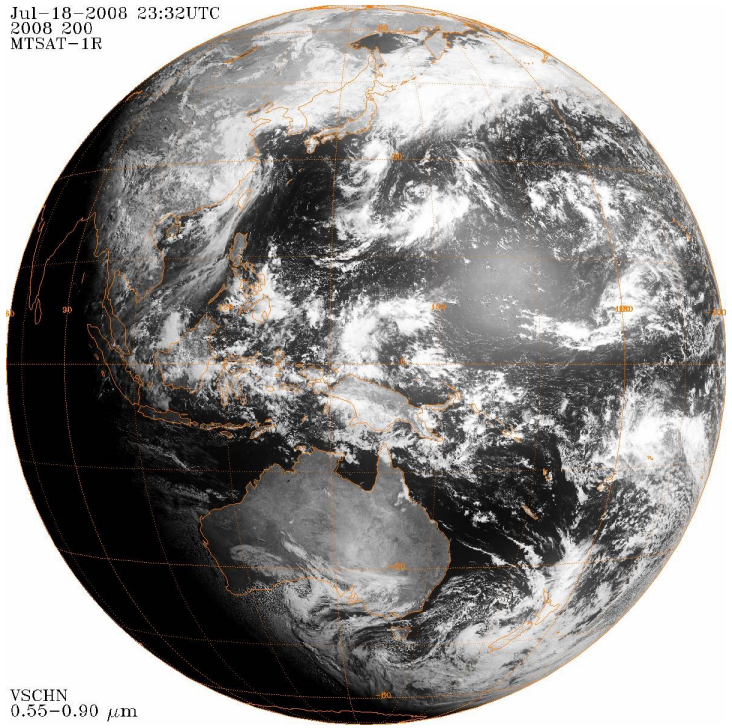
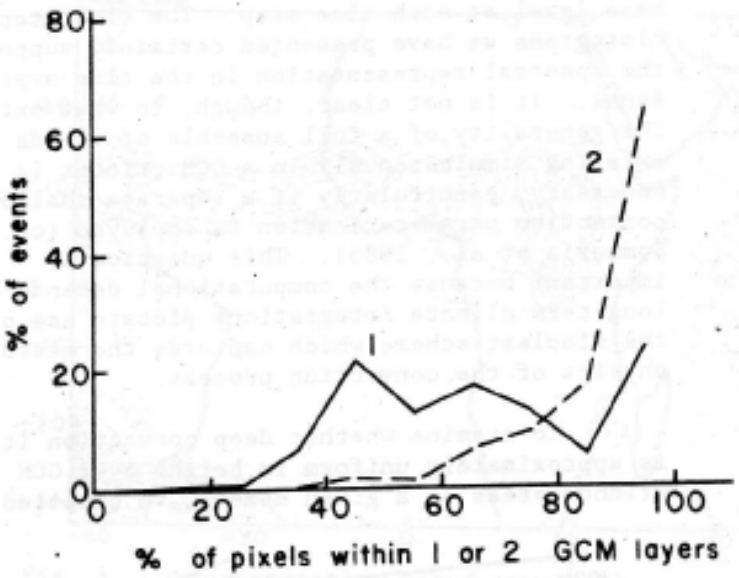
ISCCP: 25 Years of Tropical Convection

