics:

Main topics addressed by presentations and discussions

- 1) Rapid climate change and impact on environment and vegetation in China,
- 2) Development of river systems and landscape response to sea level change and Neotectonic controls on sediment distribution in nearshore areas.

Keynote lecture:

Peter D. Clift (Department of Earth Sciences, University College, London, UK and Department of Geology and Geophysics, Louisiana State University, Baton Rouge, USA) reported about the largest rivers of southern China and Indochina that deliver large quantities of sediment to the marginal seas of Asia. The facies of the sediments in the receiving marine basins record the climate and weathering of the sources area, the environmental change on the pathway to the depositional areas. On the other side the feedback of this source-to-sink system to climate variation can be considered by cause-effect models. Detailed scientific exploration both by geophysics, and through coring of the continental shelves of Southeast Asia is critical to test these models in order to generate future projections of climate and environmental development.

Regular presentations:

Shuyu Wu (Yantai Center of Coastal Zone Geological Survey, CGS, China) explained his studies to identify different Stages of Paleochannels and his Source-to-sink analysis at the beginning in the Middle Pleistocene in the Western Bohai Sea in North China.

Bing Song (Nanjing Institute of Geography & Limnology, CAS, China) studied Vegetation succession, climate change and cold events during 9.2–8.0 cal ka BP in eastern China. As proxy-data they used high-resolution pollen data from the Yangtze delta plain area

Pawel Sydor (Polish Geological Institute-National Research Institute Gdansk, Poland) reported about an investigation of the evolution of a barrier coast under condition of sand starvation and sea-level change exemplified the Polish coast of the of the tideless Baltic Sea.

Not only surface water discharge to the marine basin have been considered. **Cátia Milene Ehlert von Ahn** (Leibniz Institute for Baltic Sea Research Warnemünde, Germany) studied the influence of submarine groundwater discharge in the southern Baltic Sea on biogeochemical characterization of benthic processes in a range of coastal sediments.

Pingyuan Li (Guangzhou Marine Geological Survey, China) et al. analyzed the influence of neo-tectonic movement on south coast of Hainan Island of China changes of the coastal zone. Based on the investigation of 5 sediment cores the authors showed that unexpectedly tectonic subsidence played a significant role in the coastal development of the research area.

Qian Yu (Nanjing University, China) reported about the generation of gravity-driven sediment transport processes on muddy coasts. The author exemplified the process by the identification of such flows over the shallow sea floor of the muddy open Jiangsu Coast, China.

Mohamad Shaufi Sokiman (University Malaysia) et al. explained how heavy minerals from a lower coastal plain of the Sungai Terengganu and Sungai Dungun fluvial system can be regarded as the potential source for Rare Earth Element (REE).

Hai Lin (Guangzhou Marine Geological Survey, China) presented a video lecture, focusing on the heavy metals' pollution history and trend on semi-enclosed embayment as Shenzhen Bay in Pearl River Estuary.

Poster presentation:

Yingci Feng (South China Sea Institute of Oceanology, China) presented three-dimensional seismic evidence for depositional undulations nucleated around pre-existing relief, South China Sea.

Tiantian Sun (Zhejiang University, China), **Yaming Yang**, **Wei Li** and **Kuanle Bao** from China did not yet present regular or poster lecture due to international travelling or health problem.

4.2. Session 2

Coastal processes

Conveners: Joanna Dudzińska-Nowak (University of Szczecin, Poland; Section of Marine Geology, Polish Scientific Committee on Oceanic Research, Polish Academy of Sciences), Tarmo Soomere (Estonian Academy of Sciences; Tallinn University of Technology, Estonia), Xinong Xie (China University of Geosciences in Wuhan, China), Abdullah Sulaiman (Department of Mineral and Geoscience Malaysia, Kuala Lumpur, Malaysia)

Topics:

- 1) Geological settings, key driving forces and developing straightforward linking of dynamic forcing to account for the observed behavior
- 2) Methods integration and using the new methods and technologies to generate more effective data
- 3) Different data sources integration - from global open access datasets to high-resolution ones collected by innovative RS and in-situ technologies
- 4) Enhancing the accuracy of numerical modeling
- 5) Application results of integrated data analysis to assess coastal vulnerability

Keynote lecture:

The **Andrew Cooper** (Ulster University, UK; University of KwaZulu-Natal, South Africa.) keynote lecture highlighted **the importance of understanding the geological settings and key driving forces** in the analyses of coastal zone behaviour at multi-decadal timescales. Although

the record of morphological change is improving with advances in technology and chronological control and the record of dynamics is improving with new hindcast datasets, **straightforward linking of dynamic forcing and response is seldom able to account for observed behaviour.**

Regular Presentations:

Zhaoquan Huang (Xiamen University, China) discussed the possibility of effectively distinguishing the surface deformations caused separately by human activities and natural processes using multi-temporal InSAR images analyses, which is important in terms of spatial planning and disaster prevention and mitigation.

