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Examining Complex Nature of Diurnal Variability of Precipitation

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The nature of diurnal variability of precipitation is much more complex than once recognized. Although its regional-seasonal variability over continents has been well documented for some environments, its oceanic variability vis-à-vis geography and changing seasons is far less understood. Moreover, as will be shown based on the use of TRMM and CloudSat satellite precipitation measurements, the very nature of diurnal variability is a more multifaceted process than simple monomodal periodicity. First, diurnal variations whether over maritime or continental regions are generally multimodal in nature – noting that the individual variations stem from a wide variety of forcing mechanisms. Second, the multimodal nature of diurnal variability largely underscores whether maritime or continental forcing factors are at work. Thus, when an oceanic region exhibits signs of continental-type diurnal variability, it is likely because of the region's proximity to land. In contrast, when a continental region exhibits oceanic-type diurnal variability, it may be because of the region's proximity to water – or in the case of deep inland reverse behavior, because an ambient flow regime is steering maritime processes over an extended continental span penetrating into the region in question. Although reverse behavior is often found over ocean regions, it appears that this type of variability is more intermittent in nature, variability that extended time-space averaging tends to dispel, rather than some type of large spatiotemporal-scale continental flow process exerting itself over the maritime locale. Third, diurnal variability of precipitation is often vertically phase-shifted, at times in a coherent fashion – demonstrating the underlying time-dependent fallout process of hydrometeors – which is the natural behavior of precipitation as it gathers up its hydrometeor size properties necessary to achieve fallout velocities. Fourth and finally, diurnal variability takes on very distinct spectral signatures as a function of geography and seasonality – in which spectral denotes the underlying rain-rate spectrum. In fact, it is the nature of the 3rd and 4th processes that has made it difficult to understand the exact means by which latent heating, the ultimate atmospheric end-state due to precipitation, achieves its diurnal amplitude and phase properties. In this presentation, we examine such intricacies of the diurnal variability of precipitation that have eluded past research investigations – with the additional intent of shedding light on how estimates of latent heating might be improved upon given knowledge of these intricacies.