

Mulligan, K. R. 1997. Aeolian processes controlling dune morphology, Salton Sea, California. Ph.D. dissertation. Texas A&M University. College Station, Texas. 251 pp.

To better understand the nature of aeolian processes, a field study was undertaken to investigate the interaction between wind flow, sand transport, and dune morphology. The field study was designed to collect detailed measurements of wind flow over a dune and detailed measurements of the subsequent change in dune morphology. The purpose of this dissertation is to describe and analyze these field data and thereby develop a more sound basis for modeling the process-response system that controls dune morphology. The results from this research can be summarized in terms of several main conclusions. On the western shore of the Salton Sea the wind regime is controlled by a combination of superimposed local, regional, and synoptic-scale atmospheric processes. As the dune moves downwind, the dune form is very robust and the spatial pattern of erosion and deposition is strongly related to the tangent of the local slope angle. The results from this study also indicate that the wind flow pattern over the dune is strongly affected by relatively minor changes in wind direction. Moreover, the wind flow pattern changes with the strength of the prevailing wind as a result of variable surface roughness. Upwind of the dune the near-surface wind speed is controlled by back-pressure and shear velocity is unrelated to the surface roughness. The results from this study also indicate that several distinct aerodynamic processes control wind flow and sand transport over the dune. Upwind of the dune the near-surface wind speed and sand transport are controlled by an increase in static pressure. On the lower windward slope there is a complex transition. From the lower windward slope to the break in slope at the top of the upper windward slope, sand transport is controlled by the compression of streamlines and subsequent flow acceleration. Between the break in slope at the top of the windward slope and the dune crest there is a second transition. From the dune crest to the brink sand transport is controlled by the expansion of streamlines near the surface and subsequent wind deceleration.