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Boundary exchanges and biogeochemical processes in the monsoon driven Indo-Pacific region

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The Indo-Pacific region experiences the Asian monsoon system, comprising South Asia, Southeast Asia and East Asia components, in summer which is one of the most dynamic ocean-atmosphere interactive systems of the earth. The interactions among the ocean, atmosphere and land are strong with the seas of this region receiving the largest run-off in the world, resulting from precipitation over land driven by the monsoons. Wind forced surface ocean circulation and river discharges make this region highly productive. While the river transported mineral matter acts as a ballast to scavenge organic carbon from the water column the freshwater stratification cause coastal hypoxia in the Indian Ocean. The consequent biogeochemical processes and emissions of gases of climatic importance are significant; for instance the Arabian Sea is a perennial source whereas the Bay of Bengal and East China Sea are sinks of atmospheric CO_2. N_2O emissions from this region are globally significant. Associated with these processes, significant dust deposition over the North Indian Ocean (from India and west Asia) and China Sea-West Pacific Ocean (from East Asia) regions could play a role in natural fertilization. Ocean-atmosphere interactions are also important during winter as the cold dry winds from Asia carry pollutants to South Indian (from South Asia) and West Pacific Oceans (from East Asia). While deposition of nitrogen compounds facilitates biological production in surface waters, presence of oxidants in polluted air facilitates oxidation of dimethylsulfide in atmosphere, which together with anthropogenic SO_2 can form nuclei that may alter atmospheric radiation balance. Indo-Pacific region is also rich in wetlands and gas hydrates that could potentially emit CH_4 to atmosphere. Importantly, this is region is prone for natural disasters such as typhoons, hurricanes, cyclones and tsunamis, that make the present conventional boundary exchange computations only tentative.