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Characteristics of grain size distribution of typical environmental sediments and Physical mechanism of multiple-modes of grain size distribution

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Almost all sediments are deposited after transportation and thus the sorting process is absolutely innegligible. Grain size distribution of sediment samples faithfully records their dynamic depositional environment. By investigating thousands modern sediments from different typical depositional environments and comparing with their grain size distributions, the typical grain size distribution of sediments are classified. It was found that there are up to six modes in grain size distribution of sediments. Among them, there are three modes of suspension particles (<∼100um), one saltation mode (∼100-∼450um) and one rolling mode (>∼500um). Multimode of Aeolian deposits is similar to that of fluvial or lacustrine deposits but the range of grain size of each mode of Aeolian deposits is slightly smaller than that of corresponding mode of fluvial or lacustrine deposits because the density and the viscosity coefficient of water are larger than that of air. If Aeolian deposits are washed into rivers and lakes by rain, the mixture of three modes of dust aerosol with fluvial or lacustrine three modes may result in the occurrence of four modes in suspension component, that is, 1, 2 and 3 modes belong to the suspension component of dust aerosol, 1, 2 and 4 are the suspension component of fluvial or lacustrine deposits. Dynamic mechanism analysis demonstrates that the Brown diffusion, turbulence and gravitation dominate the particle settlement of fine, moderate and coarse modes in suspension component, respectively. Thus, temperature, turbulence intensity, wind strength and dust transport distance can be evaluated according to three modes in grain size distribution of dust deposits by several physical models. Similarly, lake depth can be evaluated according to three modes in grain size distribution of lacustrine deposits on basis of a physical model. The physical models have been applied to study loess-paleosol sections and lacustrine cores. The results provide a lot of important information of plaeo-climate change.