

# Oceanic Influence on Global Hydrologic Cycle Observed from Space

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Past studies of oceanic influence on terrestrial and cryospheric hydrological cycles were consisted largely of showing the relation between precipitation over landmasses and the surface temperature of surrounding oceans, based on numerical model simulation and analysis of model products. The long-term acceleration of the hydrologic cycle was mainly demonstrated through its manifestation in the radiation budget. Direct physical linkage has been lacking because measurements of the hydrologic parameters, such as evaporation and moisture transport over the ocean, are extremely sparse. We have derived hydrologic parameters over global oceans using newly available and high-resolution space-based data, making use of our pioneering effort and unique expertise in space-based observations of surface evaporation and moisture transport. The geographic distribution of mean fresh water flux (evaporation-precipitation) over global tropical and subtropical ocean is found to agree with the divergence of the water vapor transport integrated over the depth of the atmosphere.

The temporal variation of these two parameters, from intraseasonal to interannual time scales, also agree with each other and with the variation of ocean surface salinity, at selected locations where salinity data are available. The closure of the hydrologic balance adds credibility to the spacebased data. Global moisture advection data was interpolated to simplified coastlines of major land masses and the component normal to the coastline was compared with precipitation over land. The temporal and spatial variations the moisture transport from the surrounding ocean were found to correlate well with the increase in snow accumulation in Greenland in 2003. The hydrologic parameters reveal the extreme phases of the Arctic Oscillation. Onset of Indian Monsoon is observed to occur earlier in the Bay of Bengal than in the Arabian Sea. Temporal variation of rainfall in China and Indochina was found to be in phase and approximately in magnitude with moisture advection from the Indian Ocean but out of phase with those from the Pacific. During the onset of summer monsoon, moisture advected out of Indian into the Bay of Bengal occurs earlier the moisture advected into the subcontinent from the Arabian Sea. Rainfall over the Amazon is influenced by moisture from Atlantic; the influence is particularly strong at intra-seasonal time scales. Strengthening of convergence and divergence regions of the Hadley and Walker circulation in the tropical Pacific is observed in the past 16 years.