Longwave AIRS Cloud Radiative Effects Decomposed by MODIS Cloud Regime

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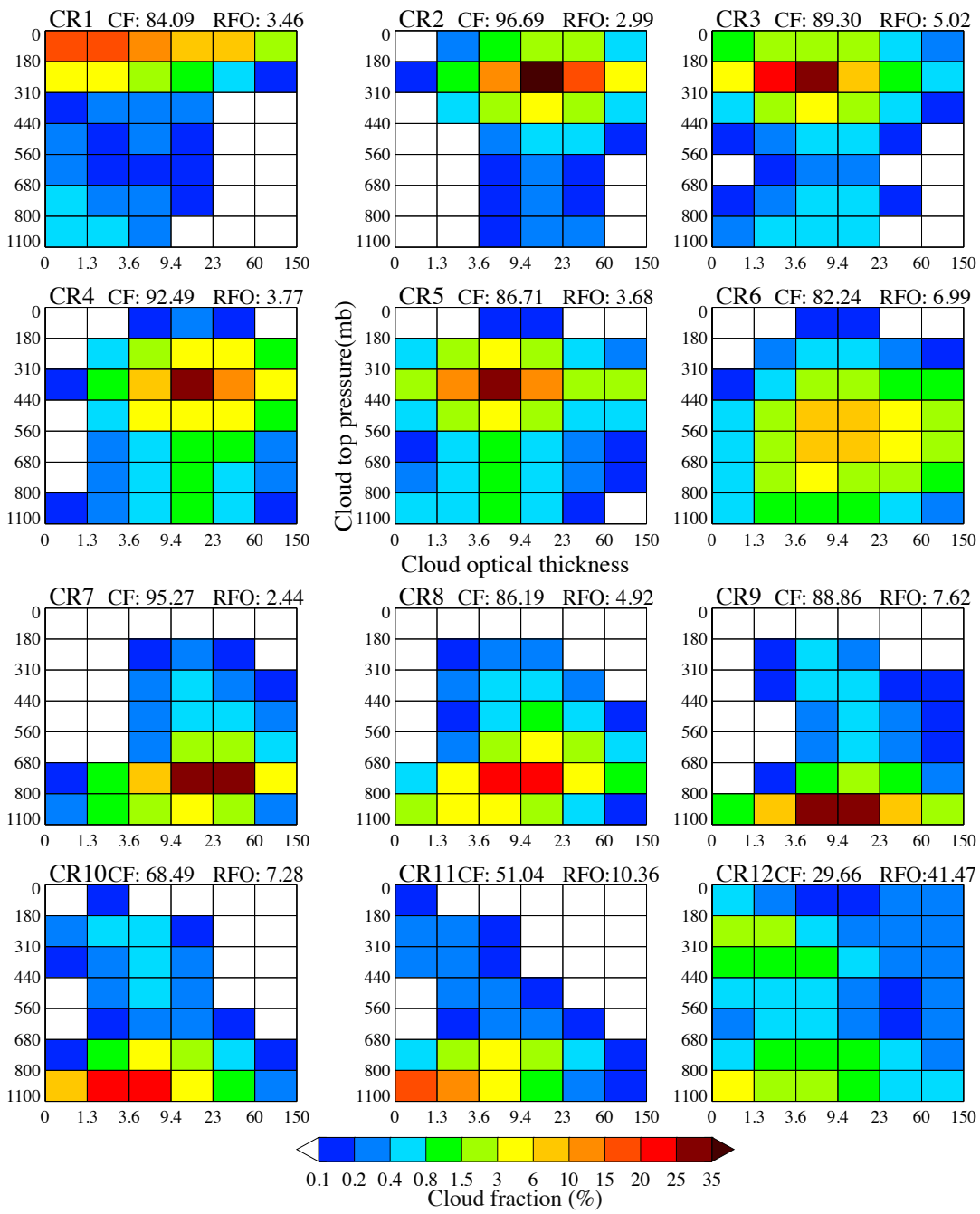
Motivation

- Need to understand effects of clouds on Earth's Radiation Budget
- A major issue is how to organize the information, i.e., breakdown in terms of dominant cloud systems
- Because in areas ~$(100\text{-}300\text{km})^2$ multiple cloud types may exist, cloud "mixtures" more relevant than cloud "types".
- Such prevailing mixtures can be obtained by performing clustering analysis on cloud property co-variations; we call these "cloud regimes" (CRs)
- You may also know ISCCP "Weather States"

