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Evaluation of the critical shear stress for erosion by use of wind and turbidity observations in a shallow tidal area

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Intertidal areas exhibit a high biodiversity and primary productivity and play a key role in the overall bio-geomorphological evolution of lagoons and estuaries, which are currently often subjected to intense erosive processes as a result of anthropogenic and climatic changes. One of the key processes governing the dynamics of intertidal geomorphology is sediment re-suspension induced by wind-waves. Here we implement a wind-forced wave model to estimate the bottom shear stress as a function of the maximum horizontal orbital velocity on the basis of wind velocity observations. We apply the model to wind observations performed within the Venice Lagoon in the period 2004-2007 and relate the estimated bottom shear stress values to simultaneous turbidity observations performed in the vicinity of the anemometers in order to evaluate the critical shear stress for sediment re-suspension. In the case of our study sites we find a critical shear-stress for erosion between 0.4 *Pa* and 0.5 *Pa*, which is determined by the occurrence of a sudden increase in the observed turbidity. The procedure developed provides critical shear stress estimates in natural and undisturbed conditions, which account for the fundamental biostabilization effects operated by benthic microbial assemblages. The method thus appears to have distinct advantages over more traditional in situ procedures (e.g. the Sea Carousel or the Cohesive Strength Meter) because it does not interfere with the surface biofilm and provides a direct and quantitative physical estimate of the critical-shear stress.