AN EXPERIMENTAL STUDY OF DUNE DEVELOPMENT AND ITS EFFECT ON SEDIMENT SUSPENSION*

By Fujiko Iseya**

(received February 23, 1984)

ABSTRACT

In alluvial sand-bed rivers, it is found that the concentration of suspended bed material load (referred to as the "suspended sediment" in this paper) is higher during the rising stage than during the falling stage of a flood, in which the water discharge changes rapidly enough. In this study, the mechanism of this phenomenon was examined in a large sand-bed recirculating flume. The flume tests, which were designed to evaluate a possible relation between the sediment suspension and the bedform, were performed under such hydraulic conditions that dunes in the lower flow regime developed.

Run simulating a runoff event indicated that the suspended sediment concentration was extremely high during the rising leg of a flood hydrograph, when the dune grew. Six different runs with constant discharge revealed that changes in the bed configuration could be classified into two stages. One is "Developing dune stage" and the other is "Equilibrium dune stage". It is concluded from continual measurements of suspended sediment that suspended sediment concentration is higher in the developing dune stage than in the equilibrium dune stage. In the developing dune stage, strong eddies associated with the dune growth carry large amount of sediment particles periodically from the bed surface into the main flow. On the other hand, in the equilibrium dune stage, suspended sediment concentration has little variation with time, because only weak eddies are generated in spite of the presence of largest dunes on the bed surface. The examination on the time required to attain the equilibrium dune size makes it clear that the larger the stream power is, the longer time it takes to attain the equilibrium dune size.

During floods of natural rivers, the stream power at a station increases as the water discharge increases. Therefore, it is reasonable to state that the developing dune stage is always present in the rising rimb of a runoff event in which the water discharge changes rapidly. The active growth of dune dimensions in the rising stage of a flood has a notable effect on turbulant flow and thus on sediment suspension. It can be concluded that the high suspended sediment concentration in the rising leg of a flood hydrograph is strongly affected by the rapid growth of dunes.

---

*A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Science in Doctoral Program in the University of Tsukuba

**Address from April 1, 1984 is the Environmental Research Center, the University of Tsukuba, Ibaraki 305 Japan