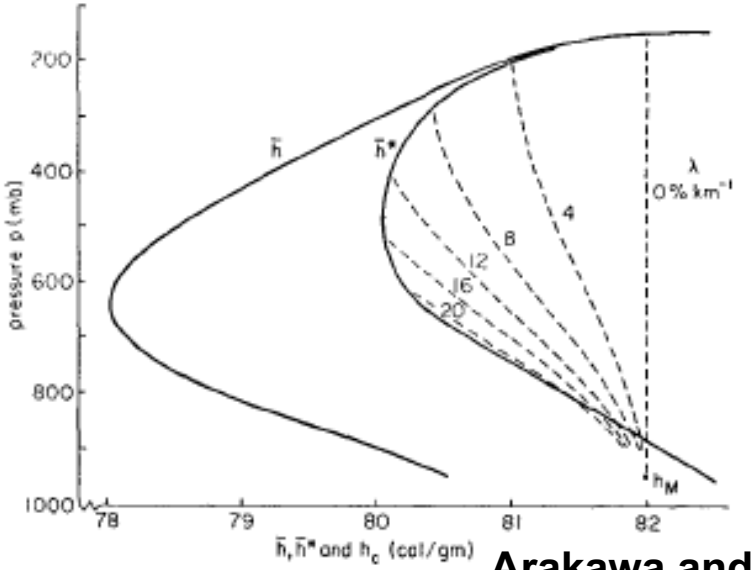


Tony Del Genio
NASA GISS

ISCCP 25th Anniversary Symposium

AMS

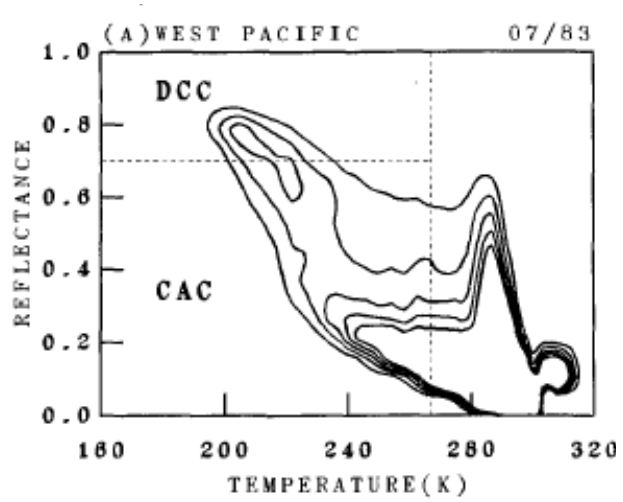


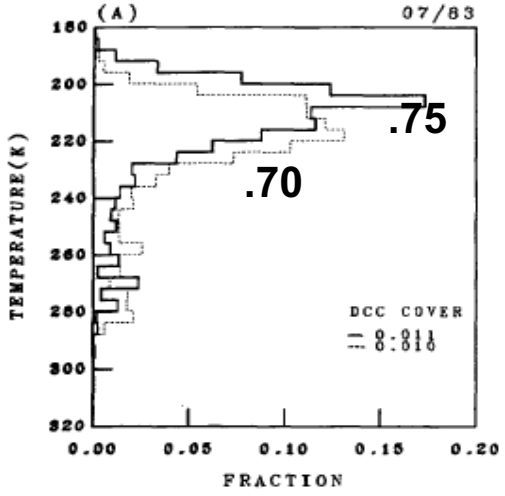


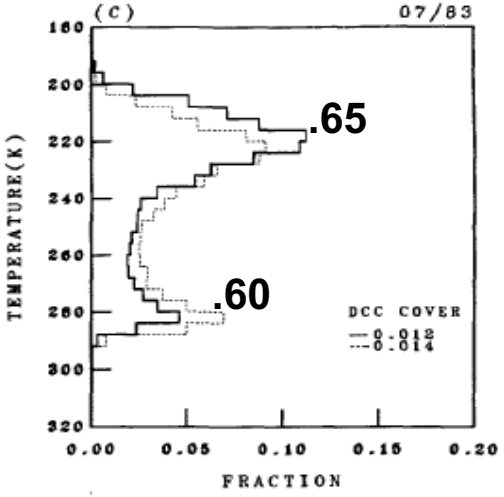
Arakawa and Schubert (1974)

