Topic 2 - Annual Meeting 2024

List of Poster

Subtopic 2.1 Warming climates

No	Name	Poster title	Center	Contact
1	**Güntzel, Janina**	**Evolution of grounding-line retreat along the mac. Robertson shelf (East Antarctica) over the past 30,000 years: Creating reliable spatiotemporal benchmarks for validating ice-sheet simulations**	**AWI**	janina.guentzel@awi.de
The future behaviour of the Antarctic Ice-Sheet is considered as one of the largest unknowns in global climate predictions. This emphasizes the strong need for reliable long-term data of mass balance change in time and space, particularly for sectors along the East Antarctic margin that play key roles in supplying the world's oceans with bottom waters. We present newly acquired geophysical and geological datasets from the previously insufficiently studied East Antarctic Mac. Robertson Shelf. Combined analyses of these data will allow for creating a four-dimensional framework of mass-balance variations over the past ~30,000 years. These unique data provide valuable spatiotemporal records for benchmarking paleo-ice sheet models and thus contribute to improve simulations of those changes for the coming decades and centuries. Furthermore, they advance our understanding of past variability in the formation of Antarctic Bottom Water that originates in the nearby Cape Darnley polynya today.				
2	**Fraga Ferreira, Paula Luiza**	**Redox Evolution on the Peruvian Margin since the Pliocene: Insights from Geochemical Proxies**	**GEOMAR**	pferreira@geomar.de
Due to the upwelling of nutrient-rich waters, the Peruvian Margin ranks as one of the most productive regions in the global ocean and hosts one of the planet's most intense and shallow oxygen minimum zones. As a result, it is an ideal location for studying historical changes in redox conditions. In this research, we employed a variety of geochemical proxies (iron speciation, redox-sensitive elements, and Mo, N, and C isotopes) to trace the area's evolution since the Pliocene. Our findings indicate that, over the last eight interglacial periods, climate				

		influenced Mo accumulation in the sediments. During warm periods, increased denitrification promoted the particulate delivery of Mo, which is adsorbed on the surface of Fe oxy(hydroxides). During glacial periods, Mo accumulation primarily occurred through diffusion from the water column. We also observed that during interglacials, surface productivity was linked to denitrification rates and the benthic redox state, whereas during glacials, external factors affected the oxygen levels in the OMZ. Lastly, in the Pliocene, high reactive iron/total iron ratios did not correspond with the low concentrations of redox-sensitive elements. We propose that these high ratios are associated with intensified weathering of the Andes during the warmer Pliocene.		
3	**Hirsch, Nora**	**Warming on the East Antarctic Plateau based on Borehole Thermometry Measurements**	**AWI**	nora.hirsch@awi.de
		While polar amplification is clearly observed in the Arctic, it is not as unambiguous in Antarctica. This unknown sensitivity to global warming and the associated potential changes in accumulation contribute to a large uncertainty in future predictions, for example, of global sea level rise. Borehole thermometry is a method to determine recent warming trends with respect to the past. Here, we show preliminary results from Kohnen Station from last austral summer season.		
4	**Urban, Anais**	**Impacts of Global Warming on Regional Hydro-Climates in the Eastern Mediterranean**	**GFZ**	amsurban@gfz-potsdam.de
		The Mediterranean region warms faster than the global average and is highly sensitive to climate change. Models forecast a drying trend with increased frequencies and magnitude of extreme rainfall events. To estimate future effects of a warming climate, it is crucial to understand drivers of past climatic changes. ICDP sites 5017 (Dead Sea) and 5034 (Lake Van) serve as key geo-archives for detailed reconstructions of past hydroclimatic variability. Throughout Glacial/Interglacial transitions the lakes have undergone significant lake level changes but revealed contrasting patterns which highlight the complexity of the Mediterranean hydroclimate. In these terminal lakes, lake-level changes can be read as an evaporation/precipitation proxy and the deposition of annual lamination allows a high-resolution analysis of hydroclimatic variability.		

