

# Towards a Trilateral Research Agenda for the Wadden Sea Region

## Geosciences

### Background

Based on decisions formulated in the in declarations from the Trilateral Ministers meetings 2010 and 2014 the preparations of an upcoming similar meeting in 2018 has resulted in the establishment of five working groups under the following headings: Geosciences, Ecology, Economy & Society, Cultural Heritage and Climate & Water. The groups are supposed to formulate a report (A) before August 1, 2016 with the following content: 1) Major achievements and persisting gaps of knowledge (5-10 most important research questions) 2) Main questions relevant for policy and 3) Suggestions for transdisciplinary themes. This report is expected to form background for the formulation of a combined draft version for a trilateral research agenda (B), to be circulated in due time prior to the Trilateral Scientific Symposium to be held in Denmark in February 2017. At the symposium a broad range of scholars are supposed to get the opportunity to comment on the work and give input to further content or enhancements. Subsequently a finished proposal (C) is to be formulated and presented to the ministers at the Minister Conference scheduled to be held in early 2018. An earlier draft of the present report (A) formed the background for discussions at a workshop held at Hanse-Wissenschaftskolleg in Delmenhorst May 9, 2016 attended by 22 scientists with participation from all three Wadden Sea countries.

The challenge of selecting a limited number of research items is here met by evaluating earlier and ongoing research as well as taking into account what seems possible in light of new technological achievements and what represents the most urgent actual needs.

### **Major achievements and persisting gaps of knowledge regarding a research agenda for the Geoscience Group. The suggestions are listed in random sequence.**

**Point 1 (Wadden Sea Region - Holocene):** TNO Geological Survey of the Netherlands compiled – in cooperation with surveys of Germany and Denmark – a large scale map of the ‘Base and extent of the Wadden Sea sedimentary System’ in 2012. The Surveys should work out a plan for a comprehensive trilateral mapping program starting in 2018. Funded for a period of four years by the local government of Lower Saxony the project ‘WASA’ (The Wadden Sea Archive) started at the beginning of May 2016. The subject here is the reconstruction of dynamic states of palaeolandscapes in the Wadden Sea region (northern Germany) as a basis for predictive modelling of human settlement pattern and its possible impact since the last LGM. One major topic of this transdisciplinary project is high-resolution (decimeter-scale) subbottom profiling, vibrocoring, core-dating etc. which will be worked out in the back barrier tidal flats and in front of the East Frisian Islands down to 15 m water-depth. This topic is also part of the upcoming proposal for the new MARUM excellence initiative (decided in 2019 latest). It seems obvious that these activities could form a kind of pioneer program and inspiration for a combined trilateral research scheme on this topic formulated by the three Geological Surveys.

**Point 2 (‘Trilateral’ Data bases):** TNO Geological Survey of the Netherlands operates two geoscience databases: [www.dinoloket.nl](http://www.dinoloket.nl) (Geo-data and information of the Netherlands subsurface) and [www.nlog.nl](http://www.nlog.nl) (geo-data and information related to exploration and production of oil, gas, geothermal energy in the Netherlands). These databases are linked with [www.waddenmonitor.org](http://www.waddenmonitor.org)

(Advisor Wadden monitor and Wadden data), which is also the portal to data and information on ecology, climate and water, and social and spatial economics of the Dutch Wadden Region. 'Pangaea' is a scientific relevant database for German research projects funded by the DFG (German Research Foundation) and the BMBF (Ministry for Education and Science). Located at the AWI (Alfred Wegener Institute) this unit keeps alive on the basis of self-applied projects and funding coming mainly from DFG-projects. In the funding of FONA (BMBF) 'Manida' (Marine Network for Integrated Data Access) as a new initiative by the Helmholtz Society should be established as a data portal for German Marine research under the guidance of MARUM. To integrate marine data from German authorities (harbor, water pathways, BSH, BAW etc.), 'MDI-DE' (Marine Daten-Infrastructure Deutschland) was build up on the base of 'NOKIS' which is more a meta-data base (see <https://www.mdi-de.org>). The Geozentrum Hannover (German Geological Survey (BGR)) in cooperation with the LBEG (Landesamt für Bergbau [Mining], Energie und Geologie) provides on NIBIS web services and maps of geological relevance. In addition, the data portal of the BMBF-funded 'GPDN' (Geopotential der Nordsee, see <http://www.gpdn.de/gpdn/wilma.aspx>) contents geological data of the German North Sea territory. All these activities and supplements from the Danish Wadden Sea should form the basis for an easy accessible Wadden Sea geodatabase maintained by a group of scientists from all three national geological surveys and coastal authorities.

**Point 3 ('Trilateral' Digital Terrain Models):** The digital terrain model of the Netherlands is available on [www.ahn.nl](http://www.ahn.nl), which comprises the Actual Altitudes of the Netherlands. Specifically on the Wadden Sea Region there are huge amounts of open survey data over a long period of time; these are collected since many decades by e.g. oil companies operating in the Wadden Region. Digital terrain model of the coastal section of Germany is available on the NIBIS-Webserver (see: <http://nibis.lbeg.de>) which will be updated and completed by regular LIDAR-surveys in the next few years. In the Danish Wadden Sea a topographic survey of the Wadden Sea is available from 1960<sup>s</sup> and 2000<sup>s</sup>. Based on the fact, that the Wadden Sea represents a highly dynamic landscape, and that the still improving LIDAR-technique makes it possible and relatively cheap to establish a survey of at least the intertidal part, such a survey should be carried out for the whole Wadden Sea with a frequency of a few years, and made available for research and monitoring. It seems to be an obvious task for the coastal authorities in all three countries.

