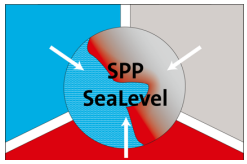
**DFG SPP-1889**
**Regional Sea Level Change and Society 'SeaLevel'**



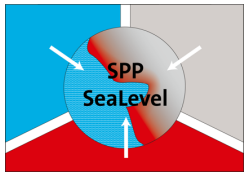

**Oral/Poster Presentations at AGUFall2018**

| Date | Abstract ID and Title | Presentation Type | Session | When & Where |
|---|---|---|---|---|
| **Monday 10th December** | G13D-0564:<br>Ocean mass change from GRACE and Swarm<br><br>**Juergen Kusche**[1], Bernd Uebbing[2], Roelof Rietbroek[2], Christina Lück[3], Sophie Stolzenberger[2] and Felix W Landerer[4], (1)University of Bonn, Institute of Geodesy and Geoinformation, Bonn, Germany, (2)University of Bonn, Bonn, Germany, (3)University of Bonn, Institute of geodesy and geoinformation, Bonn, Germany, (4)Jet Propulsion Laboratory, Pasadena, CA, United States | Poster | G13D Satellite Geodesy for Climate and Atmospheric Research | 13:40 - 18:00<br><br>Hall A-C (Poster Hall) |
| | **Find out everything about the SPP1889 SeaLevel program!**<br>Meet the SeaLevel Coordination team.<br><br>Eleni Tzortzi, University Hamburg | When: 14.00-16.00<br>Where: Exhibit Hall, Booth #1013 | | |
| **Tuesday 11th December** | **Find out everything about the SPP1889 SeaLevel program!**<br>Meet the SeaLevel Coordination team.<br><br>Eleni Tzortzi, University Hamburg | When: 11.00-12.30<br>Where: Exhibit Hall, Booth #1013 | | |
| | **Find out everything about the SPP DECVAR project "Causes of Decadal to Centennial Regional Sea Level Variations".**<br>(Principal Investigators: D. Stammer, A. Köhl, J. Jungclaus)<br><br>Meet the postdoc Sayantani Ojha, University Hamburg | When: 14.00-16.00<br>Where: Exhibit Hall, Booth #1013 | | |
| **Wednesday 12th December** | G31A-02B:<br>Non-linear evolution of vertical land motion as a key to improve sea-level estimates<br><br>Anna Klos, **Jürgen Kusche**, Luciana Fenoglio, Machiel Bos, Janusz Bogusz | Oral | G31A Satellite Geodesy for Climate and Atmospheric Research I | 08:15 - 08:30<br>Marriott Marquis - Independence A-C |

**DFG SPP-1889**
**Regional Sea Level Change and Society 'SeaLevel'**

**Oral/Poster Presentations at AGUFall2018**

| Date | Abstract ID and Title | Presentation Type | Session | When & Where |
|---|---|---|---|---|
| **Thursday 13th December** | OS43B-07:<br>Downscaling Regional Sea Level Change Projections in the North Atlantic<br><br>**Armin Koehl**[1], Frank Siegismund[1], Detlef Stammer[1], (1)University of Hamburg | Oral | OS43B: Sea Level Change and Coastal Impacts and Flooding I | 14.50-15.00 Convention Ctr; 102AB |
| **Friday 14th December** | OS51E-1296:<br>Glacier elevation and mass change of mountain glaciers outside the polar regions, derived from TanDEM-X InSAR data and SRTM C-Band between 2000 and 2011-15<br><br>Philipp Malz, **Thorsten Seehaus**, David Farías, Matthias Braun and Christian Sommer, (1)University of Erlangen-Nürnberg) | Poster | OS51E: Sea Level Change and Coastal Impacts and Flooding Posters | 08:00 - 12:20 Hall A-C (Poster Hall) |
| | OS51E-1301:<br>DFG Special Priority Program (SPP-1889) Regional Sea Level Change and Society ('SeaLevel')<br><br>D. Stammer[1], **Eleni Tzortzi**[1], (1) University of Hamburg/ CEN | Poster | OS51E: Sea Level Change and Coastal Impacts and Flooding Posters | 08:00 - 12:20 Hall A-C (Poster Hall) |
| | OS51E-1308:<br>Sensitivity Of Sea Level Response In FAFMIP Experiments To Model Resolution<br><br>**Sayantani Ojha**[1], Armin Köhl[1], Helmuth Haak[2], Johann H Jungclaus[3] and Detlef Stammer[1], (1)University of Hamburg, Hamburg, Germany, (2)Max Planck Institute for Meteorology, Hamburg, Germany, (3)Max Planck Inst, Hamburg, Germany | Poster | OS51E: Sea Level Change and Coastal Impacts and Flooding Posters | 08:00 - 12:20 Hall A-C (Poster Hall) |




