AGENDA

CHESS- Chinese and European Coastal Shelf Seas Ecosystem Dynamics – a Comparative Assessment

First bilateral workshop

25-27 November, 2020

Day 1

November 25th, 2020, Wednesday		
08:00-08:20 (UTC+1) 15:00-15:20 (UTC+8)	Opening Ceremony Chairs: Prof. Corinna Schrum & Prof. Xueen Chen	
Session 01: Seasonal-to-decadal variability of atmospheric forcing and impact on primary production and ecosystem structure Chair：Prof. Wensheng Jiang, OUC		
08:20-08:35 (UTC+1) 15:20-15:35 (UTC+8)	Added value and uncertainty from coupling high-resolution river forcing to long-term simulations of the North and Baltic Sea ecosystem	Fabian Werner
08:35-08:50 (UTC+1) 15:35-15:50 (UTC+8)	Can environmental conditions at North Atlantic Sponge grounds be predicted several years ahead?	Feifei Liu
08:50-09:05 (UTC+1) 15:50-16:05 (UTC+8)	Simulating coastal marine ecosystems to understand long-term changes and Process interactions	Ute Daewel
09:05-09:20 (UTC+1) 16:05-16:20 (UTC+8)	Less Nutrients but More Phytoplankton: Long-Term Ecosystem Dynamics of the Southern North Sea	Xu Xu
09:20-09:40 (UTC+1) 16:20-16:40 (UTC+8)	Extended Discussion	
09:40-09:50 (UTC+1) 16:40-16:50 (UTC+8)	Coffee/Tea break	
09:50-10:05 (UTC+1) 16:50-17:05 (UTC+8)	Shifts in species' ranges and marine community dynamics in the Bohai Sea	Jun Sun
10:05-10:20 (UTC+1) 17:05-17:20 (UTC+8)	Spatiotemporal variability of ultraviolet Attenuation from satellite observations	Tinglu Zhang
10:20-10:35 (UTC+1) 17:20-17:35 (UTC+8)	Zooplankton study in the Bohai Sea	Wuchang Zhang
10:35-10:50 (UTC+1) 17:35-17:50 (UTC+8)	Estimation and Prediction on Storm Surge in Qingdao, China	Wensheng Jiang
10:50-11:30 (UTC+1) 17:50-18:30 (UTC+8)	Extended Discussion	

Note: Each talk consists of 12-min Presentation plus 3-min Discussion

Day 2

November 26th, 2020, Thursday		
Session 02: Coupled physical-biogeochemical model development and application Chair: Prof. Corinna Schrum, HZG		
08:00-08:15 (UTC+1) 15:00-15:15 (UTC+8)	Improving regional model skills during typhoon events: A case study for super Typhoon Lingling over the northwest Pacific Ocean	Delei Li
08:15-08:30 (UTC+1) 15:15-15:30 (UTC+8)	The significance of hydrodynamical noise in modelling dynamics in marginal seas	Hans von Storch
08:30-08:45 (UTC+1) 15:30-15:45 (UTC+8)	A Case Study of Bohai Bay Ecosystem by Using a 3D Hydrodynamic-Ecosystem Couple Model Part I: Model Description, Calibration and Validation	Hanfang Lu
08:45-09:15 (UTC+1) 15:45-16:15 (UTC+8)	Extended Discussion	
09:15-09:30 (UTC+1) 16:15-16:30 (UTC+8)	Coffee/Tea break	
09:30-09:45 (UTC+1) 16:30-16:45 (UTC+8)	Modelling tidally induced ecosystem dynamics at the NWEU shelf break	Jan Kossack
09:45-10:00 (UTC+1) 16:45-17:00 (UTC+8)	The turnback and meandering of the inflow through the Bohai Strait from northern Yellow Sea in Summer	Yinfeng Xu
10:00-10:15 (UTC+1) 17:00-17:15 (UTC+8)	Seasonal variations of the Yellow Sea Cold Water Mass and its formation mechanisms	Lin Lin
10:15-11:30 (UTC+1) 17:15-18:30 (UTC+8)	Extended Discussion	