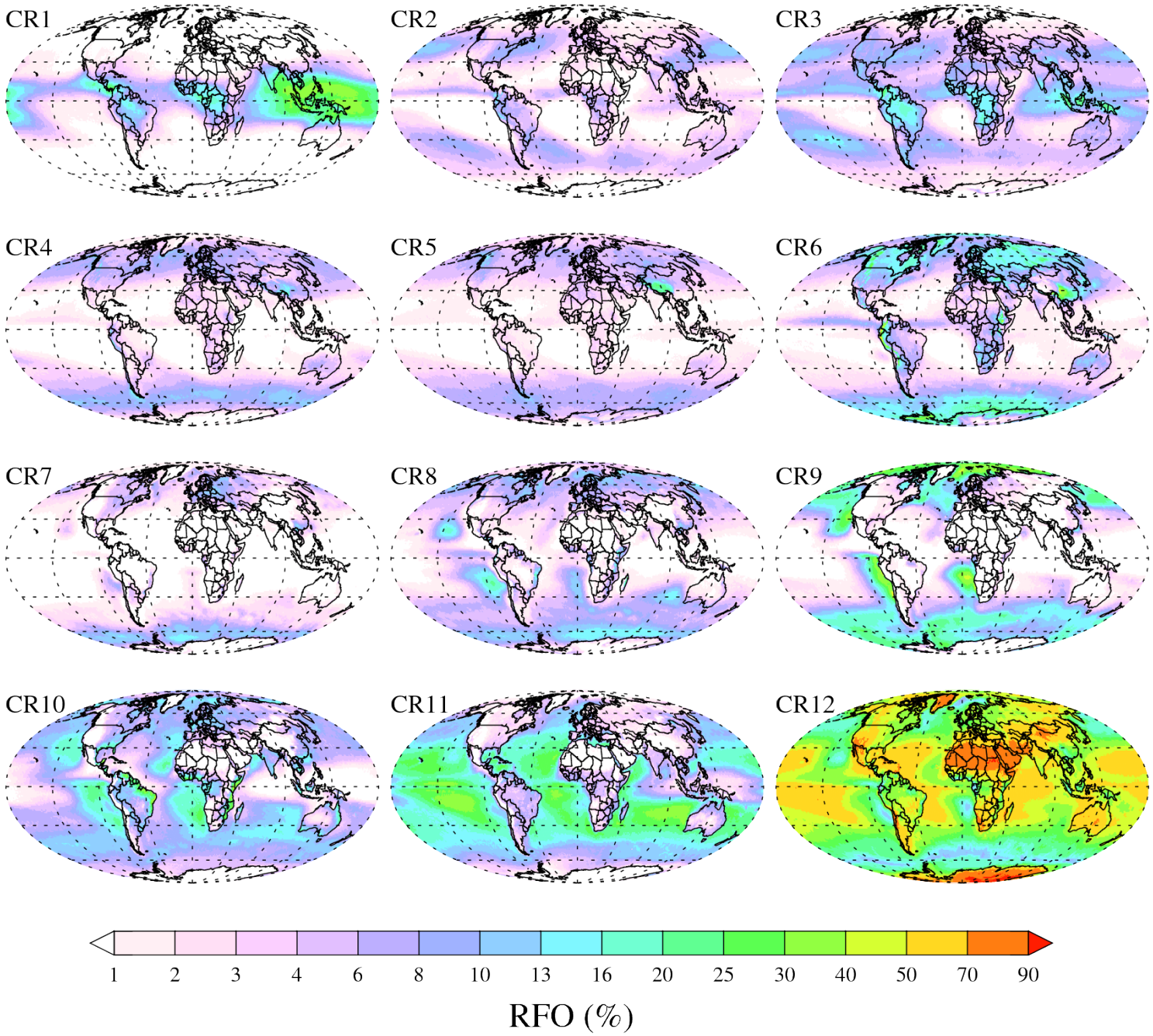
Dataset and methodology

- 12 years of Aqua-Terra L-3 daily (D3) 1° data; Collection 6
- Joint histograms of CTP-TAU
- MODIS CRs from *k-means* clustering
- $CRE = OLR_{clr} - OLR = CF(OLR_{clr} - OLR_{ovc})$ from AIRS V6 L3; also from CERES SYN1deg-3hr and 2B-FLXHR-LIDAR (CloudSat/CALIPSO)
- Composite LW TOA CRE onto MODIS *Aqua* CRs
- Intra-regime variability is also examined

