

HGM002-08

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Bedform distribution where the substratum is partly covered with sand: field observation and flume experiment

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In the area where the substratum is partly covered with sand, the characteristic bedform distributions composed of dune trains surrounded by sand ribbons and sand patches are developed. I conducted the field observation and flume experiment on the distribution in order to investigate the forming processes and conditions.

Field observation in Kizu river: Unique bedforms in the area where there are insufficient sand to cover whole surface were observed in the field observation in Kizu river. Typhoon No.18 in 2009 gave a heavy rain to the south and central Kinki area, then the water level of Kizu river rose approximately 6 m. There were not only the barchan (lunate) and transverse dunes but also sand patches without a sharp crest line and sand ribbons lying parallel to the streamline on the athletic fields in the flood channel of Kizu river.

The distributions of the bedforms were also characteristic. These distributions had the same features as the block diagram on the distribution of bedforms formed by tidal flows on the seafloor (Belderson, 1982). For example, barchan dunes and sand ribbons existed adjacently, a sand patch field laid at the downstream side of a dune train, and sand patches composed of the coarser grains at the upstream side of a dune train.

Flume experiment: The same bedform distributions as the field observed were formed in the flume experiment. The flow velocity spatially varied in the range from 23 to 33 cm/s (at 5 mm above the bottom of flume) due to a gentle (1:100) slope on the bottom of the flume. The initial topography was a flat sand bed of 240 g weighted moderately-sorted very fine sand (0.11 mm in mean diameter, 0.72 in the standard deviation). The developing processes of the bedform distribution were recorded from the top of the flume.

In the first stage of the experimental run, dune trains developed at the upstream side. At the same time, the downstream part was covered with sand patches. While the dune train developed from the sand moving in traction, the sand patches were formed from suspended sand. The growth rate of the dunes was much lower than that of the sand patches.

The dune train migrated into the field covered with sand patches after formation of the dunes. This is because the dunes move to the downstream direction, although the sand patches hardly move. In the boundary area between two bedforms, a new crest line was formed on the sand patches. The spacing between the new crest and the existing crest at the downstream end of the dune trains was the same as the wave length in the dune train.

Reference: Belderson, R. H., Jonson, M. A. and Kenyon, N.H., 1982. Bedforms, pp.27-57. In: Stride, A.H. (Ed.), Offshore Tidal Sands Processes and Deposits. Chapman and Hall, London, New York, 222p.

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