Apply novel optical and acoustic instruments for long-term and high-frequency morphodynamics observation on a mangrove tidal flat

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Tidal flats provide a range of valuable ecosystem services and play a critical role in nature-based coastal defense. The morphology and evolution of tidal flat are constantly influenced by hydrodynamic conditions (tides and waves), surface and sub-surface biotic contributions (i.e., mangroves, salt marshes and benthos). In addition, global climate change (sea-level rise) and human activities (terrigenous sediment supply decrease, reclamation and beach nourishment) pose new challenges regarding the equilibrium of tidal flats. Previous studies have revealed the importance of short-term bed level change on the window opportunities of salt marshes and mangroves in tidal flats. However, long-term and high-frequency field evidence is still limited for understanding the effects of bio-geomorphic processes and anthropogenic activities on tidal flat morphodynamics. In consideration of this, we employed the state-of-the art LSED-sensor (Laser-based Surface Elevation Dynamics sensor) in combination with the ASED-sensor (Acoustic Surface Elevation Dynamics sensor) to observe bed level dynamics in a mangrove tidal flat. The aims of this study are (1) to establish a novel tidal flat morphodynamics monitoring system and obtain multi-time scales (hourly, daily, seasonal and annual) hydrodynamic and morphological data, (2) to contrast the LSED-sensor with ASED-sensor according to the principles of operation, application scenarios and data precision, and (3) to reveal the effects of mangroves and beach nourishment project on sediment transport and bed level dynamics in tidal flats. We expect this work can make a progress in establishing continuous and high-frequency field observation system and deepen our knowledge about the impacts of anthropogenic disturbance and vegetation on long-term morphodynamics of tidal flats.