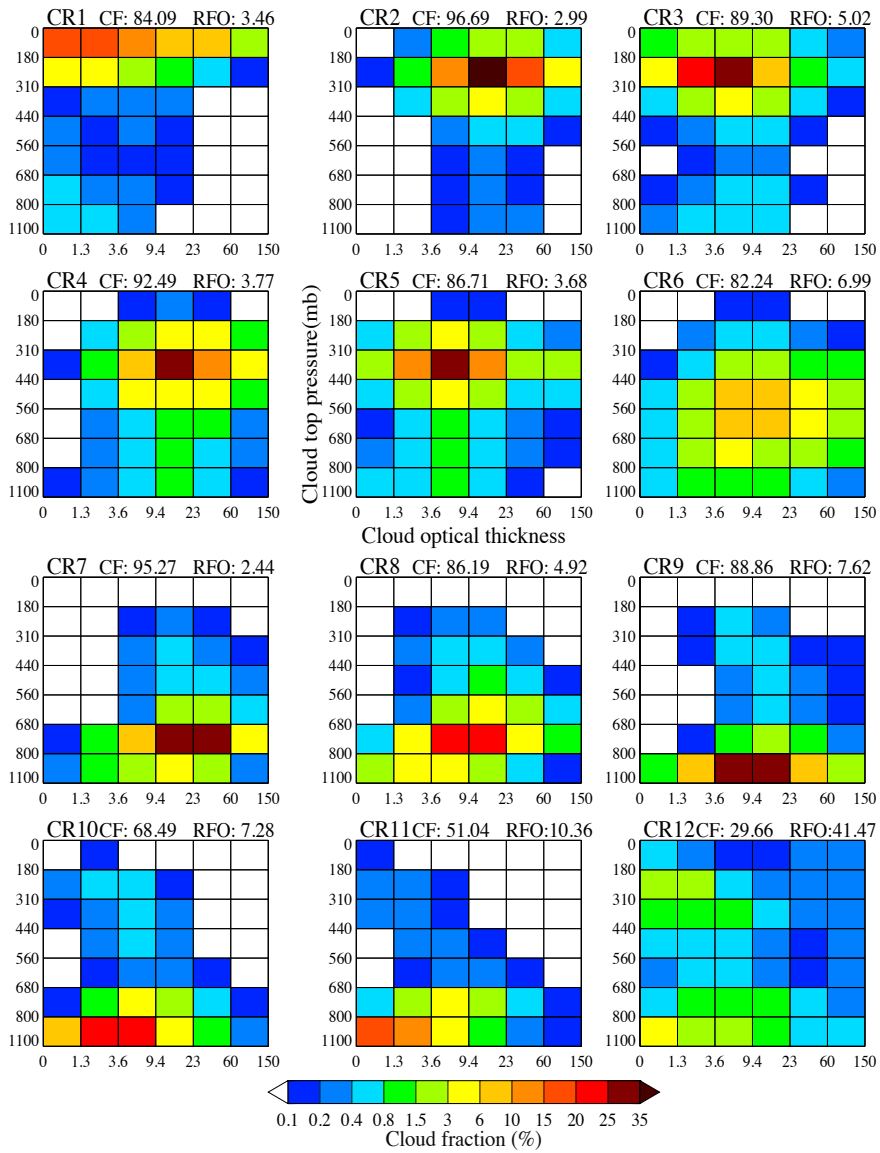
The 12 MODIS Collection 6 CRs