This study aims to investigate the hydrological patterns in Lake Van and the Dead Sea on inter-annual timescales during Termination II using XRF, microfacies analysis, stable isotope analysis and dD on leaf waxes.				
5	**Hohmeier, Björn**	**Reconstructing Ethiopian Hydroclimate from a Varved Lake Sediment Core**	**GFZ**	hohmeier@gfz-potsdam.de
The focus of this research will be understanding the sensitivity of hydroclimates to global perturbations during the past 6,000 years. Specifically, we aim at reconstructing the variability of past rainfall in central Ethiopia in this project (Rain6K). The last 6000 years were marked by intense human activity in the upper and lower Nile Valley and include intervals of significant climate changes. We aim to investigate the drivers of hydroclimate variability over the past 6000 years.				
6	**Köhler, Raphael**	**Effect of Regional Polar Refinements in Global Atmosphere Model Simulations**	**AWI**	Raphael.koehler@awi.de
Polar regions exhibit the largest uncertainties in future climate projections due to limitations in climate models, such as poor parametrizations and low resolution. Variable-resolution atmosphere models address these issues by focusing on specific regions with high resolution while maintaining global integration for feedbacks. Within the Horizon 2020 EU-project PolarRES, we analysed three models—MPAS, VR-CESM, and ICON—using a bipolar approach. The impact of the higher resolution extends beyond the polar regions; for example, the North Atlantic jet is simulated more realistically in winter.				
7	**Rossel, Pamela E.**	**Organic carbon dynamics in extreme environments**	**GFZ**	prossel@gfz-potsdam.de

Organic matter on the Earth's surface can have multiple sources (biological, atmospheric deposition, rock erosion) and can be altered by abiotic and biotic processes. Abiotic alteration could occur for example during the exposure of organic matter to high temperatures (e.g. in hydrothermal vents) or solar radiation. Moreover, through their biological activity, organisms can also change the amount and composition of the organic matter. Environmental conditions could also facilitate the transfer from organic matter between particles and liquid, which would result in the transport of organics in streams, rivers, porewater or meltwater. To get insights into carbon dynamics (i.e., production/degradation, alteration by biotic/abiotic processes), environmental sampling or laboratory experiments, in combination with different instrumental techniques (untargeted and untargeted analysis) can be applied. Examples of their use to study organic carbon dynamics in glacier environments will be presented in this overview poster.				
8	**Tiedeck, Sofie**	**Warm moist air intrusions and their impact on the surface energy budget in the Arctic**	**AWI**	sofie.tiedeck@awi.de
Atmospheric Rivers (ARs) are long, narrow atmospheric structures that carry anomalously warm and moist air from lower latitudes into higher latitudes. Therefore, ARs are discussed to contribute to Arctic Amplification via water vapor feedback and cloud-radiation processes. We analyze the impact of ARs on the SEB and related physical processes using complementary methods, including reanalysis (ERA5) and model data (ICON-LAM) and Eulerian and Lagrangian approaches. The impact of ARs is dependent on the surface type and the season, with the strongest impacts in winter and over open ocean.				
9	**Schicks, Judith**	**Natural gas hydrates: the hidden climate risk factor in polar regions**	**GFZ**	**schick@gfz-potsdam.de**
Polar regions are warming faster than the rest of the planet leading to drastic and cascading environmental impacts including ice shield and glacier melting, sea ice decline, and rapid permafrost thawing. Permafrost hosts methane (CH4) and other hydrocarbon gases stored in gas hydrates. The stability of these gas hydrates requires low temperature and high-pressure conditions; therefore, gas hydrates occur not only				

within or below permafrost but also in the shallower parts of the Arctic Ocean as well as beneath large ice shields. Current estimates of the methane stored in these environments are highly uncertain, ranging from 27 to 800 gigatons of methane, whereas older studies even suggest up to several thousand gigatons (Ruffine et al. 2023 and literature within). This represents between 200 to 6,000 times the amount of methane released annually into the atmosphere, highlighting the potential impact of these carbon reserves on global climate. Despite the potentially large methane stores, their increased vulnerability to amplified and cascading polar environmental change, cryosphere associated gas hydrates are currently understudied. The magnitude, location and temporal evolution of hydrate dissociation rates, as well as of resulting methane emissions to the atmosphere over the next decades and centuries are unknown. On a small scale, the gaps in knowledge also include an understanding of which factors influence their dissociation behavior. These factors include, for example, the influence of the host sediments or the composition of the gas hydrates. In a study involving both, experiments and numerical simulations, we were able to show how the composition and structure of the gas hydrates lead to different dissociation behavior: After initial decomposition, pure structure I methane hydrates showed an unusual self-preservation; a behavior that is also suspected for the gas hydrate deposits in the permafrost areas in Siberia. In contrast, gas hydrates, which contain higher hydrocarbons in addition to methane, decompose continuously and show no self-preservation effect. Further experimental investigations showed that the type of host sediment also strongly influences the decomposition kinetics.

