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The diversity of aeolian dune forms and their causes - examples from deserts in northern China

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In one side the form and size of aeolian sand dunes vary greatly on Earth and it is difficult to project the future form of a particular dune's further development. In the other side the constitution of sand dunes should reflect patterns of interactions between various long-lasting geomorphological processes associated with local, regional and even global environmental conditions. Earlier studies on the dune forms have paid great attention to wind data, sand availability and vegetation coverage but they still cannot precisely explain the occurrence of large variations in dune forms in a single desert like those in northern China. Many dunes in the deserts of northern China are even difficult to be listed in the inventory of dune forms because they are "compound" or "dune chains" consisting of multiple dune generations. Here we present our ongoing investigation of geoenvironmental factors controlling the distributions of sand seas in northern China and the forms of dunes in individual large sand seas, particularly in the Badain Jaran Desert, western Inner Mongolia. Our methods include interpretation of remote sensing data and geomorphological mapping in the field. We conclude that not only aridity but also regional tectonics control the occurrence of large sand seas which occur mainly in endorheic basins with large amount of loose sediments brought in by rivers with head waters in the surrounding mountains. The form of a single dune in northern China may have the potential of recording changes of climate parameters like the directions and strengths of winds, and precipitation although it is strongly influenced by onsite bedrock and local hydrological processes.