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Video monitoring of meso-scale aeolian activity on a narrow beach

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The morphologic evolution of coastal dunes is inextricably linked to the neighbouring beach through the incessant exchange of sand. Intense storm-wave processes erode the foredune within a few hours and transport its sand sand seaward, while aeolian processes return the eroded sand from the beach into the dune system, although at a much lower pace (months to years, or meso scale). Here we use an 8-year long data set of half-hourly snapshot video images, collected from an $\approx$ 50 m high tower on Egmond Beach (The Netherlands), and a concurrent meteorological and water level data set, to examine which factors affect aeolian sand delivery into the dunes. Egmond is a north-south oriented, micro- to meso-tidal, wave-dominated site that faces the North Sea. Its beach is relatively narrow ($\sim$ 100 m at spring low tide) and mildly sloping ($\sim$ 1 : 30), and consists of quartz sand with a median diameter of about 300 μm. Aeolian activity is clearly visible on the images as sand streamers and, in particular, sand strips, defined as low-amplitude, large-wavelength and slipfaceless deposits that migrate slowly in the wind direction and, depending on wind direction, can have orientations from almost shore-parallel to shore-normal. Beach width in combination with wind direction appeared to be the dominant factors in controlling aeolian activity. Many high wind ($>\approx$ 13 m/s) events, especially from the west and northwest, were associated with a storm surge that inundated almost the entire beach with, accordingly, no possibility for aeolian transport. In contrast, sand-strip fields covered the entire beach during medium wind ($\approx 12 - 13$ m/s) events, especially when the wind was nearly shore-parallel. Many sand-strip events were observed to be regulated by the tide. Prominent sand-strip fields on the intertidal and upper beach were largely limited to low-tide situations with a wide beach, with a rising tide obviously destroying the intertidal sand strips and sometimes also negatively affecting aeolian activity on the upper beach. Rain was seen to shut-down the aeolian system when sand strips were not well developed (low wind speeds, $\approx 8 - 12$ m/s), but not so during substantially stronger winds. Although our assessment of aeolian transport magnitude is qualitative, our work does indicate that there may be a considerable mismatch between the relative importance of potential and actual aeolian transport events on narrow beaches. Future work, in concert with continuous video monitoring, is necessary to actually quantify meso-scale aeolian sand supply.