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TITLE: Transformation of dissolved and particulate materials on continental shelves influenced by large rivers: plume processes

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ABSTRACT:

The world's ten largest rivers transport approximately 40% of the fresh water and particulate materials entering the ocean. The impact of large rivers is important on a regional/continental scale (e.g. the Mississippi drains ~40% of the conterminous US and carries approximately 65% of all the suspended solids and dissolved solutes that enter the ocean from the US) and on a global scale (e.g. the Amazon River annually supplies approximately 20% of all the freshwater that enters the ocean; e.g. approximately 85% of all sedimenting organic carbon in the ocean accumulates in coastal margin regions). River plume processes are affected by a suite of complex factors that are not fully understood. It is clear however, that the composition, concentration and delivery of terrestrial materials by large rivers cannot be understood by simply scaling up the magnitudes and impacts of dominant processes in smaller rivers. Because of high rates of particulate and water discharge, the estuarine processes associated with major rivers usually take place on the adjacent continental shelf instead of in a physically confined estuary. This influences the magnitude and selectivity of processes that transform, retain or export terrestrial materials. Buoyancy is a key mediating factor in transformation processes in the coastal margin. In this paper we review and synthesize current understanding of the transformation processes of dissolved and particulate organic and inorganic materials associated with large river (buoyant) plumes. Chemical and biological activities are greatly enhanced by the changed physical and optical environment within buoyant plumes. Time and space scales over which these transformation processes occur vary greatly, depending on factors such as scales of discharge, suspended sediment loads, light and temperature. An adequate understanding of transformation processes in these highly dynamic, buoyancy-driven systems is lacking. In this paper, we review the biogeochemical processes that occur in large river plumes.

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