MODIS dynamical and microphysical regimes as viewed by AIRS

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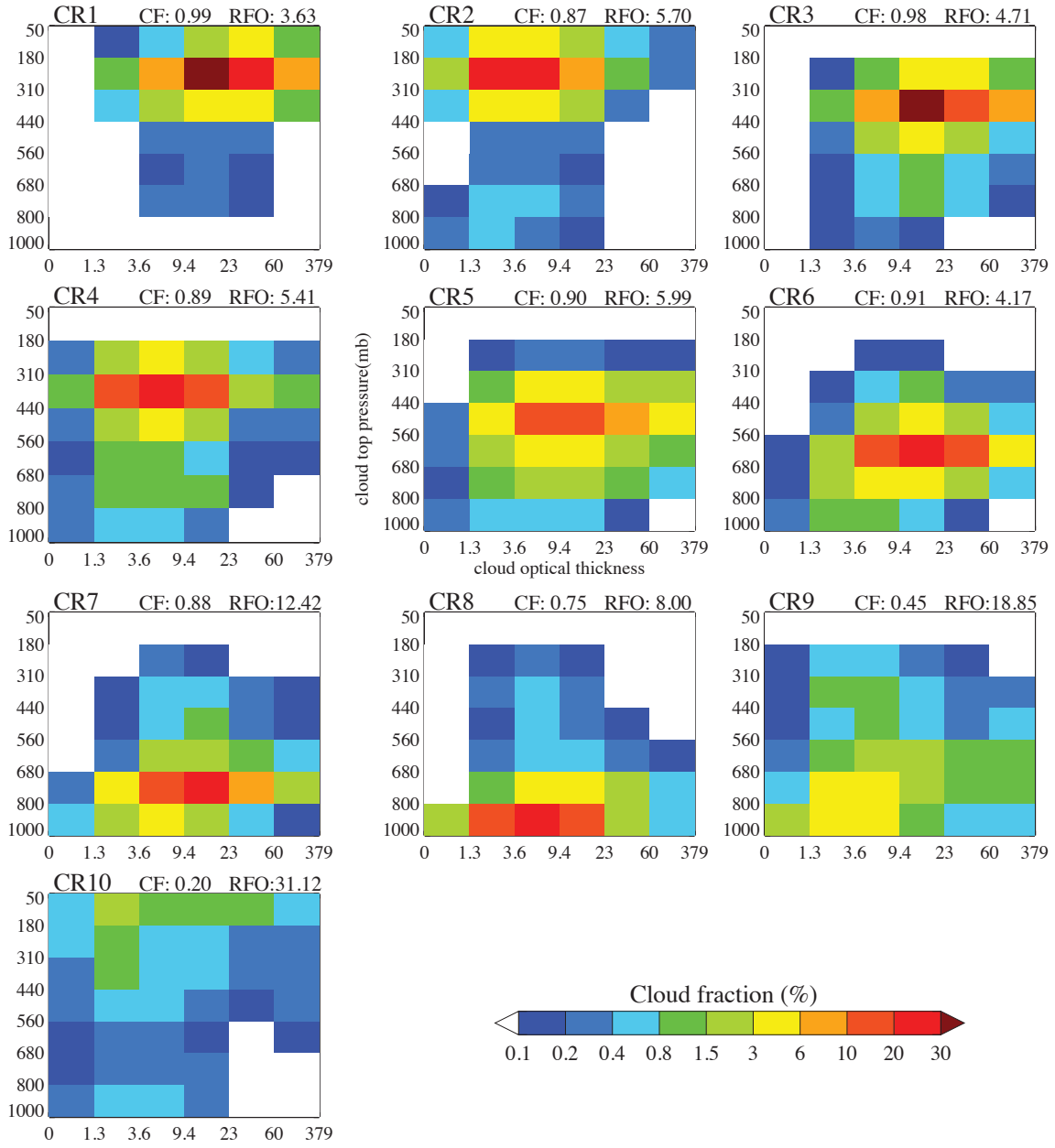
MODIS cloud regimes

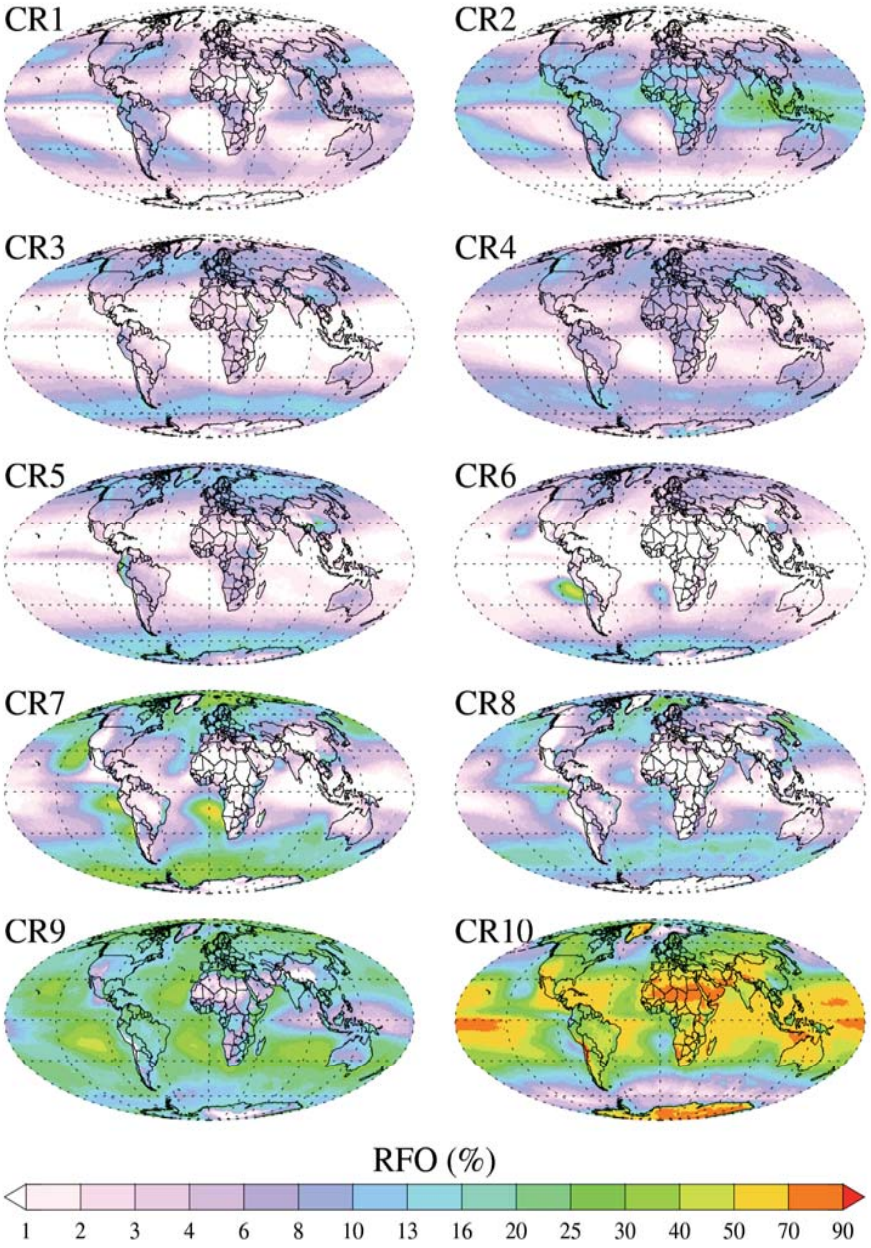
Grouping systematic patterns in co-variations of cloud extinction and vertical location according to MODIS

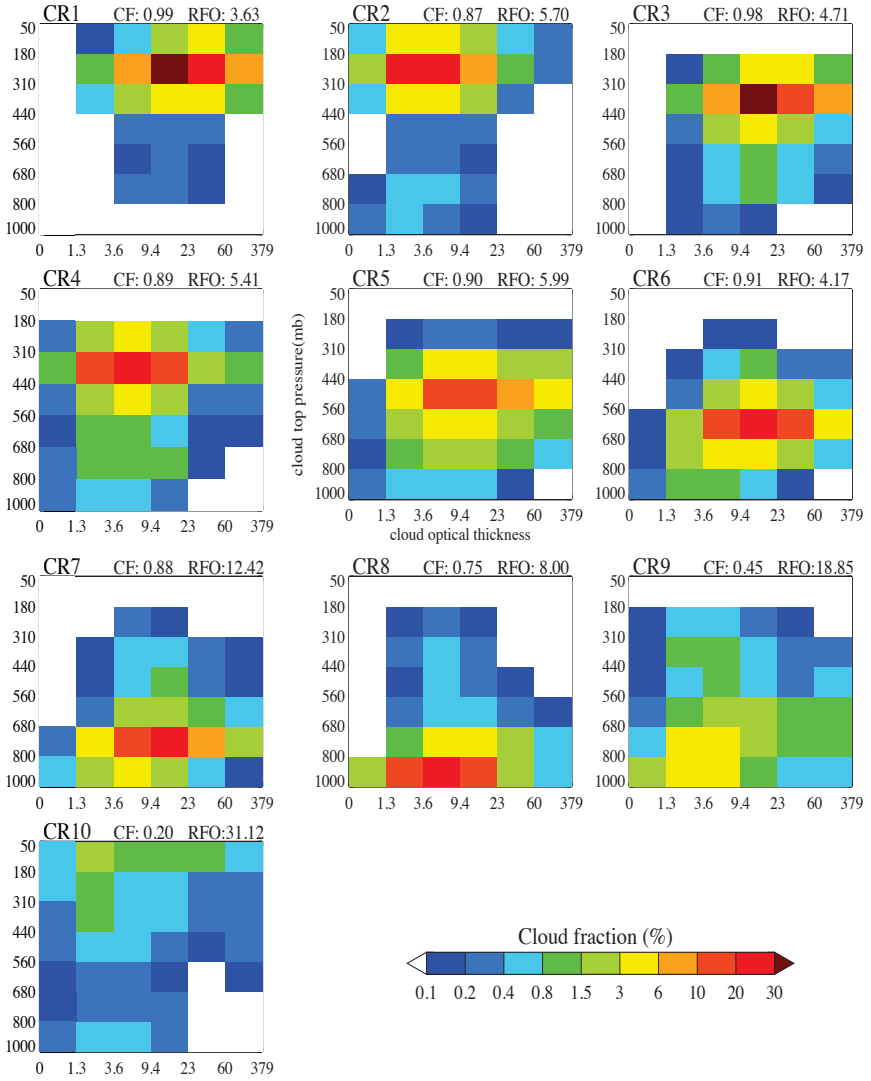
About 12% of 1° gridcells have no retrievals (“clear” regimes)