## G13D-0564: Ocean mass change from GRACE and Swarm

***Juergen Kusche***[1], *Bernd Uebbing*[2], *Roelof Rietbroek*[2], *Christina Lück*[3], *Sophie Stolzenberger*[2] *and Felix W Landerer*[4], *(1)University of Bonn, Institute of Geodesy and Geoinformation, Bonn, Germany, (2)University of Bonn, Bonn, Germany, (3)University of Bonn, Institute of geodesy and geoinformation, Bonn, Germany, (4)Jet Propulsion Laboratory, Pasadena, CA, United States*

**Session:** G13D Satellite Geodesy for Climate and Atmospheric Research I Posters
Monday, 10 December 2018
13:40 - 18:00, Walter E Washington Convention Center - Hall A-C (Poster Hall)

Estimates of ocean mass change are of key importance for separating steric sea level change from sea level measured with satellite altimeters; and thus for constraining ocean heat change.
However, published ocean mass rates from GRACE data differ by several 0.1mm/a globally and up to more than 1mm/a for individual ocean basins. Here, we show that the largest part of this discrepancy (up to 0.6 mm/a) can be explained by which model is used to account for the effect of glacial isostatic adjustment. The second-largest part (0.3–0.4 mm/a) of the discrepancy is related to inconsistent procedures of restoring of the background atmosphere-ocean models. We provide a reconciled range of ocean mass rates (1.4-1.8mm/a depending on analysis interval, assuming the A et al. (2013) GIA model) that agree within 0.01mm/a across direct and inverse methods globally, but not for individual ocean basins. However, we note that ocean mass estimates as low as 1.05 mm/a are admissible when one prefers other published GIA corrections with lower mass-equivalent signals over Antarctica.
We compare ocean mass change derived from our Swarm gravity processing (Lück et al., 2018) to GRACE results and create a consistent and composite time series of ocean mass until mid-2018. This time series is then used to investigate ocean mass change and steric sea level change in the North Atlantic as a possible response to increased Greenland freshwater flux.

## G31A-02B: Non-linear evolution of vertical land motion as a key to improve sea-level estimates

*Anna Klos, **Jürgen Kusche**, Luciana Fenoglio, Machiel Bos, Janusz Bogusz*

**Session:** G31A Satellite Geodesy for Climate and Atmospheric Research I
Wednesday, 12 December 2018
08:15 - 08:30, Marriott Marquis - Independence A-C

The growing record of space-gravimetric and -geodetic data (GRACE, GNSS, radar altimetry, InSAR, VLBI, …) provides a new view on Essential Climate Variables such as tropospheric water vapor, water storage and ice mass changes, steric and barystatic sea level, sea surface winds, waves or sea ice extent. These observations have the advantage to be globally homogeneous, and independent from other data commonly used to develop and evaluate climate models. Geodetic time series reveal a complex picture of natural climate variability, long-term climate change and anthropogenic modifications. Combined with other observations or reanalyses, they provide excellent tools to assess climate models and improve our understanding of land- and ocean-atmosphere interactions.
We invite contributions dealing with (1) detecting climate signals in geodetic observations (2) evaluating climate models using geodetic data, (3) creating long and consistent geodetic time series, (4) climate modelling of geodetically observable variables, and (5) the prospects of future missions.

# OS43B-07: Downscaling Regional Sea Level Change Projections in the North Atlantic

***Armin Koehl***[1], *Frank Siegismund*[1], *Detlef Stammer*[1], *(1)University of Hamburg*

**Session:** OS43B: Sea Level Change and Coastal Impacts and Flooding I
Thursday, 13 December 2018
14:50 - 15:00, Walter E Washington Convention Center- 102AB