Note: Each talk consists of 12-min Presentation plus 3-min Discussion

Day 3

November 27th, 2020, Friday		
Session 03: Benthic-pelagic coupling Chair: Dr. Wenyan Zhang, HZG		
08:00-08:15 (UTC+1) 15:00-15:15 (UTC+8)	The community upper vertical position as a key trait for the spatial organization of macrobenthos	Carsten Lemmen
08:15-08:30 (UTC+1) 15:15-15:30 (UTC+8)	Mutual dependency between coastal morphodynamics and benthic biological functioning: Identifying the main drivers for long-term morphological evolution	Peter Arlinghaus
08:30-08:45 (UTC+1) 15:30-15:45 (UTC+8)	Structure of benthic food web and trophic relationship of macrofauna in the Yellow Sea	Xiaoshou Liu
08:45-09:00 (UTC+1) 15:45-16:00 (UTC+8)	Benthic oxygen consumption in coastal shelf seas – the quantitative importance of abiotic and biotic drivers	Wenyan Zhang
09:00-09:30 (UTC+1) 16:00-16:30 (UTC+8)	Extended Discussion	
09:30-09:45 (UTC+1) 16:30-16:45 (UTC+8)	Coffee/Tea break	
Session 04: Anthropogenic impacts on hydrodynamics and ecosystems Chair: Prof. Jun Sun, CUG		
09:45-10:00 (UTC+1) 16:45-17:00 (UTC+8)	Anthropogenic impacts on biogeochemistry in the Chinese marginal seas: the Huanghe estuary and Bohai Sea as an example	Sumei Liu
10:00-10:15 (UTC+1) 17:00-17:15 (UTC+8)	Regional Impacts of Offshore Windfarming on the Hydrodynamics in the North Sea	Nils Christiansen
10:15-10:30 (UTC+1) 17:15-17:30 (UTC+8)	Extended Discussion	
10:30-11:30 (UTC+1) 17:30-18:30 (UTC+8)	Summary and Next Step Chairs: Prof. Corinna Schrum & Prof. Xueen Chen	

Note: Each talk consists of 12-min Presentation plus 3-min Discussion

Can environmental conditions at North Atlantic Sponge grounds be predicted several years ahead?

Feifei Liu
Helmholtz-Zentrum Geesthacht, Institute for Coastal Research, Geesthacht, Germany

Abstract: A regional downscaling decadal prediction system is dedicated in the North Atlantic to investigate the predictability of the environmental conditions at deep-sea sponge grounds, which involves a global climate decadal prediction system MPI-ESM-LR (Max Planck Institute Earth System Model – low-resolution configuration) and a regional North Atlantic coupled physical-biological model (HYCOM-ECOSMO). In particular, a set of ensemble prediction simulations initialized from a well-validated long-term historical hindcast are used to assess the predictive skill of the system. We find that the environmental conditions (temperature, salinity, nutrients and oxygen) at deep-sea sponge grounds in the North Atlantic are subject to large multi-year variability and that their potential predictive skill is up to 8 years within the current prediction framework, in which the ensemble simulations are constrained to 8 years. We therefore infer a longer predictive skill of up to several decades if extended ensemble prediction simulations are presented. The results show that the prediction system can be further used to investigate the possible response of the distribution and functioning of the ecosystem to future climate change and anthropogenic influence on a decadal to multi-decadal time scale.