Vice versa, the gas hydrates can also influence the geo-mechanical properties of the host sediments. Investigations of hydrate-bearing sediments in our ring shear cell show the direct correlation between hydrate saturation and the shear strength of the sediment. We were able to show that gas hydrates have a stronger influence on the strength of the sediment than ice. The dissociation of gas hydrates in permafrost regions could therefore lead to greater destabilization of the ground and endanger the infrastructure than the beginning thawing of the permafrost already does. In order for the results of such individual studies to lead to a reliable prediction of the possible effects of cryosphere-associated gas hydrates on the climate, we are striving for a coordinated, cross-scale, interdisciplinary and international research project including data mining and modeling, a land-to-sea-drilling campaign and an interdisciplinary and coordinated global collaboration on laboratory experiments. In addition to the results of our studies on a small scale, ideas for future research into cryosphere associated gas

hydrates will also be presented. Reference: Ruffine, L. Tang, A. M., O'Neill, N., Toffin, L., Paris, J.-D., Yang, J., Georgiev, V., Fietzek, P., Giustiniani, M., Tinivella U., 2023, Earth-Science Reviews, 246, 104578.

Subtopic 2.2 Variability and extremes

No	Name	Poster title	Center	Contact
10	Chen, Lu	Salinity effects on surface currents and ENSO in simplified ocean and coupled models	GEOMAR	lchen@geomar.de
Salinity plays an important role in modulating ocean density, pressure gradients, and consequently, ocean state variability. However, its effects are often omitted in simplified models for El Niño-Southern Oscillation (ENSO) simulation and prediction. In this study, we integrate salinity effects into an Intermediate Ocean Model (IOM) and an Intermediate Coupled Model (ICM), respectively, to investigate its impacts on surface currents and ENSO. In the improved IOM, the inclusion of salinity significantly improves the simulation of meridional surface currents in the equatorial central Pacific, increasing the correlation with observations from 0.3 to 0.5 and yielding more realistic amplitude; the interannual variability of sea surface temperature in Niño 3.4 and Niño 4 regions increased by 4% and 12%, respectively, due mainly to enhanced meridional and vertical advection. In the improved ICM, salinity effects, combined with Bjerknes feedback, increase ENSO amplitude by about 40% and leads to more second-year events. This study highlights the effects of salinity on ENSO through advection processes and is important for understanding and predicting ENSO evolution.				
11	Dilmahamod, Fehmi	Subpolar eddies from a high-resolution, multi-platform experiments in the Labrador Sea	GEOMAR	fdilmahamod@geomar.de
Mesoscale structures are key dynamical features of the ocean. They are associated with a variety of short-lived and small-scale dynamics linked to physical, biological, chemical processes at the submesoscale, such as cascading energy, impacting ocean stratification and guiding ocean carbon and oxygen uptake. In the high latitudes, the spatial extent of the mesoscale is only tens of kilometres, making it challenging to observe the submesoscale processes. In August-September 2022, an extensive submesoscale-resolving multiplatform experiment was conducted across an Irminger Ring in the Labrador Sea. The experiment leveraged two underwater electric gliders equipped with nitrate, microstructure shear, chlorophyll fluorescence, oxygen, and turbidity sensors, operated in concert with a variety of ship operated instruments				

