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Sediment accumulation at Northern Germany's marsh islands - An evaluation of a natural adaptation mechanism to Holocene sea level rise

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Hooge, Langeness, Nordstrandischmoor and Süderoog are four out of ten Northern Germany's marsh islands the so called 'Halligen' that were investigated in autumn 2007. Several times in the year these islands are flooded during storm surges, mainly in the winter season. The benefit of these flooding comes from sediments that accumulate over time and increase the surface elevation of the Halligen compared to the mean high tide. Sea level changes were obviously compensated due to this process in the last centuries. In order to quantify the annual increase of the surface elevation and to compare these values with recent sea level rise two drill cores of 2m length were taken on each Hallig with percussion coring. OSL, 137 Cs and 210 Pb dating were applied in order to calculate sedimentation rates. The measured OSL ages range between 100-2490 a (Hooge), 280-990 a (Langeness), 100-360 a (Nordstrandischmoor) and 120-520 a (Süderoog). These ages correspond to mean sedimentation rates for the shortest/longest dated time period of 1.7/0.7 mm/a (Hooge), 1.4/1.6 mm/a (Langeness), 3.5/4.7 mm/a (Nordstrandischmoor) and 2.3/3.6 mm/a (Süderoog). 137 Cs dating revealed peaks from 1986 Chernobyl fallout and 1963 nuclear bomb test maximum. The according mean sedimentation rates for both time periods (1986-2007/1963-2007) were 3.0/2.6 mm/a (Hooge), 2.3/1.8 mm/a (Langeness), 3.7/3.8 mm/a (Nordstrandischmoor) and 2.9/3.2 mm/a (Süderoog). The recent sea level rise in the area based on local gauge values can be estimated between 3.5 - 5.5 mm/a. The comparison of gauge values and most recent sedimentation rates reveal a trend of decreasing surface elevation relative to mean high tide for the Halligen Hooge, Langeness, Süderoog and – at best – a steady state situation for Nordstrandischmoor.