Simulating coastal marine ecosystems to understand long-term changes and Process interactions

Ute Daewel
Helmholtz-Zentrum Geesthacht, Institute for Coastal Research, Geesthacht, Germany

The ecosystem model ECOSMO has been developed to understand and reveal process-interactions relevant for ecosystem dynamics in coastal marine ecosystems. The analysis of a 61-year (1948–2008) hindcast reveals a quasi-decadal variation in salinity, temperature and current fields in the North Sea in addition to singular events of major changes during restricted time frames. These changes in hydrodynamic variables were found to be associated with changes in ecosystem productivity that are temporally aligned with the timing of reported regime shifts in the areas. Especially in the North Sea, a correlation analysis between atmospheric forcing and primary production (PP) reveals significant correlations between PP and the North Atlantic Oscillation (NAO) and wind forcing for the central part of the region, while the Atlantic Multi-decadal Oscillation (AMO) and air temperature are correlated to long-term changes in PP in the southern North Sea frontal areas. A combination of statistical methods and scenario simulation indicate that the dominant impact on long-term variability and major shifts in ecosystem productivity of the North and Baltic Seas was introduced by modulations of the wind field. New simulations with ECOSMO E2E additionally indicate that these long term changes might also have implications for higher trophic productivity.

Less Nutrients but More Phytoplankton: Long-Term Ecosystem Dynamics of the Southern North Sea

Xu Xu
Helmholtz-Zentrum Geesthacht, Institute for Coastal Research, Geesthacht, Germany

We here assess long-term trends in marine primary producers in the southern North Sea (SNS) with respect to ongoing regional Earth system changes. We applied a coupled high-resolution (1.5–4.5 km) 3d-physical-biogeochemical regional Earth System model that includes an advanced phytoplankton growth model and benthic biogeochemistry to hindcast ecosystem dynamics in the period 1961–2012. We analyzed the simulation together with in situ observations. Coinciding with the decreasing nutrient level at the beginning of the 1990s, we find a surprising increase in phytoplankton in the German Bight, but not in the more offshore parts of the SNS. We explain these complex patterns by a series of factors which are lacking in many state-of-the-art coupled ecosystem models such as changed light availability and physiological acclimation in phytoplankton. We also show that many coastal time-series stations in the SNS are located in small patches where our model predicts an opposite trend than found for the surrounding waters. Together, these findings call for a reconsideration of current modeling and monitoring schemes.

Shifts in species' ranges and marine community dynamics in the Bohai Sea

孙军 / Jun Sun, 徐文喆/ Wenzhe Xun, 张桂成/ Guicheng Zhang

The increasing contamination of coastal areas is a severe environmental problem throughout the world as it affects aquatic life and human health. The contaminants can cause systematic community-level effects in an ecosystem and eventually, lead to losses of biodiversity and ecological functions. The Bohai Sea, under rapid industrialization and urbanization, is threatened by numerous synthetic chemicals, and geogenic compounds discharged from agricultural, industrial and domestic activities. Since 1960s, the concentrations of chlorophyll a fluctuated, but showed an overall upward trend. Long-term observation on phytoplankton community showed that the replacement of diatom by dinoflagellates is the main feature of changes in the past decades, which is probably due to the changes of nutrient proportions. The wide-temperature-salinity and neritic low-salinity species are commonly dominant in zooplankton community. However, thermophilic species assumed to be transported from southern regions were recorded during last decades, probably due to the subtle climate change. The control of micro-zooplankton grazing on phytoplankton in Bohai is high, with a range of 0%-280% on primary production. The macrobenthic assemblages have undergone some succession, with large body size, long life expectancy species replaced by species with small body size and short generation time. The integrated effects from the changes in climate and the anthropogenic disturbances that happened in Bohai Sea over the past decades were suggested to be the trigger factors for these long-term community successions.

Key words: marine ecosystems, Bohai Bay, community, climate changes, anthropogenic disturbances

Spatiotemporal variability of ultraviolet Attenuation from satellite observations in Eastern China Sea

