



Coastal sand nourishments under super accelerated sea level rise

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Sand dunes, formed by natural aeolian processes, are the primary sea defence for a large part of the low-lying Dutch coast. Currently, the safety of the Dutch sandy coast is maintained with shoreface, beach and mega sand nourishments. Subsequently, natural wind and wave processes transport the nourished sand from the fore-shore to the dunes. The natural wind-driven build up processes of the dunes are, however, expected to have limited capacity.

Recent studies showed that global warming induced sea level rise could be up to 60 mm/yr under the rcp8.5 scenario at the end of this century (Le Bars et al. 2017, Haasnoot et al., 2018). Those high sea level rise rates correspond with an increase of approximately 1.5 m in sea level compared to present-day level and therefore call for a reliable and effective coastal maintenance strategy. Here we analyse up to which rate of sea level, natural processes keep pace in redistributing the sand (cross-shore and alongshore) in order to maintain coastal safety. To this end we combine measurements along the Dutch coast with a model (Stronkhorst et al., 2018) that can redistribute nourished sediments in cross-shore and alongshore direction.

Based on this analysis we conclude that at places with extensive nourishments approximately 12 m³/m/yr can be transported to the dunes. Along the Dutch coast, nourishment volumes are related to the rate of sea level rise. Under a sea level rise of 4 mm/yr, the volume of the dunes as a whole will keep pace with sea level rise, although the distribution of sand to the back dunes (which can be 4 km wide) depends on the local dune morphology and subsequent aeolian transport potential. However, at 8 mm/yr only the most seaward section of beach and dunes (about 400 m in the cross-shore) will be able to increase its volume and compensate for sea level rise. While the aeolian supply will be insufficient to let the dunes keep pace with a sea level rise of 20 mm/yr. A different coastal adaptation strategy than conducted so far might therefore be needed in between sea level rise rates of 8 mm/yr and 20 mm/ yr.

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