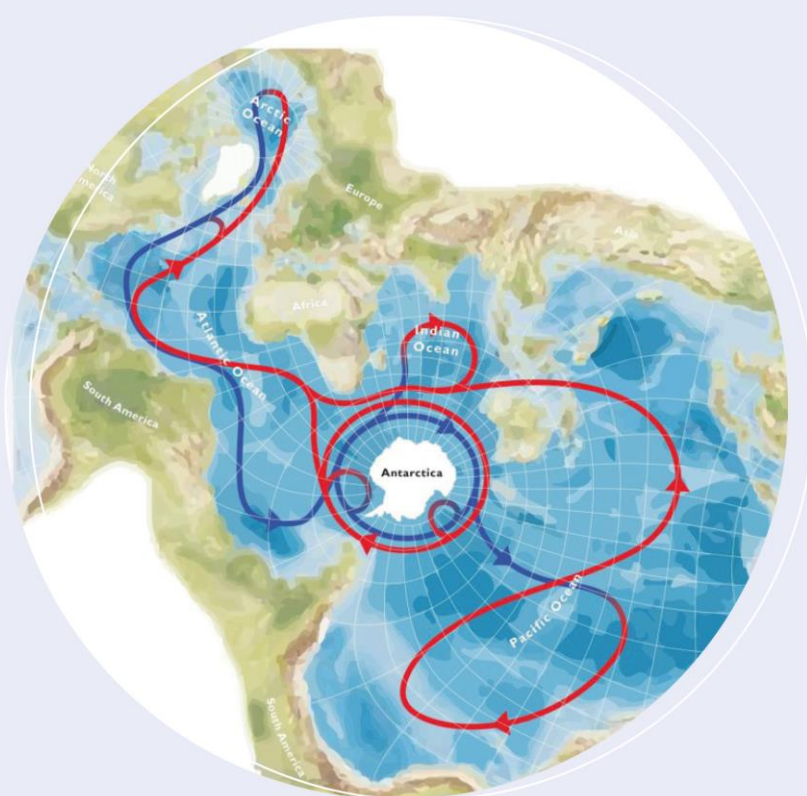


United Nations Decade of Ocean Science
for Sustainable Development



FRONTIER FORUM ON PROGRESS
IN OCEAN SCIENCE AND TECHNOLOGY

Climate Change, Ocean and Sustainable Society (CCOSS)



3-4 November 2026
Paris (FRANCE)

PROGRAM AND ABSTRACTS

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**United Nations Decade Science for Sustainable Development
(2021-2030)**

***4th CAS-EurASc Frontier Forum
on Marine Science and Technology***

Dates and place :

*3-4 November 2026, Ecole Normale Supérieure, 24 rue Lhomond,
75005 Paris. Room: Serre, 5th floor, building E (Erasmus)*

On-line via Zoom link (for audience):

3 Nov. 2026, ID : 941 0294 6962

<https://sciencespo.zoom.us/j/94102946962>

4 Nov. 2026 : ID : 967 2756 4161

<https://sciencespo.zoom.us/j/96727564161>

*Chairs : Prof. Paul Tréguer, University of Western Brittany, France ;
Prof. Jing Zhang, East China Normal University, China*

*Organising Committee : EurASC : Anny Cazenave, Jean-Pierre
Gattuso, Sabrina Speich, Paul Tréguer*

*CAS : Shi Jian Hu, Rui Bo Lei, Xian Yao Chen, Shan Jiang, Yi Xu, Fang
Zuo, Li Tan, Wei Zheng, Jing Zhang*

*Sponsors : European Academy of Sciences & Chinese Academy of
Sciences,*

Organizer : Ecole Normale Supérieure, Paris

Climate Change, Ocean and Sustainable Society (CCOSS) conference European Academy of Sciences (EurASc) – Chinese Academy of Science (CAS) 3-4 November 2026 Ecole Normale Supérieure, Paris (France) Chaired by Paul Tréguer (IUEM, France) and Jing Zhang (ECNU, China)			
2026/11/03, Tuesday			
08:00-08:30 (CET)	15:00-15:30 (Beijing)	Opening ceremony & Group photo	
Theme1. Ocean observation sciences and technologies			
Co-Chairs: Sabrina SPEICH (ENS, Paris), Shi Jian HU (Hohai University, Nanjing)			
08:30-08:50 (CET)	15:30-15:50 (Beijing)	Sabrina Speich (Ecole Normale Supérieure, France) “The Global Ocean Observing System at a Critical Juncture: GCOS Priorities and the Case for Shared Responsibility”	
08:50-09:10 (CET)	15:50-16:10 (Beijing)	Ze Xun Wei (First Institute of Oceanography, Ministry of Natural Resources, China) “Observing and Predicting the Pacific-Indian Ocean Exchange: Difficulties and Challenges”	
09:10-09:30 (CET)	16:10-16:30 (Beijing)	Sebastiaan Swart (University of Göteborg, Sweden) “Advancing observations of the air–sea interface: from process studies to a coordinated global observing system”	
09:30-09:50 (CET)	16:30-16:50 (Beijing)	Shi Jian Hu (Hohai University, China) “Observations from moored buoy systems combined with drifting buoys reveal the multi-scale dynamics of the Indo-Pacific boundary current system”	
09:50-10:10 (CET)	16:50-17:10 (Beijing)	Fabrice Not (Station Biologique de Roscoff, France) “Observing the oceanic microbiome: challenges and perspectives”	
10:10-10:30 (CET)	17:10-17:30 (Beijing)	Yan Bai (Second Institute of Oceanography, Ministry of Natural Resources, China) “Satellite Remote Sensing Estimation of Ocean Carbon Fluxes and Their Long-Term Variations”	

