Transient aggregation of convection: Observed behavior and underlying processes

*Hirohiko Masunaga[1], Christopher E Holloway[2], Hironari Kanamori[1], Sandrine Bony[3], Thorwald H. M. Stein[2]

1. Nagoya University, 2. University of Reading, 3. LMD/IPSL, CNRS, Sorbonne Universities

Convective self-aggregation is among the most striking features emerging from RCE simulations, but its relevance to convective disturbances observed in the real atmosphere remains under debate. While some aspects of idealized simulations are unlikely to be observed in nature, some underlying physics at the process level may be testable against observations. This work seeks the observational signals of convective aggregation intrinsic to the life cycle of organized convective systems or cloud clusters, which typically have a sub-daily to daily time scale. To this end, composite time series of the Simple Convective Aggregation Index (SCAI), a metric of aggregation, and other variables are constructed around the temporal maxima of precipitation. All the parameters analyzed are large-scale means over 10˚×10˚ domains.

Major findings for the case of intense precipitation (P>35 d mm^{-1} at t=0) are (1) The composite evolution shows that cloud clusters are gathered into fewer and larger members during a period of ±12 h as precipitation picks up and the high-cloud cover expands to its peak, suggesting a transient occurrence of convective aggregation presumably in close association with the life cycle of cloud clusters; (2) This transient aggregation is detectable over warm oceans (SST>28℃) but less prominent over colder oceans; (3) The latent and sensible heat are invariant during the evolution; and (4) The horizontal advection imports MSE immediately before the precipitation peak, while the vertical advection exports MSE. When the composite samples are stratified into less-aggregated (SCAI>1.5 at t=0) and more-aggregated (0.6<SCAI<0.9 at t=0) cases, the evolution is very similar but with a subtle difference in the dynamics (advection).

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