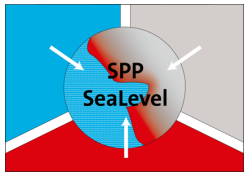
The dynamic topography is one of the components to be considered when projecting future sea level change. Though zero globally by definition, on a regional to local scale long-term variations in dynamic topography can be a significant contributor to the overall change and have to be considered for future adaptation strategies. The representation of dynamic topography including its temporal variations, however, strongly depends on the spatial resolution of the dynamic model applied for the projection. We present here results of a dynamical downscaling of CMIP5 climate change projections of the Earth System model of Max Planck Institute of Meteorology in medium resolution (MPI-ESM-MR). Results from the historical and RCP 4.5 and 8.5 integrations of the climate model are applied as forcing for a high resolution set-up of the Massachusetts Institute of Technology General Circulation Model (MITgcm) covering the North Atlantic starting from 30°S and including the Arctic Mediterranean. For long spatial scales similar patterns and temporal evolvement of sea level is observed in both models, while strong deviations exist from regional to local scales. Both models show a general strengthening of the subpolar gyre in both projections while only the MITgcm reveals a northward shift of the Gulf Stream around 70°W and a significant increasing trend in sea level along the U.S. east coast between 28-35°N of up to 12 cm (18 cm) for the time average and 24 cm (25 cm) as maximum annual mean over the period 2060-2099 of the RCP 4.5 (8.5) projection. To further analyse the projected regional changes and its relation to changes in the North Atlantic circulation, the variations in dynamic topography are decomposed into its thermo-steric, halo-steric and bottom pressure component, respectively, and differences between the two models and the two projections are discussed.

# OS51E-1296: Glacier elevation and mass change of mountain glaciers outside the polar regions, derived from TanDEM-X InSAR data and SRTM C-Band between 2000 and 2011-15

*Philipp Malz, **Thorsten Seehaus**, David Farías, Matthias Braun and Christian Sommer, (1)University of Erlangen-Nürnberg)*

**Session:** OS51E: Sea Level Change and Coastal Impacts and Flooding Posters
Friday, 14 December 2018
08:00 - 12:20, Walter E Washington Convention Center - Hall A-C (Poster Hall)

Mountain glaciers outside the polar regions are important sources of fresh water for agriculture, irrigation, hydro power and also drinking water, particularly in arid and semiarid regions.Accelerated retreat and surface lowering have been reported by numerous studies from various regions, e.g. the South American Andes, the European Alps and the Himalaya range.However, the accuracy and intercomparability of glacier dynamics in different regions is hampered by a lack of measurements in remote areas and a broad variety of applied methodology.
Our aim is to provide a comprehensive overview of glacier elevation and mass change and contribution to sea level rise for the entire glacierized area outside the Polar regions.We use elevation data derived from space-borne interferometric synthetic aperture radar (InSAR) remote sensing to estimate glacier dynamics over the last decade.Therefore, we calculate changes in glacier surface elevation by differentiating vertically and horizontally co-registered TanDEM-X DEMs (2011-2015) from SRTM C-Band DEM (2000) to derive glacier mass change and the respective contribution to sea level rise.
Preliminary results show a glacier mass loss rate of 19.5±1.76 Gt $a^{-1}$ for the South American continent over the observation period, mainly caused by the large Patagonian icefield outlet glaciers. For the tropical Andes and Tierra del Fuego our results show a less pronounced glacier retreat than previous studies.
Glaciers in High Mountain Asia show an overall loss rate of 3.33 Gt $a^{-1}$ measured over the area analyzed so far from Bhutan to Afghanistan with regional differing change patterns.It is envisaged that more regions of High Mountain Asia are processed and persisting gaps are filled to adequately compare the work to other results by the presentation date.
Our approach enables a high comparability of regional and world wide glacier change and provides important information for estimating the role of mountain glaciers in changing sea level.We recommend regular acquisitions of TanDEM-X imagery over glacierized regions in order to improve and consistently expand the temporal coverage for geodetic glacier mass balances for glaciers and ice caps.