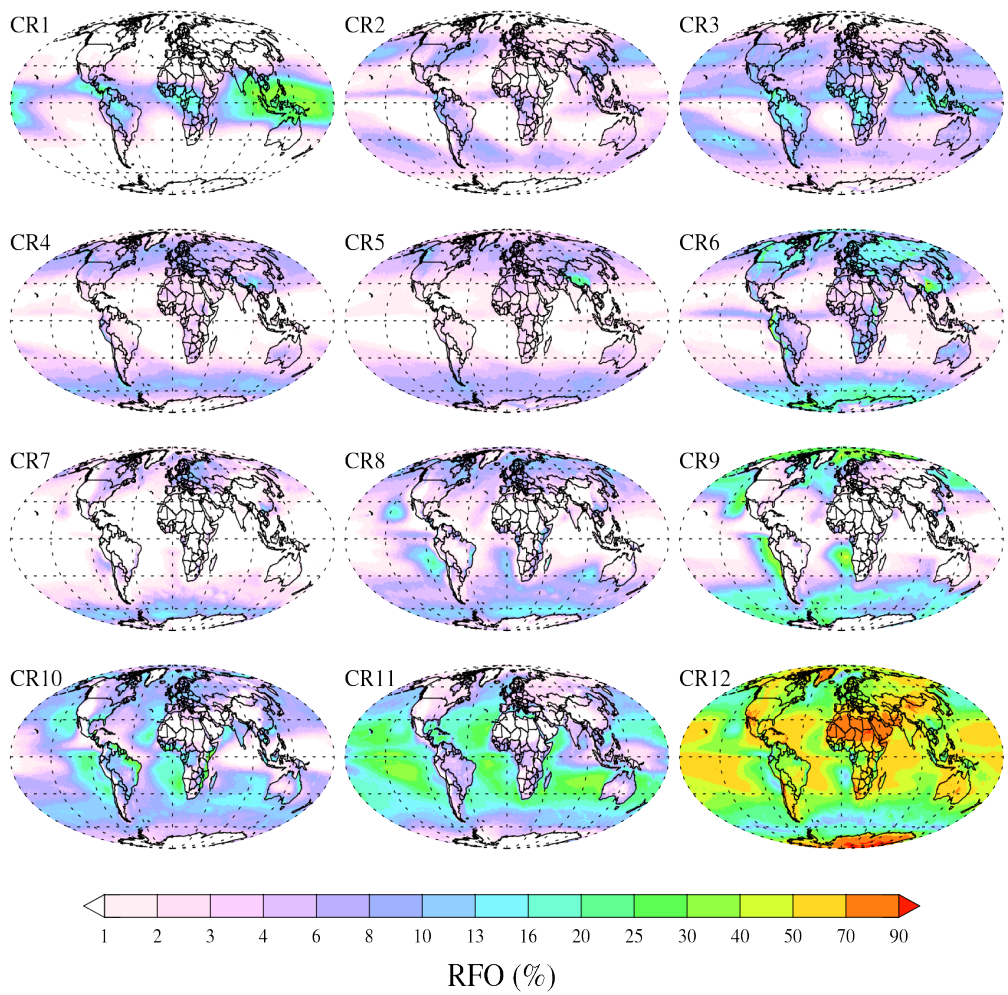


Where the CRs occur

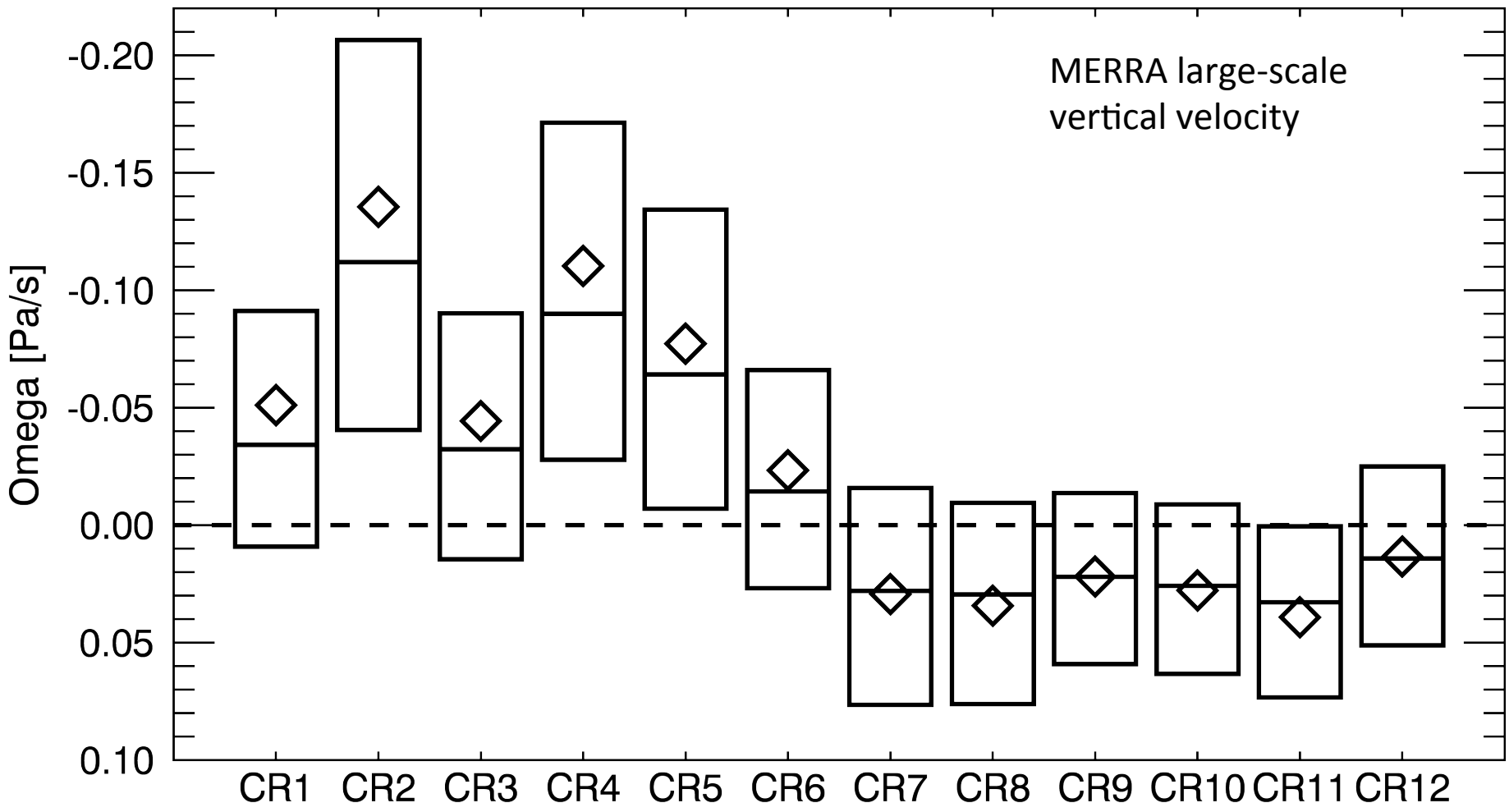