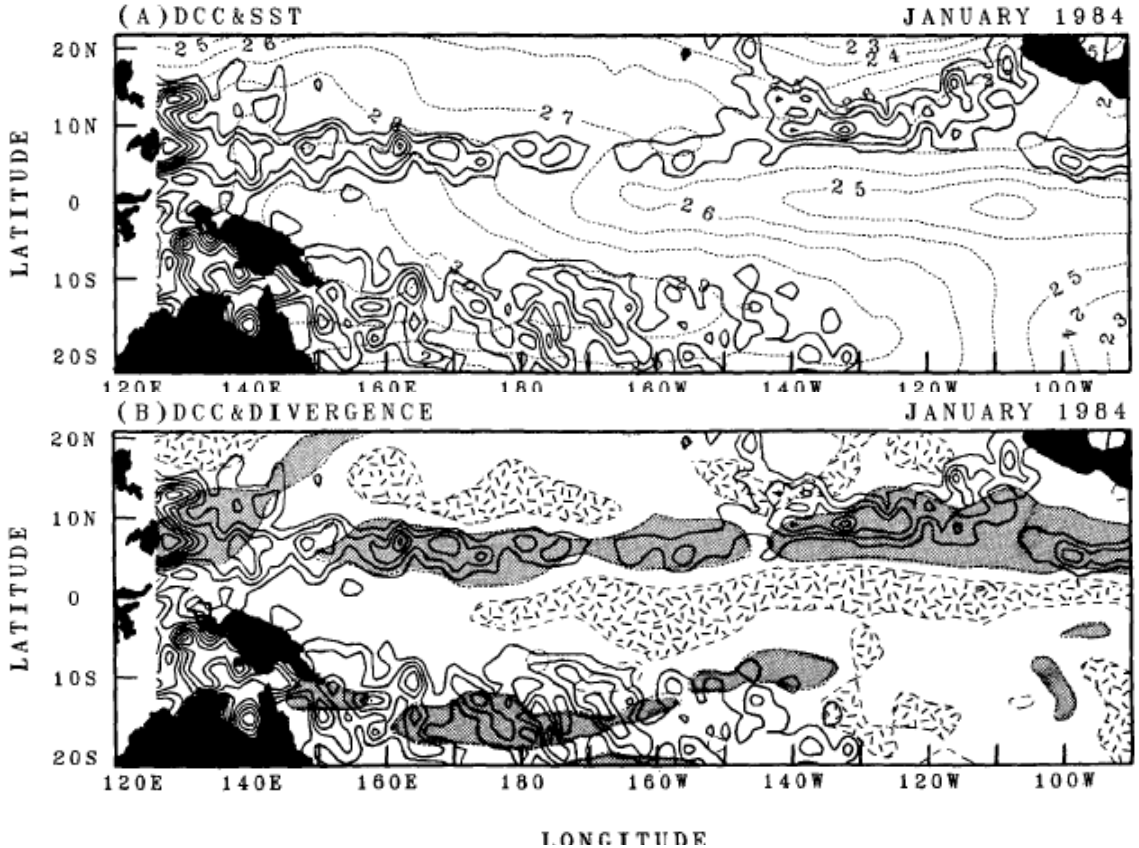
ISCCP Pilot Dataset

(Del Genio and Yao (1987)







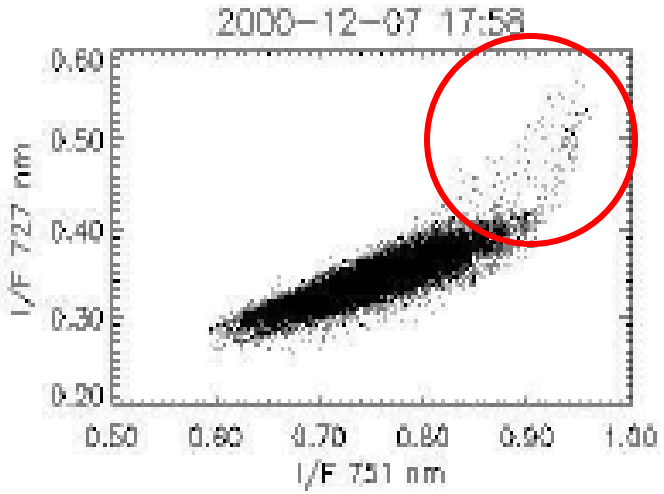


Fu et al. (1990): ISCCP B3 vis-IR deep convective cloud ID

Convection not entirely defined by threshold 27°C SST; regulated by surface convergence

