Comparative beach surveys using an unmanned aerial system, ground-based GPS, terrestrial laser scanning, and airborne laser scanning

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AIMS OF THE RESEARCH PROJECT

• To compare accuracy of UAV-based surface modelling to terrestrial laser scanning and airborne laser scanning
• To test the potential of unmanned aerial systems for monitoring highly variable mixed sand and gravel beaches
• To evaluate the extent to which surface sediment characteristics affect measurement accuracy of TLS, ALS and UAV-based surface monitoring

DATA COLLECTION AND ANALYSIS

• UAV flying height 60 m above ground
• simultaneous measurements using UAV-based photogrammetry, RTK-GPS, quad-based TLS and ALS
• Complemented by RTK-GPS line transects
• point-cloud inter-comparison
• comparison of point-cloud performance against RTK transect data
• evaluation of differences between elevation models generated based on point clouds

RESULTS

• UAV-based point cloud had positive offsets of 9 cm (RMS 10 cm) compared to TLS
• UAV-based point cloud had positive offsets of 6 cm (RMS 8 cm) compared to ALS
• Significant performance differences between surface types, with best results for gravel and dry sand and worst for soft mud surfaces
• UAV and ALS data overall showed better agreement than UAV to TLS for nearly all surface types

CONCLUSIONS

• UAV appeared to systematically overestimate surface heights compared to laser scanning approaches but RMS is very similar
• Needs to be considered when comparing UAV data with laser-scanning-based elevations
• Overall UAV approaches show to be a robust method to detect ≥dm level elevation changes
• Promising approach to deploy UAV for surveys in high temporal resolution to monitor short-term elevation changes and to spatially resolve associated sediment fluxes
• Flight regulations and sensitivity to wind / weather conditions represent significant operational limitations