Oreopoulos et al. JGR, 2014

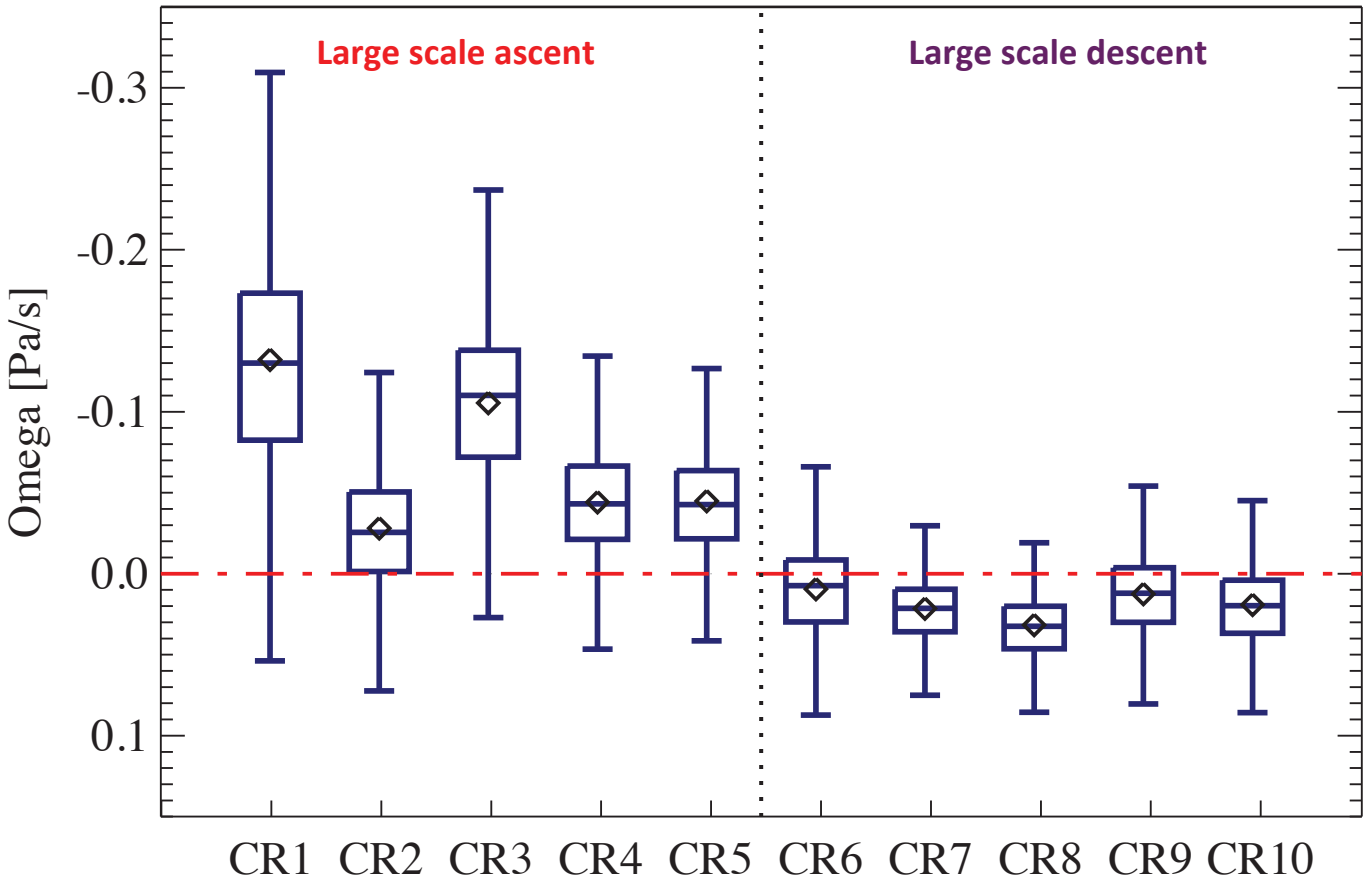


Where the CRs occur

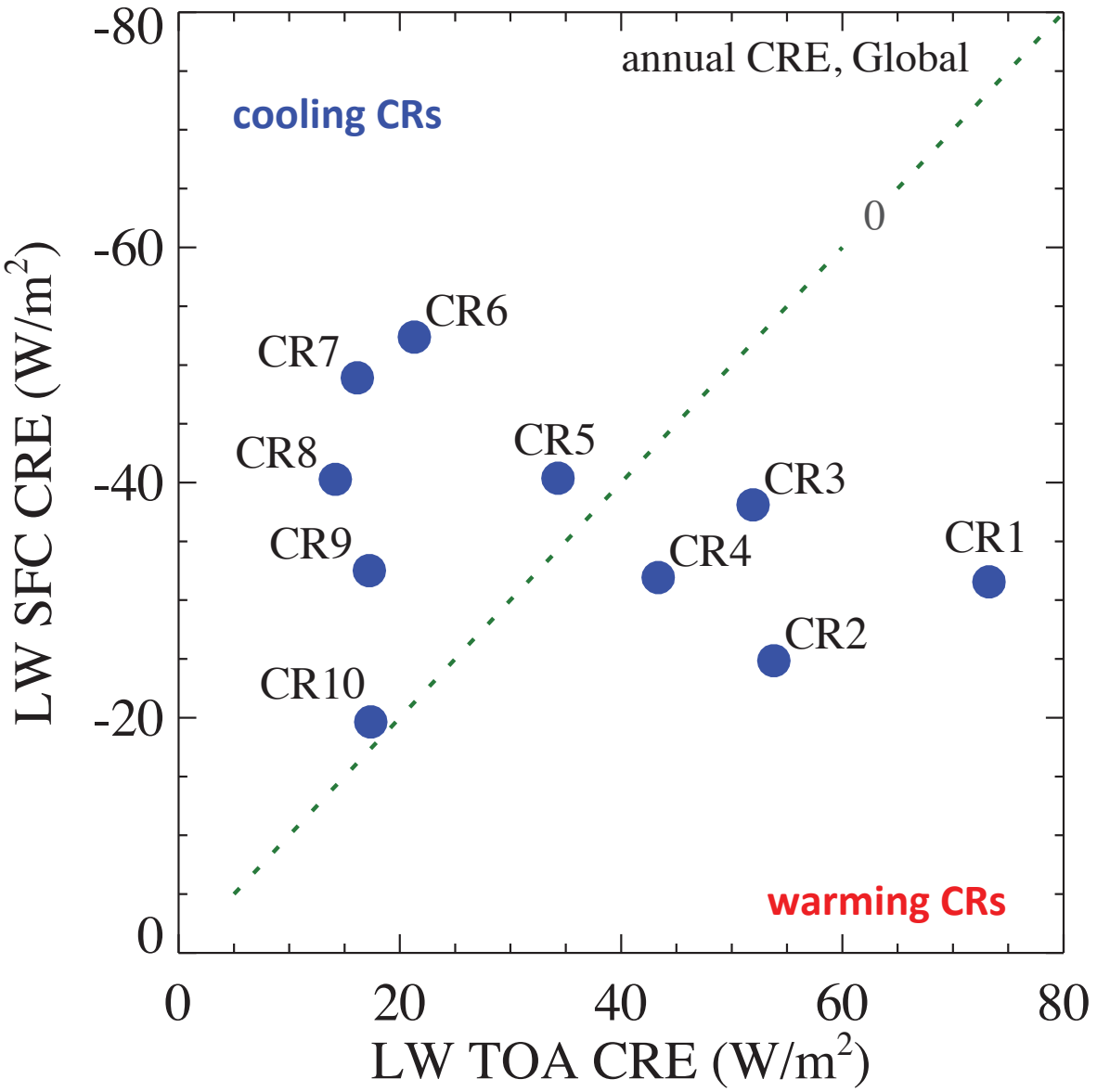




CRs in distinct dynamical environment



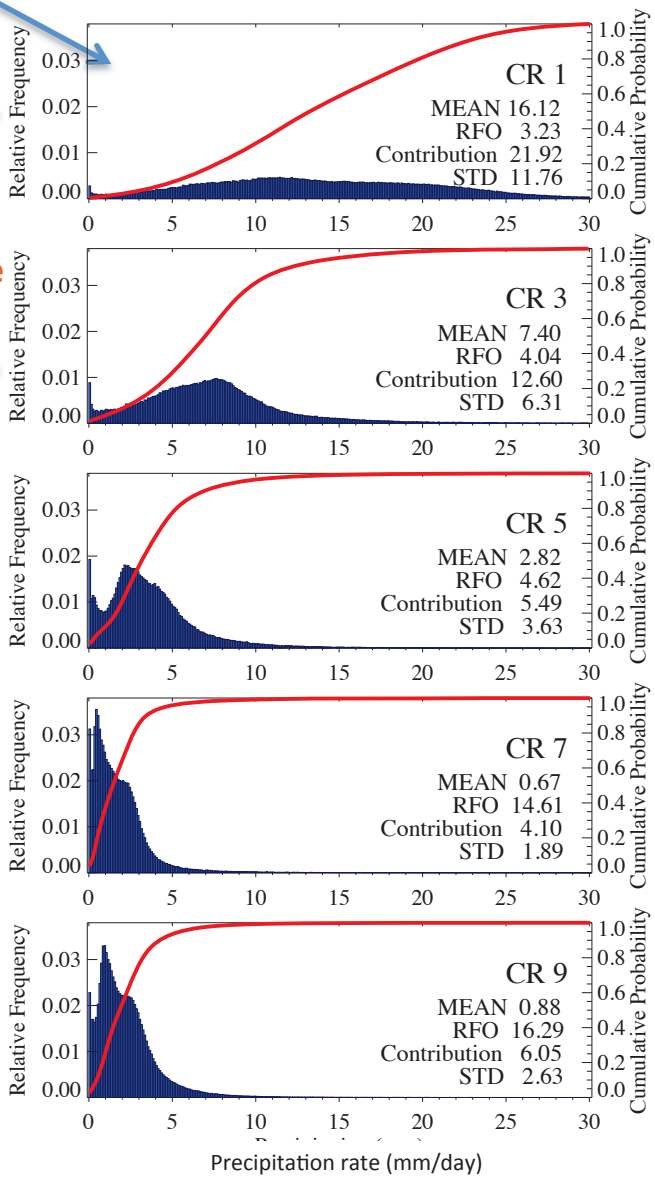
