

# Providing climate information for the German Coast

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## DAS core service „Climate and Water”

The German coastal areas of the North Sea and Baltic Sea: Wadden Sea World Heritage Site, 23000 km<sup>2</sup> of shipping lanes, around 600 km of dyke line and home of over 7 million people. Numerous actors work on and with the coast and have to consider potential response of the coastal ocean to future climate change. For this reason a new national governmental climate service has been established in Germany. This is one of the measures translating the political framework “German Strategy for Adaption to Climate Change” (DAS) into action. Within this DAS core service “Climate and Water” the Federal Maritime and Hydrographic Agency (BSH) is providing a broad range of climate information focussed on the German coast. The existing product portfolio is ranging from e.g. historical ice conditions to information on storms and sea level variations. A main focus of the DAS core service is to provide information on the regional coastal response to future climate changes especially for sea level rise, temperature increase and changes in salinity for regarding the mean state as well as extreme events.

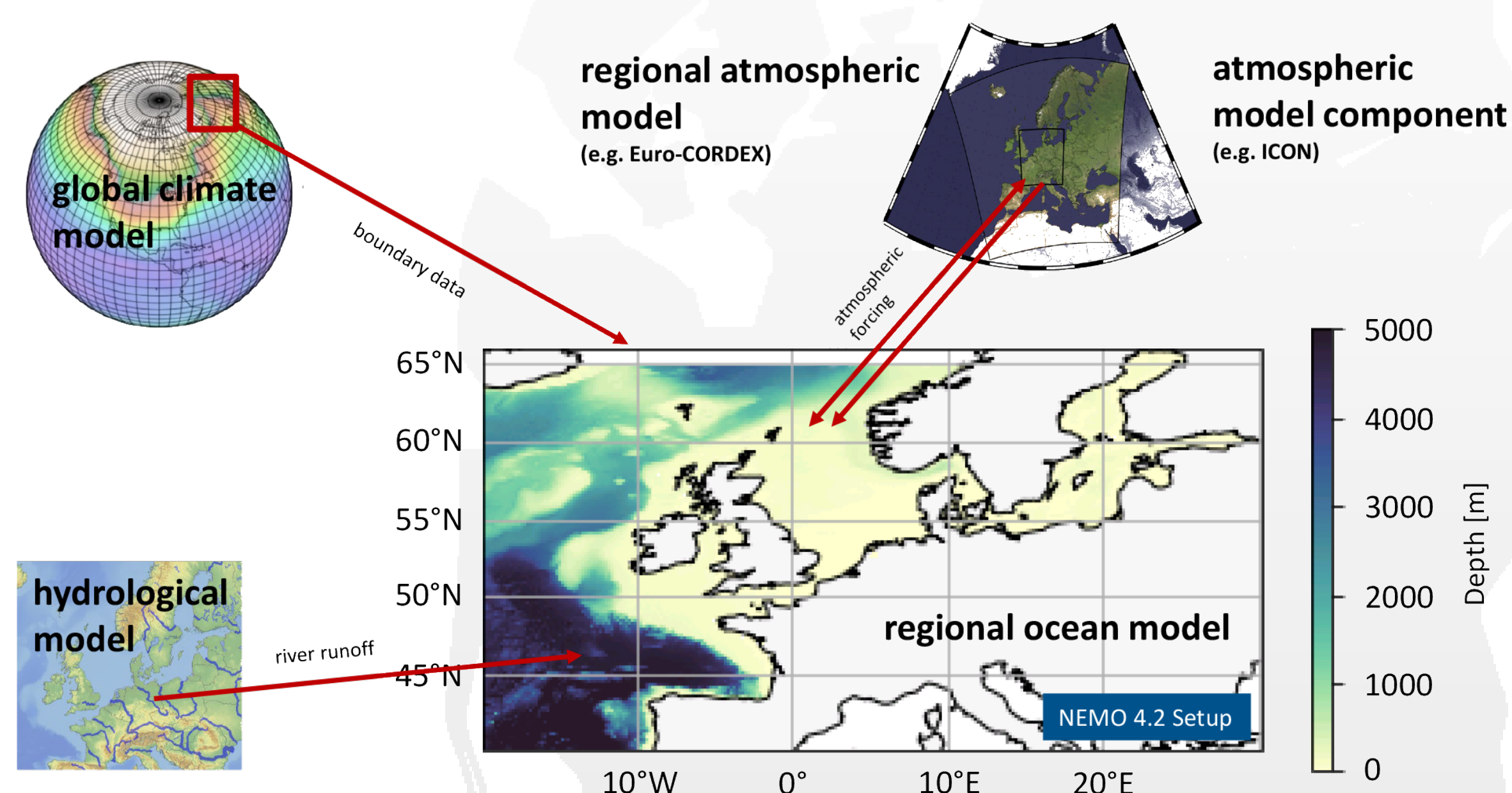


Figure 1: NEMO 4.2 setup model region for regional setup and interfaces to regional model boundary and forcing data.

