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The influence of boundary conditions on the order of aeolian dune-field patterns

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The ordering of dune-field patterns is internally driven through dune-dune interactions. In natural dunes systems external boundary conditions, many of which arise from the antecedent conditions, always exist. These conditions may modestly to strongly alter the evolving dune-field pattern. Because of the highly dissipative nature of dune systems, only those boundary conditions of similar spatial and temporal scales to the evolving pattern impact system ordering. Some important boundary conditions include the sediment source type, the basinal configuration and the antecedent dune topography. The influence of these boundary conditions on dune-field patterns is addressed through a type of pattern analysis where the pattern parameters (crest orientation, spacing, crest length and defect density) are measured in series in the dune migration direction and plotted against distance and each other. Where a point or line source of sand is upwind of the dune field there is a trend of increasing spacing and crest length, and decreasing defect density in the migration direction. In contrast, where there is an in situ sediment source or plane source, no trend is observed. Where evolving dune patterns are not yet spatially restricted, cross-plots indicate that the pattern parameters vary interdependently. These relationships indicate that boundary conditions need to be considered in interpreting the geomorphic evolution of a dune field through pattern analysis.