孙昆鹏 / Sun Kunpeng, 张亭禄 / Zhang Tinglu

Underwater ultraviolet radiation (UVR) is one of the key factors in marine ecosystems, which has great impacts on biogeochemical cycles and heat budgets. Spatial and temporal variations of UVR are important to learn the dynamics of the biogeochemical properties of water bodies. This study used a novel remote sensing approach KpcaUV for estimating diffuse attenuation coefficient in UV bands (KdUV) and implemented it to the 18 years (2002-2019) Moderate Resolution Imaging Spectroradiometer (MODIS) daily products. Results show that KdUV in Eastern China Seas appears an overall temporal characteristic of high in coastal and estuary areas and low in the central area of the Yellow Sea and the East China Sea. Three subareas with different bio-optical features are also selected to analyze the influence factors of UVR. Seasonal variations were observed that high KdUV value from November to February in the coastal area, while the relatively low values during the summer. And obvious inter-annual changes were observed in the north Yellow Sea and Yangtze River estuary plume area. The results can help to improve our understanding of physical processes and ecological changes in the offshore regions.

Zooplankton study in the Bohai Sea

张武昌 / Zhang Wuchang

Study on zooplankton in the Bohai Sea began in the mid-1950s. In 1958-1959, during the Marine Investigation in China Seas Project, zooplankton all over the Bohai Sea was investigated. After that, only local investigations were carried out mainly in the three bays: Laizhou Bay, Bohai Bay and Liaodong Bay. Among them, Laizhou Bay had the most intensive attention due to aquaculture, artificial fish reef and artificial fishery enhancement and releasing. There were about 100 species of zooplankton in the Bohai Sea. Temperate neritic species (Calanus sinicus, Paracalanus parvus, Acartia Bifilosa, Paracalanus crassirostris, Oithona similis, Sagitta crassa) dominated the zooplankton community. The Bohai Sea zooplankton community could be divided into these in the central part and in the three bays. Some warm water species intrude into the central part from the east entrance of the Bohai Sea. Knowledge on the annual evolvement of the zooplankton community is lacking. Although Bohai Sea had lowest salinity in China Seas, zooplankton community along salinity gradient was not analyzed. The zooplankton study in Liaodong Bay (which is the northernmost part of China Seas) should be carried out considering its data scarcity. Long-term monitoring to reveal the influence of climate change should be established.

Key words: Zooplankton, Bohai Bay, community, long-term monitoring

Estimation and Prediction on Storm Surge Inundation in Qingdao, China

江文胜 / Jiang Wensheng, 王延平/ Wang Yanping, 刘行/ Liu Xing, 于格 / Yu Ge

An unstructured grid hydrodynamic model was developed for the Qingdao China, using the ADCIRC (ADvanced CIRCulation) to estimate and predict the impact of climate change on storm surge and inundation induced by 8 typical typhoon tracks in current and future scenarios. Model results were validated with the available observations. The result shows the storm surge caused by typhoons with different intensities of different paths has different effects on the Qingdao area. Furthermore, by counting the storm inundation area in the future scenario, we find that in any case, with the future sea level rise, the typhoon intensity increases, the inundation area, and the storm surge intensity increase. In response to the changes of the storm surge and the actual situation in Qingdao, we put emphasis on the coastal flooding caused by the storm surge, 3 adaptation measures scenarios were set as the current level of adaptation measures (CLA), Continuation level of adaptation measures (CA) and Enhanced level of adaptation measures (EA). Based on the different scenarios, we find that the CA will reduce most of the inundation area caused by coastal flooding compare to CLA. EA is the most significant to reduce inundation, which can reduce inundation by more than 50% at 2℃ and 4℃. The research has shown that a good coastal protection level will reduce most of the coastal flooding, and building dams will be considered as the significant measure in the whole adaptation systems.

Improving regional model skills during typhoon events: A case study for super Typhoon Lingling over the northwest Pacific Ocean

Delei Li, Joanna Staneva, Jean-Raymond Bidlot, Sebastian Grayek, Yuchao Zhu, Baoshu Yin

