

BEHAVIOR OF SUSPENDED SEDIMENT FLOCS IN TIDAL BASINS –
A CASE STUDY FROM THE BACKBARRIER AREA OF SPIEKEROOG ISLAND,
GERMAN NORTH SEA

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The complex wadden sea system is driven by periodical draining and flooding of large areas. This water exchange is mainly controlled by tidal currents. These currents transport, resuspend and deposit large volumes of sediment in dependence of the particle size. Embedded in a multidisciplinary research group „BioGeoChemistry of the Wadden Sea” we analyse the dynamics of suspended sediment transport in the backbarrier area of Spiekeroog Island, Lower Saxony, German North Sea Coast.

The field measurements combine acoustical and optical instrumentation. Tidal currents are surveyed over the entire water column using “Acoustic Doppler Current Profiler” (ADCP). One ADCP is in permanent operation at a measurement station. Another ADCP is used on a boat to cover complete main tidal channel transects during tidal cycles. Suspended sediment concentrations are calculated based on the ADCPs backscatter signal. Suspended sediment floc sizes are measured by a “Laser In-Situ Scattering and Transmissiometry” (LISST) System at the station successively at several water depths. Additionally floc sizes are recorded by a photogrammetric system. A pump centrifuge system is used to obtain suspended sediment samples for analysing grain size distributions and suspension concentrations.

Comparing pump samples and LISST and photogrammetric data shows that the suspended sediment is mainly transported in complex, highly changeable flocs. These consist of single grains as well as smaller flocs. Flocculation is resulting in different orders. Flocs of higher order are generally less dense and more fragile. These macroflocs are on one hand only stable around slack water but on the other hand have a large contribution to sedimentation due to their higher settling velocity. Integrating ADCP data into the analysis documents that floc sizes are mainly controlled by combination of current velocity and suspended sediment concentration. The maximum floc size is limited by current velocity and shear stress in the bottom boundary layer. A higher concentration of suspended sediment on the other hand aid faster flocculation and thus larger floc sizes.