And now for something completely different…

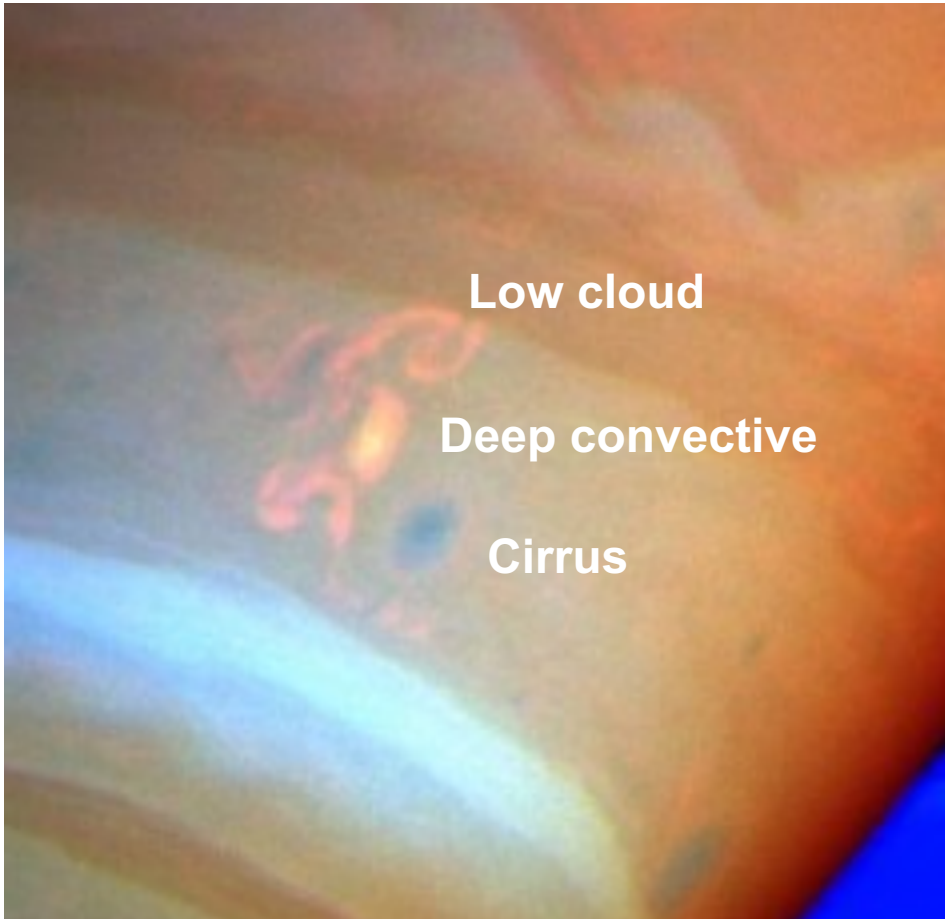
Saturn

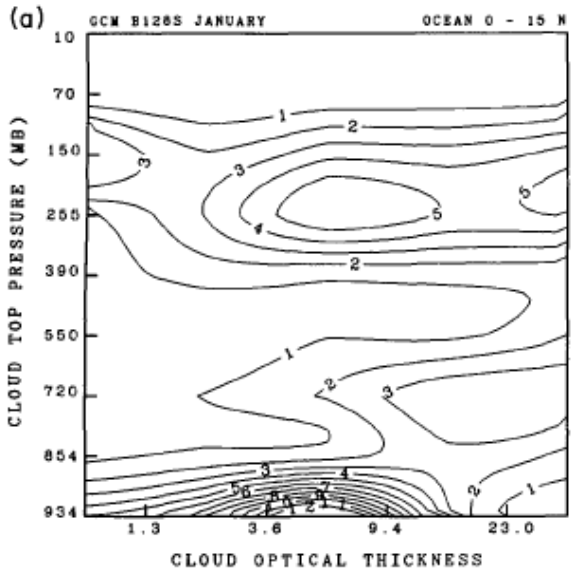


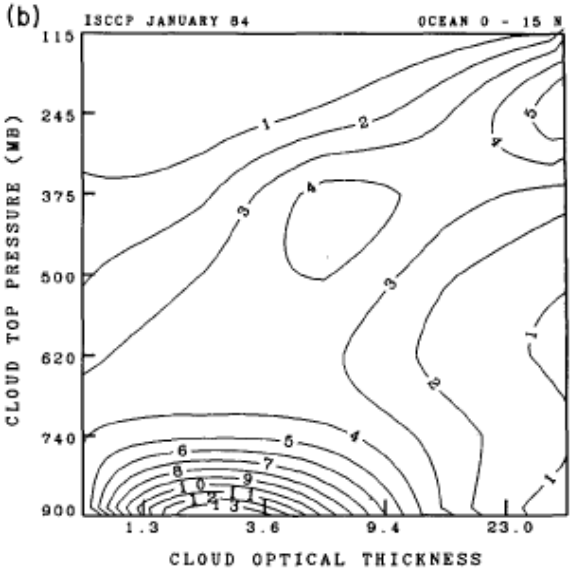
CH_4 band

Continuum