including underway-CTD's, a moving vessel profiler, Thermosalinograph, ADCPs and a X-band radar system. Observations were acquired both, along the peripheries and within the core of the eddy, and offered insight into submesoscale dynamics of the ring.				
12	**Lenz, Nina**	**Provenance of detrital sediments in the North Sea and the Skagerrak based on radiogenic Nd-Sr-Hf isotopes and clay mineral compositions: Assessing the impact of coastal and seabed erosion**	**GEOMAR**	nlenz@geomar.de
The Skagerrak basin provides a natural sediment trap in the North Sea region and forms the largest depocenter for fine-grained sediments derived from the Atlantic, the Baltic Sea and the surrounding continental margins and coasts. However, the precise end-member and their quantitative proportional contributions to the North Sea and Skagerrak sediments are not well understood. Radiogenic isotopes in combination with clay mineral compositions are a powerful tool for characterizing sediment sources and reconstructing sediment transport pathways. In order to trace the predominant sources of the sediments deposited in the Skagerrak basin and to gain a better understanding of the sedimentary processes in the North Sea, radiogenic Sr, Nd, and Hf isotope signatures and clay mineral compositions of the detrital clay fraction of surface sediment samples from the entire North Sea, the Scandinavian margin and the Baltic Sea were measured. The results strongly indicate that the predominant source for Skagerrak clay-sized sediments is the northern North Sea where seabed and coastal erosion are enhanced by the inflowing Atlantic Currents and provide the Skagerrak with high amounts of clay size sediments. In contrast, Mid-European rivers such as Elbe, Weser and Ems are only minor contributors suggesting that sediments transported along the current-driven pathways of the southern North Sea predominate, which mainly originate from coastal erosion in the English Channel and are partly trapped in the Wadden Sea or deposited in the German Bight. Compared to the northern North Sea, the sediments from the southern North Sea are minor suspended matter contributors to the Skagerrak region. These findings deviate from previous studies, which based on both clay and silt fraction and suggest a dominant source from the southern North Sea. These reconstructed sediment processes are only related to the clay-sized sediments which mostly represent the Skagerrak deposits (up to 60%) and thus explains the different findings from previous studies based on clay and silt fraction. These results emphasise the role of coastal and seabed erosion as a previously underestimated supplier for fine-grained sediments for depocenters in the entire North Sea. With regard to climate change, the global sea-				

level rise will likely enhance erosional processes and can therefore significantly influence the sediment transport processes in the entire North Sea.				
13	**Skiba, Vanessa**	**Is polar amplification in low-frequency temperature variability exaggerated in climate models?**	**AWI**	vanessa.skiba@awi.de
Knowledge on natural climate variability is pivotal for making future climate projections. Previous studies based on observational and proxy data have shown that climate models underestimate supra-decadal temperature variability. Additionally, proxy data indicates a weaker increase in variability towards polar regions than climate models suggest, which often exhibit strong polar amplification in the amplitude of temperature variations. Using a multi-archive and -proxy approach, we characterise the latitudinal pattern of low-frequency climate variability of the Holocene and assess the ability of climate models to reproduce it. We investigate whether processes affecting the proxy signal can explain the pattern or whether the models are biased.				
14	**Schulz, Marco**	**Dynamical processes and future development of eastern boundary upwelling systems**	**GEOMAR**	mschulz@geomar.de
The upwelling systems of the ocean at the eastern boundaries are an essential part of the global carbon cycle and are of central importance for the sustainability of economic and food resources. The contributions of the individual drivers of nutrient supply to these highly productive ecosystems such as wind stress (curl), currents, coastal trapped waves (CTW), heat fluxes, tidal mixing, dust deposits and their interactions within this dynamic system are still poorly understood. This heavily impedes the predictive skills for the future development of these systems under global change. Traditionally, the strength and seasonality of upwelling are related to local wind forcing. However, in tropical upwelling systems (latitude <15°), seasonal maxima of productivity occur when upwelling favorable winds are weak. For example, in the tropical Angolan upwelling system, the seasonal productivity maximum is due to the combined effect of CTWs and elevated tidal mixing on the shelf. In the tropical North Atlantic tides could be similar important. Results from a baroclinic tidal model for the eastern tropical North Atlantic				

suggest that the energy flux of the tides is mostly directed toward the shelf, and tidal energy dissipation enhances towards the coast. Previous (moored) short-term observations in the region also indicate this. These valuable insights into the importance of the tides but also the hydrography, currents, nutrient distribution and biology will be complemented by an upcoming expedition in February/March 2024, to be conducted during the main upwelling season. Specifically, the recently recognized critical role of internal waves/tides and (sub)mesoscale processes for mixing and nutrient transport as well as for the intensity and distribution of upwelling will be investigated. To improve our understanding, observational data will be analyzed in conjunction with data from current satellite projects (SWOT, Surface Water and Ocean Topography mission). In addition, the promising initiative "FUTURO" will seamlessly build on these results and additionally use an unprecedented interdisciplinary approach to continuously study the region for a whole year.