Giovanni Fasciglione presented the analysis of the changes of the sea bed morphology due to the restoration of two breakwaters protecting a significant urban beach of Naples' coast (southern Italy) based on the different sources of data integration from global open access datasets (meteo-marine data, aerial and satellite photos between 1994 and 2021) to high-resolution ones (morpho-acoustic and GPS data) collected by innovative technologies for marine surveys.

Marek Harenda (Institute of Hydro-Engineering of the Polish Academy of Sciences) presented the method of analyzing changes in various morphometric parameters over time, such as shoreline change or sediment erosion in the nearshore zone as well as an influence of the hydro-engineering structures and measures based on high-resolution ALS monitoring.

Yunwei Wang (Nanjing Normal University, China) focuses on uncovering variances in the efficacy of distinct datasets, like RS data and in-situ measurements, when extracting periodic features of the suspended sediment concentration, thus aiding individuals in comprehending the range of application scenarios and constraints associated with such extractions.

Rhodelyn Saban (Leibniz Institute for Baltic Sea Research Warnemünde, Germany) presented study based on isotope biogeochemical investigations to identify the basic processes and the possible influence of the on-going anthropogenic changes due to the disturbance of the coastal protection systems which indicates the influence of lithology and coastal morphology on the hydrogeodynamics of the coast.

Huang Cheng (Haikou Marine Geological Survey Center, China) presented the application of ambient noise tomography method for coastal granite Wuzhizhou island in Hainan, which not only enriches the experience of underground structure detection based on background noise in the island, but also provides key basic information for the study of geological evolution history, island spatial planning and geological disaster prevention.

Amin Noorasid Abdul Jalil (Department of Mineral and Geoscience Malaysia, TSD, Malaysia) presented coastal geological and geohazard mapping in Malaysia based on integrated various datasets and the development of a number of geological indicators, such as geological and geophysical data to address coastal environmental issues with in coastal zone.

Mirza Iryawan Bin Hamza from Malaysia focused on the new possibilities and advantages offered by unmanned surface vessel for coastal seabed and sub-seabed mapping.

Junjie Deng (Sun Yat-sen University, China) presented the conceptual model of the historical evolution of the river mouth based on modern velocity measurements and results derived from model experiments, which can be applied to river mouths where suspended sediment transport is dominant and influenced by angled incoming tides.

Alessia Sorrentino (University of Naples, Parthenope, Italy) discussed the recent morphological and environmental changes that occurred since the second half of the 20th century along the sandy coast based on an integrated GIS analysis of topographic maps, aerial and satellite photos, and high-resolution data (a photogrammetric survey carried out with an aerial drone in April 2023), showing the importance of an integrated approach for the analysis of coastal dynamics in a fast-evolving world, where human presence could strongly interfere with natural processes.

Nabanita Sarkar (University of Modena and Reggio Emilia, Italy) presented the study to assess coastal vulnerability with respect to a series of hazardous processes, using an index-based approach supported by extensive field surveys.

Rachel Jankowski (University of Szczecin, Poland) focused on the decadal-scale morphodynamics of the southern Baltic Sea. The presented results pointed out the considerable temporal and spatial variability as well as high dynamics of the coastal changes, which can

strongly bias the past reconstructions and future projections based on short-term observation and pose a potential threat to the infrastructure.

Poster presentation:

Mengting Li (Yantai/CGS, China) presented the study on distribution and ecological risk assessment of pollutant in the coastal zone of Yantai, China. **Wenxin Jiang** (Yantai Center/CGS, China) presented the study on changes of coastline morphology and submarine geomorphology in Caofeidian Area, Bohai Sea.

