



Large Scale Airflow Perturbations and Resultant Dune Dynamics

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Large-scale atmospheric turbulence can have a large impact on the regional wind regime effecting dune environments. Depending on the incident angle of mesoscale airflow, local topographic steering can also alter wind conditions and subsequent aeolian dynamics. This research analyses the influence of large-scale airflow perturbations occurring at the Maspalomas dunefield located on the southern coast of Gran Canaria, Spain. These perturbations in turn significantly influence the morphometry and migration rates of barchan dunes, monitored at the study site through time. The main meteorological station on Gran Canaria records highly uni-modal NNE wind conditions; however, simultaneously measured winds are highly variable around the island, showing a high degree of steering. Large Eddy Simulations (LES) were used to identify large-scale airflow perturbations around the island of Gran Canaria during NNE, N, and NNW incident flow directions.

Results indicate that approaching surface airflow bifurcates around the island's coastline before converging at the lee coast. Winds in areas located around the islands lateral coast are controlled by these diverging flow patterns, whereas lee-side areas are influenced primarily by the islands upwind canyon topography leading to highly turbulent flow. Characteristic turbulent eddies show a complex wind environment at Maspalomas with winds diverging-converging up to 180° between the eastern and western sections of the dunefield. Multi-directional flow conditions lead to highly altered dune dynamics including the production of temporary slip faces on the stoss slopes, rapid reduction in crest height and slope length, and development of bi-crested dunes. This indicates a distinct bi-modality of airflow conditions that control the geomorphic evolution of the dunefield. Variability in wind conditions is not evident in the long-term meteorological records on the island, indicating the significance of large scale atmospheric steering on localized airflow perturbations and thus dune dynamics.