10:30-11:00 (CET)	17:30-18:00 (Beijing)	Discussion	
11:00-12:00 (CET)	18:00-19:00 (Beijing)	Break	
Theme 2. Climate change and polar systems			
Co-Chairs: Michael MEREDITH (British Antarctic Survey, Cambridge), Rui Bo LEI (Polar Research Institute of China, Shanghai)			
12:00-12:20 (CET)	19:00-19:20 (Beijing)	Michael Meredith (British Antarctic Survey, UK) “Polar ocean changes, including sea ice, ocean circulation and ocean properties”	
12:20-12:40 (CET)	19:20-19:40 (Beijing)	Ren He Zhang (Fudan University, China) “Linkage of Arctic amplification to the change in mid-latitude land-ocean thermal contrast in boreal winter”	
12:40-13:00 (CET)	19:40-20:00 (Beijing)	Bettina Meyer (Alfred Wegener Institute, Germany) “From Antarctica to the Arctic: Managing Change in Polar Pelagic Ecosystems”	
13:00-13:20 (CET)	20:00-20:20 (Beijing)	Rui Bo Lei (Polar Research Institute of China, China) “IPY-5 China’s National Action Plan: Vision and Prospects”	
13:20-13:40 (CET)	20:20-20:40 (Beijing)	Anna Wahlin (University of Gothenburg, Sweden) “Ocean/ice shelf interactions and ice sheet deglaciation”	
13:40-14:00 (CET)	20:40-21:00 (Beijing)	Zhaoru Zhang (Shanghai Jiao Tong University, China) “Coupled ocean-ice-atmosphere processes controlling the Antarctic Bottom Water formation and the impacts on the ecosystem”	
14:00-14:30 (CET)	21:00-21:30 (Beijing)	Discussion	

2026/11/04, Wednesday

Theme 3. Climate change and ocean circulation

Co-chairs: Stefan RAHMSTORF (PIK, Postdam), Xian Yao CHEN (Ocean University of China, Qingdao)

08:30-08:50 (CET)	15:30-15:50 (Beijing)	Stefan Rahmstorf (PIK, Germany) “Is the Atlantic meridional overturning circulation approaching a tipping point?”	
08:50-09:10 (CET)	15:50-16:10 (Beijing)	Fan Wang (Institute of Oceanology, China) “Pacific Deep Circulation: Patterns, Variations and Rapid Responses to the Upper Ocean and Atmosphere”	
09:10-09:30 (CET)	16:10-16:30 (Beijing)	Marina Levy (IPSL, France) “The role of the AMOC in observed and future changes in North Atlantic net primary production”	
09:30-09:50 (CET)	16:30-16:50 (Beijing)	Xian Yao Chen (Ocean University of China, China), “Deep Arctic Warming”	
09:50-10:10 (CET)	16:50-17:10 (Beijing)	Swinda Falkena (Utrecht University, The Netherlands) “Tipping Risk of the North Atlantic Subpolar Gyre”	
10:10-10:30 (CET)	17:10-17:30 (Beijing)	Yu Hong Zhang (South China Sea Institute of Oceanology, China) “Salinity Transport and Circulation Changes in the Indian Ocean: Implications for Global Climate Links”	
10:30-11:00 (CET)	17:30-18:00 (Beijing)	Discussion	
11:00-12:00 (CET)	18:00-19:00 (Beijing)	Break	

Theme 4. Climate Change and coastal zones

Co-chairs: Anny CAZENAVE (CNES, Toulouse), Shan JIANG (East China Normal University, Shanghai)