The ability of forecasting systems to simulate tropical cyclones is still insufficient, and currently, there is an increased interest in improving model performance for intense tropical cyclones. In this study, the impact of reducing surface drag at high wind speeds on modelling wind and wave conditions during the super Typhoon Lingling event over the northwest Pacific Ocean in 2019 is investigated. The model response with respect to the parameterization for momentum exchange at the ocean surface is demonstrated using a fully coupled regional atmosphere model (the Consortium for Small-Scale Modelling-Climate Limited-area Modelling, CCLM) and a wind wave model (WAM). The active two-way coupling between the atmosphere and ocean waves model is enabled through the introduction of sea state-dependent surface drag into the CCLM and updated winds into the WAM. The momentum exchange with the sea surface is modelled via the dependency of the roughness length (Z0) on the surface stress itself and, when applicable, on the wind speed. Several high-resolution simulations are performed using one-way or two-way fully coupled atmosphere-wave (CCLM-WAM) models. The model simulations are assessed against the best track data as well as against buoy and satellite observations. The results show that the spectral nudging technique can improve the model's ability to capture the large-scale circulation, track and intensity of Typhoon Lingling. Under the precondition of large-scale constraining, the two-way coupling simulation with the proposed new roughness parameterization performs much better than the simulation used in older studies in capturing the maximum wind speed of Typhoon Lingling due to the reduced drag at extreme wind conditions for the new Z0.

The significance of hydrodynamical noise in modelling dynamics in marginal seas

陈学恩 / Chen Xueen,林璘 / Lin Lin, 唐声全 /Tang Shengquan and Hans von Storch

An ongoing cooperation between the ocean University of China (OUC, prof. Chen Xueen) and the Institute of coastal Research HZG (prof Hans von Storch) deals with the issue of unprovoked variability ("hydrodynamics noise") in marginal seas. This issue is significant for the understanding of the dynamics, as being partly stochastic, partly deterministic, and for the detection of the effect of a forcing on the ocean, as well as for validation of ocean models. The work is done in two PhD projects funded by CSC and supervised by Chen and von Storch. The first, by Tang, is almost completed, with two publications on the hydrodynamics noise in the Southern China Sea, and the preferred (namely small) scales of the noise; the second by Lin, commenced earlier this year, has examined the role of tides in increasing the signal-to-noise ratio, and will in future deal with the effect of this mostly small-scale noise on regional and local ecosystem trajectories.

A Case Study of Bohai Bay Ecosystem by Using a 3D Hydrodynamic-Ecosystem Couple Model Part I: Model Description, Calibration and Validation

Lu Hanfang , Zheng Peng, Liu Feifei , Shen Haiwei, Chen Xueen

Base on FVCOM (Finite-Volume Coastal Ocean Model), ECOSMO (ECOSystem MOdel) model, a 3D hydrodynamic-ecosystem couple model was bult to study the ecosystem of Bohai Bay, China. In the biological module, two phyto- and two zooplankton components, four nutrient components, detritus, DOM, oxygen, and three sediment components are included. The couple model is driven by surface forcing using atmospheric re-analysis data and tidal forcing at temporal scale of 1 hour. The couple model was integrated for 2016. After biological module calibration base on observation data, the simulated result showed that the couple model, with limiting processes consideration, is able to reproduce the observed spatial and seasonal variability of the Bohai bay ecosystem.

Modelling tidally induced ecosystem dynamics at the NWEU shelf break

Jan Kossack
Helmholtz-Zentrum Geesthacht, Institute for Coastal Research, Geesthacht, Germany

Tidal forcing influences ecosystem dynamics and carbon cycling in shelf seas like the North Sea by regulating mixing-stratification processes. In a previous modelling study, Zhao et al. (2019) highlighted the importance of tides for the spatial and temporal distributions of phytoplankton, nutrients and light availability in the North Sea. The impact on simulated net primary production was however assumed to be potentially underestimated due to the omission of vertical mixing of nutrients induced by internal tides at the shelf break. Until recently, the small spatial scales of such mixing processes at the shelf break (approx. 1km) have prevented their proper representation in regional ocean models. Building on recent progress in high-resolution modelling, we developed a setup of the regional coupled SCHISM-ECOSMO system for the North-West European shelf seas that makes use of SCHISMs flexible cross-scale modelling capabilities to locally enhance horizontal resolution at the shelf break. In this talk, the motivation for the research and the current status of the project will be presented. It will focus on the development of numerically stable and physically sound unstructured horizontal model grid and show first results from the validation of the dominant barotropic tides in the model domain.

