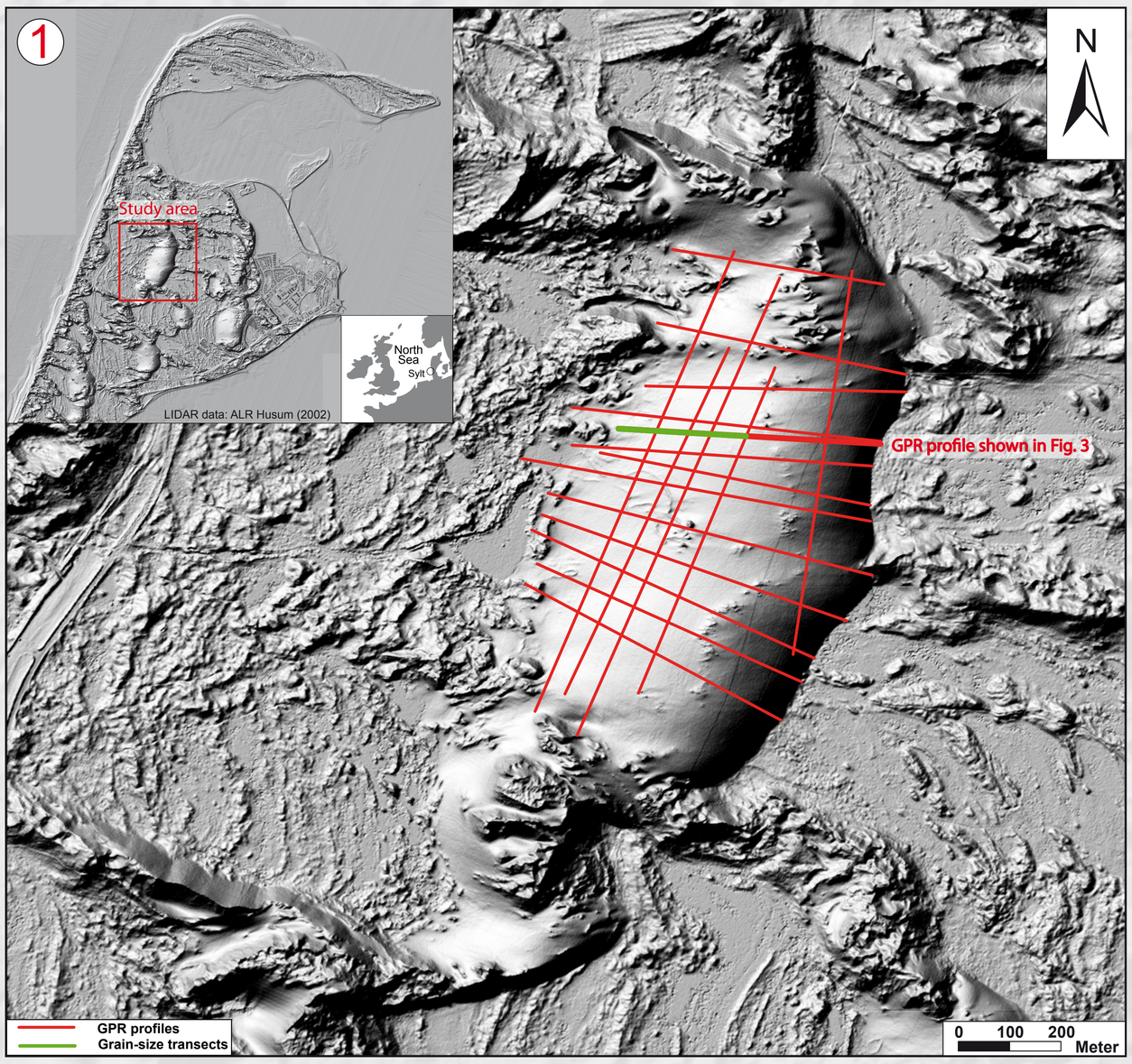
Sedimentgeologie und Beckenanalyse Hamburg

Climate Archive Dune (ClimAD)