Cooling vs warming CRs

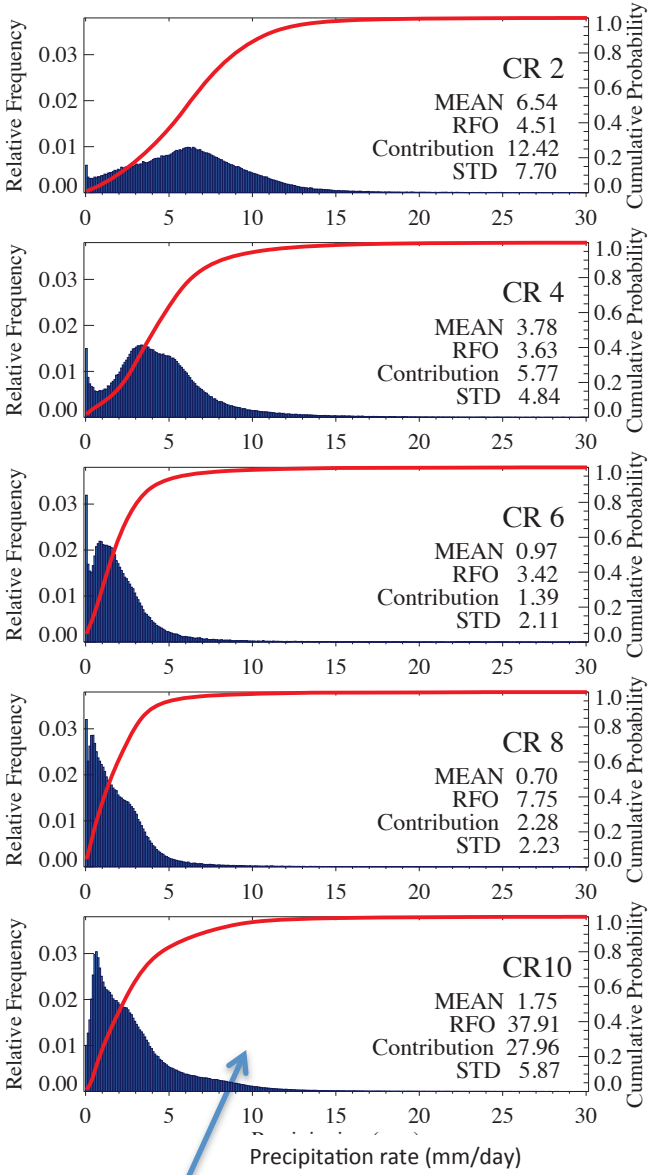


GPCP precipitation

Strongest PR

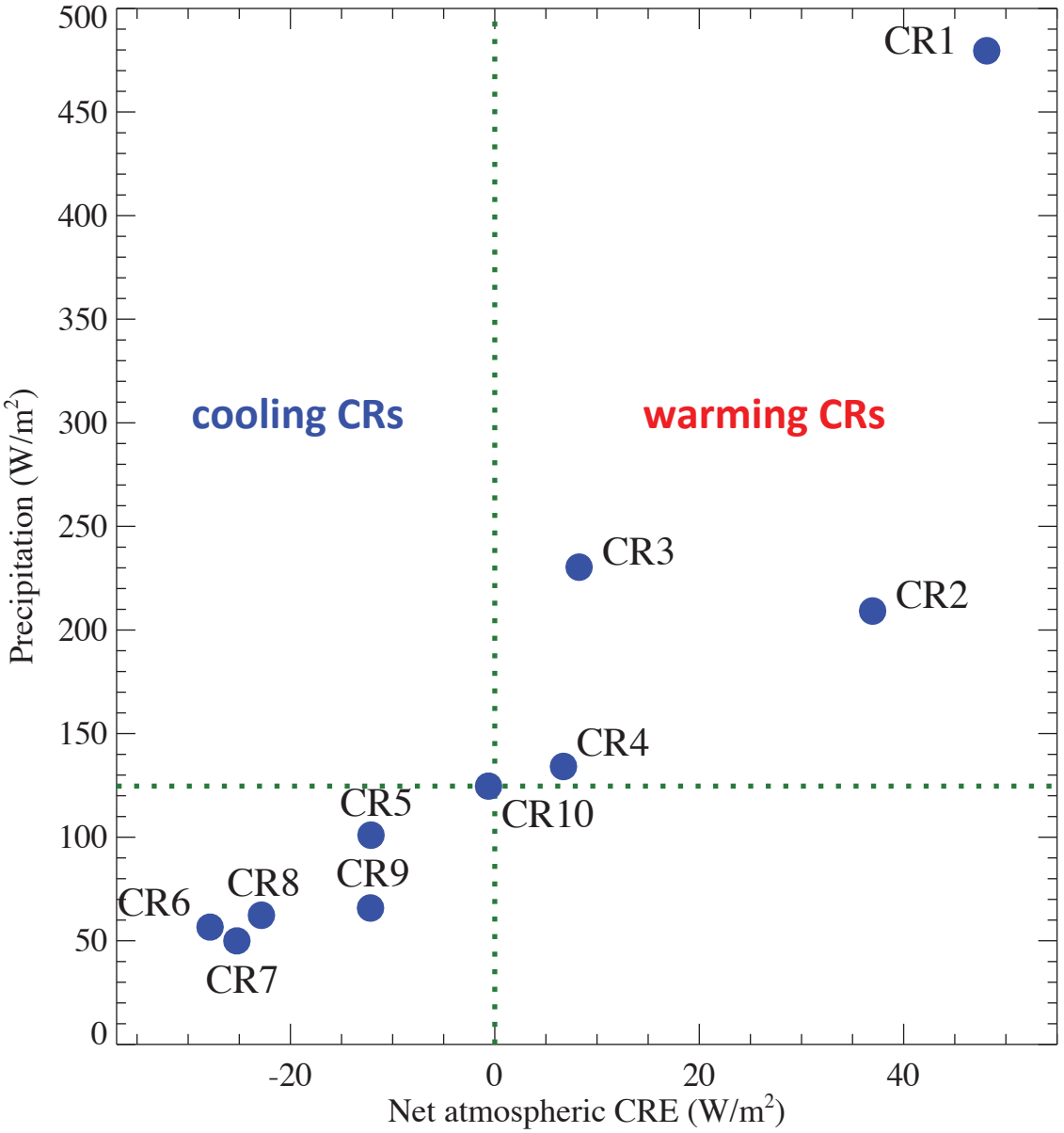
35% of global precip, occur 14% of the time