Michael Boettcher (Leibniz Institute for Baltic Sea Research Warnemünde, Germany), **Hongze Yu** and **Jingyu Hu** from China did not yet present regular or poster lecture due to computer problem or other issues.

4.3. Session 3

Ecosystem dynamics

Conveners: Yenny Risjani (Brawijaya University, Indonesia), Jinpeng Zhang (Guangzhou Marine Geological Survey, CGS, China), Yahui Gao (Xiamen University, China)

Topics:

- 1) Biogeography distribution of living and recent diatom and harmful algae in marginal seas.
- 2) Fossil diatom from coastal to shelf to deep basin in marginal seas, and their response to paleo-climate and paleo-oceanography change, and meteorology events (i.e., typhoon).
- 3) Laboratory methods development on diatom and bacteria interaction analysis, and on autophagy of zooxanthellae and host cells in giant clam *Tridacna noae* observation.

Keynote lecture:

The keynote speech from **Yenny Risjani** (Universitas Brawijaya, Malang, Indonesia) gave a whole view of high biodiversity and species richness of marine diatoms along the Indonesian Archipelago, with huge diatom species observed from the samples site (~ 100 stations). That extremely higher marine diatom species level diversity has over other biodiversity hotspots on the earth. Plenty of new species were found in their samples that collaborated with prof.

Andrzej Witkowski, (USZ, Poland). The memories are to him, the respected natural scientist, diatomologist.

Regular presentations:

Min Chen (Third Institute of Oceanography, MNR, China), reported their study on southeast China coastal and shelf area to investigate the past-typhoon record through the micro-paleontology analysis, especially based on diatoms, but included other microfossil groups to highlight the record.

Jérôme Kaiser (Leibniz Institute for Baltic Sea Research Warnemünde (IOW), Germany), gave a new-style found of diatom bloom mechanism in Baltic Sea, on the basis of laminated sapropel sediments in a sediment core. That interval is dated to the middle Holocene, in terms of warm stage, indicating the stratification water mass, those similar Mediterranean-like “fall dump” events.

Miaomiao Liu from Shantou University, China, gave a presentation to introduce biological facies variations with foraminifera and diatom in the NW South China Sea, since the late MIS 3, combined the previous study results, she discussed the paleoenvironmental implications and potential mechanism.

Chunlian Li from South China Normal University, China, gave a presentation about laboratory experiment on diatom and bacteria culture, via different conditions. The results shown bacteria with high nitrogen condition can trigger diatom growth, that make sense for understanding diatom-bacteria interaction in natural estuary environment.

Jinpeng Zhang from Guangzhou Marine Geological Survey, CGS, China, has shown the fossil diatom distribution in the drilling core from west shoal of inner Pearl River Estuary, with relative continental depositional units. The study exposed the fast and low depositional rate in Holocene and shown millennial-scale pulses phenomena of relative fast depositional processes in early, middle, and late Holocene, respectively. The diatom and sediments parameters indicated human being forces in last 1.4 kyr.

Poster presentation:

Zheng Wang from Xiamen University, gave a poster slides presentation to introduce sub-fossil diatom distribution in Taiwan Strait, and the multi-statistical analysis with environment variables, showing the strong relationship of diatom distribution pattern and water currents, freshwater input, and seawater salinity.

In addition, **Conghui Peng** from China submitted abstract but without presentation, the abstract focusing on harmful algal species attached to microplastics in the typical bays, East China Sea.

Minghua Guo from China, submitted abstract but due to her travelling business missed the poster presentation time. Her topic is about zooxanthellae and host cells in the outer mantle of the giant clam *Tridacna noae* with a stable fecal microbiota.

4.4. Session 4.

Methodological approaches and Geodata management, including Machine Learning and Artificial Intelligence

Conveners: Federica Foglini (The Institute of Marine Sciences of the National Research Council, Bologna, Italy), Jennifer McKinley (Queen's University Belfast, UK), Minghua Zhang (R&D Center of CGS, Beijing, China), Yuanzhi Zhang (The Chinese University of Hong Kong, China)

Topics:

- 1) Formatting, harmonizing, processing, and mapping marginal sea data including AI and ML various application scenarios (such as data cleansing, image interpretation, semantic classification and segmentation, digital mapping).
- 2) Methodological approaches to manage geodata and to make the spatial database FAIR (Findable, Accessible, Interoperable, and Reusable) through the implementation of dedicated Marine Spatial Data Infrastructure at different scales.

