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Aeolian vertical mass flux profiles above a dry and moist sandy beach

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The vertical distribution of aeolian mass flux was investigated in a natural beach environment. Field experiments conducted on the beach of the Łeba Barrier, southern Baltic coast, Poland, measured the sand transport rate and the vertical mass flux distribution above dry rippled sand and a moist flat sandy surface. The experiments were intended to show the changes in the vertical distribution of sand with changing wind speed. All the data represent maximum flux conditions achieved during alongshore winds. Sand transport was measured using 0.5 m-high vertically segmented sand traps, the wind speed and direction were monitored at 1 m elevation. The obtained dataset comprises 65 measurements on dry surfaces and 51 measurements on moist sandy surfaces.
The sand transport rate above the moist surface was higher than above the dry surface, but higher velocities gave smaller differences between the surfaces. The saltation layer was thicker above the moist surface than above the dry surface. All the vertical sand flux profiles are best described by exponential decay functions. Analysis of the normalised flux profiles grouped by wind velocity shows that the fitted curves are less inclined for moist surfaces than dry surfaces.The regression coefficients depict a marked trend in which the intercept decreases and the slope increases with increasing wind speed; this indicates that more sand is transported at higher elevations above the bed and less at lower elevations. The proportion of total transport seems to be independent of wind speed at elevations of approximately 35 mm and 50 mm above the dry and moist surfaces, respectively. Differences between the measured- and exponential-fit values of mass flux are particularly distinct close to the bed, where the exponential fit either over- or under-predicts the measured values. Over-predictions occur in weaker winds, whereas under-predictions become more pronounced as the wind becomes stronger and when the layer in which the under-prediction occurs thickens. The under-predictions are particularly obvious above the moist surface; it is not clear whether this phenomenon is due to technique measurement error or to another source.
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