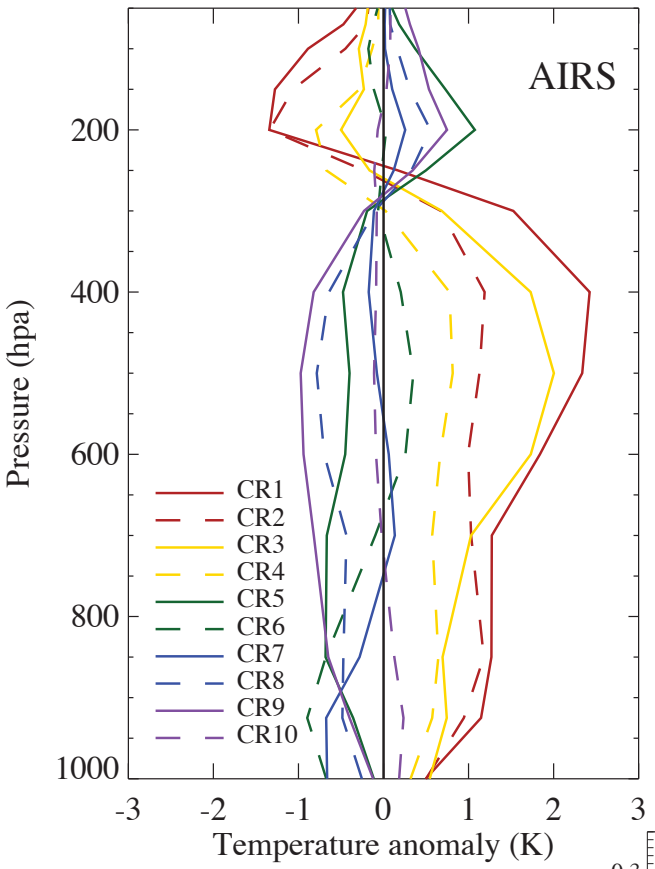


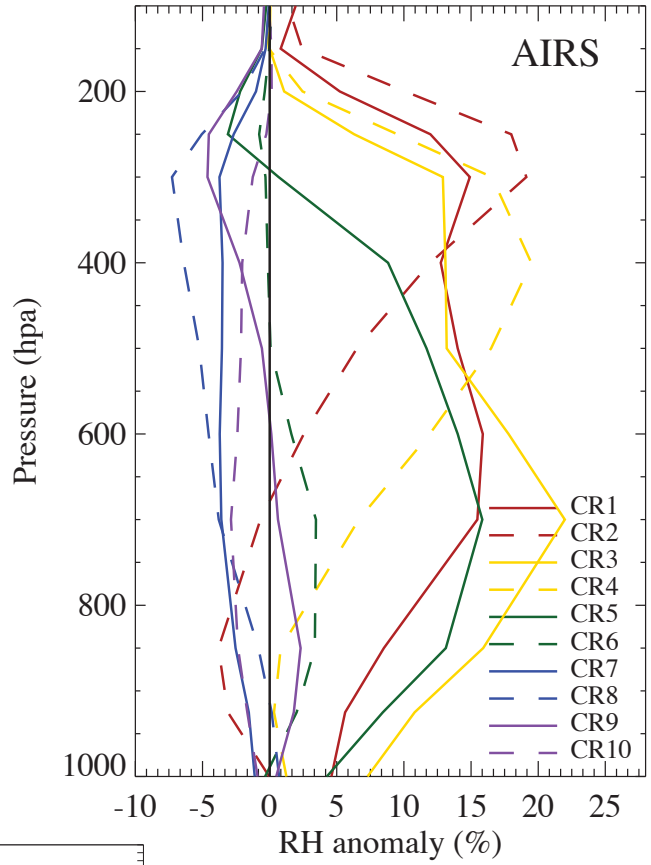
28% contribution because of 31% RFO

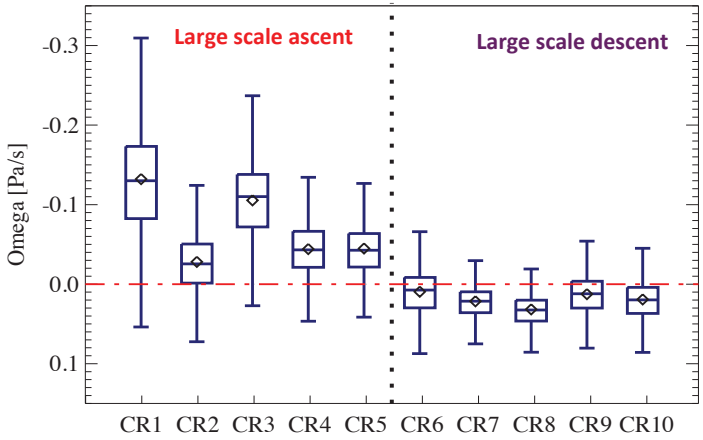
Net atmospheric CRE by CR



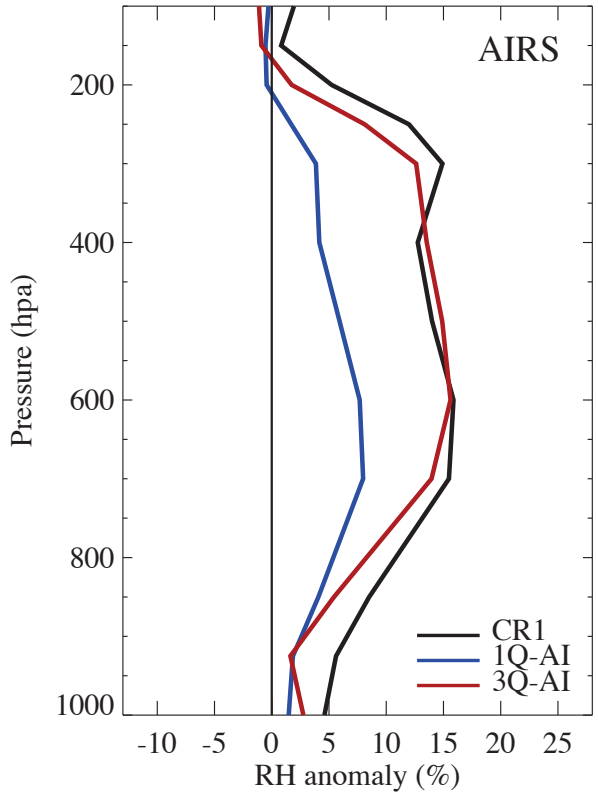
AIRS Temp and RH anomalies show distinct thermodynamic structure of MODIS regimes