ISCCP-like 2-filter detection of deep convection

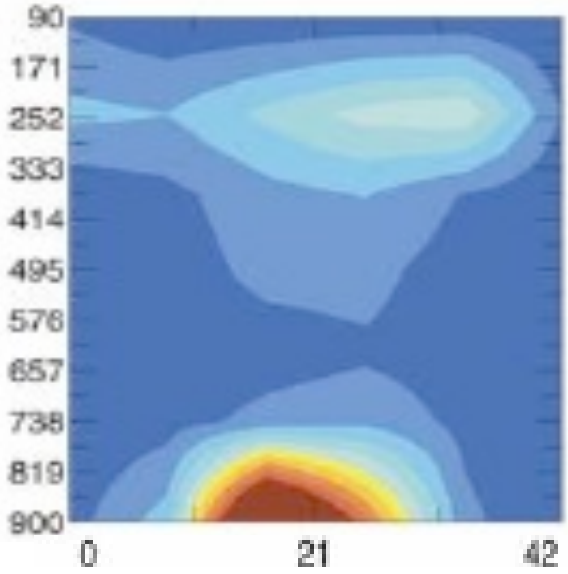


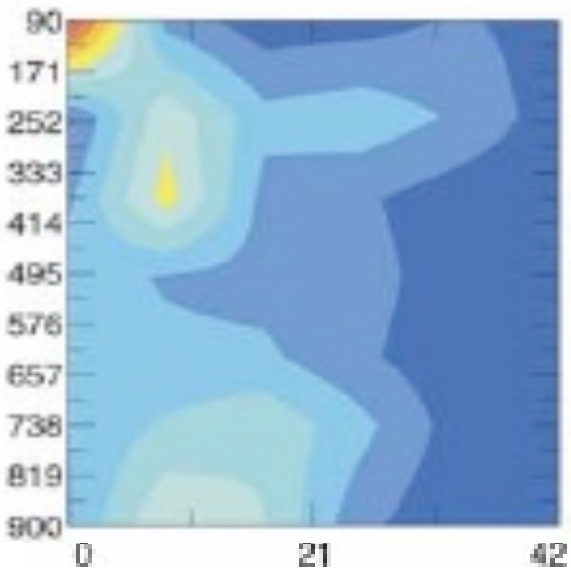




Del Genio et al. (1996): GISS Model II with prognostic cloud water + homemade simulator

