Geophysical Research Abstracts
Vol. 20, EGU2018-2088, 2018
EGU General Assembly 2018

Long-term observations of airflow patterns in a man-made coastal trough blowout

Gerben Ruessink (1), Christian Schwarz (1), Bas Arens (2), Marieke Kuipers (3), and Jasper Donker (1)

(1) Utrecht University, Faculty of Geosciences, Department of Physical Geography, Utrecht, Netherlands (b.g.ruessink@uu.nl), (2) Bureau for Beach and Dune Research, Soest, Netherlands, (3) PWN Drinking Water Company, Velserbroek, Netherlands

Blowouts are characteristic features of many natural coastal foredunes. These dynamic bowl- or trough-shaped depressions act as conduits for aeolian transport of beach sand into the more landward dunes. Along many inhabited coasts, foredunes and their blowouts have been planted with vegetation to retain the sand in the foredune, facilitate blowout closure and hence function as sea defense. The resulting vegetated and uniform foredune has, subsequently, contributed to a widespread reduction in the biodiversity of the backdunes. Present-day dune management therefore increasingly involves artificially creating blowouts to maintain and improve backdune biodiversity. The design criteria are high, aiming to postpone or prevent blowout closure as long as possible. Such dune restoration projects often follow a learning-by-doing approach, as information on the underlying aeolian processes, including airflow patterns that steer blowout development, is scarce. Improved knowledge on these processes may help to improve future designs of dune restoration measures, to optimize aeolian throughput into the backdunes, and to better understand the functioning of natural blowouts.

Here, we focus on airflow patterns measured in a man-made trough blowout in Dutch National Park Zuid-Kennemerland excavated in winter 2012. The blowout is approximately 100 m long and up to 11 m deep, and has a trapezoidal plan view that narrows from 100 to 20 m in the landward direction. It is approximately aligned with the dominant southwesterly wind direction and hence obliquely with the roughly N-S coastline. Four ultrasonic 3D anemometers, sampling at 10 Hz, were installed in winter/spring 2017 from the mouth of the blowout, across its basin, on to the depositional lobe and have been operational since. The wind recordings at a nearby weather station operated by the Royal Netherlands Meteorological Institute serve as the offshore reference. Wind speed-up through the blowout varied with offshore wind approach angle, and was generally strongest (140%) when the wind was aligned with the blowout axis up to approximately 30° to the south of this axis. Intriguingly, winds approaching with the same angle from the north did not accelerate. We suspect that this asymmetry in speed-up is invoked by the asymmetric blowout shape, with a substantially steeper northern than southern sidewall. Wind deceleration on the lobe was also a function of offshore wind approach angle, with the largest deceleration (40%) for winds approaching from the north of the blowout axis. Winds with approach angles up to 70° were all steered into the blowout, to become approximately aligned with the blowout axis at the landward blowout end. On the lobe, however, the wind closely followed the offshore wind direction. Future work will focus on modelling air flow patterns with computational fluid dynamics, and exploring the relationship between the airflow patterns, blowout morphology and sand transport pathways using additional field observations.