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Landscape Metrics of Coastal Dunefields from LiDAR and Hyperspectral Remote Sensing

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This paper presents an upscaling study extracting landscape metrics of coastal dunefields, calculated from local topography and vegetation-type abundance, from high-resolution LiDAR and collocated hyper-spectral remote-sensing imagery, at coastal sites in Wales, UK. The hyper-spectral data (Eagle & Hawk instruments on NERC's ARSF aircraft in 2009) are analysed in combination with spectrometer ground-truthing to determine relative within-pixel (down-scaled) abundance maps of different vegetation types, using a novel method that combines linear spectral mixture modelling with a maximum likelihood classification. The resulting landscape metrics are the same state variables that have been used for classifying simulated dunefield landscapes in the DECAL model and for tracking the evolution of the ecogeomorphology in a 3D state space. The landscape metrics of the dunefields can now be plotted in the same space on the same ordinates to establish a direct and quantitative comparison beween simulated and real-world landscapes. For the Kenfig Dunefield in Wales, LiDAR and hyperspectral analysis has also been accomplished on archived (1997) data to investigate the changes in metrics over a 12-year period.