Trends in Oceanic Rainfall Derived from Microwave Brightness Temperature Histograms

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A technique has been developed to estimate monthly oceanic rainfall over 5º (over the domain 50ºN-50ºS) and 2.5º (65ºN-65ºS) latitude/longitude boxes based on microwave brightness temperature (Tb) histograms computed from Special Sensor Microwave Imager (SSM/I) measurements taken on board the Defense Meteorological Satellite Program satellites. The technique is based on a rain rate-Tb relation derived from radiative transfer calculation of an atmospheric model, uses a combination channel of 19 and 22 GHz vertical polarization to mitigation the effect of water vapor, and fits the computed Tb histogram to a rain rate distribution. This data set (July 1987 – present) serves as an input to the rain maps produced by the GPCP and as a constraint on the high spatial and temporal resolution rain products such as the Multi-satellite Precipitation and is available from the Global Precipitation Climatology Project (GPCP)- Polar Satellite Precipitation Data Center (RL: http://gpcp-pspdc.gmu.edu/).

Empirical Orthogonal Analysis of the non-seasonal data showed the El Nino/Southern Oscillation as the dominant mode of interannual variability. Linear trend analyses showed no significant trend in the domain average rain rate, however, analyses of zonal average rain rates show a significant trend of about 10% increase between 0-10º N in the Pacific between 1987 and 2004. Results from Empirical Mode decomposition (EMD) analysis showed the trends started around early 1990s and the trend in monthly rainfall is dominated by an increase in the rain frequency. This decadal increase is interpreted as an enhancement of the Hadley circulation, which is consistent with the observed radiative fluxes and evaporation changes in the tropics reported by other investigators.