The full picture

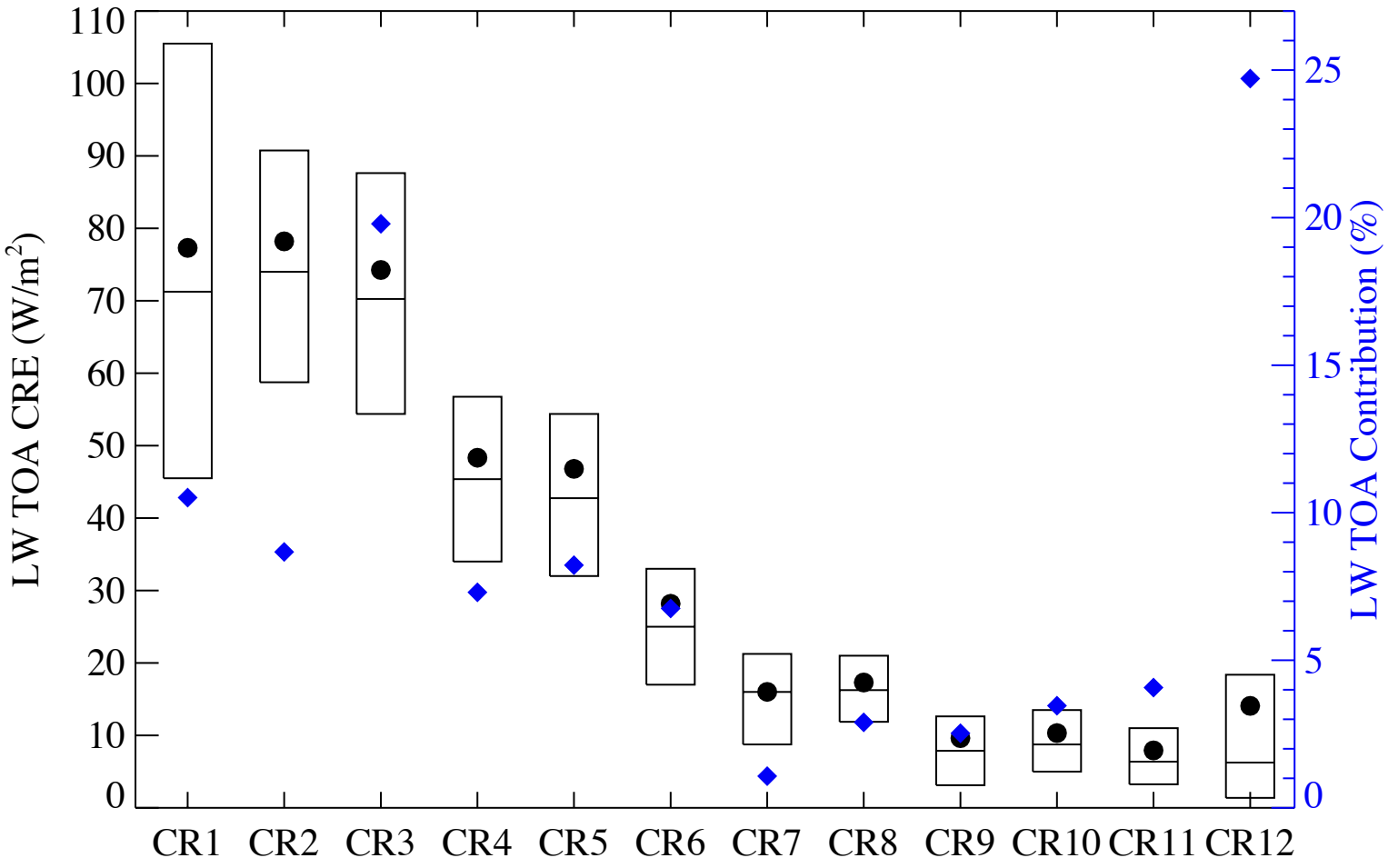