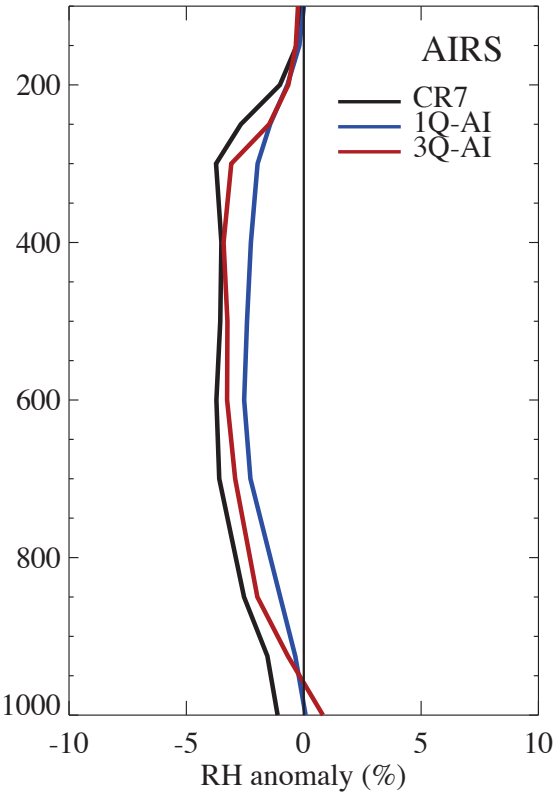


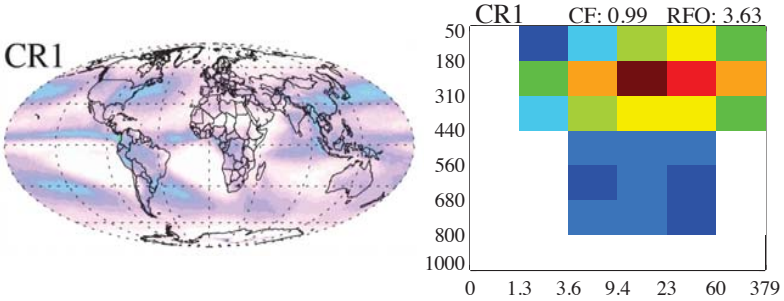


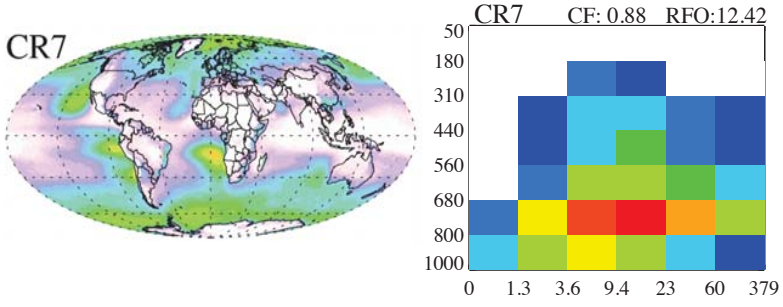


AIRS RH anomalies for untangling aerosol indirect effects

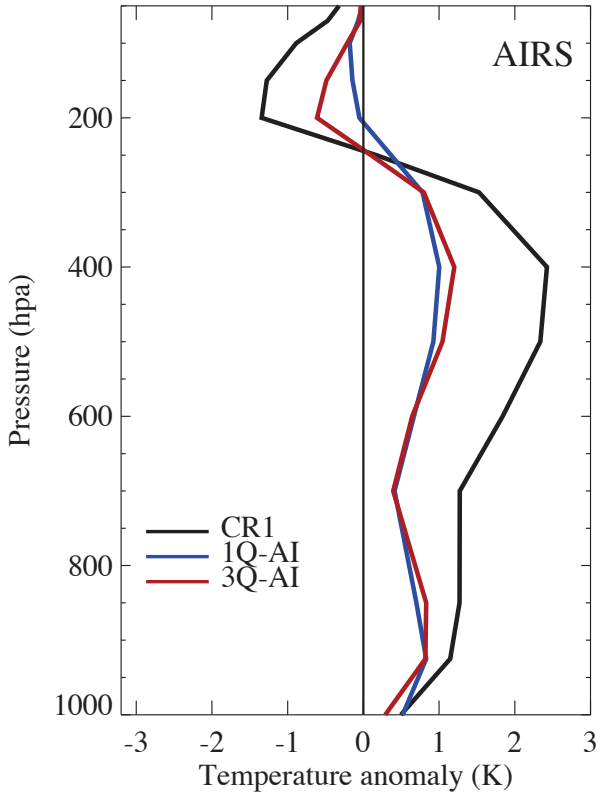


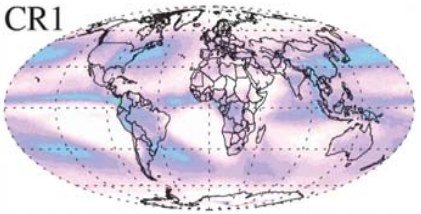


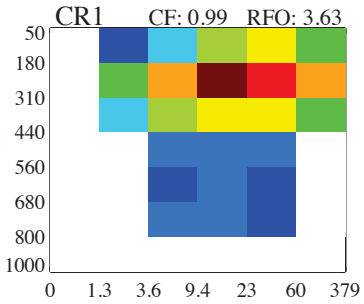


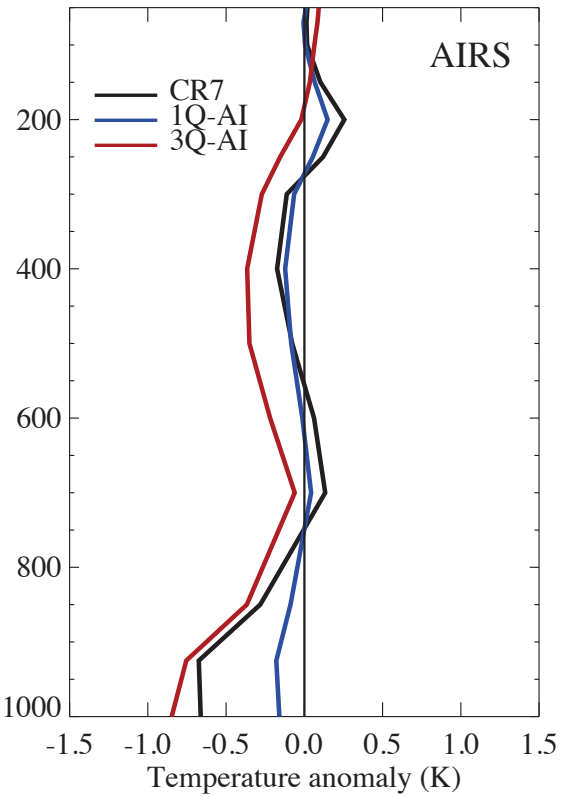


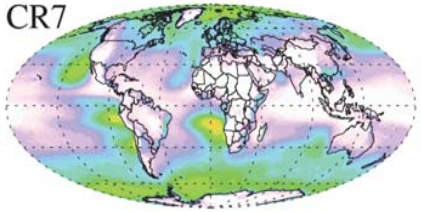
AIRS temp anomalies for untangling aerosol indirect effects