12:00-12:20 (CET)	19:00-19:20 (Beijing)	Sanne Muis (Deltares, The Netherlands) “A Global Perspective on Extreme Sea Levels and Coastal Flooding in a Changing Climate”	
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12:20-12:40 (CET)	19:20-19:40 (Beijing)	Zhi Ming Yu (Institute of Oceanology, China) “Coastal eutrophication and harmful algal blooms”	
12:40-13:00 (CET)	19:40-20:00 (Beijing)	Joaquim Garrabou (Institut de Ciències del Mar-CSIC, Spain) “Tracking ecological climate change impacts in the Mediterranean coastal ecosystems: when observations overcome the worst scenarios”	
13:00-13:20 (CET)	20:00-20:20 (Beijing)	Shan Jiang (East China Normal University, China) “Nutrient dynamics in estuarine environments under climate change: Source identification, management strategies and economic implications”	
13:20-13:40 (CET)	20:20-20:40 (Beijing)	Robert Nicholls (Tyndall Center for Climate Change Research, UK) “Sea-level rise and coastal systems: diagnosing problems and finding solutions”	
13:40-14:00 (CET)	20:40-21:00 (Beijing)	Ke Fu Yu (Guangxi University, China) “Coral bleaching: From the present to the past and to the future”	
14:00-14:30 (CET)	21:00-21:30 (Beijing)	General Discussion	
14:30-14:50 (CET)	21:30-21:50 (Beijing)	Synthetic conclusions by sessions co-chairs, and general conclusions by Paul Tréguer (IUEM, France) and Jing Zhang (ECNU, China)	

EurASc – CAS Frontier Forum

Climate change, Ocean, and Sustainable Society (CCOSS)

3-4 November 2026, Paris, France

Theme 1. Ocean observation sciences and technologies

Co-Chairs: Professors Sabrina SPEICH (ENS, Paris) and Shi Jian HU (Hohai University, Nanjing)

Professor Sabrina Speich (Ecole Normale Supérieure, Paris, France)

“The Global Ocean Observing System at a Critical Juncture: GCOS Priorities and the Case for Shared Responsibility”

Ocean observations underpin climate research, prediction, early warning, risk assessment and adaptation. Yet the forthcoming Global Climate Observing System (GCOS) Status Report shows an observing system that is incomplete, unevenly distributed and increasingly fragile. Roughly half of the tropical moorings sustaining ENSO monitoring and seasonal prediction have been lost in recent years, the deep ocean below 2000 m remains severely under-sampled, and funding for several biogeochemical Argo measurements is set to lapse within months. Short funding cycles, single points of failure and a heavy reliance on a small number of national contributors compound these losses, with the polar regions and ocean data infrastructure among the most exposed.

GCOS is responding with a High-Priority Action Plan aimed at safeguarding fundamental observations, stabilizing core observing and data systems, and addressing the most consequential gaps.

No single region can deliver this alone. Recent analysis shows that the system's capacity to deliver robust climate information emerges from interdependent national and multinational contributions, none of which can secure the whole. Europe's emerging contribution, notably OceanEye, the EU ocean observation initiative, illustrates one path, but durability will depend on a wider distribution of responsibility, complementary regional capacities and closer integration with the Global Ocean Observing System (GOOS). This talk outlines the GCOS priorities and asks what a more resilient, more widely shared observing architecture would require.

Ocean observing must be recognized and supported as critical infrastructure and a global public good.

Professor Ze Xun Wei (Key Laboratory of Marine Science and Numerical Modeling, First Institute of Oceanography, Ministry of Natural Resources, Qingdao, China)

“Observing and Predicting the Pacific-Indian Ocean Exchange: Difficulties and Challenges”

The inter-ocean exchange between the tropical Pacific and Indian Oceans, occurring primarily through the Indonesian Seas and the South China Sea, constitutes a critical pathway for the transfer of mass, momentum, and energy between the two basins, and serves as an oceanic conduit for the propagation of climate anomalies and the closure of the global ocean conveyor belt. Since the 1990s, international observational programs have been undertaken in this region; since 2007, collaborative efforts between Chinese and Indonesian researchers have established the world's largest in-situ array for synchronous observation of inter-ocean exchange, covering the key inflow, throughflow, and outflow sections. Despite these advances, observational research remains challenging. This report reviews the current observational infrastructure, observation-based scientific understanding, and progress in numerical simulation and forecasting in the region, and identifies key challenges for future research.

Professor Sebastiaan Swart (University of Göteborg, Sweden)

“Advancing observations of the air–sea interface: from process studies to a coordinated global observing system”

The ocean and atmosphere interact through the air-sea interface. This dynamic frontier is where the ocean and atmosphere exchange heat, moisture, momentum, gases, and particles, connecting the global cycles of water, energy, carbon, and life. These exchanges regulate weather and climate, drive ocean circulation, shape patterns of sea surface temperature and precipitation, provide oxygen to marine ecosystems, and enable the ocean to absorb anthropogenic carbon dioxide. Despite their fundamental importance, air–sea fluxes remain inadequately observed and understood. Consequently, their representation in weather, climate, and Earth system models relies heavily on parameterizations that introduce substantial uncertainty.