Key Note Lecture:

The session started with a Key note about AI State of the art, gaps and opportunities in marine science from **Simone Marini** (CNR ISMAR). This talk highlighted well the gaps between computer science community and marine science community stressing the importance of using

AI and machine learning to provide insights that might not have been possible using traditional scientific methods alone.

Regular Presentations:

Jan Harff (University of Szczecin, Poland) presented the concept of marginal seas taxonomy focusing diversity and generalization and finding the link with the AI, the need for an efficient data management and modelling.

Lyuwen Wu (Shanghai Jiao Tong University, China) presented the DataExpo: A One-Stop Dataset Service for Open Science Research in Geosciences, showing some good example of data searching and documentation.

Zhongfeng Qiu (Nanjing University of Information Science and Technology, China) provided new insights about Algal blooms and how to distinguished from normal waters from enhanced chromatic parameters, showing the models he implemented.

Yi Lian (Tianjin Normal University, China) presented an Extensive Geodata Analysis about Avian Biodiversity Pattern in china with a Structural Equation Models.

Qingli Luo (Tianjin University, China) and **Yanzhuo Men** (Nanjing University of Information Science and Technology, China) provided excellent presentations focusing respectively on remote sensing data analysis for Oil Spill Detection using SAR-I satellite data and Green Tide Disaster from MODIS and GF-1 Data.

Yu Li (Beijing University of Technology, China) provided a new framework that employ complex-valued neural network to detect marine oil spills using polarimetric SAR data. Comparative studies were conducted on four study cases using RadarSAR-2 and SIR-C fully polarimetric SAR data.

Bing Wang (Guangdong Climate Center, China) presented Persist Heavy Rainfall (PHR) in Guangdong-Hong Kong-Macao Greater Bay Area GBA) analysis results via WRF-MSUCM Model and statistical analysis method, on the basic of daily precipitation dataset from 31 stations.

Federica Foglini (CNR-ISMAR, Italy) reported the FAIR “Research Object” paradigm for

supporting the research lifecycle management within Earth Science communities, and offered an interesting example of the Sea monitoring community within the H2020 REALIANCE project.

Jiixin Liu (Nanjing University of Information Science and Technology, China) introduced the methodology of XGBoost- and BPNN-based algorithms to estimate TSS and Chl-a levels in Pearl River Estuary.

Huaqian Hou (First Institute of Oceanography, MNR, China) provided an excellent new finding on the spatiotemporal distribution of sub-mesoscale eddies based on latest InIRA Data.

Poster presentation:

Tianqi Lu (Sanya Institute of South China Sea Geology, CGS, China) evaluated the performance of different atmospheric correction methods on mapping the bathymetry of shallow water depth using GaoFen-2 multi-spectral remote sensing data in Lingyang Reef of Xisha Islands. **Zhixiong Li** from China did not present the poster presentation due to health problem in hospital.

5. Summary

As the seventh Marginal Seas initiative the meeting supported researchers' communication in geo-marine science and technology among the international partners, including the coastal and marine environmental research, fundamental geology, marginal sea future projections and management for the upcoming decades. It also provided opportunity for multidisciplinary collaborative research in the field of geosciences, as several actions or plans are express the strong demand international cooperation in the coming future.

The scientific lectures and discussions encourage the organizers to continue the tradition of scientific conferences on marginal sea issues. In this way, the relatively new and modern field of marginal sea research can be further developed in a targeted manner.

The initiation of new joint international research projects is emphatically supported.

For advanced research future projects the following challenges have to be considered:

(1) River impacted continental shelves - sediments and environment (Session 1):

- 1) Temporal evolution of river systems and they impact on the sediments of continental shelves.
- 2) Influence of rapid climate change on landscape.

As an extension of topical session 1, a special discussion was held about a joint R&D Project under the DDE Marginal Seas Task Group umbrella supported by the Guangzhou Marine Geological Survey (GMGS). In 2023 the GMGS did run a drilling campaign on the shelf off the PRE. The sediment core will be made available to an international research team to study the development of the Pearl River Mouth System during the Pleistocene and Holocene. Research program and options are suggested to be discussed at an ad hoc online meeting "**Marginal Seas and River-Shelf Interface (RiSI)**" on Dec. 8, 2023 hosted by the GMGS.