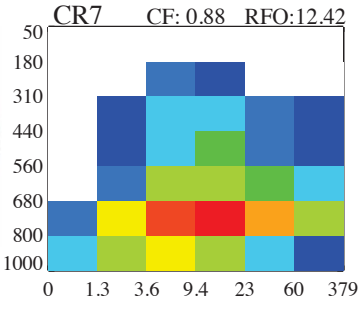




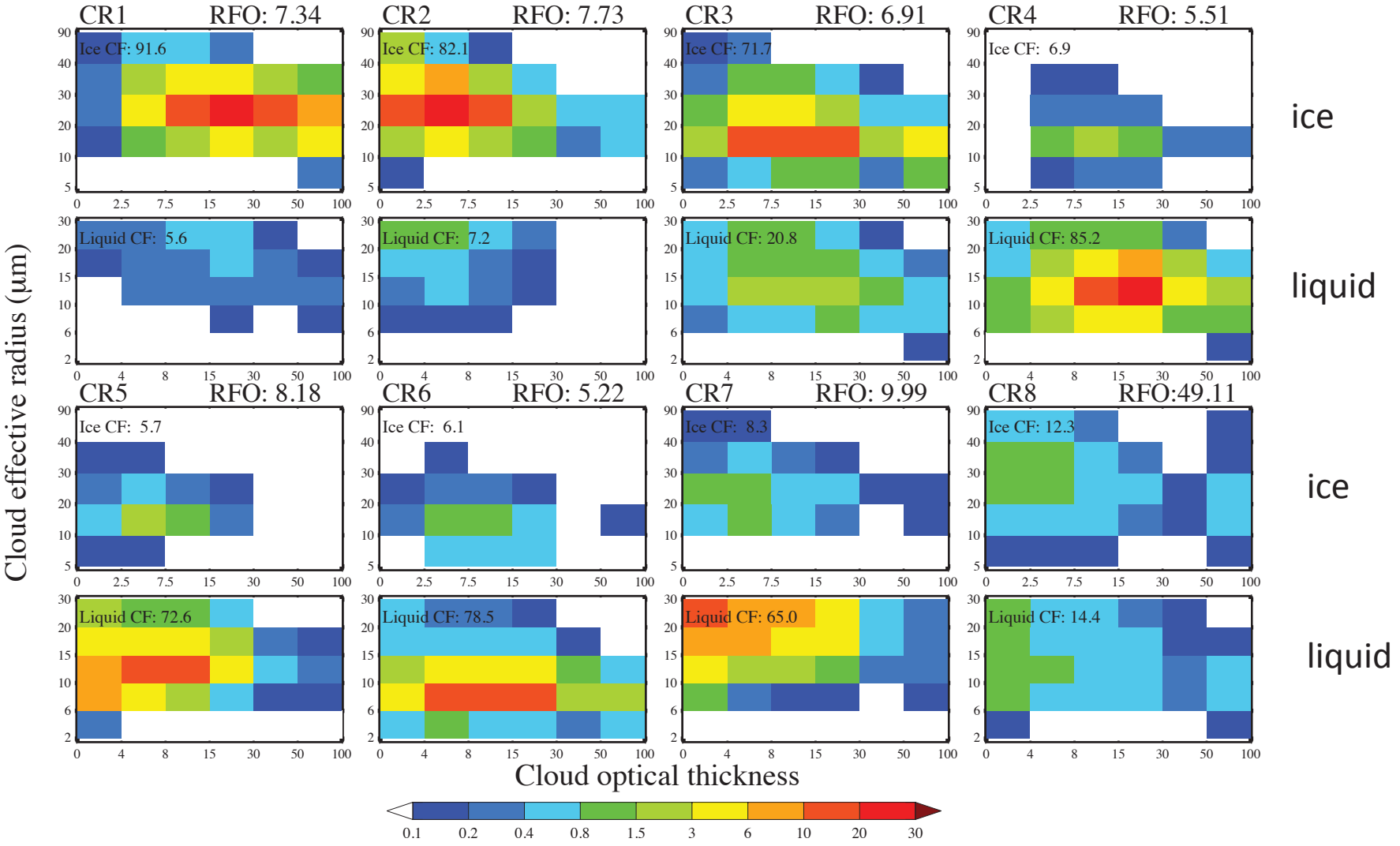




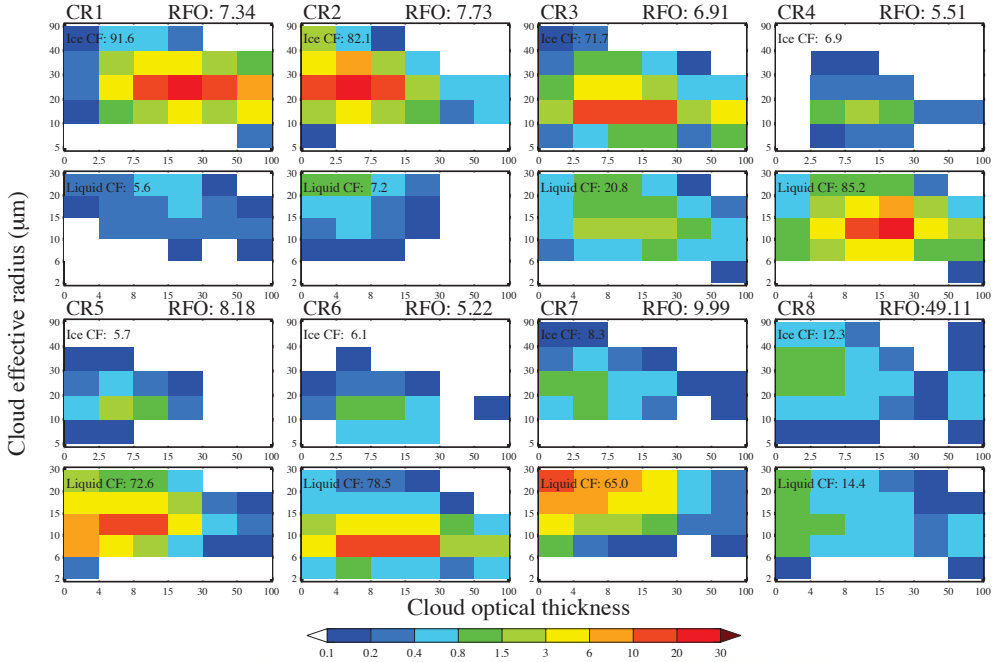


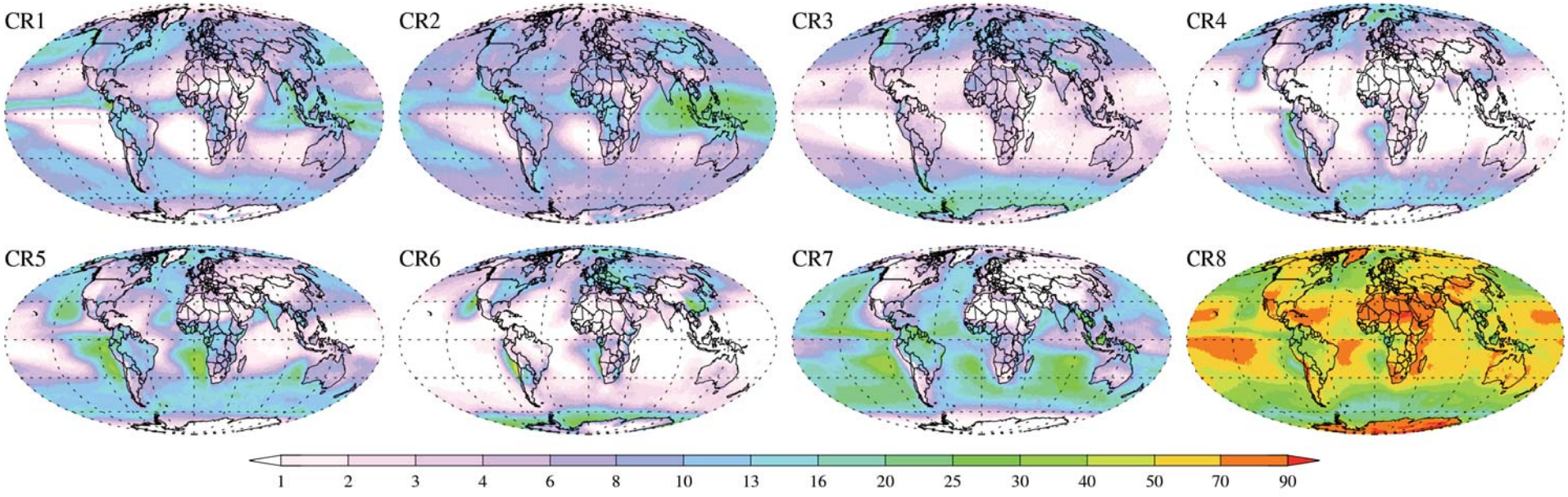


MODIS microphysical regimes (C5.1, prelim)

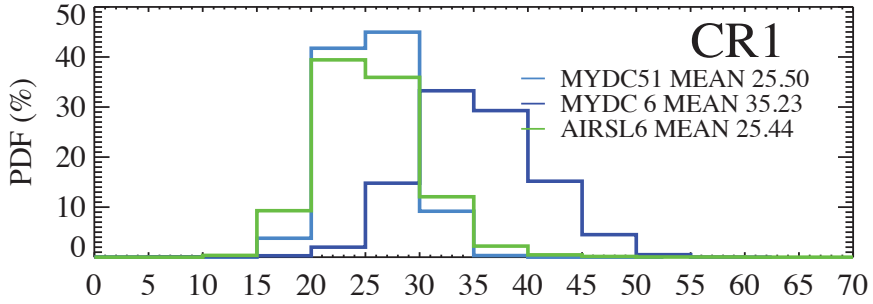


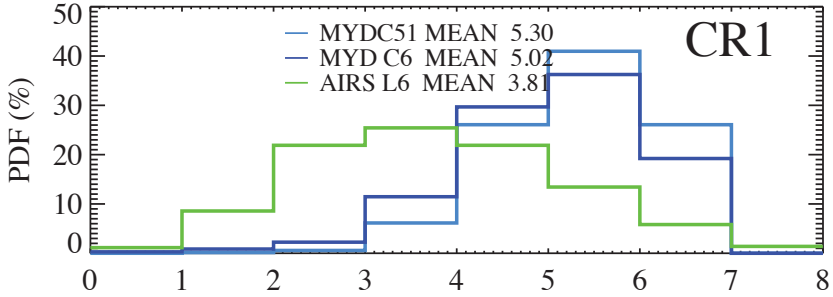
C5.1 MODIS microphysical regimes

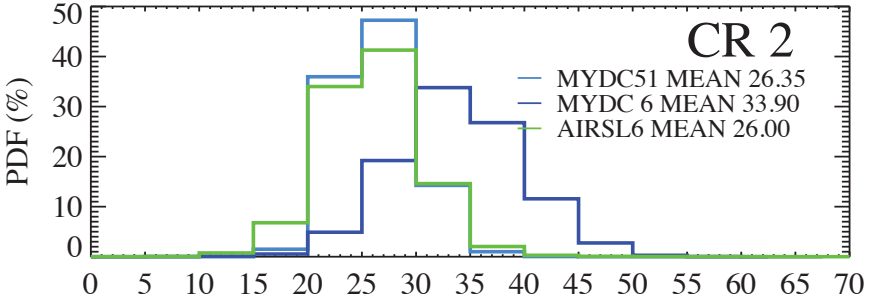


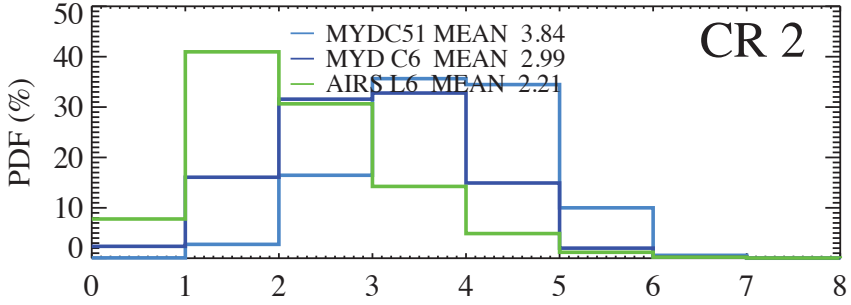


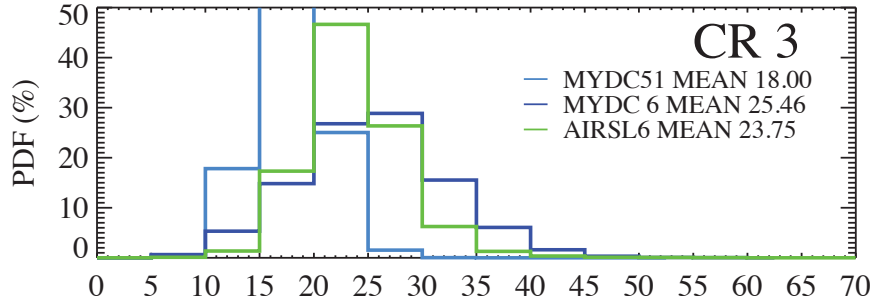
AIRS r_{eff} and COD mapping into C5.1 ice micro regimes

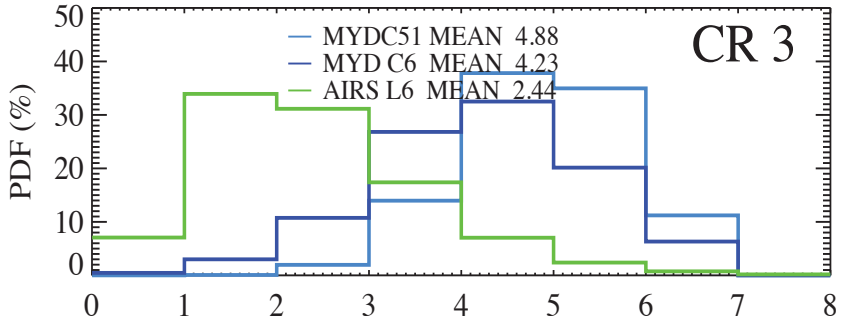












Ice effective radius (µm)

Ice cloud optical depth

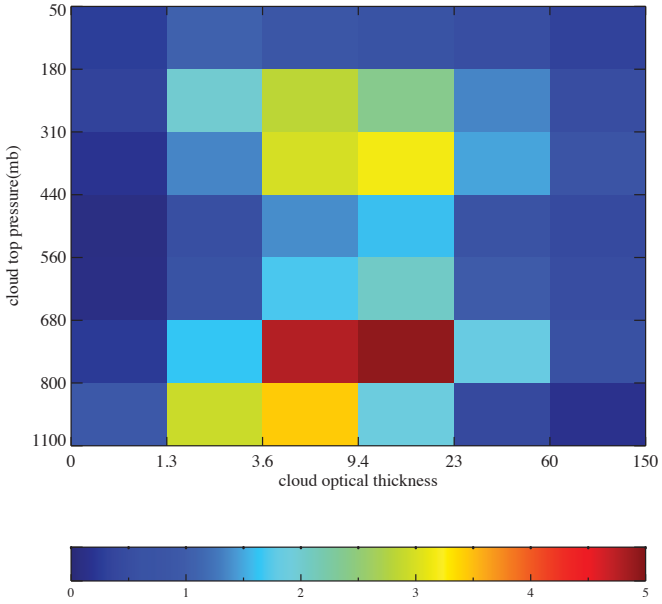
Take home messages

- We have introduced MODIS *global* "dynamical" regimes (CRs) from 10 yrs of obs (this is new; an ISCCP WS dataset also exists)
- The MODIS dynamical CRs have distinct precipitation and CRE characteristics and can be ranked in terms of global contributions
- The regimes can be clearly grouped to those that warm and to those that cool the atmosphere radiatively . The former also produce the largest latent heating.
- There may be also value in a new class of regimes, "microphysical" regimes, particularly for studying aerosol-cloud interactions
- Views from AIRS (and A-Train active sensors) are important for understanding the nature of both regime classes, cloud-aerosol interactions, and perhaps also the quality of AIRS cloud retrievals