The turnback and meandering of the inflow through the Bohai Strait from northern Yellow Sea in Summer

徐银凤 / Xu Yinfeng, 周锋 / Zhou Feng and 孟启承 /Meng Qicheng

As a semi-enclosed sea, the inflow from northern Yellow Sea is the only source for Bohai Sea to accept new water and materials from outer seas. Understanding the characteristics of the inflow is crucial to quantify water exchange between the interior of the Bohai Sea and adjoining Yellow Sea, especially in summer, when the water exchange is relatively weak due to a strong stratification and the ecological environment is fragile. This work focused on the structure and dynamics of the inflow from northern Yellow Sea to Bohai Sea during summer in a climatological condition by using the Regional Ocean Modeling System (ROMS) model. The results showed that the inflow occured mainly in the northern strait and was limited in the middle and upper layer. The inflow meandered along the thermal front in the Bohai Strait with some branches turning back to the Yellow Sea continually, which enhanced the difficulties for further water exchange between the two seas. Experiments using Lagrangian particle tracking also showed that only a small portion of the particles (about 24%) could move further after entering into Bohai Strait and most of them (about 81%) were through the big meandering of the inflow near 39℃N. Meanwhile, hardly any particles could transport northward into Liaodong Bay directly from the strait. Momentum balance analysis indicated that both the barotropic and baroclinic pressure gradients forces controlled the intensity and direction of the inflow. Besides, Sensitivity experiments were also conducted to evaluate the effects of wind and tide on the inflow. The currents were largely weakened without tides and even showed an inverse outflow at surface. The summer wind could make a non-negligible increasing or decreasing on the number of particles entering into Bohai Sea from different layers.

Seasonal variations of the Yellow Sea Cold Water Mass and its formation mechanisms

林璘 / Lin Lin, 陈学恩 /Chen Xueen, and 郑鹏 /Zheng Peng

The study presents the seasonal variations of the Yellow Sea Cold Water Mass (YSCWM) in 2010 with FVCOM model. In spring, the bottom water in the Yellow Sea trough is warmed up slower than its surrounding water, and the YSCWM starts to emerge; the northern and southern YSCWM reach strongest intensity in July and August, respectively; in autumn, they vanish gradually. Tracer-tracking experiments are performed to evaluate how much water is kept in the YSCWM during the YSCWM developing. For a 30-day model run, 59% of the water of 1 June 2010 can be kept within the YSCWM after 30 model days, which is approximately 5-6% less than those of the water of 1 July and of 1 August 2010, indicating that the water exchange speed across the boundary of the YSCWM is faster in June, when the thermoclines are relatively weak. The topography effects, the wind effects and the tidal effects in respects of stratification and turbulence kinetic energy on the formation of the YSCWM are analyzed. Results show topography plays a dominant role to the formation of YSCWM. If tidal amplitudes are reduced, the potential energy anomaly of the YSCWM increases and the turbulence kinetic energy of the bottom Yellow Sea decreases, the maximum temperature gradient over the YSCWM increases from 0.3℃/m to 1℃/m, the center temperature of the YSCWM is warmed up slower. The wind has significant influence on the Yellow Sea circulation, little influence on altering the temperature pattern and YSCWM's position.