Subtopic 2.3 Sea level change

No	Name	Poster title	Center	Contact
15	Esselborn, Saskia	The 2023 Baltic inflow event as observed by SWOT altimetry	GFZ	saskia.esselborn@gfz-potsdam.de
The Baltic Sea is a brakish inland sea which is vertically stratified with a strong halocline isolating the fresh surface layer from the salty bottom layer. The bottom layer tends to lack oxgen which leads regularly to abiotic conditions in the Deep. While freshwater is drained constantly via the Danish Straits to the North Sea oxygen-rich bottom waters can only enter the Baltic infrequently under certain atmospheric conditions. A good proxy for these socalled major baltic inflow events are sea level gradients along the Danish Straits. Here we use novel SWOT wide swath altimeter data before and during the last inflow event to study the sea level signature of the event. These sea level snapshots are compared to the output of the regional storm surge model operated by BSH.				
16	Henkelmann, Robert	The improvement of ITRF through ESA's GENESIS Mission	GFZ	robert.heinkelmann@gfz-potsdam.de
On November 23, 2022, the GENESIS mission as a component of FutureNAV received the green light at the ESA Ministerial Summit in Paris and was approved. Its primary goal is to improve geodetic reference frames. Global terrestrial reference frames (TRFs) are determined from measurements of the four space geodetic techniques GNSS (Global Navigation Satellite Systems), VLBI (Very Long Baseline Interferometry), SLR (Satellite Laser Ranging) and DORIS (Doppler Orbitography and Radio positioning Integrated by Satellite). The strengths of these measurement techniques can only be optimally utilized through careful combination. Currently, this combination is achieved by linking station coordinates using "local ties" at so-called co-location sites and by determining common EOP (Earth Orientation Parameters) as "global ties". In the future, the GENESIS satellite will be used to achieve the linking via the special satellite ("co-location in space") in addition to the previous combination of the various space geodetic techniques. So far, the current global TRFs (ITRF2020, JTRF2020 and DTRF2020) do not meet the requirements set by GGOS (Global Geodetic Observing System) of the IAG (International Association of Geodesy) (accuracy of 1				

mm and long-term stability of 1 mm/decade). A major problem is the lack of linking of the spatial segments of the observation methods. With the GENESIS mission, it is now possible for the first time to realize this link for all four space geodetic techniques. The mission concept enables the identification of significant systematic errors between the four techniques mentioned.

17	**Xu, Minghui**	**Astrogeodesy by VLBI Global Observing System for improving the Terrestrial Reference Frame**	**GFZ**	minghui.xu@gfz-potsdam.de

Astrogeodesy, funded by Horizon Europe, is a project dedicated to improving the accuracy and stability of the Terrestrial Reference Frame (TRF) by using the new generation of geodetic VLBI system, the so-called VLBI Global Observing System (VGOS). With the support of this project, we aim to meet the stringent requirements of TRF by geoscience, such as determining sea level rise, 1 mm accuracy for station positions, and 0.1 mm/year stability for station velocities on global scales. VGOS regularly observes hundreds of quasars in the sky with twelve widely-spread antennas in 2024 (more antennas to join in the next years), producing VLBI observables with the lowest measurement noise level. However, one of the systematic errors limiting the precision of the geodetic products from VGOS is the intrinsic structure of the quasars, i.e., the angular distribution of the radio emission in the sky. The main objective of the project is to study and monitor the source structure of the quasars in the VGOS observations and to develop consistent models for removing systematic errors during the routine VGOS data analysis process. We have successfully obtained structure images from VGOS observations, which is the first and key step, and we will present these images in our contribution. Through analyzing the existing VGOS observations, we will report on source position time series and demonstrate one of the impacts of source structure. We will also present the result of the baseline length variation of GGAO12M—WETTZ13S, which will manifest the current capability of VGOS in determining station positions. The method and strategy of how to address the challenges for VGOS through our project will also be discussed.

