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Detection of aeolian streamers in video images

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Introduction

The growth of dunes requires the supply of sediment from the subaerial beach by wind-driven processes. Though recent approaches in coastal management try to utilize these processes to ensure that the dunes offer the desired level of coastal protection, the controls regulating longer-term sediment supply remain poorly constrained. In part this is due to the lack of datasets which permit studies at these timescales. To this end, video images provide a useful tool. Large-scale transport events are often characterized by the presence elongate regions of intense transport which are orientated parallel to the mean wind direction and are visually identifiable in images. Studies suggest that a few large-scale transport events may be responsible for the majority of the sediment supply towards the dunes at monthly to annual timescales (Delgado-Fernandez & Davidson-Arnott, 2010). Consequently, the identification of these features, which are termed streamers, may be pertinent in the evaluation of longer-term transport rates. The identification of streamers in video images remains a largely manual task, making the development of long-term datasets a time consuming task. Thus, the aim of the current research is to develop a (semi-) automated procedure in support of the identification of streamers in video images.

Methods and Results

The current procedure considers a series of points in an image corresponding to positions on the subaerial beach, within a given radial distance from the camera. Pixels surrounding each point are extracted and spectral analysis is conducted. A preferred orientation is estimated from the resulting spectra. Fig. 1 presents the results of one such analysis. Red/green dots denote positions where the orientation of the determined features are less/greater than 10º from the 10 minute averaged wind direction. Lines passing through the respective points illustrate the orientation of the features. The technique shows promise and appears to be particularly successful in estimating streamer orientation in the regions where they are most visually distinguishable. Further work is needed both to refine the technique and evaluate its the robustness and accuracy.

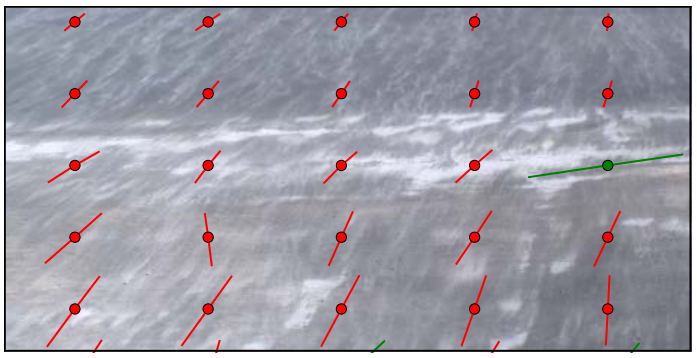

Fig. 1: An image exhibiting visible wind-driven sediment transport. Dots denote points in the image around which the orientation of features are estimated. The corresponding lines illustrate the estimated orientations. Red/green indicate orientations that are less/greater than 10º from the 10 minute averaged wind direction.

References

Delgado-Fernandez, I. and Davidson-Arnott, R. (2010). Mesoscale aeolian sediment input to coastal dunes: The nature of aeolian transport events. Geomorphology, 126(1):217-232