The community upper vertical position as a key trait for the spatial organization of macrobenthos

Carsten Lemmen and Kai W. Wirtz
Helmholtz-Zentrum Geesthacht, Institute for Coastal Research, Geesthacht, Germany

Macrobenthos communities occupy and engineer important and ecologically diverse habitats in our coastal seas. They connect the deeper layers of the water column and the upper levels of the sea floor ecologically, biogeochemically and structurally. For the spatially explicit modeling of benthic – pelagic interactions, however, the observational knowledge about community distribution and functioning is insufficient. We here propose a functional trait approach that considers the vertical positioning of macrobenthos not only as a key trait but also as an adaptive trait that is responsive to its environment. This trait definition allows us to generate rich macrobenthos community growth dynamics, where positioning defines the trade-offs between predation avoidance, access to food, and physical stress and burrowing costs. We apply the new vertical positioning model prognostically in a benthic—pelagic coupled ecosystem model for the Southeastern North Sea (SNS), using the coupling infrastructures supplied by the Modular System for Shelves and Coasts (MOSSCO) and the Framework for Aquatic Biogeochemial Models (FABM). We show that the model is able to represent the spatial, seasonal, and interannual dynamics in a well-sampled multi-annual data set of the macrobenthos community composition in the SNS.

Mutual dependency between coastal morphodynamics and benthic biological functioning: Identifying the main drivers for long-term morphological evolution

Peter Arlinghaus, Wenyan Zhang & Corinna Schrum
Helmholtz-Zentrum Geesthacht, Institute for Coastal Research, Geesthacht, Germany

Coastal morphodynamic and hydrodynamic processes impose a first-order control on biogeochemical cycling and distribution of benthic habitats. Although many studies report that benthos significantly interferes with their environment, little is known on how this interference in turn affects sediment transport, biogeochemical cycling and morphodynamics at regional and long-term scales.

In order to bridge this gap we will firstly introduce the major benthic functioning and present a mini review on the state of the art modelling approaches implementing those interactions between benthic biota and coastal morphodynamics. Special emphasis is put on 1) synergetic effects of dominant benthic functional groups on sedimentation and erosion processes, and 2) the macrobenthic response to changing morphological, hydrodynamic and biogeochemical conditions.

In a second part we will present preliminary simulation results on an idealized test scenarios based on Jade Bay (Wadden Sea) using coupled hydrodynamic-biogeochemical-morphodynamic models supported by taxonomic and sedimentological field monitoring data. The emergence and development of channels in tidal embayment systems under combined influence of physical forcing and different benthic activities are investigated with the aim to identify and understand the main drivers triggering and guiding morphological evolution. Based on our results further insights into future development of coastal ecosystem can be gained.

Structure of benthic food web and trophic relationship of macrofauna in the Yellow Sea

刘晓收 / Liu Xiaoshou, 倪大朋 / Ni Dapeng, 钟鑫 /Zhong Xin and 张志南/Zhang Zhinan

The Yellow Sea is an important component of the Chinese coastal ecosystem, which has abundant biological resources. In this study, carbon and nitrogen stable isotope techniques were used to study the food sources, trophic levels of macrofauna as well as the benthic food web structure in the Yellow Sea. Results showed that the average values of δ15N ratio of the potential food sources of macrofauna were: zooplankton > phytoplankton > SOM (sediment organic matter) > POM (particulate organic matter). The average values of δ13C ratio were: SOM > zooplankton > phytoplankton > POM. A total of 54 species of macrofauna were analyzed for carbon and nitrogen stable isotopes. The δ15N values ranged from 5.81‰ (Ampelisca miharaensis) to 14.6‰ (Setipinna taty), and the δ13C values ranged from -21.51‰ (Ennucula nipponica) to -8.38‰ (Stegophiura sladeni). Results showed that SOM and phytoplankton were the major food sources for bivalves. Gastropods mostly fed on small mollusks and polychaetes. Crabs was omnivorous which mostly fed on POM, SOM, plankton, small mollusks and polychaetes. Shrimps mostly fed on small crustaceans such as zooplankton and amphipods. Small-sized fish mostly fed on zooplankton and small malacostraca. Large and medium-sized fish mostly fed on small-sized fish, small malacostraca and small mollusks. Trophic levels of the 54 species of macrofauna in this study ranged from 1.20 to 3.57. Trophic levels of the 10 species of bivalves were 1 to 2, and those of the 36 species of gastropods, crabs, shrimps and small fish were 2 to 3. Trophic levels of large and medium-sized fish were over 3. Based on the food sources and trophic levels of macrofauna, the preliminary structure of benthic food web was constructed.