(2) Coastal processes (Session 2):

- 1) To define the linking of geological and geomorphological settings and driving forces and the response in coastal zone morphodynamic.
- 2) To develop methods of different data source integration for reliable analysis.
- 3) To increase the accuracy numerical modeling by integration with measured data

(3) Ecosystem dynamics (Session 3):

- 1) Biodiversity of diatom and their biogeography, huge species and genera numbers and potential news taxa finding
- 2) Diatom fossil application in coastal and sea area for record on paleo-meteorology, paleo-climate events, paleo-bloom in higher and low latitude zone.
- 3) Assessment of human being forcing and natural impact on the nearshore and shelf area.

(4) Methodological approach and Geodata management (Session 4):

- 1) All the presentation provided an idea about the need of modelling natural phenomena. To this aim FAIR data management is the key and the way forward to effectively being able to provide reliable models.

- 2) While a large amount of publications present the current status of AI methodologies used by the marine science community, many other AI topics are not yet in use in the marine domain and need to be considered to advance the current observing systems and data analysis procedures.
- 3) Given the multidisciplinary of the presentations future steps will be also to integrate different results to give a holistic view of the marginal sea and being able to provide valuable models.

6. Conference photos

Conference photos





7. Appendix: Conference agenda

Conference Agenda

Opening Ceremony

UTC/GMT+8 Time zone (Beijing Time).

Time/28 th	Issue	Speaker/Affiliation/Local time	Host
15:00-15:05	Welcoming words	Lixia Xing, Deputy Director General, Guangzhou Marine Geological Survey, CGS, China	Gaowen He
15:05-15:10	Opening the conference	Guangsheng Yan, Conference Chairman, Leadership of China Geological Survey, China	
15:10-15:15	Brief speech	Jennifer McKinley, IUGS Executive Committee councilor IAMG, Committee councilor/Past President; DDE GC chairman/Queen's University Belfast, UK [7:00am, London]	
15:15-15:20	Brief speech	Waldemar Tarczyński, Rector, University of Szczecin, Poland [8:15am, Szczecin]	
15:20-15:25	Brief Speech	Abdullah Sulaiman, Director, Department of Mineral and Geoscience Malaysia, Kuala Lumpur, Malaysia. [15:20, Kuala Lumpur]	
15:25-15:30	Video adjustment		

Time/28th	Plenary lecture	Speaker/Affiliation/Local time	Host
※ 15:30-16:00	The Influence of the Fraser River Delta on an Active Margin Urban Sea System – Central Salish Sea – USA and Canada	H. Gary Greene, Moss Landing Marine Laboratories/San José State University USA [23:30, California]	Jinpeng Zhang
※ 16:00-16:30	Revisiting Spatio-temporal Evolution of Ganges-Brahmaputra-Meghna Mega Delta System	Snigdha Ghatak, Geological Survey of India, Kolkata, India. [13:30, Kolkata]	
※ 16:30-17:00	GMGS/CGS work for Eurasia Marginal Seas - Past and Future Initiative	Gaowen He, Deputy Chief-Geoscientist, Guangzhou Marine Geological Survey, CGS, China	
17:00	Group photo		

(※, keynote speech, green colour remarks the in-site presentation)

Session One: River impacted continental shelves - sediments and environment

Time/28 th	Lecture	Speaker/Affiliation/Local time	Host
※ 19:00-19:30	Large River Deltas and their Continental Shelves in Southeast Asia as Recorders and Controllers of Regional and Global Climate	Peter Clift, London University College, UK/ Louisiana State University, USA [11:00am, London]	Jan Harff
19:30-19:50	Evolution of barrier coast under condition of sand starvation and sea-level changes; an example from the Polish coast of the Baltic Sea	Paweł Sydor, PGI-NRI, Poland [12:30am, Szczecin]	
19:50-20:10	Heavy Minerals Occurrence as The Potential Source for Rare Earth Element (REE) - A Case Study from Lower Coastal Plain Fluvial Systems (Sungai Terengganu and Sungai Dungun)	Mohamad Shaufi Sokiman, UMT, Malaysia [19:50, Kuala Lumpur]	
20:10-20:30	Gravity-driven sediment transport processes on muddy coasts	Qian Yu, Nanjing University, China.	
20:30-20:50	Biogeochemical characterization of benthic processes in a range of coastal sediments affected by submarine groundwater discharge in the southern Baltic Sea	Cátia Milene Ehlert von Ahn, IOW, Germany [13:30, Berlin]	
20 minutes	Breaktime		
21:10-21:30	Vegetation succession, climate change and cold events during 9.2–8.0 cal kyr BP in eastern China: High-resolution pollen evidence from the Yangtze delta plain area	Bing Song, Nanjing Institute of Geography & Limnology, CAS, China.	Peter Clift
21:30-21:50	Identification of Three Stages of Paleochannels and Main Source Analysis Beginning in the Middle Pleistocene in the Western Bohai Sea in North China	Shuyu Wu, Yantai Center of Coastal Zone Geological Survey, CGS, China.	
21:50-22:10	Influence of neotectonic movement on south coast of Hainan Island of China, Pingyuan Li, GMGS, China	Pingyuan Li, Guangzhou Marine Geological Survey, CGS, China	
22:10-22:50	EXTENSION Session Discussion	All participants	Peter Clift

