



## Assessing the Variability of Radiation, Water and Energy in the Deep Tropics Over the Last 3 Decades

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Global surface energy closure and its variability depends heavily upon the surface radiative energy budget in the deep tropics. A key process observed is the change in convection regimes from disorganized convection to organized deep convection. During these periods an imbalance is observed between energy and water fluxes in terms of energy closure in some atmospheric reanalysis systems, implying that processes are not simulated well. A recent paper by Hsaio et al (2023, pre-published version) found that the transition process has wind shear and longwave cloud radiative feedback signatures. In this presentation, we assess the surface radiative budget in the deep tropics by comparing multiple data products (GEWEX SRB Rel4IP, CERES Ed4.1, ISSCP FH, etc.) and describing the variability across the deep tropics for the period from 1988 to near present. We assess this variability of the radiative flux anomalies (including the net TOA, surface and the atmospheric divergence fluxes) against water vapor divergence, cloud properties (include ISCCP "Weather States, Tselioudis et al. 2021) and larger scale wind shear. We include further analysis contrasting 6 key tropical oceanic regions (Indian Ocean east and west, tropical western, central and eastern Pacific Ocean, and Tropical Atlantic Ocean) and the sensitivity of the fluxes as a function of fluctuations in cloud types in response to various larger scale atmospheric processes (e.g. El Niño, Indian Ocean Dipole). These are contrasted against the modeled radiative fluxes from ERA-5 and MERRA-2. Ocean buoy measurements of radiative fluxes are utilized to help assess data radiative flux uncertainty over the nearly 40 year period. In general, the variability for overlap periods of these various data products agrees well, but there are significant differences in the net fluxes that vary according to the rendering of surface, atmospheric, aerosol and cloud properties. We conclude with recommendations for continuing work.