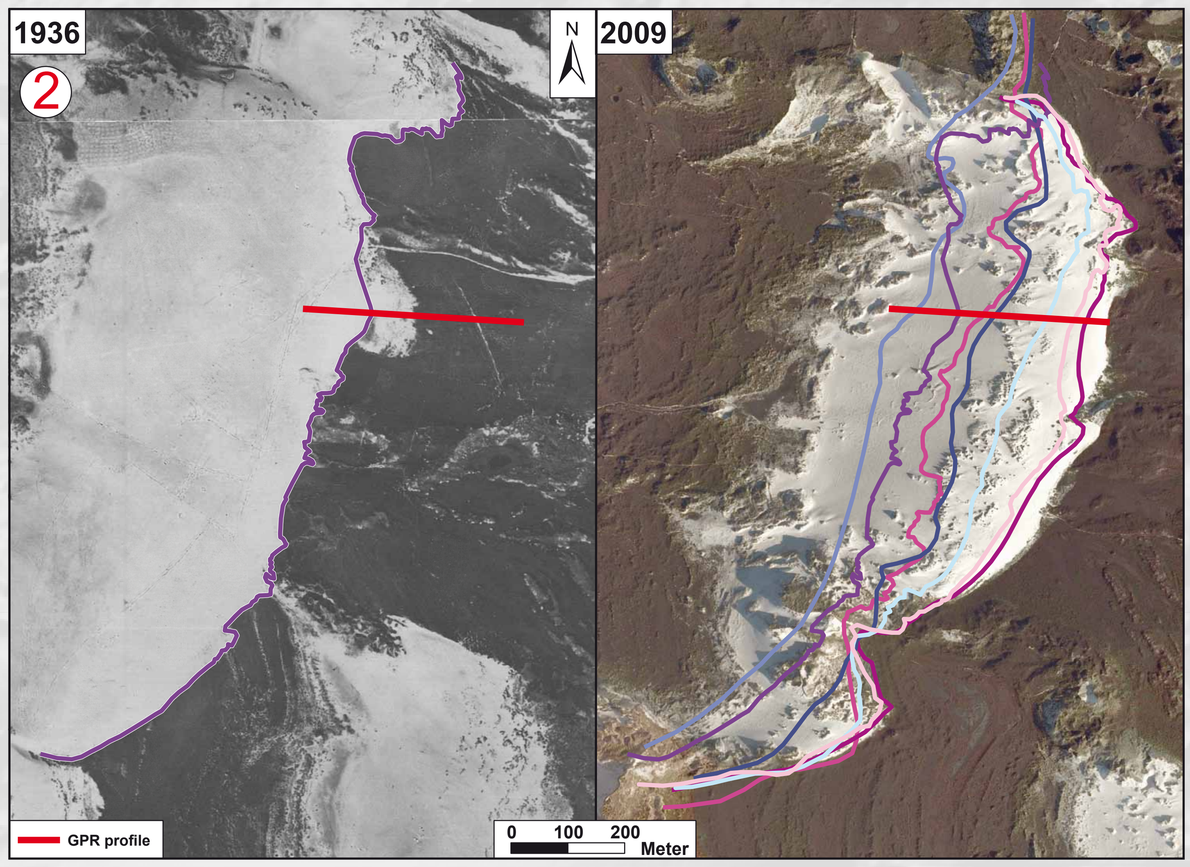
KlimaCampus

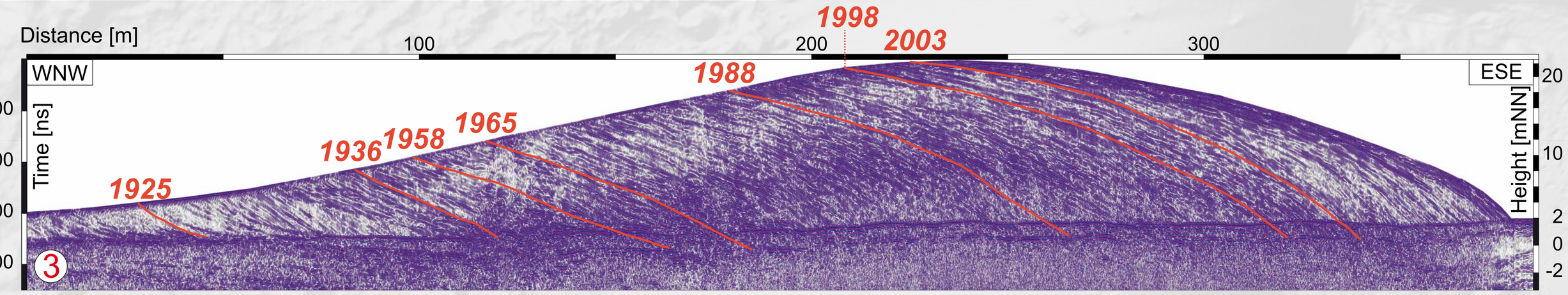
Costas, I.[1], Ludwig, J.[1], Lindhorst, S.[1], Betzler, C.[1], Hass, C.H.[2], von Storch, H.[3], Reimann, T.[4] & Frechen, M.[4]