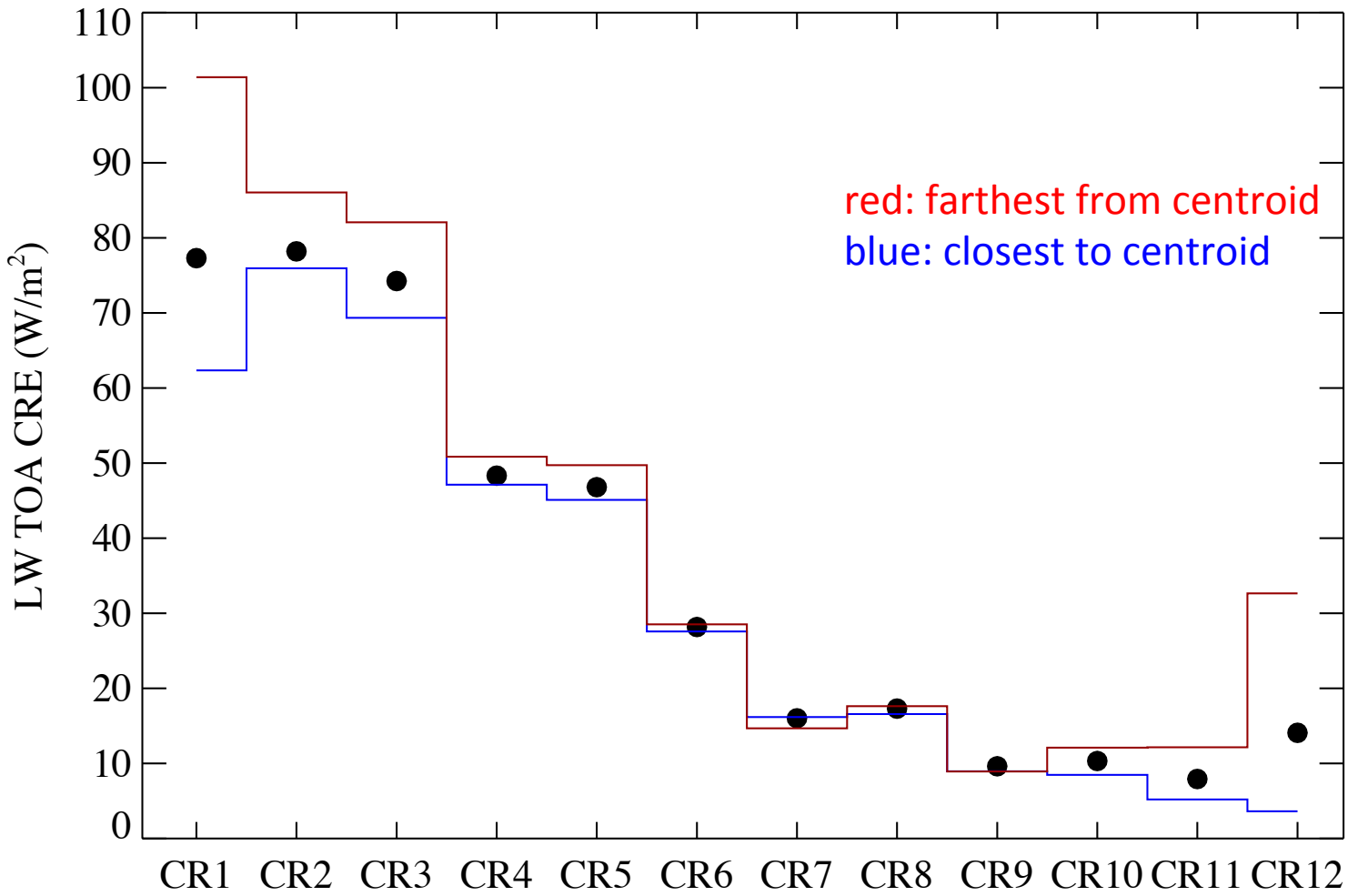
CRs occur in different dynamical environment