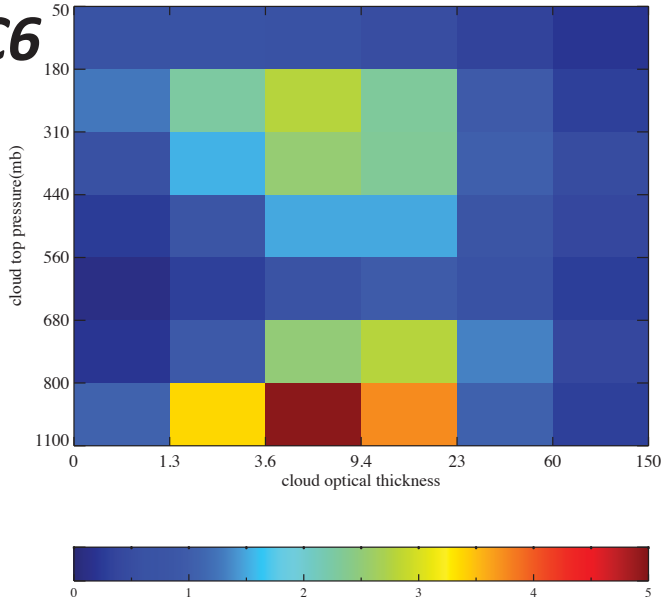
Additional slides

Aqua only

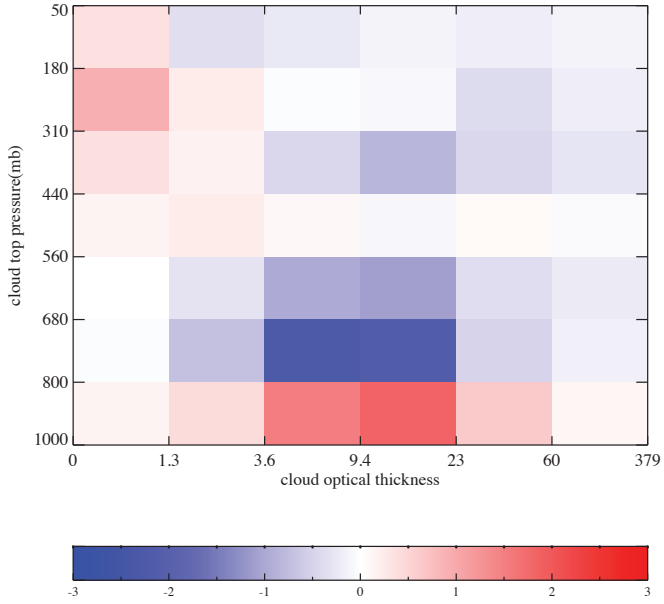
C5.1



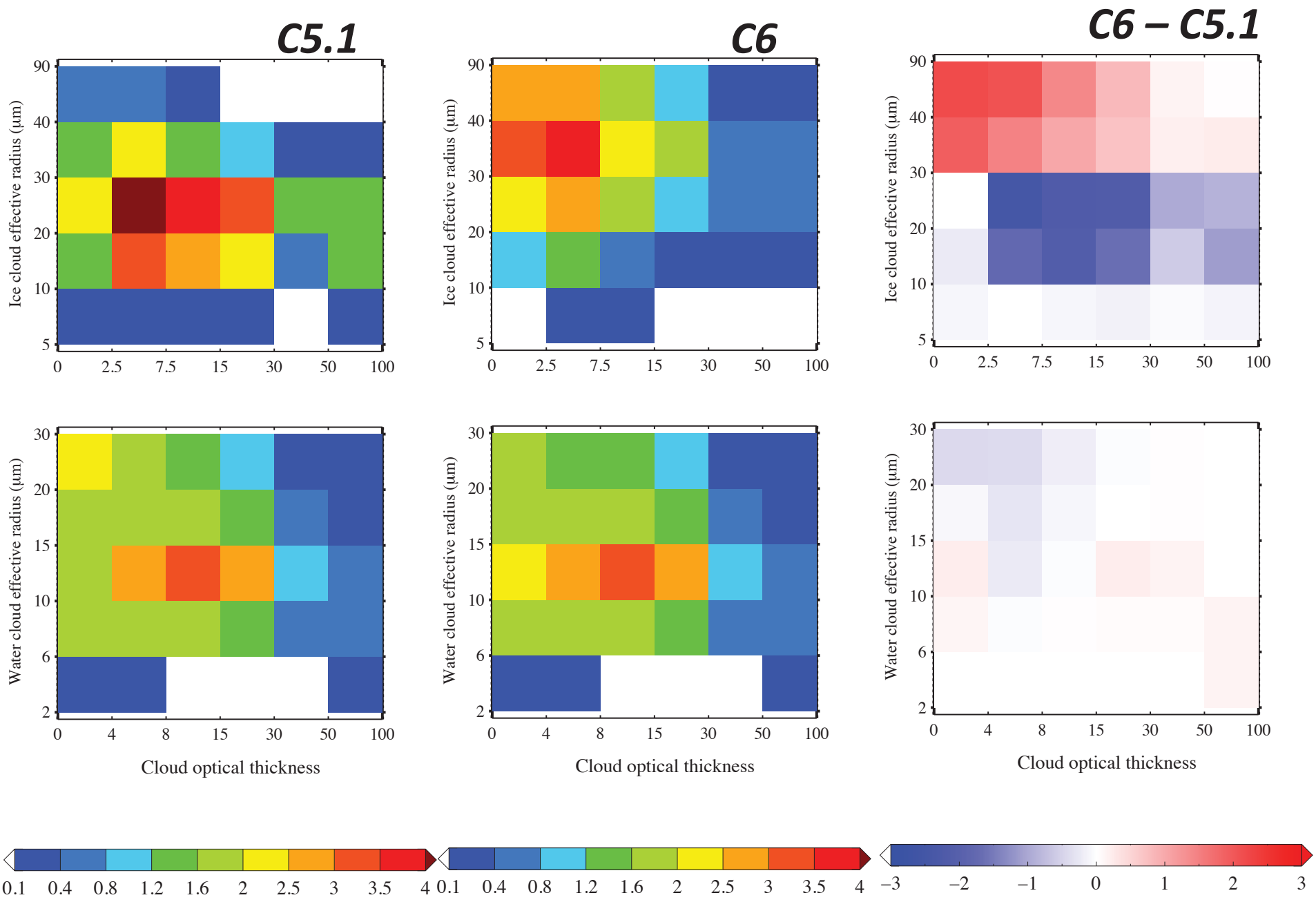
C6



C6 – C5.1

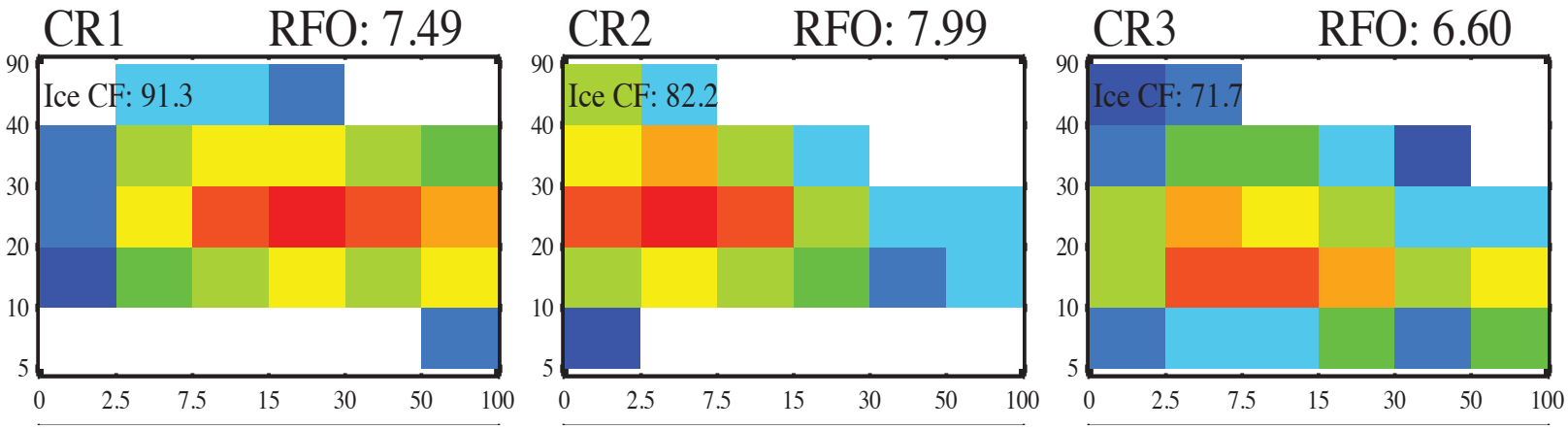


Ice regimes will change with Collection 6

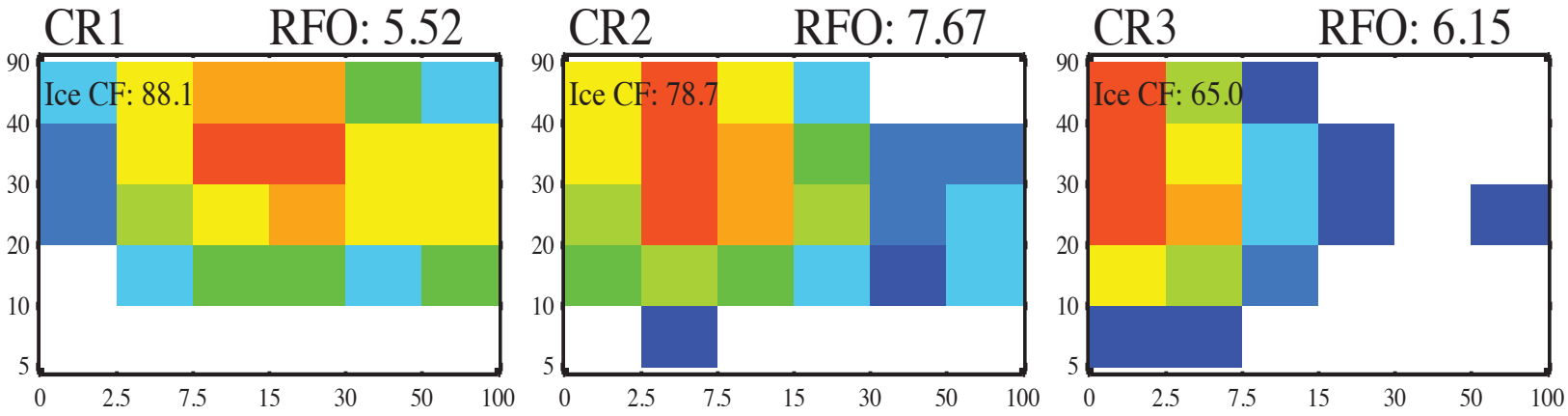


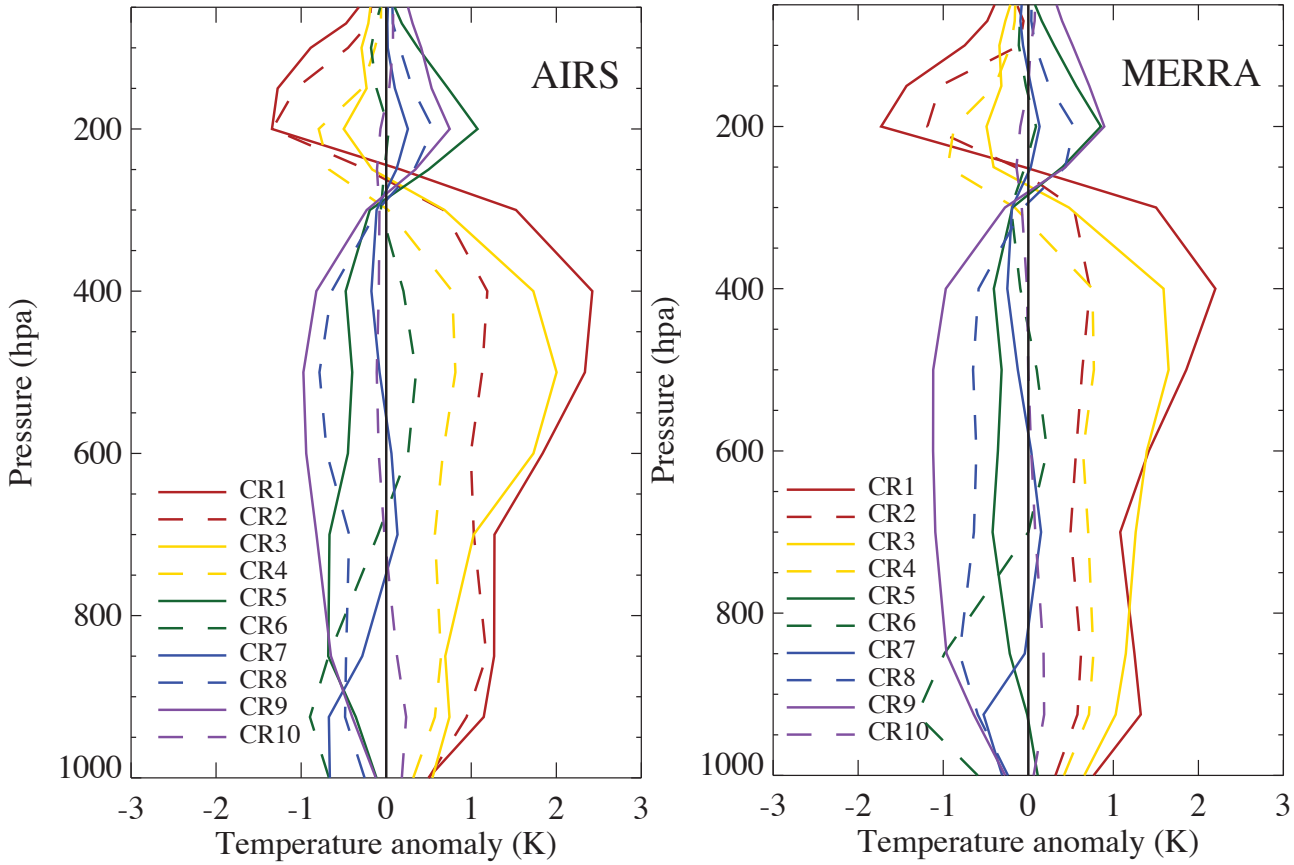
