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### The use of small-Unmanned Aerial Systems for high resolution analysis of tidal creek evolution

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#### Abstract

Tidal creek networks play an important role in coastal wetland environments. However, little is known of the early evolution and development of tidal creek networks and there is a lack of quantitative analysis of field datasets and measurements. One environment that allows for empirical studies of creek evolution is wetland restoration schemes, such as managed realignment (MR) sites, through the transition from a non-channelled to channelled landscape. However, previous studies assessing morphological development in MR sites have relied on surveying techniques, such as LiDAR, which lacks the surveying resolution and frequency required to identify subtle (but important) changes in morphology. Small-Unmanned Aerial Systems (sUAS) are being increasingly used across a number of scientific disciplines to provide high resolution imagery which, through the low-cost photogrammetric method Structure-from-Motion (SfM), can be used for high resolution topographic reconstruction.

This study assesses the suitability of this approach for measuring creek evolution in intertidal wetlands. Three sUAS surveys were taken from a near-breach site at a large open coast MR site, the Medmerry Managed Realignment Site, UK (breached September 2013), to assess morphological evolution. Results indicate the surveyed area experienced up to 85 cm of accretion between 2016 and 2018. Stream order analysis classified the creek networks into five orders in 2016 (total: 291) and four orders in 2017 (total: 117) and 2018 (total: 112). This study provides an innovative high resolution insight into the evolution of restored intertidal wetlands, and suggests that SfM analysis of images taken using a sUAS is a useful tool in order to investigate creek morphogenesis. Findings are discussed in terms of the potential for sUAS analysis to advance the management of intertidal wetlands in order to ensure the provision of ecosystem services, and to protect against future anthropogenic activity, sea level rise and climate change.

#### Keywords

Tidal creeks, small-Unmanned Aerial Systems, Wetland Restoration, Intertidal Morphology