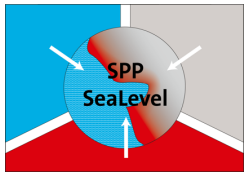



# OS51E-1301: DFG Special Priority Program (SPP-1889) Regional Sea Level Change and Society ('SeaLevel')

*D. Stammer[1], **Eleni Tzortzi[1]**, (1) University of Hamburg/ CEN*

**Session:** OS51E: Sea Level Change and Coastal Impacts and Flooding Posters
Friday, 14 December 2018
08:00 - 12:20, Walter E Washington Convention Center - Hall A-C (Poster Hall)

The Deutsche Forschungsgemeinschaft (DFG) Special Priority Program (SPP-1889) '**Regional Sea Level Change and Society (SeaLevel)**' performs a comprehensive, interdisciplinary analysis to advance our knowledge on regional sea level change (SLC), while accounting for the human-environment interactions and socio-economic developments in the coastal zone. SeaLevel consists of 20 projects, bringing in synergy over 80 natural and social scientists from 23 German research institutions and a wide range of disciplines, such as physical oceanography, geophysics, geodesy, hydrology, marine geology, coastal engineering, geography, sociology, economics and environmental management. By combining diverse modern methodologies, observations and models, natural and social scientists jointly aim to create a scientific base for quantitative, integrated coastal zone management (ICZM), applicable to many endangered places globally and essential for safety, coastal/land use planning, and economic development.
The program focuses on the North and Baltic Seas with potential impacts on Germany, and the South-East Asia/Indonesia region, encompassing coastal megacities, low-lying islands and delta regions. These study regions contrast developed/developing countries, thus differ fundamentally in their socio-politico-economic and cultural contexts, societal impact, adaptation and response strategies towards SLC.
SeaLevel is organized around 3 interactive working packages: *A. Origin of Regional Sea Level Changes at Annual to Multi-Decadal Scale*, *B. Regionalization of Decadal Sea Level Projections*, and *C. Socio-economic Impacts and Risk Governance*. The program's **main research activities** include to improve the physical knowledge of SLC and regional-to-local scale projections, investigate which socio-institutional factors enable/hinder coastal societies to cope with SLC, determine the natural and social coastal systems' responses to future SLC, and assess adaptation strategies under given technical, cultural, socio-politico-economic constraints. Such integrated analyses require SLC information (local SL projections, storm surges, waves and extremes), uncertainty and risk measures to be provided at the coastlines. Here we describe the goals and status of the SeaLevel program.




# OS51E-1308: Sensitivity Of Sea Level Response In FAFMIP Experiments To Model Resolution

***Sayantani Ojha*[1]**, *Armin Köhl*[1], *Helmuth Haak*[2], *Johann H Jungclaus*[3] *and Detlef Stammer*[1], *(1)University of Hamburg, Hamburg, Germany, (2)Max Planck Institute for Meteorology, Hamburg, Germany, (3)Max Planck Inst, Hamburg, Germany*

**Session:** OS51E: Sea Level Change and Coastal Impacts and Flooding Posters
Friday, 14 December 2018
08:00 - 12:20, Walter E Washington Convention Center - Hall A-C (Poster Hall)

We present an inter-comparison study of the response of the MPI-ESM coupled Atmosphere-Ocean General Circulation model (AOGCM) in global as well as regional sea level to surface flux anomalies applied under two different model resolutions.The study is being performed as part of the CMIP6 Flux-Anomaly-Forced Model Intercomparison Project (FAFMIP) which aims to identify forcing mechanism of regional sea level response and changes in the ocean density and circulation pattern under well-defined conditions and their sensitivity to model resolution. As part of the experiment, two configurations of the same climate model with different resolution are driven by the same surface forcing anomalies in heat, freshwater and momentum flux targeted to understand the mechanisms of sea level changes under climate change scenarios. In the experiments, a prescribed set of surface flux perturbations, resulting from CMIP5-AOGCM projections for doubled CO2 concentration, is applied to the ocean. The two configurations are the MPI-ESM1.2-LR and MPI-ESM1.2-HR version that are also applied for historical and scenario experiments in the upcoming CMIP6. MPI-ESM-1.2LR features a resolution of ca. 200 km in the atmosphere (ECHAM6.3 T63L47) and 150 km in the ocean (MPIOM1.6 GR1.5/L40). MPI- ESM-1.2HR features a resolution of ca. 100 km in the atmosphere (ECHAM6.3 T127L95) and 40 km in the ocean (MPIOM1.6 TP04/L40). The inter-comparison of the two resolutions shows that the geographical patterns of the global dynamic sea level (DSL) change relative to the pi-control are similar although they differ in magnitude over some regions. Noticeable difference in DSL change is visible over the North Atlantic Ocean in all the three sensitivity experiments. In the high-resolution model the DSL change is lower in magnitude over the Southern Ocean in both the momentum and fresh water flux perturbation experiments. Compared to the other two experiments, the regional sea level response of the heat flux perturbation experiment shows less sensitivity to model resolution.