

Session Unmanned Aircraft Systems for Observing and Analyzing Coastal Systems

Title: Evaluation of UAS-based monitoring of a coastal sand dune system at Jockey's Ridge State park, NC

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Jockey's Ridge State Park, located on the North Carolina Outer Banks, is the largest sand dune complex on the east coast of the U.S. Historical observations of the dunes date back to the early 1900s, and offer a unique record of dune system evolution. Lidar surveys performed over the past 20 years have successfully captured the dune system transformation from crescentic to parabolic dunes and its migration to the south. However, lidar surveys have often been motivated by storm events, and so capturing seasonal changes and dune system recovery has been limited.

Unmanned aerial systems (UAS) provide the opportunity to fill in the gaps in the lidar surveys and thus afford new insight into the drivers of the most recent, dramatic dune system transformation at Jockey's Ridge. With image data collected by UAS, centimeter scale orthomosaics and digital elevation models (DEMs) can be derived. Moreover, regular flights are inexpensive and so longitudinal surveys of the Park are readily attainable.

To test the accuracy and reliability of such UAS-based surveying of this highly dynamic coastal system with almost no distinct, stable features, we carried out several mapping campaigns at the Park in fall 2016 and spring 2017 with the DJI Phantom 4 UAS. We varied numerous parameters, including flight altitude and percentage of image overlap, to explore how image data quality and DEM accuracy was affected. We deployed 18–20 ground control points per flight to georeference acquired image data, from which DEMs were then generated with structure from motion. Our UAS-derived DEMs were then compared with lidar data, using those few stable features as tie points, to evaluate the accuracy of the UAS survey. Although we identified non-linear distortions in the data acquired by UAS, our surveys successfully captured the continuing southern migration of the dune system, as well as seasonal transport in directions not observed before.