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Spatial Scales of Tropical Precipitation inferred from TRMM Microwave Imager Data

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The local spatial scales of tropical precipitating systems were studied using TRMM Microwave Imager (TMI) rain rate imagery from the Tropical Rainfall Measuring Mission (TRMM) satellite. Rain rates were determined from TMI data using the Goddard Profiling (GPROF) Version 5 algorithm. Following the analysis of Ricciardulli and Sardeshmukh (RS, [1]) who studied local spatial scales of tropical deep convection using Global Cloud Imagery (GCI) data, active precipitating months were defined as those having greater than 1mm/hr of rain for more than 5 % of the time. Spatial autocorrelations values of rain rate were subsequently computed on these grid cells for convectively active months from 1998 to 2002. The results were fitted to an exponential correlation model using a nonlinear least squares routine to estimate a spatial correlation length at each grid cell. The mean spatial scale over land was 94.3 km and over oceans was 121.8 km. An error analysis was performed which showed that the error in these determinations was of order 1-5 %. The results of this study should be useful in the design of convective schemes for general circulation models and for precipitation error covariance models for use in numerical weather prediction and associated data assimilation schemes. The results of the TMI study also largely concur with those of RS, although the more direct relationship between the TMI data and rain rate relative to the GCI imagery provide more accurate correlation length estimates. The results also confirm the strong impact of land in producing short spatial scale convective rain.

[1] Ricciardulli, L., and Sardeshmukh, P. D., “Local Time and Space Scales of Organized Tropical Deep Convection,” *J. Climate*, v. 15, pp. 2775-2790, 2002.