## Model requirements

In addition to products describing the climate history and the current climate conditions, climate projections are important for coastal adaptation to climate change. The resolution of global ocean models is far from sufficient for the North Sea and the Baltic Sea. To describe the response of the German coast to future climate, a regional downscaling for the atmosphere as well as for the ocean model is essential. High resolution atmospheric forcings for climate simulations with reliable data especially over the ocean is needed. The ocean model setup has to be appropriate to the regional characteristics like narrow straits, shallow coastal areas and wetting and drying of tidal flats. Hydrological data is an important factor to represent the conditions especially in semi enclosed basins like the Baltic Sea.

## NEMO4.2 Setup

Based on the state of the art ocean model NEMO4.2, a regional setup (figure 1) is developed to provide climate projection data for the target regions North Sea and Baltic Sea with focus on the German coastal region and its estuaries. This setup will be used both as standalone regional ocean model and coupled to an atmospheric model. It includes the entire North-West-Shelf to take into account the impact of the North Atlantic weather systems on the dynamics of the seas and the cross-shelf transport. An adjusted bathymetry based on up-to-date measurements of the sea floor from the EMODNET network is implemented. The setup is also tested for its response on the use of different data sets of boundary data and initial data for tides, temperature and

salinity, providing insights into the influence of temporal resolutions of boundary data on projection results. First results from the calibration phase are shown in figure 2.

The NEMO4.2 setup will be calibrated with focus on sea level at the German coast and water exchange between the North Sea and the Baltic Sea through the Danish Straits. Furthermore, special attention is paid to the thermal stratification and to the seasonality and thickness of sea ice.