18	**Ince, Sinem**	**Forward Gravity Modelling to Augment High-Resolution Combined Global Gravity Field Models**	**GFZ**	sinem@gfz-potsdam.de

The gravity field plays a crucial role in Earth System Sciences. Currently available static global gravity field models are limited in resolution due to the band-limited spectral content of the input data from satellite observations and gravity measurements on the Earth’s surface. Such

models are complemented beyond their current limits using topographic gravity field models derived from high-resolution digital elevation models (DEMs) and density estimations. At GFZ, we develop such high-resolution topographic models to enhance the representation of static global gravity field models such as EIGEN-6C4 at shorter wavelengths and fill in the areas where gravity measurements are not present. Our current models are expected to resolve features as small as 5 km resolution.				
19	**Shihora, Linus**	**Connecting NADW transports to ocean bottom pressure**	**GFZ**	linus.shihora@gfz-potsdam.de
Estimating oceanic transports of volume, heat, carbon, and freshwater is fundamental to understanding the ocean's role in the changing climate system. Unique in this context is the Atlantic Meridional Overturning Circulation (AMOC) that comprises a net northward transport of relatively warm water at depths of $\lesssim$1 km throughout the Atlantic basin, compensated at depths of $\gtrsim$1–5 km by a colder net southward return flow (NADW). While in-situ measurements, such as the RAPID array at 26.5°N, are considered the 'gold standard' to monitor changes in the AMOC, measurements at many latitudes and the detection of e.g. basin-wide modes are not feasible with such costly arrays. However, variations in the geostrophic part of the AMOC are to a good degree described by variations in NADW transport and therefore accessible through bottom pressure measurements using bottom pressure recorders or possibly even future satellite gravimetry missions. Here, we investigate the connection between changes in the NADW transport and associated variations in bottom pressure along the western continental slope and shelf in the North and South Atlantic in the regional high-resolution ocean model VIKING20X provided by GEOMAR. We assess to what degree the transport variations can be inferred from bottom pressure signatures alone, limitations of the approach and especially how such signatures could be implemented into a future iteration of the ESA Earth-System-Model which is commonly used in simulation studies for satellite gravimetry. This would allow the inclusion of these transport-related OBP changes in dedicated simulation studies in preparation for future satellite gravimetry missions.				
20	**Sulzbach, Roman**	**Treatment of Modern Global Ocean and Atmospheric Tide Atlases in Precise Orbit Determination**	**GFZ**	sulzbach@gfz-potsdam.de

Tidal variability originating from the orbital dynamics of the Sun and the Moon can be observed in virtually all subsystems of the Earth. The evoked tidal phenomena in the atmosphere, the solid Earth, and the world oceans cause a large-scale redistribution of masses, primarily on daily and sub-daily time scales. The implied tidal variability impacts geodetic measurements. For example, the induced mass transport induces temporal changes in the Earth's gravity field which impact the orbits of artificial satellites. However, observations of a single satellite are generally insufficient to precisely estimate tidal signatures, resulting in a decreased accuracy of the Precise Orbit Determination (POD) of near-Earth satellites. Therefore, a priori prediction of tidal signals, especially ocean tidal signatures, by tidal atlases is necessary to exploit the full potential of geodetic data sets.
The most accurate ocean tide atlases are produced by incorporating satellite altimetry observations into the modeling process. However, limitations arising from the ambient signal-to-noise level have hindered their ability to accurately estimate small signals associated with minor tidal constituents. For those minor constituents, data-unconstrained ocean tide models can yield valuable constraints. For processing satellite altimetry data, initial experiments have been undertaken to integrate empirical and numerical models, aiming to deliver comprehensive tidal corrections (Hart-Davis et al., 2021, doi: 10.3390/rs13163310). It has been proposed that experimentation is necessary across all geodetic applications to determine the preferred model for specific tidal constituents and the optimal approach for merging models. This also includes the possibility of including minor ocean tides only implicitly, by deriving their admittance function from suitable neighboring tidal constituents.