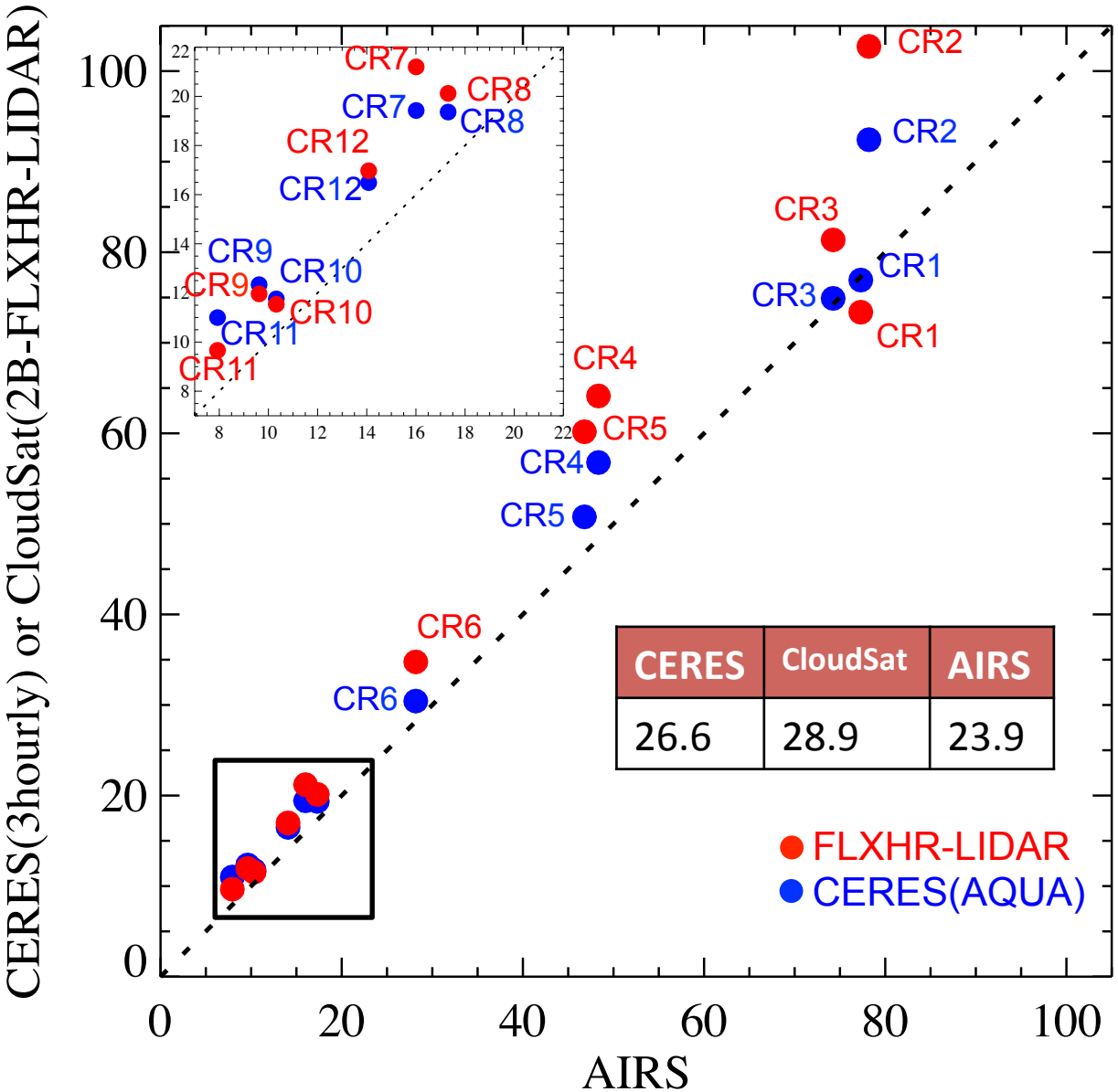
AIRS CRE breakdown and contribution



AIRS CRE breakdown intra-regime variability

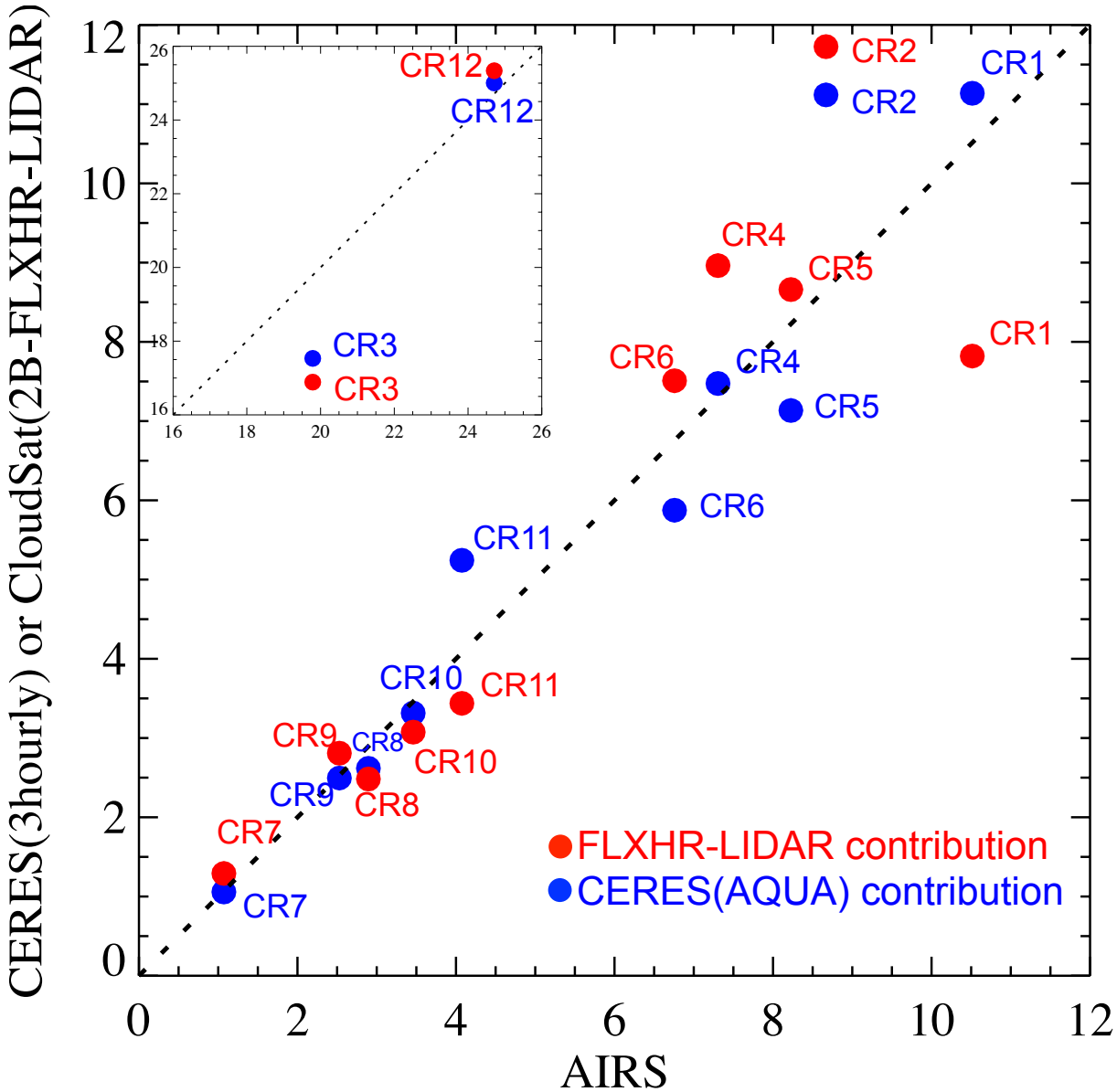


LW TOA CRE comparison



CERES	CloudSat	AIRS
26.6	28.9	23.9

LW TOA CRE *contribution* comparison



Summary and parting thoughts

- Cloud regimes can help us understand the contributions of the various prevailing cloud systems to the Earth Radiation budget.
- Breakdown of LW TOA CRE from AIRS is consistent with that from CERES and CloudSat/CALIPSO, but values systematically lower; order of importance differs
- While LW TOA was only discussed here, there are flux products for SW, SFC, even full flux profiles (CloudSat)
- A-Train makes compositing more meaningful
- Next: Composites of spectral CRE