**Point 4 (Mud in the Wadden Sea System):** For the Netherlands there is an action plan for understanding fine sediment dynamics: 'Clear as Mud'. During the mid 90's in the "Ökosystem-Forschung Niedersächsisches Wattenmeer (ÖsF) and at the DFG-funded research group "Bio-Geochemie des Watts" located at the ICBM (University of Oldenburg) mud deposits have been investigated in order to their spatial distribution, grain size composition and transport carrier of organic load. An intensive German-Dutch cooperation surfaced in the project "Future Ems" founded by both countries. In Denmark individual research projects have concentrated on establishing net sediment budgets for individual tidal areas and on evaluating the survival of salt marsh areas based on different sea level rise scenarios. Still under discussion are the suspended transport and the models to explain the circulation of fine material between the Wadden Sea and the open North Sea as well as inside the Wadden Sea as such. As this topic is vital not just from a basic research point of view but also for e.g. understanding pathways of pollution and for a comprehensive maintaining of navigation channels and harbors, research topics related to this theme should be given priority in the research agendas of all three countries.

**Point 5 (Evolution & Morphodynamics/sediment balance Wadden Sea System):** There are research activities and research ideas on these topics in all three countries. The 'WASA'-project, the

reorganization of the NLWKN (Niedersächsischer Landesbetrieb für Wasserwirtschaft, Küsten und Naturschutz) and the LLUR (Landesamt für Landwirtschaft, Umwelt und ländliche Räume) in Schleswig Holstein are focusing on time series base data. These ones are also part of the risk analyses of the CSPL (Trilateral Working Group on Coastal Protection and Sea Level Rise). Based on the contribution of 'WIMO' these parameters will find more consideration in the future monitoring programs (BLANO workgroups). Of special interest here, is the faith of ebb-tidal deltas in relation to sea-level rise as well as dredging of navigation channels through them. Ebb tidal deltas often play a vital role in protecting adjacent barrier islands from wave erosion. It is therefore obvious that this theme should be giving priority in the research agendas of all three countries.

#### **Point 6 (Wadden Sea Region Subsurface – pre-Holocene):**

In the Netherlands and Northern Germany the most extensive geoscience monitoring and geoscience research programs are linked to exploration and production of natural resources (sand for coastal supply, groundwater for drinking water and agriculture, gas for energy, salt for industry). The vast majority of these activities are located in the Coastal Region of the Wadden Sea and not in the Wadden Sea Proper. The human-induced ground surface movements in these areas is superimposed on natural uplift and subsidence related to processes on larger time and spatial scales in the deeper subsurface, such as natural compaction and glacio isostatic adjustments since the last LGM. The models for this still need to be further developed and supported by field data from the subsurface (boreholes and seismic data) as well as from surface measurements (now available from precise GPS-measurements). The combined effect of these adjustments together with the expected near future sea level rise most likely will influence the groundwater flow in the Wadden Sea Region.

#### **Main questions relevant for policy**

A vital question relevant for policy is related to the procedures used by authorities in the three countries when research vessels for scientific purposes need to cross country borders. A recent example, relevant to be mentioned here, is the research taken place in and in the vicinity of the tidal inlet between Sylt and Rømø (Lister Tief/Dyb). A vital part of this research is conducted by the Alfred Wegner Institute in List, and they need to fill out an endless number of forms to the Danish authorities each time a cruise has to cross the border, as well as they need have to have a Danish citizen is onboard. This of course is an intolerable obstacle for research which for obvious reasons frequently needs to cross the border in order to pursue coherent results in the inlet area. It is strongly suggested that all three countries formulate a smooth procedure, so cross-border research can be carried out without obstacles like these, which seems to belong to another period of time in the history of Europe.

#### **Suggestions for transdisciplinary themes**

The combined effect of natural and anthropogenic surface movements together with the expected near future sea level rise most likely will influence the groundwater flow in the Wadden Sea region and forms an obvious transdisciplinary theme directly related to the theme *Climate & Water*.

In the Netherlands (e.g. the Coastal Morphodynamics Group of Utrecht University) geoscientists are involved in climate-related projects on the Wadden Sea Islands. Examples are ongoing research projects on restoration of washover zones on the islands. In context with 'WASA' the former research idea related to salt water intrusion to the German coast as relict of a former planed SFB-draft 'Beaches' will now get funded by Lower Saxony. Together with the above stated Point 5, all these research themes seem relevant also to the theme *Climate & Water*.

On behalf of the Geosciences-group consisting of: Hessel Speelman, Alexander Bartholomä and Jesper Bartholdy,

A handwritten signature in blue ink, appearing to read 'Jesper Bartholdy', with a large, sweeping underline that loops back under the first part of the name.

Jesper Bartholdy  
Chairman