vs. ISCCP C1



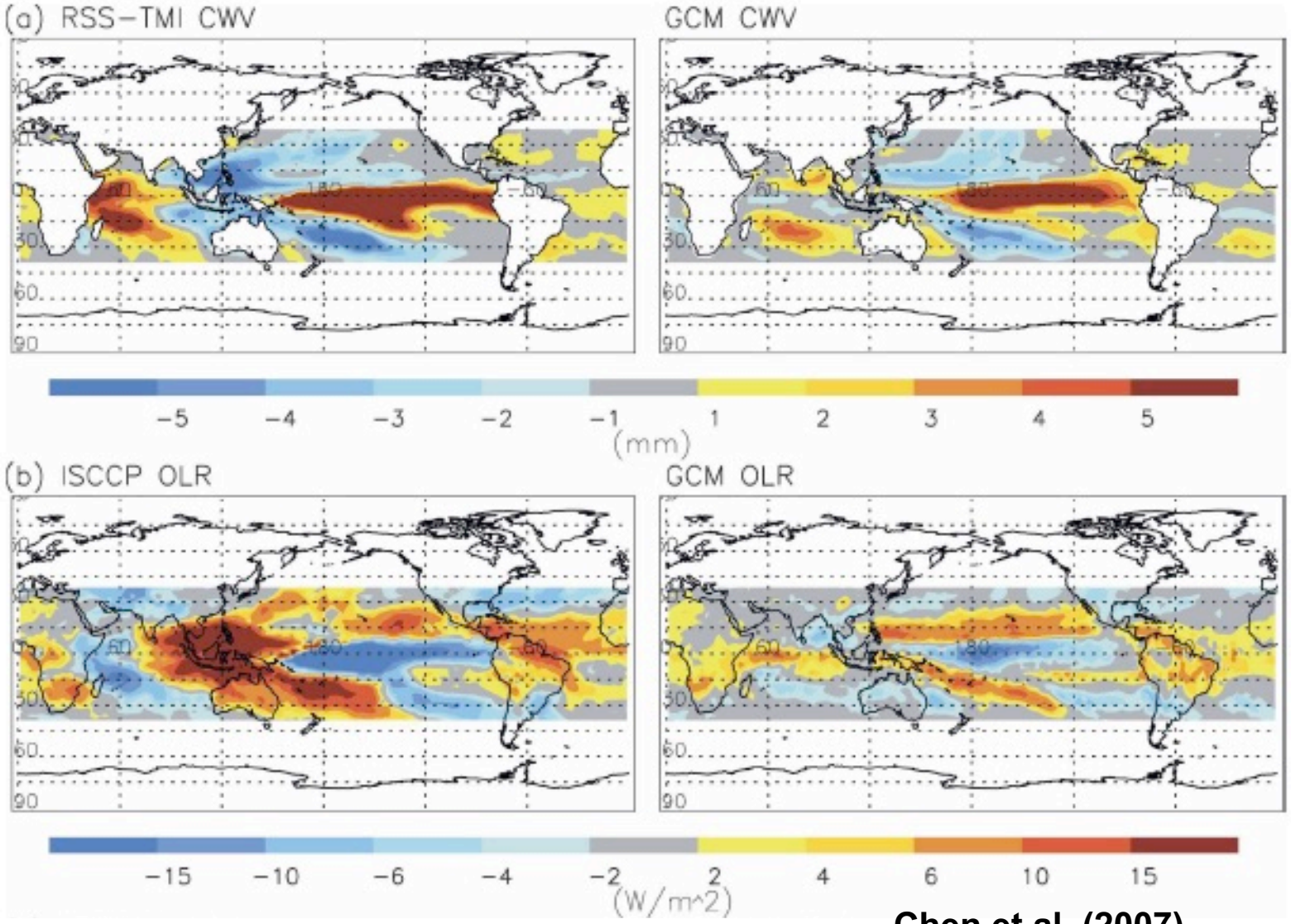


Schmidt et al. (2006): GISS Model E + ISCCP simulator

vs. ISCCP D1

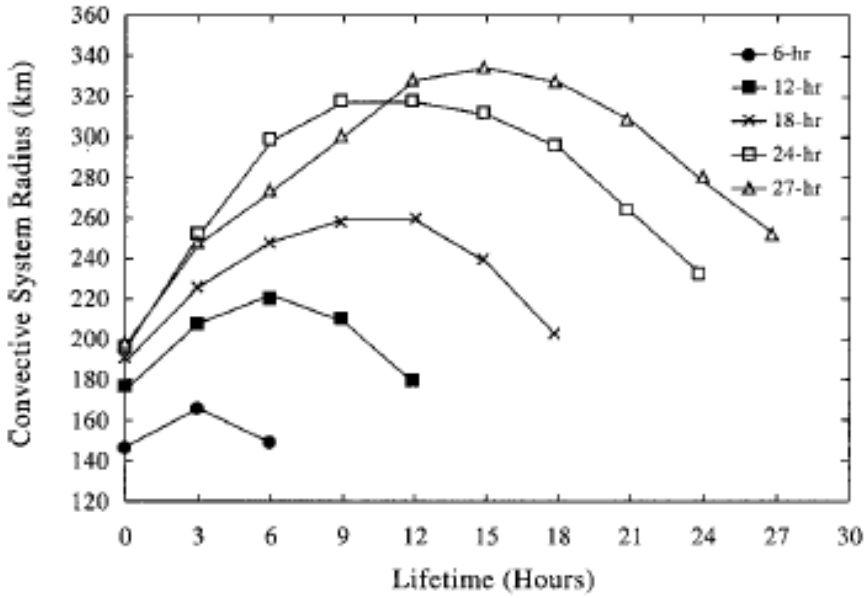
The more things change…

Long-term ISCCP FD flux time series: Climate variability
Many ENSOs, almost up to PDO scale