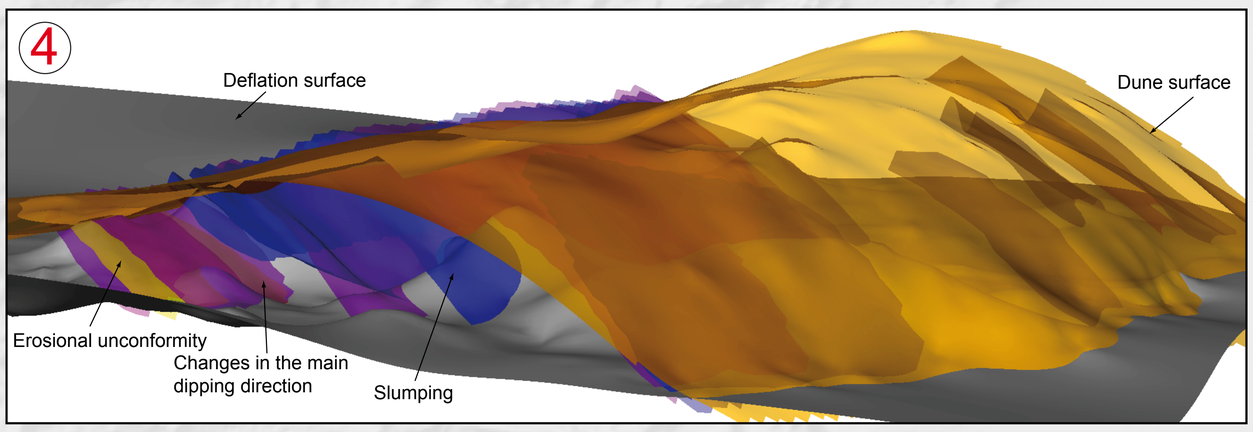


Introduction

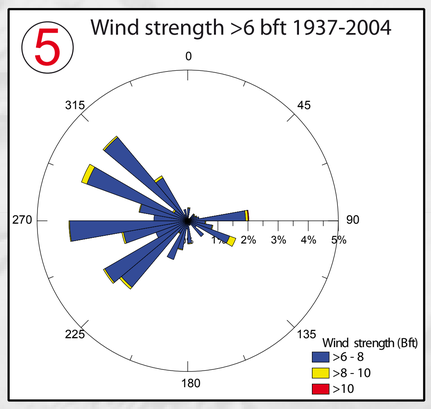
The aim of this project is to access a new archive of temporal wind-field variations recorded in the sedimentary succession of actively migrating dunes. The study area is situated in the northern part of Sylt Island (southern North Sea), and is focussed on a migrating dune of approximately 800 m length and 30 m height (**Fig. 1**). An integrated approach, combining geophysical, sedimentological, and statistical methods is applied.







