

## Resistivity anomalies in tunnel valleys of the North Sea

A. Lohrberg<sup>1</sup>, A. Micallef<sup>2</sup>, N. Moosdorf<sup>3</sup> and S. Krastel<sup>1</sup>

<sup>1</sup>Kiel University, Germany, arne.lohrberg@ifg.uni-kiel.de

<sup>2</sup>Monterey Bay Aquarium Research Institute, amicallef@mbari.org

<sup>3</sup>Leibniz Centre for Tropical Marine Research, nils.moosdorf@leibniz-zmt.de

---

### SUMMARY

The role of large subsurface landforms produced during glaciations of the Pleistocene is still poorly understood with respect to groundwater flow. In particular, so-called tunnel valleys formed beneath ice sheets acted as drainage systems of glacial meltwater. Their dimensions (up to 5 km width, 400 m depth, 100s of km length) reflect the massive amount of meltwater that flushed the subsurface beneath ice sheets and incised into the subsurface. Due to their mechanism of formation, the fill of buried tunnel valleys often consists of highly permeable sands and gravels in their lower part and fine-grained deposits at their top.

To understand the potential of tunnel valleys as potential preferential flow pathways of offshore freshened groundwater (OFG) in the southeastern North Sea, we sailed 320 km of time-domain marine controlled-source electromagnetic on 10 profiles using the surface-towed SWAN system on R/V ALKOR to answer the following questions: (1) Does the distribution of electrical resistivities indicate the presence of freshened groundwater in the subsurface of the North Sea? and (2) Can we delineate different resistivity distributions inside tunnel valleys? Here we show the first inversions of the TD-CSEM data with minimal constraints. The CSEM data show good correlation with the structures prevalent in the 2D seismic reflection data, where the deeper Paleogene and Neogene sediments with low electrical resistivities have been updomed into a large anticline due to salt tectonics in the area. Shallower Pleistocene sediments, and the tunnel valleys in particular, are regions of high electrical resistivities. However, the contrast is low for such tunnel valleys, that have incised into low electrical resistivity Neogene sediments, likely representing brines.

**Keywords:** Tunnel valleys, North Sea, offshore freshened groundwater, time-domain CSEM

---