Subaqueous light attenuation in the Dutch Wadden Sea: Developing a luminescence-based tool to reconstruct pathways of nourished sand

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The ability to trace the movement of sediment in nature is key to understanding sediment pathways and designing nourishment strategies. Luminescence, that is, the ability of sediment grains to store energy as a trapped charge and release that charge as light upon (sun)light or heat exposure, presents a novel and largely undeveloped means of sediment tracing. Within the TRAILS project we develop luminescence-based tools and Lagrangian particle tracking models to track sand of the Ameland ebb-tidal delta nourishment. A key unresolved question concerns the relationship between spatial and temporal light attenuation and varying sediment or water parameters. For coastal environments it is widely known that light attenuates with water depth, thereby depleting the short (UV) and long (nIR) wavelengths more quickly than the range between green and red visible light (~500-750 nm) (Anthony et al., 2004). Nevertheless, detailed information on how weather and metocean conditions influence spectra in dynamic coastal environments is lacking (Murray et al., 2012). In winter (February) and spring (May) 2022 we conducted two cruises where we performed in-situ optical spectroscopy at a water depth up to 16 meters, in combination with measurements of suspended sediment concentration, salinity, temperature, chlorophyll, sediment grain size and flow velocities. Our results show that depending on the tidal stage and weather conditions, 99% of light is attenuated at a depth range of ~2-7 meters. Our ultimate aim is to relate these water quality changes to the studied systems' bleaching potential and the in-situ resetting of the luminescence signal.