How storms can save our Wadden Islands – PhD project

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Research aim

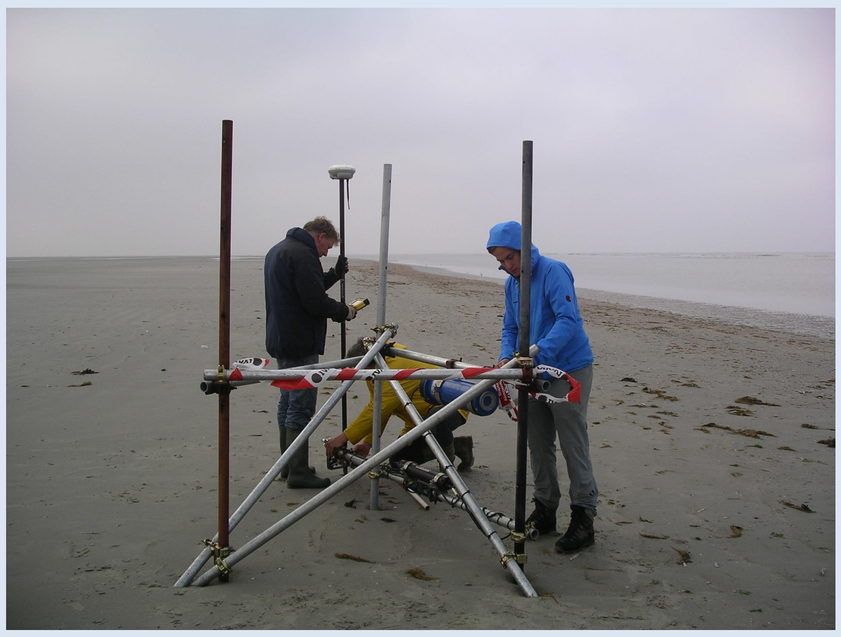
- The Wadden Islands are slowly drowning because of sea level rise…
- Therefore, it is considered to go back to more natural islands: create openings in the dunes (Figure 1).
- Elevated water levels during storms will then inundate the Wadden Islands (Figure 2) and deposit sand behind the dunes: In this way, the islands can grow in height and counteract sea level rise on the long term.
- We try to figure out whether this will actually work or not!

Figure 1: Spiekeroog (left) and Wangeroog, two Wadden Islands in Germany that look differently.