Addressing these knowledge gaps requires multidisciplinary process studies within a coordinated, sustained global observing strategy. The Observing Air-Sea Interaction Strategy (OASIS), a UN Decade Program, advocates for coordinated observations of the state variables governing air–sea fluxes. Sustained in situ observations that resolve processes at the interface, provide validation, and connect remotely sensed quantities to estimates of air–sea exchange. Uncrewed Surface Vehicles (USVs) are emerging as a transformative component of this observing system, providing sustained, high-resolution observations across the remote and undersampled oceans. As part of OASIS, the Surface UNcrewed Fleet (SUN Fleet) was endorsed as an emerging Global Ocean Observing System (GOOS) network in 2025, providing

an international framework for coordinating USV observations, standards, and data delivery. Together, OASIS and SUN Fleet help integrate satellite, autonomous, and conventional observations into a comprehensive observing system for the air–sea interface, delivering trusted observations needed to address climate change and ocean sustainability.

Professor Shi Jian Hu (Hohai University, Nanjing, China)

“Observations from moored buoy systems combined with drifting buoys reveal the multi-scale dynamics of the Indo-Pacific boundary current system”

The Indo-Pacific Ocean is characterized by highly complex ocean dynamic processes and a vigorous boundary current system. Through the transport and redistribution of mass and heat, the Indo-Pacific boundary current system exerts a crucial influence on the climate system and marine ecosystems. The level of understanding and monitoring of the Indo-Pacific Ocean depends heavily on the development of ocean observations. However, conducting *in situ* observations in the Indo-Pacific region—a water body with numerous islands and involving territorial seas—is extremely difficult. We will briefly review the new understanding of the multi-scale dynamics of the Indo-Pacific boundary current system that the international community has achieved over the past two decades through international cooperative programs such as the Northwestern Pacific Ocean Circulation and Climate Experiment (NPOCE), by conducting moored buoy and subsurface mooring observations complemented by drifting buoy observations. We will also review the current challenges to *in situ* observations arising from difficulties in funding and international cooperation, and look ahead to how integrating artificial intelligence technologies can enable long-term, stable monitoring of the Indo-Pacific boundary current system based on satellite observations, sparse *in situ* observations, and AI technologies.

Professor Fabrice Not (Station Biologique de Roscoff, France)

“Observing the oceanic microbiome: challenges and perspectives”

The oceanic microbiome plays a central role in global biogeochemical cycles and provides a sensitive indicator of ecosystem health. However, its routine observation remains constrained by limited spatial and temporal coverage and by labour-intensive sampling and analytical approaches. Building on French national initiatives, including MOOSE-GE in the Northwestern Mediterranean Sea, and European programmes such as EMO-BON and JERICO, this presentation examines the emergence of “augmented observatories” for marine microbial biodiversity. It shows how the integration of environmental DNA (eDNA) analyses and *in situ* imaging, embedded within a robust oceanographic framework, can deliver a more comprehensive and size-resolved view of ocean biodiversity while generating the long-term time series required for sustained observation. Major challenges nevertheless remain, including the harmonisation of protocols across observing networks, the reduction of taxonomic resolution losses in high-throughput approaches, and the integration of multi-

source data into reliable ecological indicators. Meeting these challenges will require coordinated transnational efforts and data management practices aligned with FAIR principles.

Professor Yan Bai (Second Institute of Oceanography, Ministry of Natural Resources, Hangzhou, China)

“Satellite Remote Sensing of Ocean Carbon Fluxes: Long-Term Changes and Integrated Monitoring Across Multiple Interfaces”

Satellite remote sensing has become a key observational approach for studying the global ocean carbon cycle, supported by multi-satellite observations, and increasingly long time series. Recent developments in deep learning and artificial intelligence are extending satellite retrievals from basic surface parameters to carbon chemistry and ecological variables, and enabling multi-source data fusion, thereby offering new insights into global ocean change. However, ocean carbon fluxes span multiple interfaces and scales, involve coupled processes, and exhibit strong temporal variability, making their remote sensing estimation challenging.

This presentation examines satellite remote sensing observations and long-term changes in multi-interface ocean carbon fluxes. It presents methods for monitoring and estimating key processes, including air–sea CO₂ fluxes, carbon fluxes along the river–estuary–coastal continuum, and sinking particulate export fluxes. Under carbon-neutrality goals, carbon flux monitoring places greater demands on high spatiotemporal resolution, functional-zone identification, and the detection of extreme events. Accordingly, this presentation introduces an integrated carbon flux monitoring system for complex coastal environments that combines satellite remote sensing with buoys, flux towers, and underway measurements, together with associated data-processing methods. It concludes by discussing application prospects and remaining challenges, with the goal of supporting global and regional assessments of ocean carbon sources and sinks.