Time/29 th	Lecture	Speaker/Affiliation/Local time	Host
9:50-10:10	Mn (II) carbonate authigenesis marks the benthic SMTZ and is fueled by Mn-driven anaerobic oxidation of methane: A Black Sea perspective	Tiantian Sun, ZU-China/IOW-Germany	H. Gary Greene, Jan Harff
10:10-10:30	Characterization of grain size and clay mineral distribution and provenance implication of surface sediments in Tangshan Harbor, Bohai Bay	Yamin Yang, Natural Resources Comprehensive Survey Command Center, CGS, China.	
10:30-10:50	Heavy metals pollution history and trend on semi-enclosed embayment — take Shenzhen Bay for example	Hai Lin, Guangzhou Marine Geological Survey, CGS, China	
10:50-10:55	Three-dimensional seismic evidence for depositional undulations nucleated around pre-existing relief, South China Sea 【Poster】	Yingci Feng, South China Sea Institute of Oceanology, CAS, China.	
10:55-11:00	Annual Assessment of Seawater Quality of Qinzhou Bay in 2020 【Poster】	Wei Li, Yantai Center of Coastal Zone Geological Survey, CGS, China.	
11:10-11:15	Geomorphologic characteristics and genetic analysis of the submarine pockmarks in the west of the North Yellow Sea (East of Miaodao Islands) 【Poster】	Kuanle Bao, Yantai Center of Coastal Zone Geological Survey, CGS, China.	
5mitues	Break time		

Session Two: Coastal processes

Time/29 th	Lecture	Speaker/Affiliation/Local time	Host
11:20-11:25	Enhancing Estuarine Evolution Projection under Human Influences: A Synergy of Bayesian Network and Process-Based Modelling 【Poster】	Hongze Yu, Sun Yat-Sen University, China.	Xinong Xie
11:25-11:30	Changes in sedimentary environment of the bayhead delta front depositions of the Lingding Bay, Pearl River Estuary 【Poster】	Jingyu Hu, Sun Yat-Sen University, China.	
11:30-11:35	Distribution and ecological risk assessment of pollutant in the coastal zone of Yantai,	Mengting Li, Yantai Center of Coastal	

	China 【Poster】	Zone Geological Survey, CGS, China.	
11:35-11:40	Study on changes of coastline morphology and submarine geomorphology in Caofeidian Area, Bohai Sea 【Poster】	Wenxin Jiang, Yantai Center of Coastal Zone Geological Survey, CGS, China.	

Session Two: Coastal processes

Time/29 th	Lecture	Speaker/Affiliation/Local time	Host
※15:00-15:30	Multi-decadal barrier behaviour: some geological constraints	Andrew Cooper, Ulster University, Northern Ireland, UK/University of KwaZulu-Natal, South Africa [7:00am, Ulster]	Joanna Dudzinska-Nowak
15:30-15:50	Scale Characteristics of InSAR Surface Deformation and Its Analysis of Natural and Human-Induced Drivers along the coast of Fujian, China	Zhaoquan Huang, Xiamen University, China	
15:50-16:10	Multi-technical approach for coastal changes reconstruction in urbanized context	Giovanni Fasciglione, University of Naples, Italy. [8:50am, Rome]	
16:10-16:30	Last 15 years erosion patterns along the root section of the Hel Peninsula, Poland in the light of LiDAR measurements	Marek Harenda, Institute of Hydro-Engineering of Polish Academy of Sciences, Poland. [9:10am, Gdansk]	
16:30-16:50	Periodicity of Suspended Sediment Concentration from Diverse Data Perspectives	Yunwei Wang, Nanjing Normal University, China.	
16:50-17:10	Isotope hydrobiogeochemistry of and material transport from modern hard-water creeks discharging to the southern Baltic Sea: In crusts we trust	Michael Boettcher, Leibniz Institute for Baltic Sea Research Warnemünde Germany. [9:50am, Berlin]	