Figure 2: Storm event at Schiermonnikoog results in a flooded beach and washover

What for work is included in my PhD project…

Fieldwork,

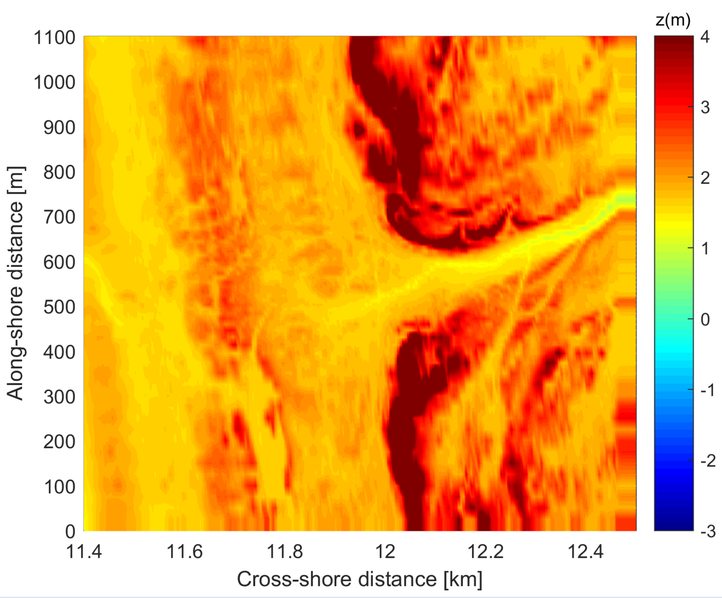


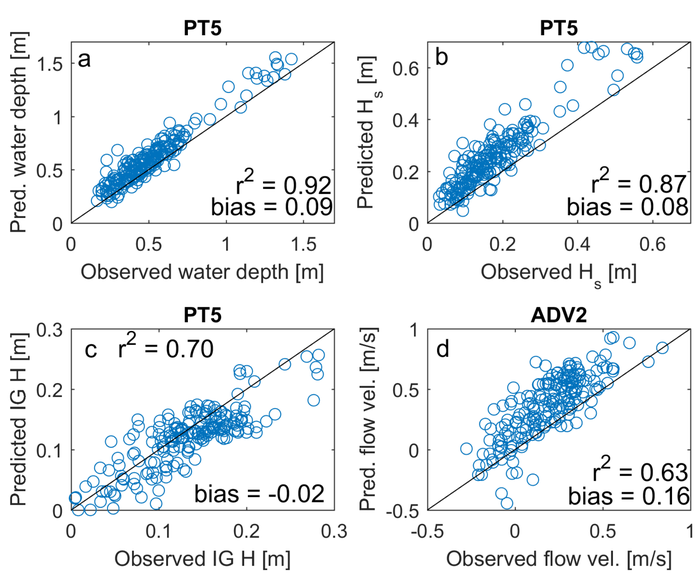
Schiermonnikoog

Rottumeroog

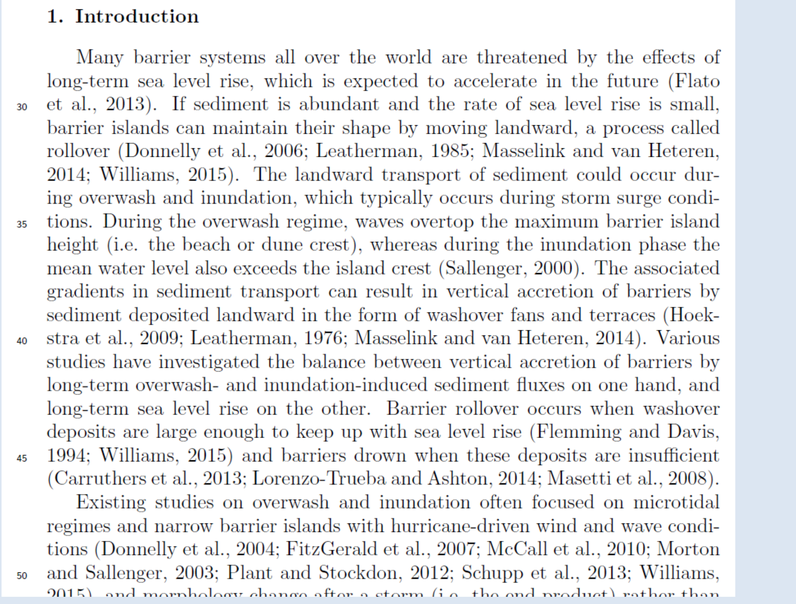
The Slufter, Texel

Modelling





and a lot of writing!!



1. Introduction

Many barrier systems all over the world are threatened by the effects of long-term sea level rise, which is expected to accelerate in the future (Flato et al., 2013). If sediment is abundant and the rate of sea level rise is small, barrier islands can maintain their shape by moving landward, a process called rollover (Donnelly et al., 2006; Leatherman, 1985; Masselink and van Heteren, 2014; Williams, 2015). The landward transport of sediment could occur during overwash and inundation, which typically occurs during storm surge conditions. During the overwash regime, waves overtop the maximum barrier island height (i.e. the beach or dune crest), whereas during the inundation phase the mean water level also exceeds the island crest (Sallenger, 2000). The associated gradients in sediment transport can result in vertical accretion of barriers by sediment deposited landward in the form of washover fans and terraces (Hoekstra et al., 2009; Leatherman, 1976; Masselink and van Heteren, 2014). Various studies have investigated the balance between vertical accretion of barriers by long-term overwash- and inundation-induced sediment fluxes on one hand, and long-term sea level rise on the other. Barrier rollover occurs when washover deposits are large enough to keep up with sea level rise (Flemming and Davis, 1994; Williams, 2015) and barriers drown when these deposits are insufficient (Carruthers et al., 2013; Lorenzo-Trueba and Ashton, 2014; Masetti et al., 2008).

Existing studies on overwash and inundation often focused on microtidal regimes and narrow barrier islands with hurricane-driven wind and wave conditions (Donnelly et al., 2004; FitzGerald et al., 2007; McCall et al., 2010; Morton and Sallenger, 2003; Plant and Stockdon, 2012; Schupp et al., 2013; Williams, 2015), and morphology change after a storm (i.e. the end product) rather than