Theme 2. Climate change and polar systems

Co-Chairs: Professors Michael MEREDITH (British Antarctic Survey, Cambridge) and Rui Bo LEI (Polar Research Institute, Shanghai)

Professor Michael Meredith (BAS, Cambridge, UK)

“Changing Polar Oceans: Sea Ice, Circulation and Climate”

Rapid changes are underway across the polar oceans, with profound implications for regional climate, global sea level, marine ecosystems, and the wider Earth system. This talk will provide a high-level overview of contemporary change in both the Arctic and Southern Oceans, focusing on evolving sea-ice conditions, shifts in ocean circulation, and transformations in ocean properties. In the Arctic, long-term declines in sea-ice extent and thickness are altering air–sea exchange, stratification, and freshwater storage, with consequences for deep-water formation and the wider Atlantic circulation. Around Antarctica, contrasting regional trends in sea ice, recent episodes of extreme sea-ice loss, and shifting interaction with the cryosphere, highlight the complexity of Southern Ocean change. The talk will examine how warming, freshening, changing wind patterns, and evolving ocean mixing are modifying polar overturning circulation and the uptake and storage of heat and carbon. The presentation will emphasise the interconnected nature of polar processes and the importance of sustained observing systems and coordinated international research in understanding and anticipating future change.

Professor Ren He Zhang (Fudan University, Shanghai, China)

“Linkage of Arctic Amplification to the Change in Land-Ocean Warming Contrast in Boreal Winter”

Global warming is spatially uneven on a planetary scale, with the Arctic warming faster than other regions (so-called the Arctic Amplification, AA) and the surface air temperature warming faster over land than over the ocean (so-called land-ocean warming contrast, LOWC). AA has been a focus of research in the context of global warming. However, it is still unclear whether AA and LOWC are connected. In this study, based on observations over recent decades, we find a weakening trend of LOWC that significantly impacts AA during the boreal winter. We show that the trend of stationary zonal wave-2 component at mid-high latitudes in the lower troposphere is well related to the LOWC trend. A poleward shift of the sea level pressure in the stationary zonal wave-2 component over recent decades resulted in an increased heat transport to the Arctic, which contributes not only to the spatial distribution of AA but also to about 31% of the warming over the Barents Sea, where the most prominent warming occurs. This study provides a new mechanism which in favour of the AA formation.

Professor Bettina Meyer (Alfred Wegener Institute, Germany)

“From Antarctica to the Arctic: Managing Change in Polar Pelagic Ecosystems”

The polar regions are warming faster than any other parts of Earth, driving profound changes in pelagic ecosystems largely due to the extensive loss of winter sea ice. While rapid warming is occurring across the entire Arctic Ocean, warming in the Southern Ocean has been more regionally concentrated, with particularly intense events observed around the Antarctic Peninsula. Consequently, long-term observational efforts have primarily focused on the Arctic. At the same time, the cumulative effects of anthropogenic stressors already evident in the Antarctic Peninsula region — including rising temperatures, shifts in key pelagic organisms, increasing fishing pressure, and expanding ship-based tourism — are increasingly being considered a potential future scenario for the central Arctic Ocean. This talk will examine the pelagic ecosystems of both regions and discuss the research needed to protect these environments from ongoing anthropogenic pressures while also addressing the growing exploitation of pelagic resources. The Antarctic Peninsula region will serve as a case study to explore how comparable future developments in the central Arctic might be anticipated and managed.

Professor Rui Bo Lei (Polar Research Institute of China, Shanghai, China)

“IPY-5 China’s National Action Plan: Vision and Prospects”

The International Polar Year (IPY) stands as the largest and most influential international collaborative programme in polar scientific research. Four previous IPY campaigns have greatly enhanced the capacity of polar observation, deepened the understanding of polar dynamics, and improved the system of global polar governance. Among them, the fourth IPY (IPY-4, 2007–2008) represents one of the most ambitious international scientific initiatives in history. As an active participant, China made remarkable contributions to IPY-4 while comprehensively upgrading its capabilities of polar expedition and research. To support China's participation in the upcoming fifth IPY (IPY-5, 2032–2033), this review systematically summarizes the core achievements of IPY-4, and proposes targeted strategic plans for IPY-5 based on global frontier scientific advances and China's logistical-technological capacities. The key research priorities cover Antarctic ice sheet instability, ice sheet-ice shelf-ocean interactions, cross-shelf and inter-basin mass and heat exchange in the Arctic, polar carbon cycles, freshwater balance, and multi-timescale global linkages of polar system variations.