17:10-17:30	Isotope biogeochemical investigations on the spatial and temporal dynamics of a coastal peatland in the southern Baltic Sea	Rhodelyn Saban, Leibniz Institute for Baltic Sea Research Warnemünde Germany. [10:10am, Berlin]	
17:30-17:50	Application of ambient noise tomography to coastal granite islands- A case study of Wuzhizhou Island in Hainan, China	Cheng Huang, Haikou Marine Geological Survey Center, China	
70 minutes	Break time		
19:00-19:20	Coastal Geological and Geohazard Mapping in Malaysia	Amin Noorasid Abdul Jalil, Department of Mineral and Geoscience Malaysia, TSD, Malaysia. [19:00, Kuala Lumpur]	Xinong Xie
19:20-19:40	Unmanned Surface Vessel for Coastal Seabed and Sub-seabed Mapping	Mirza Iryawan Bin Hamza, Hidrokinetik Technologies Sdn Bhd, Malaysia. [19:20, Kuala Lumpur]	
19:40-20:00	Asymmetric evolution of river mouth bifurcation under angled river-tide interaction, a case study at river mouths of Lingding Bay, Pearl River Estuary	Junjie Deng, Sun Yat-sen University, China	
20:00-20:20	Reconstructing recent coastal changes in sites of community importance by integrating geomorphological and remote sensing surveys: the case of Cala Cefalo (Southern Italy)	Alessia Sorrentino, University of Naples, Parthenope, Italy. [13:00, Rome]	
20:20-20:40	Coastal vulnerability assessment in a Mediterranean changing environment: A case study from the Maltese Islands	Nabanita Sarkar, University of Modena and Reggio Emilia, Modena, Italy. [13:20, Rome]	
20:40-21:00	Decadal scale morphodynamics of the southern Baltic Sea Coast, Western Pomerania, Poland	Rachel Jankowski, University of Szczecin, Poland/Groton Connecticut, USA [7:40am, Groton Connecticut]	
20 minutes	Break time		

Session Three: Ecosystem dynamics

Time/29 th	Lecture	Speaker/Affiliation/Local time	Host
※21:20-22:50	Indonesian Archipelago reveals sustainable and high biodiversity and species richness of marine diatoms. What's next? (In memories with A. Witkowski).	Yenny Risjani, Universitas Brawijaya, Malang, Indonesia [20:20, Sekampung Udik]	Jinpeng Zhang
21:50-22:10	Microfossil Records of Modern Typhoons along the Coast of China	Min Chen, Third Institute of Oceanography, MNR, China	
22:10-22:30	Mediterranean-like “fall dump” events in the Baltic Sea	Jérôme Kaiser, Leibniz Institute for Baltic Sea Research Warnemünde (IOW), Germany. [15:10, Berlin]	
22:30-22:50	Biological facies variations since the late MIS 3 in northwestern South China Sea and their paleoenvironmental implications	Miaomiao Liu, Shantou University, China.	
22:50-22:55	Acute heat stress induces autophagy of zooxanthellae and host cells in the outer mantle of the giant clam <i>Tridacna noae</i> with a stable fecal microbiota [Poster]	Minglan Guo, South China Sea Institute of Oceanology, CAS, China.	
22:55-23:00	Sub-fossil diatom in marine sediments from the Taiwan Strait and their environmental significance [Poster]	Zheng Wang, Xiamen University, China	

Session Three: Ecosystem dynamics

Time/30 th	Lecture	Speaker/Affiliation/Local time	Host
9:40-10:00	The source of metals pollution using lead isotopic in Brunai Bay, Malaysia	Joseph Anak Bidai, University Malaysia Terengganu, Malaysia [9:40, Kuala Lumpur]	Yahui Gao
10:00-10:20	Unraveling the Complex Interplay Between Diatoms and Bacteria Under Fluctuating Nutrient Conditions	Chunlian Li, South China Normal University, China	

