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On regimes of sediment-laden flow over erodable seabed

T. Akivis, S. Antsyferov

P.P.Shirshov Institute of Oceanology RAS, Moscow, Russia

(akivis@geo.sio.rssi.ru, Fax: +7-495-124-59-83 / Phone +7-495-129-21-63)

A prediction model of time-averaged vertical distribution of suspended sediment concentration and its statistical characteristics is presented. The attention is focused on seabed relief condition and its influence of suspended sediment distribution.

Suspended sediment flow and bed micro-relief formation are interrelated processes. A form and parameters of bed ripples depend on flow intensity and bed sediment composition. Currents form asymmetric ripples while wave-generated ripples have quasi-symmetric shape. A specific structure of sediment-laden flow develops above rippled bed due to eddies generated behind the ripples crests which essentially intensify sediment pick-up from the bottom. So, a stable system of ripples and eddies with mutually controlled parameters exist in the bottom boundary layer. After further increase of flow velocity ripples can be erased and correspondingly the flow structure, namely, suspended sediment distribution, pick-up conditions and influence on the bottom will be appreciably changed. This change from rippled to flat bed is accompanied by noticeable drop of suspended sediment concentration and increase of its gradient in near bed layer. But the total discharge of sediment grows with velocity increase at the expense of flow structure reformation, namely, increase of bed-load part in total sediment transport.

The other noteworthy effect of bed relief on suspended sediment flow is an existence of so-called unstable flat phase. For flat to ripple bed change not only certain flow regime but some initial deformations are necessary. A lack of any initial deformations leads to flat bed existence under flow condition specific for rippled bed.

An estimate of suspended sediment concentration distribution and boundary condi-

tions changes due to bed relief change (flat/rippled and vice versa) are given.