Climate Archive Dune (ClimAD)

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Aeolian dunes can be an important archive of wind-field variations. The aim of this ongoing project is to access a new archive of temporal wind-field variations recorded in the sedimentary succesion of active migrating dunes. The study area is situated in the northern part of Sylt (southern North Sea). This study focusses on a migrating dune which is approximately 800 m long and 30 m high. The annual rate of dune movement is around 5 m per year.

To reach the aim of this study, an integrated approach combining geophysical, sedimentological and statistical methods is applied. Ground-penetrating radar (GPR) is used to reveal the sedimentary architecture of the dune. This will provide information about direction of dune movement in the past. The GPR is a noninvasive method that can detect sedimentary structures in the subsurface in a centimeter to decimeter scale. For sedimentological analyses a 245 m long trench orientated in the direction of the dune movement (E-W) was sampled every 5 cm at a mean depth of approximately 40 cm. Grain-size information are retrieved using a laser-diffraction particle-size analyzer. For obtaining absolute sediment ages, 24 samples were collected for dating using optically stimulated luminescence (OSL). OSL is an effective method for dating young sediments with an expected resolution of years to decades. Once a time series based on sedimentological data is obtained, it will be compared with a time series based on meteorological data, which are available since 1937. A successful relationship between the two approaches will provide a tool for reconstructing wind-field variations for time periods or regions where no meteorological data are available.

First results, obtained from the analysis of a 30 m long transect, show cyclical variations of the mean grain size. A larger-scale cyclical variation with a wavelength of approximately 5 m, and a shorter one with a wavelength of around 2 m occur. Based on the annual rate of dune movement, the working hypothesis is that the larger cyclicity corresponds to annual variations, whereas the shorter wavelength results from single events, like for example storms.