CHARACTERISTICS OF SAW-TOOTH BARS ON THE EBB-TIDAL DELTAS OF THE WADDEN SEA

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Introduction

In the southwestern part of the Wadden Sea, shore-oblique sand bars known as saw-tooth bars are found on most ebb-tidal deltas and along the shores of the barrier islands (Figure 1). Previous studies have been focusing on single occurrences of these bars, so their general characteristics are not well known. Previously, they were interpreted as transverse bars (Antia 1994), but their spatial scale seems to be much larger. Also, large-scale bedforms like saw-tooth bars are important in sediment transport, both directly by migration (Aberle *et al.* 2012) and indirectly by altering the flow structure (Kwoll *et al.* 2014). It is essential to know the characteristics and behaviour of the saw-tooth bars in order to improve our understanding of the associated sediment transport pathways. The main aim of this study is to describe their wave and crest length, orientation, migration rate and depth of occurrence.

Methods

Bathymetries from the West and East Frisian Wadden Islands (the Netherlands and Germany) were analysed for the period between 1970 and 2015. The shore-normal crest length and bar height were determined from the variance around the mean depth (Figure 1). A Fast Fourier transform of the bar area gives wave length and bar orientation. Migration speed was calculated using spatial correlation.

Results

Bar heights were found to range between 0.5 and 2m, wave lengths are approximately 700m and the angle between the bar crests and the shoreline is about 50°. The crests are between 800 and 2200m long. Saw-tooth bars occur in water depths from 3 to 12m, depending on the slope of the area. Migration speeds of 100-200m/y were found for Ameland Inlet. At Ameland Inlet the peaks in bar height and migration speed occur simultaneously. With these derived characteristics, saw-tooth bars can be defined as a new member of the nearshore-bar family.

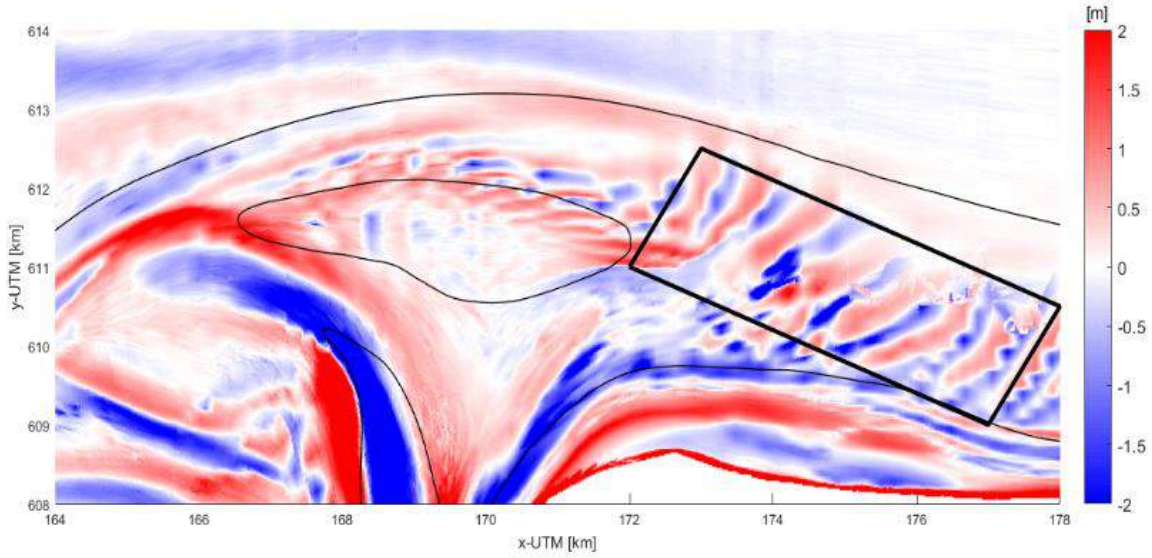

Figure 1. Variance around the mean depth of the ebb-tidal delta of the Ameland Inlet, 2005. The thin black lines indicate the 4 and 10-m depth contours, the black rectangle delineates the saw-tooth bars.

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Kwoll, E., Becker, M., and Winter, C. (2014). With or against the tide: The influence of bed form asymmetry on the formation of macroturbulence and suspended sediment patterns. *Water Resources Research*, 50, 7800–7815.