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Scale-dependence of the Space-time Anisotropy of Tropical Rainfall

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This work focuses on documenting the multiscale nature of the spatial coherence of tropical rain, using TRMM satellite-retrieved rainfall observations at multiple space and time resolutions. We take two different approaches, namely, a global and local view. The global view attempts to quantify the conventional view of rain, i.e., the dominance of the intertropical convergence zone (ITCZ), while the local view tries to answer the question: if it rains, how far is the influence felt in zonal and meridional directions? In both approaches, the classical e-folding length for spatial decorrelation is used as a measure of spatial coherence. The major finding in the global view approach is that, at short timescales of accumulation (daily to pentad to even monthly), rain over the Equator shows the most dominant zonal scale. It is only at larger timescales of accumulation (seasonal or annual) that the dominance of ITCZ around 7N is evident. The local view shows the expected dominance of the zonal scale in the tropical ocean convergence zones, with an anisotropy value (ratio of zonal to meridional scales) of 3-4. Over land, on the other hand, the zonal and meridional scales are comparable in magnitude, suggesting that rain tends to be mostly isotropic over continental regions. This latter finding holds true, irrespective of the spatial and temporal resolutions at which rain is observed. Interestingly, the anisotropy over ocean, while invariant with spatial resolution, is found to be a function of temporal resolution: from a value of 3-4 at daily timescale, it decreases to around 1.5-2 at 3-hourly resolution. We will also present preliminary results from analysis of very high resolution GPM precipitation (0.1-degree, daily). Finally, we discuss the ability of a suite of CMIP5 models to reproduce some of these observed features.