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Seasonal and directional variations of aeolian sediment transport on the coarse-grained zibar surface of the Kumtagh Desert, NW China

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The aeolian process over fine to medium sand beds has been thoroughly discussed based on short-term, in-situ observations and wind tunnel tests. However, little is known about the long period variation of aeolian sediment transport as well as the geomorphological significance of saltating process, in particular, on the coarse-grained surface. By means of a segmented, eight-directional sand trap (SEDST) designed by the authors, the aeolian sediment transport on zibar surface was measured in the Kumtagh Desert of NW China. The SEDST has eight sub-traps faced to eight directions, each sub-trap contains a vertical array of samplers with four openings at 0 – 0.1 m, 0.1 – 0.2 m, 0.2 - 0.4 m and 0.4 - 1.0 m, respectively. Each opening is connected with an underground sand chamber. During the 1-yr field observation since May 2014, sediments were collected for six times with an interval of 1 to 3 months depending on the wind strength. The total weight of the captured sediments is 314.76 kg and most of them (54%) were transported within 0.1 m above the ground. The sediment transport rate ranges from 0.43 to 64.47 g/m.min for the six runs, the maximum transport rate occurred during the period of Aug to Oct 2014 with sediments from the north direction. The annual mean transport rate changes between 11.81 and 28.49 g/m.min and the sediments are mainly blown from the N, NE and NW directions. The resultant sediment transport direction (net transport) is SSE (172.92°), which implies the major sediment source direction. The sediment flux profiles can be fitted with the exponential decay function for six runs and all directions. Three groups can be identified from the gradients of the fitting curves, i.e. the N, NE and NW cluster, the S and SE cluster, as well as the E, SE and W cluster. Each cluster represents a particular combination of sediment source features and geomorphological settings that may significantly affect the formation process of zibars. The sediment transport model (transport rate and direction) is not coincident with the calculated drift potential (DP and RDD), the possible reason may result from the sediment supply variation of different directions. The long-term field observation of aeolian sediment transport, especially the measurement of directional variation, could provide some new insights for zibar formation and evolution.