Benthic oxygen consumption in coastal shelf seas – the quantitative importance of abiotic and biotic drivers

Wenyan Zhang
Helmholtz-Zentrum Geesthacht, Institute for Coastal Research, Geesthacht, Germany

Through an integrated study combining field observation and numerical modelling of the southern North Sea as an example, we have found that: both advective and diffusive oxygen fluxes across the sediment-water interface are characterized by strong seasonality in the study area. However, the variation pattern and driving mechanisms behind them are different. Variation of the advective flux is a summer-low, winter-high pattern mainly driven by hydrodynamics and bedform morphodynamics, while variation of the diffusive flux is summer-high and winter-low resulting from a combined effect of pelagic drivers (hydrodynamics, temperature and primary production) and benthic dynamics associated with the interaction between organic carbon and macrobenthos.

In permeable sediments, a combination of the opposite seasonal varying patterns of advection and diffusion results in large spatial and temporal variability among individual sites at a local scale but a consistent and mild seasonal variation (summer-high and winter-low) at a regional scale. In impermeable sediment, benthic oxygen flux is dominated by bio-diffusion exhibiting a remarkable seasonality. Local-scale spatial and temporal variability there is mainly caused by availability of POC originated from freshly deposited phytoplanktonic detritus and consequent bioturbation intensity of macrobenthos related with food-foraging and growth.

Bio-diffusion caused by macrobenthos accounts for nearly 50% of the oxygen flux across the sediment-water interface in permeable sediments in summer, and more than 85% in impermeable sediments throughout the year in the southern North Sea.

Anthropogenic impacts on biogeochemistry in the Chinese marginal seas: the Huanghe estuary and Bohai Sea as an example

刘素美/Su Mei LIU，吴念/Nian WU，张桂玲/Gui Ling ZHANG

Anthropogenic activities have severely altered many coastal ecosystems by increasing the input of nutrients and/or changing nutrient ratios through such as riverine input, wastewater discharge, and population urbanization, resulting in eutrophication, modifying aquatic food webs, and provoking more severe hypoxic events in coastal marine environments. A better understanding of the fate of nutrients entering the coastal ecosystem is an important issue with implications for environmental management. The Huanghe estuary and Bohai ecosystem is given as an example to address the response of nutrient transport patterns to anthrogpogenic activites. The biogeochemistry-sociel ecosystem interactions are addressed to understand the impacts of coastal ecosystem to extensive human activities.

Regional Impacts of Offshore Windfarming on the Hydrodynamics in the North Sea

Nils Christiansen
Helmholtz-Zentrum Geesthacht, Institute for Coastal Research, Geesthacht, Germany

The production of renewable offshore wind energy in the North Sea increases rapidly, including development in ecologically significant regions. Recent studies identified implications like large-scale wind wake effects and mixing of the water column induced by wind turbines foundations. Depending on atmospheric stability, wind wakes imply changes in momentum flux and increased turbulence up to 70 km downstream, affecting the local conditions (e.g. wind speed, cloud development) near offshore wind farms. Atmospheric wake effects likely translate to the sea-surface boundary layer and hence influence vertical transport in the surface mixing layer. Changes in ocean stratification raise concerns about substantial consequences for local hydrodynamic and biogeochemical processes as well as for the marine ecosystem. Using newly developed wind wake parameterisations together with the unstructured-grid model SCHISM, this study addresses windfarming impacts in the North Sea for current and future offshore wind farm scenarios. The focus lies on changes in tidal mixing fronts and stratification as well as on perturbations of horizontal and vertical transport. This study creates important knowledge on how the cross-scale wind farm impacts can be modelled suitably on the system scale and indicates potential impact on ecosystem dynamics in the North Sea.

Added value and uncertainty from coupling high-resolution river forcing to long-term simulations of the North and Baltic Sea ecosystem

Fabian Werner, HZG