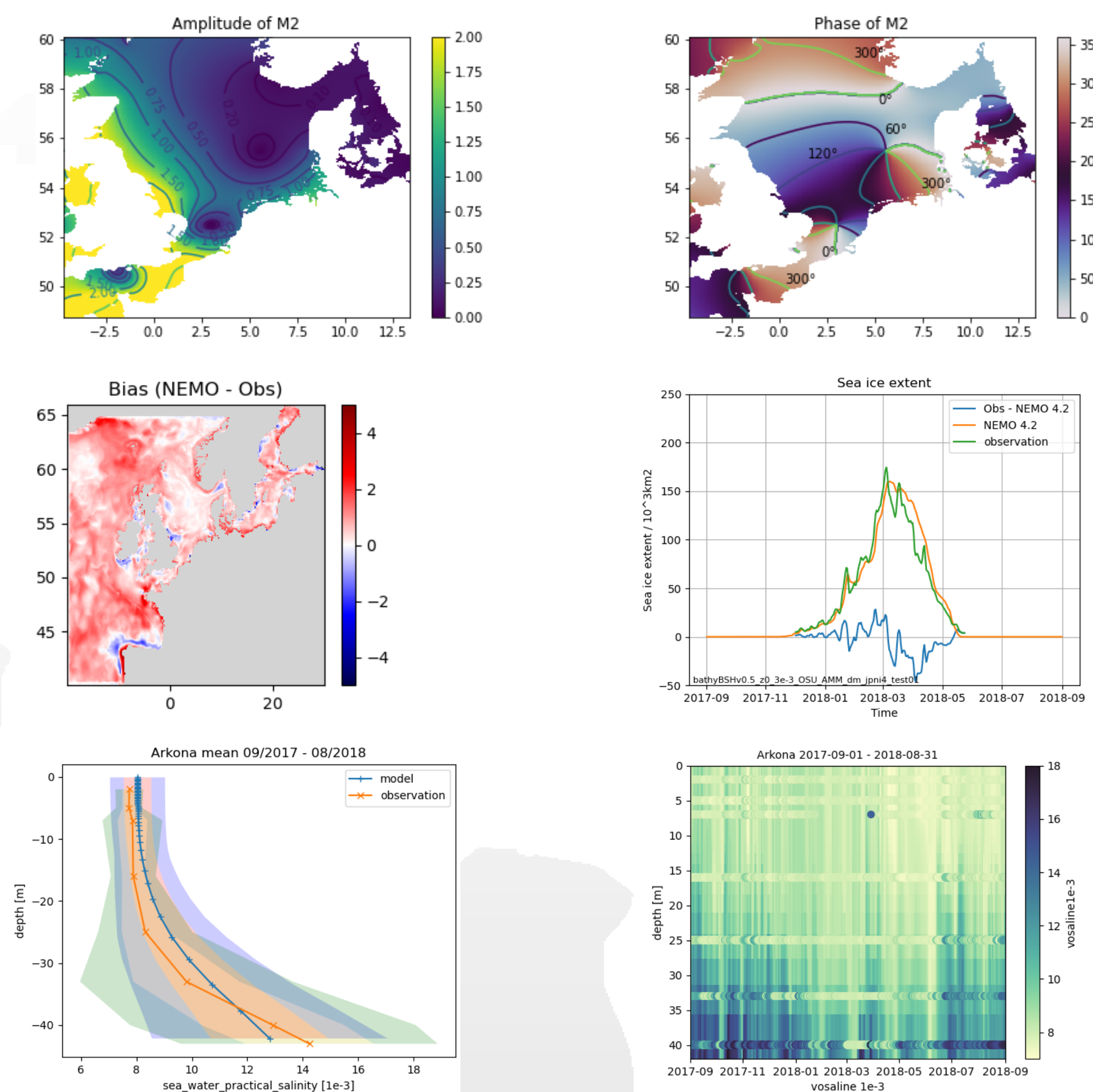


Figure 2: Exemplary diagrams for NEMO4.2 setup validation with the adjusted bathymetry, atmospheric forcing from the ERA5 dataset, tidal data from the FES2014 global ocean tide atlas and climatological boundary data from AMM7.

For the DAS core service the model will deliver information from high resolution climate simulations (figure 3) for three 30 year periods: a historic period (1971–2000), a near future (2031–2060) and a far future (2071–2100) period. Besides that the service will provide user specific information and products for appropriate climate adaption measures.

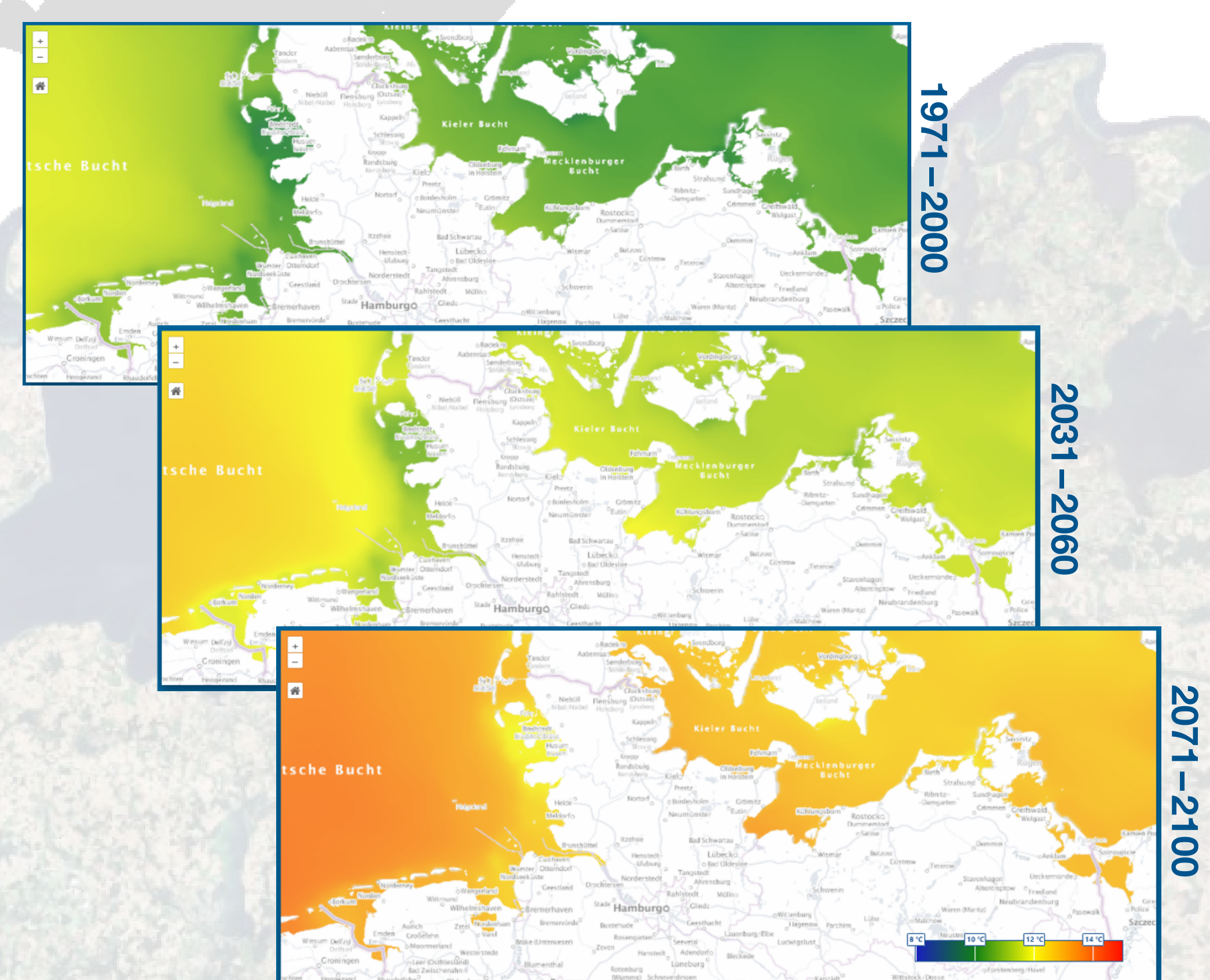


Figure 3: Prototype of Sea Surface Temperature climate projection maps for planned BSH Web Map Viewer.