First Results

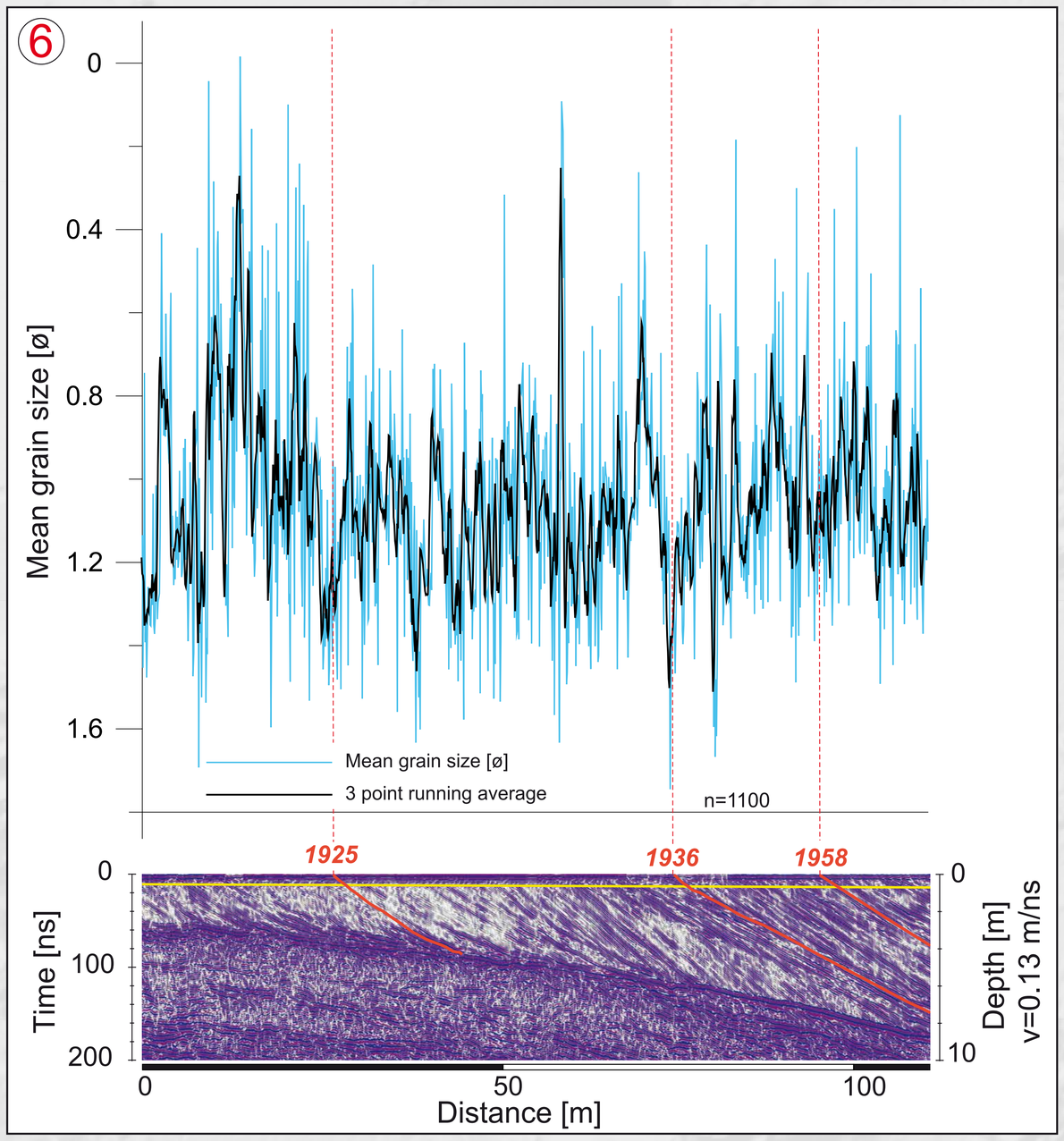


To have a better time control of the migration of the dune, we are developing an age model based on aerial images available since 1925 (**Fig. 2**). This age model will be improved by independent dating methods using optically-stimulated luminescence (OSL) and radiocarbon (14C).

To determine the internal architectural elements of the dune, ground-penetrating radar (GPR) with a 200 MHz antenna was performed (**Fig. 3**). The data reveal sedimentary bedding, erosional unconformities as well as direction of dune movement in the past. A 3D-subsurface model was developed using the software package Petrel. Based on the GPR interpretation we can observe different main surfaces including erosional unconformities and slumping surfaces (**Fig. 4**). The model indicates that large scale erosional unconformities appear only in the older part of the dune, up to the 1940s. This could indicate that frequency and/or intensity of easterly storms in the working area decreased during the last decades.

A meteorological station situated nearby the study area enable us to directly compare meteorological and sedimentary data (**Fig. 5**). Instrumental data are available since 1937 and show that westerly winds prevail. The data, however, also show some single events of extremely strong storms blowing from the East. We expect that these events are reflected in the sedimentary record of the dune as layers with coarser sediments and/or as erosional surfaces.

For a sedimentological analysis a 245 m long trench orientated perpendicular to the dune crest was sampled every 5 cm. In order to have a first overview of the grain-size variations along this transect, we are currently analyzing samples at a 10 cm spacing. These preliminary data show cyclic variations of the mean grain size (**Fig. 6**). A larger-scale cyclical variation has a wavelength of approximately 5 m, and a shorter one has a wavelength of around 2 m. As the mean grain size of dune sediments depends directly on the wind strength, these data will be used as a proxy for wind-speed changes.



Conclusions

First results indicate that variations on the grain size show two kinds of cyclicity. These variations probably reflect changes on the wind speed. The higher order cyclicity could be related to seasonal variations, whereas the lower order cyclicity could be related to decadal variations.

This study is funded by the CliSAP (Flexpool project 08/2-004)

Contact
1 Geologisch-Paläontologisches Institut, Universität Hamburg, Bundesstr. 55, 20146 Hamburg, iria.costas@uni-hamburg.de
2 AWI Wattenmeerstation, Hafenstr. 43, 25992 List/Sylt
3 Institute of Coastal Research, GKSS Research Centre, Max-Plank-Str. 1, 21502 Geestacht
4 Leibniz Institute for Applied Geophysics, Stilleweg 2, 30655 Hannover

UHH AWI GKSS FORSCHUNGSZENTRUM in der HELMHOLTZ-GEMEINSCHAFT IfAG