Professor Anna Wåhlin (University of Gothenburg, Sweden)

“New Frontiers in Ocean–Cryosphere Interaction”

Ice shelves form the fragile boundary between the ocean and the great ice sheets, regulating the flow of ice toward the sea and thereby influencing future sea-level rise. The cavities beneath them are among the least observed environments on Earth. In this presentation the knowledge gaps and recent advances about ocean-ice interaction at the ice shelf base will be described, including how melting reshapes ice-sheet stability, and why these processes are central to reducing uncertainty in projections of global sea-level rise. Highlights of new technology and how they are transforming our ability to observe these systems directly will be given. Recent measurements from previously inaccessible ice-shelf cavities are revealing energetic boundary currents, complex melting patterns, and unexpected links between ocean variability and ice response. These findings open a new exploratory frontier, where engineering, polar oceanography, glaciology, and climate science meet to understand one of the most consequential components of the Earth system.

Professor Zhao Ru Zhang (Shanghai Jiao Tong University, China)

“Coupled ocean-ice-atmosphere processes controlling the Antarctic Bottom Water formation and the impacts on the ecosystem”

Antarctic Bottom Water (AABW) is a major component of the global overturning circulation, connecting the Antarctic margins with the abyssal ocean and playing an important role in deep-ocean ventilation, heat storage, and carbon transport. Its formation depends on a tightly coupled system involving the atmosphere, ocean, sea ice, and ice shelves, yet many of these interactions remain difficult to observe and represent accurately in climate models. In this presentation, recent advances in understanding the coupled atmosphere–ocean–sea ice–ice shelf processes that regulate the production and export of AABW will be described. Particular attention will be given to how atmospheric forcing, sea ice formation, ocean circulation and ice shelf melting work together to shape the AABW properties. Observations and high-resolution coupled modeling further show that these processes provide an efficient connection between the surface and deep ocean, transporting anthropogenic carbon, particulate organic carbon, and other biogeochemical properties to depth and thereby influencing carbon storage and ecosystem structure. Looking toward the future, projected changes in AABW formation and export may alter the ventilation of the abyssal ocean and the efficiency of both natural and anthropogenic carbon transport from the Antarctic margins to the global deep ocean. These changes could have important consequences for long-term ocean carbon storage, biogeochemical cycling, and marine ecosystems. Understanding how coupled atmosphere–ocean–sea ice–ice shelf interactions control both present-day and future AABW formation is therefore essential for assessing Antarctica’s role in the global climate and carbon system.

Theme 3. Climate change and ocean circulation

Co-chairs: Stefan RAHMSTORF (PIK, Postdam), Xian Yao CHEN (Ocean University of China, Qingdao)

Professor Stefan Rahmstorf (PIK, Germany)

“Is the Atlantic meridional overturning circulation approaching a tipping point?”

The Atlantic Meridional Overturning Circulation (AMOC) has a major impact on climate, not just around the northern Atlantic but globally. Paleoclimatic data show it has been rather unstable in last 100.000 years of Earth history, leading to some of the most dramatic and abrupt climate shifts known.

These instabilities are related to two different types of tipping points, linked to amplifying feedbacks in the mechanisms driving the flow. These tipping points present a major risk of abrupt ocean circulation and climate shifts as we push our planet further out of the stable Holocene climate into uncharted waters.

There is evidence that the AMOC has already weakened in response to global warming. The current generation of climate models predicts that the AMOC will further weaken substantially during this century, and suggests a major risk that the AMOC will shut down after the year 2100. The tipping point putting the AMOC on course to shutdown may already be passed in the next few decades.

Professor Fan Wang (Institute of Oceanology, China)

« Pacific Deep Circulation: Patterns, Variations and Rapid Responses to the Upper Ocean and Atmosphere »

The Pacific Meridional Overturning Circulation (PMOC) is a critical component of the global climate system, yet its deep return pathways and basin-wide dynamics have historically been obscured by a lack of deep-ocean observations. Utilizing extensive, long-term deep-sea mooring datasets, this study reconstructs the three-dimensional structure and volumetric transport of the western Pacific deep circulation, highlighting its pivotal role in linking and closing the broader PMOC. We definitively identify the Yap-Mariana Junction (YMJ) as the singular gateway for Lower Circumpolar Deep Water (LCDW) influx. Upon entering the region, the complex, topographically constrained pathways of the LCDW facilitate significant diapycnal upwelling. This process, functioning as a powerful "topographic pump" confined within the Philippine Sea and Caroline Basins, converts abyssal inflow into upward transport, which is fundamentally essential for the closure of the Pacific overturning circulation. Furthermore, dispelling the traditional view of a stagnant abyss, our findings reveal highly active seasonal and intraseasonal variability within these deep currents. This rapid dynamic response is sustained by a full water-column energetic coupling mechanism, wherein upper-ocean and

atmospheric forcing is effectively transmitted to the deep ocean via planetary waves, topographic waves, and pressure work.

