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Spectral Distribution of Sediment Entrainment and Deposition Processes in Surface Waters

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Abstract:

Sediment entrainment and deposition activities in coastal areas have a direct influence on the seabed morphology and water quality. These activities are closely related to the production and decay of the flow energy in the water column. Based on high-frequency sediment concentration and velocity measurements collected in different flow conditions and similarity considerations of flow and sediment turbulent parameters, it has been found that each sediment exchange activity (namely the entrainment, deposition and equilibrium activities) reveals a distinctive relation between the sediment spectral signal and the frequency. Experimental analysis has been carried out to investigate the sediment spectral behaviors of various sediment transport processes subject to different but typical flow conditions. It is found that sediment spectra for the equilibrium process approximately cascade with a -5/3 slope. The cascade slope of the entrainment spectrum is steeper than that of the equilibrium spectrum, on the other hand, the slope of the deposition spectrum tends to be smaller. This result is supported by the theoretical derived sediment spectral equation and the dimensional analysis of the governing parameters of the sediment transport processes. The results obtained in this project provide a better physical understanding of the sediment transport processes.