21	**Voigt, Christian**	**Tidal and non-tidal ocean loading signals from a superconducting gravimeter on the North Sea island of Helgoland**	**GFZ**	christian.voigt@gfz-potsdam.de

A superconducting gravimeter has been continuously monitoring the variations of the gravity acceleration of the Earth since March 2020 at AWI's Biologische Anstalt Helgoland with ultimate precision of better than 1 nm/s². At this site, the main drivers of the temporal gravity variations are the tidal and non-tidal water mass variations of the North Sea, which show up in two distinctly different ways. First, the direct attraction of the local water mass variations according to Newton's law of gravitation are clearly visible, but can be reduced effectively on the basis of local tide gauge measurements. Secondly, ocean loading signals resulting from the subsidence of the Earth's crust due to large-scale

water mass variations in the North Sea are of more general interest, as these effects significantly affect high-precision geodetic measurements even hundreds of kilometres away from the coast. This is especially true during storm surges induced by westerly winds with maximum gravity increases of 85 nm/s², and associated vertical displacements of 35 mm downwards. We will present here the latest update of our work, which has been initially published already by Voigt et al., 2023 (doi: 10.1093/gji/ggad147) and Voigt et al., 2024 (doi: 10.1029/2024GL109262).

Subtopic 2.4 Advanced research methodologies for tomorrow

No	Name	Poster title	Center	Contact
22	**Wilms, Josefine**	**Gravity field recovery using co-estimation of background model errors to improve de-aliasing capabilities of the MAGIC double-pair constellation.**	**GFZ**	jowilms@gfz-potsdam.de
GFZ has performed various full-scale simulations within the ESA NGGM/MAGIC Science Support Study, including instrument noise and background model error assumptions. The focus was set on developing and applying extended parameterization techniques for improved de-aliasing of short-term mass variations. Ocean tide and non-tidal model corrections were co-estimated using covariance information, computed by the DFG Research Unit, NEROGRAV. In principle, model errors are absorbed by the additional co-estimated parameters, and gravity field estimation is thereby improved.				
23	**Liguori, Bianca; Zhang, Zhouling; Siebert, Christopher; Frank Martin**	**Constraining the Equatorial Pacific barium cycle with stable barium isotope**		**GEOMAR**
24	**Sasgen, Ingo**	**Next Generation Gravity Mission design: will new satellite constellations be able to resolve sub-monthly mass change events in Greenland?**	**AWI**	**ingo.sasgen@awi.de**
The GRACE/GRACE-FO satellite missions, operating with a trailing pair of spacecraft in near-polar orbit, have been invaluable for studying changes in Earth's gravity field and are extensively used to determine mass changes of the world's land ice. However, gravity field solutions produced by these missions represent only monthly mean changes and are subject to north-south oriented striping noise. These limitations hinder the detection of short-term mass change events and related processes, which are essential to understand for projecting future sea-level rise. To enhance both temporal and spatial resolution, new mission scenarios, such as the MAGIC constellation, are being developed —				

featuring one near-polar pair and one pair in a 70° inclined orbit. Here, we assess the potential of new mission scenarios to detect sub-monthly mass changes in Greenland.

Other

25	**Nizam, Sarwar**	**Unlocking soil organic carbon dynamics in degrading Himalayan Permafrost and Alpine Meadows**	**GFZ**	**nizam@gfz-potsdam.de**
Climate change is threatening the Himalayas and as such the billions of people dependent on its resources and water: warming leads to melting glaciers, rising lake levels, expanding growing seasons and degrading permafrost (UNEP Report, 2022). Destabilization of frozen soil organic carbon (SOC) in permafrost due to warming enhances greenhouse gas (GHG) emissions, contributing to positive climate feedback. Despite the Indian Himalayas containing the second-largest permafrost carbon reserve outside the poles (50 Pg C), GHG emissions from SOC decomposition remain understudied. The goal of our project is to understand greenhouse gas (GHG) fluxes and production mechanisms across different stages (permafrost vs peatland) of Himalayan landscape evolution. Preliminary findings reveal distinct carbon dynamics, with generally positive nitrous oxide fluxes, except in peatlands. Methane (CH_4) and carbon dioxide (CO_2) fluxes varied with soil conditions, with Ganglass and Puga being major CH_4 sources, while Tsol Tak and forest park emitted CO_2. Upscaled estimates suggest these sites emit about 1,400 tons of carbon annually, influenced by microbial and environmental factors, with organic matter ages ranging from 300-900 years.				
26	**Kearney, Rebecca**	**Important findings from the TephroMed project I: The cryptotephras of the ICDP Dead Sea deep core during the last 30-130kya**	**GFZ**	**-**