Geophysical Research Abstracts
Vol. 16, EGU2014-12929, 2014
EGU General Assembly 2014

Automated derivation of bedform orientations and bedload transport patterns on an intertidal flat from a detailed DEM generated from high-resolution airborne LiDAR

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An airborne high-resolution Light Detection And Ranging (LiDAR) survey was carried out in a 10 km x 10 km section of the natural tidal inlet system Knudedyb in the Danish Wadden Sea in autumn 2011. The survey was completed during low water where large intertidal flat areas were exposed. A detailed digital elevation model (DEM) of the intertidal flats was derived from the LiDAR data.
Automated identification of bedform lee sides and their orientation on the basis of the DEM using a combination of standard GIS tools was carried out, and the spatial distribution of bedform orientations and net sand transport directions was determined.
The analysis revealed a large elongated bedform field with complex bedform morphologies and drainage channel networks indicating distinct sand transport pathways oblique to the main tidal transport pathways. A conceptual model for the development of the bedforms and channels, comprising hypotheses of the hydrodynamic forcing of the different sand transport pathways was suggested by Ernstsen et al. (2013).
We validate the sand transport paths derived from the automated DEM analysis with a grain-size trend analysis (GSTA) based on computed grain-size statistics of the intertidal surface material from high-resolution sediment images.

Acknowledgements
This work is funded by the Danish Council for Independent Research | Natural Sciences (Steno Grant 10-081102).

References
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