Flume experiments on deformation of an isolated sand dune under bidirectional flows with angular variation

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Dune morphology depends on the available sand volume and the seasonal variability of wind direction. In order to make it clear how the angular variation of bidirectional flows affects the morphology of an isolated sand dunes, we carried out flume experiments on the deformation of a sand pile under bidirectional water flows changing the angular difference in the range from 0 degree to 180 degrees. The shape of sand dunes in the water flume showed four characteristic forms depending on the angular difference between the two flows: barchan, teardrop-shaped, seif (longitudinal), and reversing shape. This variation of the morphology was caused by difference of the deformation process of the crest line due to every switching of the flow direction.

Key words: barchan dunes, flume experiments, seif dunes, wind direction

Hydro-environmental fluctuations around Lake Biwa during the past 2000 years

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Lake sediments have high resolution regional records in its surrounding catchments as well as global environmental ones such as climate fluctuation. Therefore, they are of great use for reconstructing past hydro-environmental fluctuations. To obtain past environmental records is the first step for estimating future environmental fluctuations. Here we will discuss hydro-environmental fluctuations in the instrumental observation period and historical one around Lake Biwa, Japan and its surroundings on the basis of physical properties of lake sediments (surface core and long core sediment). Surface core sediments reveal information; i) Isewan Typhoon and Meiji heavy rainfall are recorded in physical properties of lake sediments, ii) there is a good relationship between 100mm excess daily rainfall and mineral grain size during the past 100 years, and iii) there are two types in mineral grain size distributions; one is single modal distribution (mainly small grain size), and another is bimodal distribution (small and large), indicating that single one is related to small tractive force and bimodal large tractive force. Probably, the coarser part of mineral grain may be carried into the lake by river discharge in heavy rainfall periods. Long core sediments reveal information on historical periods: the Medieval Warm Period (MWP) and the Little Ice Age (LIA) are recorded in the fluctuations in mineral grain size, biogenic silica content and organic matter content. The interval studied is divided into four periods; MWP (about AD 700-1200), the transition period, LIA (about AD 1600-1900) and the present. Application of synthesized normal distribution to mineral grain size shows that normal distribution in coarse fraction (over 30 μm) is larger in MWP than LIA and it becomes gradually small, suggesting gradual decrease in tractive force. Biogenic silica and organic matter contents indicate that biological productivity in MWP is higher than LIA. Skewness of mineral grain size in LIA widely fluctuates, indicating frequent abrupt hydro-environmental changes.

Key words: lake sediment, hydro-environment fluctuation, Lake Biwa