# SHOREWARD PROPAGATING ACCRETIONARY WAVES (SPAWS): OBSERVATIONS FROM A MULTIPLE SANDBAR SYSTEM (EGMOND AAN ZEE)

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## Motivation

At straight sandy coasts, wave- and wind-induced processes often lead to intriguing, yet unexplained alongshore-variable morphology on spatial scales from tens of meters to a few kilometers. Recent observations have shown that the shallow parts of subtidal crescentic sandbars may separate from the bar and migrate onshore as spatially coherent features, termed Shoreward Propagating Accretionary Waves (SPAWs). It is thought that the onshore migration of these SPAWs plays a role in the sand exchange within the bar-beach-dune system, by merging with the intertidal beach and resulting in alongshore variations in sand supply for wind-induced transport towards the dunes. With only a handful of observations, however, it remains unclear how much sand is typically brought onshore as SPAWs weld to the shoreline over multiple years. Using a 15-year data set of daily video images from the multiple-barred beach of Egmond aan Zee, the Netherlands, we aim to 1) objectively quantify SPAW occurrence (i.e. frequency, duration, migration rate, size) and 2) characterize the wave conditions and bar morphologies associated with SPAW emergence and onshore migration.

## Observations

We observed 93 SPAWs (on average 6.6 per year), with average lifetimes of approximately 40 days, average lengths and widths of 200 m and 30 m, respectively, migrating onshore at an average rate of ~1.3 m/day. Bar patterns were found to determine the alongshore locations of SPAW emergence, emerging either from crescentic bars or from bar splitting, both during more energetic conditions with obliquely incident waves. The interannual net offshore migration of sandbars, in turn, determined from which bar (i.e. the inner or the middle bar) SPAWs emerged. SPAWs typically migrated onshore under moderately energetic conditions (Figure 1), but were found to disappear under more energetic, obliquely incident waves. Using model-data assimilation we estimated the amount of sand within a SPAW to be 15,000 $m^3$. With 6.6 SPAWs annually this sums up to 100,000 $m^3$ of sand and, within the 4 km alongshore extent of the field site, an average annual onshore sand transport of 25 $m^3$/m/year related to SPAWs. This amount is slightly larger than the observed annual aeolian sand transport of 10-15 $m^3$/m/year from the intertidal beach to the foredune at this site, suggesting that SPAWs play a significant role in the onshore movement of sand within the bar-beach-dune system.

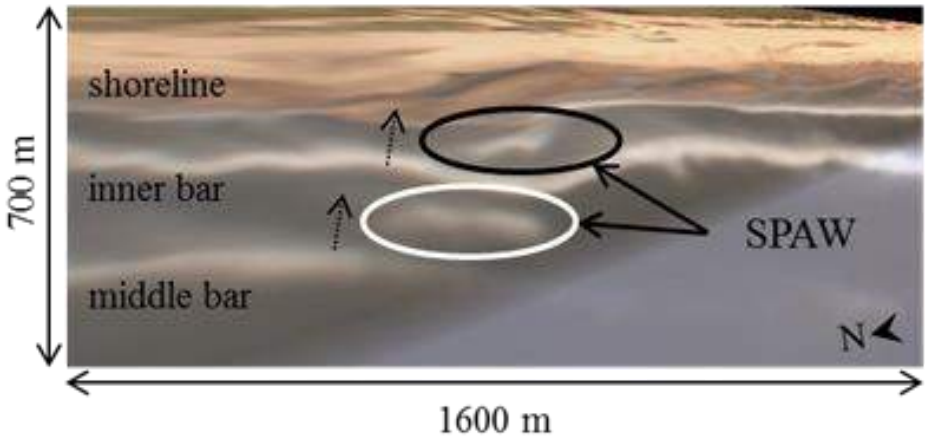


*Figure 1. Plan-view time-exposure image, taken on 30 August 2012, showing SPAWs migrating (arrows with dotted lines) from the middle bar to the inner bar (white oval) and from the inner bar to the shoreline (black oval).*

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