Professor Marina Lévy (IPSL, France)

“The role of the AMOC in observed and future changes in North Atlantic net primary production”

The Atlantic Meridional Overturning Circulation (AMOC) is a fundamental component of the climate system, regulating the transport of heat, carbon and nutrients across the North Atlantic. Because nutrient supply strongly constrains marine primary production, changes in the AMOC are expected to have profound consequences for marine biogeochemistry and ecosystems. Yet the extent to which ongoing and future changes in the AMOC control biological productivity remains uncertain.

I will examine the links between long-term AMOC decline and long-term changes in net primary production in the North Atlantic. I will first discuss what can be learned from recent observations, highlighting both emerging signals and the challenges of detecting circulation-driven changes against the backdrop of natural variability and observational uncertainties. I will then explore the physical mechanisms through which the AMOC influences nutrient transport and phytoplankton productivity, drawing on the nutrient stream framework. Finally, I will review results from numerical models, from idealized process studies to Earth System Models, showing how projected changes in the AMOC emerge as a major source of uncertainty in future projections of marine productivity. Together, these different lines of evidence provide a broader perspective on the links between ocean circulation, marine biogeochemistry and ecosystem responses under climate change.

Professor Xian Yao Chen (Ocean University of China, China)

« Deep Arctic Warming »

The deep Arctic Ocean is warming in response to climate change. In this talk, we present that the Arctic Ocean deep water below 1500 m is warming at different rates over recent decades. This difference is most pronounced at 2000-2600 m depth, with the Eurasian Basin deep water warming at nearly five times faster than the Amerasian Basin deep water. We employ an idealized model of the Arctic Ocean to attribute the faster warming in the deep Eurasian Basin to the deep Greenland Basin warming and its transport to the Arctic through the Fram Strait. We show that the Lomonosov Ridge acts as a barrier to preventing the warm signal from the Eurasian Basin to the deep Amerasian Basin. We also argue that the slope convection can contribute to this differential warming pattern by entraining the warmer Atlantic Water into the deep Arctic Ocean.

Professor Swinda Falkena (Utrecht University, The Netherlands)

« Tipping Risk of the North Atlantic Subpolar Gyre »

The North-Atlantic subpolar gyre is at risk of crossing a tipping point under future climate change associated with the collapse of deep convection. This would lead to a 1-2 degree cooling in 10-20 years and could happen as early as 2040. It would have significant climate impacts, especially in the regions around the North Atlantic Ocean, as well as impact the stability of the Atlantic Meridional Overturning Circulation.

In this talk I will start with giving an overview of the current understanding of the subpolar gyre dynamics and how this connects to its tipping potential. Next, I will discuss the representation of the mechanisms of subpolar gyre variability in climate models, focusing on the feedbacks that are most relevant for subpolar gyre tipping. In particular, the interaction between the boundary current and convection in the interior, which is critical for the bistability mechanism of the gyre, is not well represented in many models. Finally, I will discuss the consequences of this for estimates of the tipping risk of the North Atlantic subpolar gyre.

Professor Yu Hong Zhang (South China Sea Institute of Oceanology, China)

« Salinity Transport and Circulation Changes in the Indian Ocean: Implications for Global Climate Links »

The Indian Ocean is a critical bridge linking the monsoon system, Pacific variability, and global climate. This presentation examines how monsoon-driven circulation, the Indonesian Throughflow, and basin-scale gyre changes redistribute salinity and reshape upper-ocean stratification across the basin. Particular attention is given to the Arabian Sea–Bay of Bengal salinity contrast, the Salinity-IOD, and their interannual-to-decadal variability. We further explore how salinity and circulation changes associated with the IOD, IPO, and Pacific climate modes modify upper-ocean stratification and circulation. Finally, we discuss how global warming and increasing climate extremes may reshape Indian Ocean salinity transport and its role in the climate system.

Theme 4. Climate Change and Coastal Zones

Co-chairs: Professors Anny Cazenave (CNES, Toulouse) and Shan JIANG (East China Normal University, Shanghai)

Professor Sanne Muis (Deltares, The Netherlands)

“A Global Perspective on Extreme Sea Levels and Coastal Flooding in a Changing Climate”

Coastal flooding is projected to increase substantially in the coming decades, putting millions of people across the globe at risk. Sea-level rise will drive more frequent and severe extreme sea levels, while climate change may also alter the frequency, intensity, and tracks of extra-tropical storms and tropical cyclones. In this contribution, I will present recent advances in global extreme sea-level research in understanding historical variability and projection of future changes.

