

OCEANIC INFLUENCE OF CONTINENTAL RAINFALL OBSERVED FROM SPACE

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ABSTRACT:

The never-ending recycling process in which a small fraction of water is continuously removed from the ocean as excess evaporation over precipitation into the atmosphere, redistributed through atmospheric circulation, deposited as excess precipitation over evaporation on land and ice, and returned to the ocean as river discharge and ice-melt, is critical to the existence of human life. Linking the variability of the oceanic to terrestrial water reservoir is important to the understanding and prediction of weather and climate. We have developed and validated a method to estimate the moisture transport integrated through the depth of the atmosphere over ocean using spacebased measurements. The decade long data allow us to resolve the precipitation jump paradox over the Sahel. The abrupt change of monsoon rain onset in Sahel region is not caused by the meridional moisture transport from the Gulf of Guinea nor the easterly waves aloft, but by the onshore moisture transport from the Atlantic against the offshore easterly flow. The data also reveal that the high peaks and low dips (extremes) of rainfall over the U.S. Southern Great Plain over a 8 year period has strong correlation with the meridional moisture transport from the Gulf of Mexico. The moisture transport reflects the winds aloft, which are different from the surface transport that shows strong seasonal cycle. The data also show that the seasonal rainfall in East Asia is dominated by moisture transport from the Indian Ocean, while transport from the Pacific influences the interannual variation. The transport integrated over coastlines, in conjunction with the mass change measured by the Gravity Recovery and Climate Experiment (GRACE), and climatological river discharge, also allow us to balance the water budget over continents, such as, North and South America.