Ice microphysical regimes sensitive to Collection

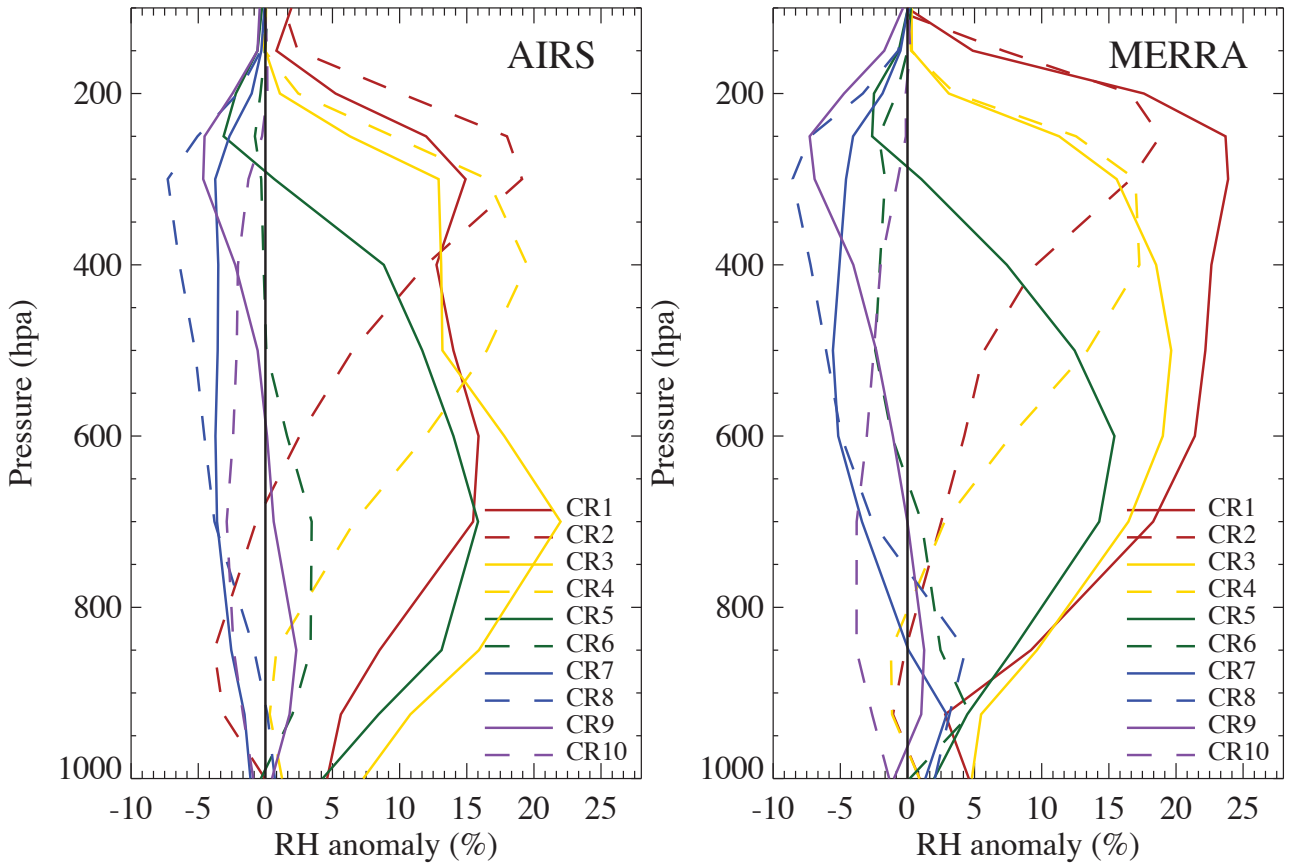
C5.1



C6




AIRS
MERRA
Pressure (hpa)
200
400
600
800
1000
-3
-2
-1
0
1
2
3
Temperature anomaly (K)
CR1
CR2
CR3
CR4
CR5
CR6
CR7
CR8
CR9
CR10


AIRS
MERRA
Pressure (hpa)
200
400
600
800
1000
-10
-5
0
5
10
15
20
25
RH anomaly (%)
CR1
CR2
CR3
CR4
CR5
CR6
CR7
CR8
CR9
CR10