Professor Zhi Ming Yu (Institute of Oceanology, China)

« Coastal eutrophication and harmful algal blooms »

On June 8, 2026, the 3rd World Ocean Assessment (WOA III) of United Nations has been released, stating that at present, anthropogenic eutrophication (caused by nutrient inputs linked to human activities) is one of the most important environmental impacts on the ecosystem's health and services. Coastal eutrophication, as a global marine ecological environment issue, is characterized by rapid increase in nitrogen levels in the coastal areas and imbalance in the nitrogen-to-phosphorus ratio, leading to ecological effects such as hypoxia, harmful algal blooms (HABs), loss of biodiversity, and various synergistic impacts. This report explores the development process and characteristics of coastal eutrophication in China, as well as the essential role of environmental control policies in improving coastal conditions. Taking HABs, the typical ecological effect of coastal eutrophication, as an example, it discusses the current status and evolution characteristics of HABs in Chinese coastal areas, and introduces the effective emergency control methods and technologies.

Professor Joaquim Garrabou (Institut de Ciències del Mar-CSIC, Spain)

“Tracking ecological climate change impacts in the Mediterranean coastal ecosystems: when observations overcome the worst scenarios”

Anthropogenic climate change is accelerating marine mass mortality events (MMEs) across the Mediterranean, a global climate-change hotspot. Analysing more than 40 years of records (1979-2020), including over 2,100 observations from 145 benthic species, we document an exponential increase in MMEs frequency, extent and impact. Since 1999, these events have

shifted from being rare and localized to becoming near-annual, basin-wide disturbances, largely driven by marine heatwaves. Long-lived, habitat-forming species are disproportionately affected, leading to major changes in benthic community structure, reduced ecosystem resilience and higher extinction risk. These findings underscore the urgent need to incorporate accelerating MMEs into conservation and management strategies.

Professor Shan Jiang (East China Normal University, China)

« Nutrient dynamics in estuarine environments under climate change: Source identification, management strategies and economic implications »

This conference presentation delivers a 10-year continuous observational study conducted at the hydrological gateway (Xuliujing) of the Changjiang Estuary, where we systematically tracked long-term nutrient dynamics under climate change by combining dual stable isotope measurements of $\delta^{15}\text{N-NO}_3^-$ and $\delta^{18}\text{O-NO}_3^-$ with synchronous full major ion analysis, quantitatively partitioning the proportional contributions of agricultural non-point runoff, domestic sewage input and in-situ nitrification across interannual and seasonal hydrological regimes, and revealing how extreme precipitation events, altered river discharge patterns and periodic saltwater intrusion reshape nutrient source apportionment and biogeochemical transformation pathways at this critical estuarine transect. The decade-long in-situ records further underpin the discussion of cost-effective watershed-estuary integrated management strategies and their associated economic implications, including avoided eutrophication-related losses from harmful algal blooms and seasonal hypoxia, as well as the co-benefits of targeted nutrient regulation for coastal ecosystem services, offering robust long-term field evidence for climate-adaptive nutrient governance in estuarine systems.

Professor Robert Nicholls (Tyndall Center for Climate Change Research, UK)

“ Sea-level rise and coastal systems: diagnosing problems and finding solutions”

Coastal areas concentrate people and economic activity, but they are also the site of hazards and problems be it erosion, flooding or salinization. Society expects responses and finding solutions to these problems, but in practice solutions often prove partial and we often find ourselves coexisting with an evolving problem. A core issue is that coasts are subject to multiple and interacting stresses, but we often over simplify the situation because we don't recognize the coast as a system. For example, we expect global sea-level rise of up to 1 m by 2100, and maybe more, but how will this interact with other drivers of change. In this talk, I will briefly examine coasts from a systemic perspective and consider its implications for coastal management and the solution of coastal problems.

Professor Ke Fu Yu (Guangxi University, China)

« Coral bleaching: From the present to the past and to the future »

This presentation begins by introducing the phenomenon, causes, and ecological consequences of coral bleaching. It then summarizes the current status of coral reef bleaching based on four global-scale bleaching events. Drawing on the reporting team's recent geochemical studies of Holocene coral skeletons in the South China Sea, the presentation provides evidences and historical records of bleaching in the region, highlighting that coral bleaching is a recurring ecological phenomenon throughout Holocene history. Finally, based on changes in the composition of symbiotic zooxanthellae in modern corals in the South China Sea, the presentation concludes that these corals are enhancing their adaptability to global warming through natural domestication, acquiring heat-tolerant zooxanthellae types. Additionally, corals may adapt to climate change by migrating to higher-latitude regions, and adjusting their feeding patterns, such as by increasing the proportion of heterotrophic feeding.