Application of LiDAR to the Systematic Monitoring of Creek Networks in Natural and Restored Saltmarshes

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Summary of project

Coastal habitats such as saltmarshes play a valuable role as biodiversity hotspots and natural flood defences. However they are being lost globally to urban development and rising sea levels. Current restoration projects aim to artificially recreate those habitats. They require rigorous monitoring schemes to assess their efficiency as ecosystems. LiDAR (Light Detection and Ranging) offers a unique opportunity to monitor the morphological evolution of saltmarshes over the years, both natural and artificial.

My PhD project, started in September 2014, focuses on the evolution of creek networks. Their crucial role in distributing water, sediment and plant seeds makes them good morphological markers of saltmarsh development. Using a semi-automated creek extraction algorithm, applied to consecutive LiDAR datasets, we monitor the evolution of artificial saltmarshes towards morphological equilibrium. Early results show the development of artificial creeks towards a steady state within 13 years after site opening. The evolution rates depend on design choices such as elevation within the tidal range and breach size. By validating the remote sensing data with field observation, and collaborating with ecologists to draw links between artificial channel development and improved plant diversity, we will be able to use those results to improve the design of future projects.

Value of BSG grant in the project

The £905 grant awarded to me by the British Society of Geomorphology was essential to my participation to the International LiDAR Mapping Forum ILMF in Denver, Colorado, US, from February 13th to 15th, by covering my flight and accommodation costs. The forum showcased the latest LiDAR technologies and their most cutting-edge applications for terrestrial and coastal management. Giving an oral presentation and taking part in a panel discussion at this forum gave me a unique opportunity to introduce my creek extraction algorithm to a highly specialised audience. It highlighted various potential applications of my work, for wetland monitoring, but also watershed mapping in forested areas for instance. Visiting the exhibits also gave me a better technical understanding of LiDAR data collection, its associated errors, and the evolution of the technology's reliability over the years (Fig. 1). This will increase the quality of my LiDAR data interpretation, both in my PhD thesis and in the future coastal monitoring projects I am aiming to undertake afterwards through postdoctoral positions.

Figure 1: LiDAR data collection demonstration at the exhibition hall.