10:20-10:40	Marine facies deposition history in inner bay of Pearl River Estuary, South China recorded from diatom and grainsize in Holocene	Jinpeng Zhang, Guangzhou Marine Geological Survey, CGS, China.	
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Session Four: Methodological approaches and Geodata management, including Machine Learning and Artificial Intelligence

Time/30 th	Lecture	Speaker/Affiliation/Local time	Host
10:40-11:00	Marine oil spills detection and classification based on polarimetric synthetic aperture radar	Yu Li, Beijing University of Technology, China.	Yuanzhi Zhang
11:00-11:20	Demystifying the Changes and Characteristics of Persistent Heavy Rainfall in the Guangdong-Hong Kong-Macao Greater Bay Area, South China	Bing Wang, Guangdong Climate Center, China.	
11:20-11:25	Effect of Atmospheric Corrections on Shallow Sea Bathymetric Mapping Using GaoFen-2 Imagery: A Case Study in Lingyang Reef, South China Sea 【Poster】	Tianqi Lu, Sanya Institute of South China Sea Geology, GMGS/CGS, China	
11:25-11:30	Influence of Different Experimental Conditions on the Determination of Available Phosphorus Content in Alkaline Soils 【Poster】	Zhixiong Li, Kunming Natural Resources Comprehensive Survey Center, CGS, China.	
3h30mitues	Break time		
※ 15:00-15:30	AI State of the art, gaps and opportunities in marine science	Simone Marini, Institute of Marine Sciences of the National Research Council, La Spezia, Italy. [8:00, Rome]	Federica Foglini
15:30-15:50	Marginal Seas – Diversity and Generalization	Jan Harff, University of Szczecin, Poland. [8:30, Szczecin]	
15:50-16:10	DataExpo: A One-Stop Dataset Service for Open Science Research in Geosciences	Lyuwen Wu, Shanghai Jiao Tong University, China.	

16:10-16:30	Algal blooms distinguished from normal waters from enhanced chromatic parameters	Zhongfeng Qiu, Nanjing University of Information Science and Technology, China	
16:30-16:50	Exploring Avian Biodiversity Patterns: Insights from Extensive Geodata Analysis and Structural Equation Modeling	Yi Lian, Tianjin Normal University, China.	
16:50-17:10	Deep Convolutional Neural Network for Sentinel-1 SAR Oil Spill Detection	Qingli Luo, Tianjin University, China.	
17:10-17:30	Remote Sensing Monitoring of Green Tide Disaster from MODIS and GF-1 Data: A Case Study in the Yellow Sea	Yanzhuo Men, Nanjing University of Information Science and Technology, China.	
90 minutes	Break time		
19:00-19:20	The FAIR “Research Object” paradigm for supporting the research lifecycle management within Earth Science communities – the example of the Sea monitoring community within the H2020 REALIANCE project	Federica Foglini, CNR-ISMAR, Bologna, Italy [12:00, Rome]	Minghua Zhang
19:20-19:40	Estimation of total suspended solids and chlorophyll-a in estuaries by remote sensing: a case in Pearl River Estuary and its coast	Jiabin Liu, Nanjing University of Information Science and Technology, China.	
19:40-20:00	New Findings on the Spatiotemporal Distribution of Submesoscale Eddies Based on Latest InIRA Data	Huaqian Hou, First Institute of Oceanography, MNR, China.	
20:00-20:20	Automatic classification of coastline and prediction of change - an exemplary study for the North Sea and Baltic Sea	Peter Arlinghaus, Helmholtz-Zentrum Hereon, Geesthacht, Germany [13:00, Berlin]	
10 minutes	Break time		

Conclusion Session

Time/30 th	Lecture	Speaker/Local time	Host
20:30-21:10	Conference content discussion, Conclusion	Session's convenors, All the participants	Jan Harff
21:10-22:00	Future joint work discussion, Conclusion	All the participants	Jan Harff, Peter Clift, Jinpeng Zhang
22:00-22:10	Publication issues discussion, Conclusion	Potential Journal/Magazine editorial office, all the participants	Jinpeng Zhang
22:10	CONFERENCE CLOSE (Closing ceremony)	GMGS/CGS Managers	Jinpeng Zhang