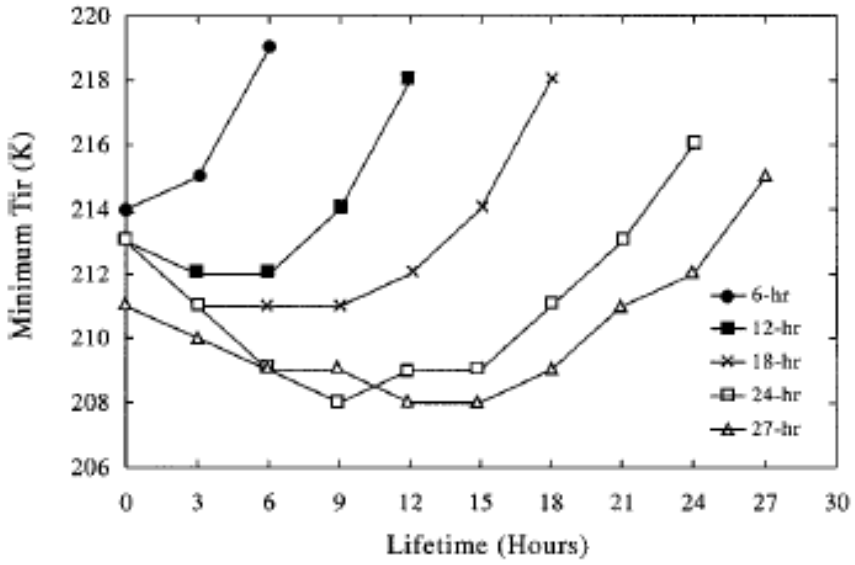


Chen et al. (2007)

(a)



(c)

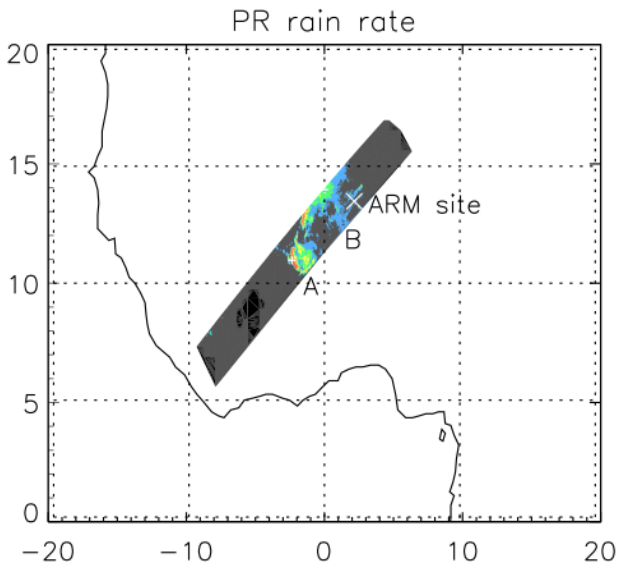


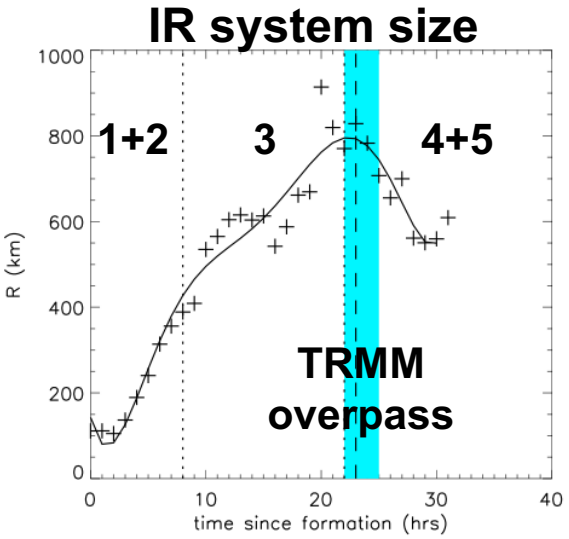
Things you can do only with geostationary data:

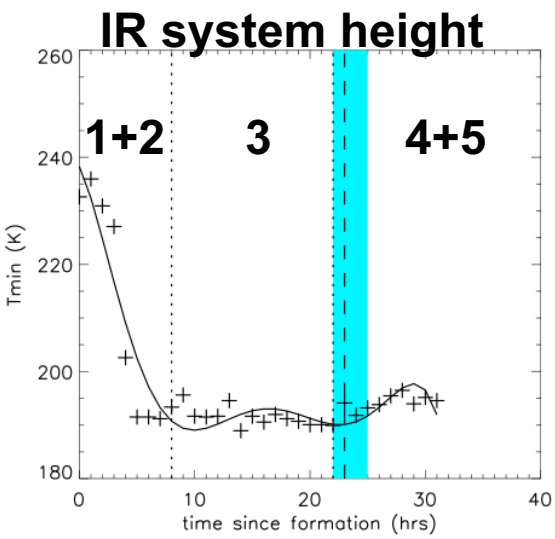
Tropical mesoscale convective system lifecycle statistics using ISCCP B3 data

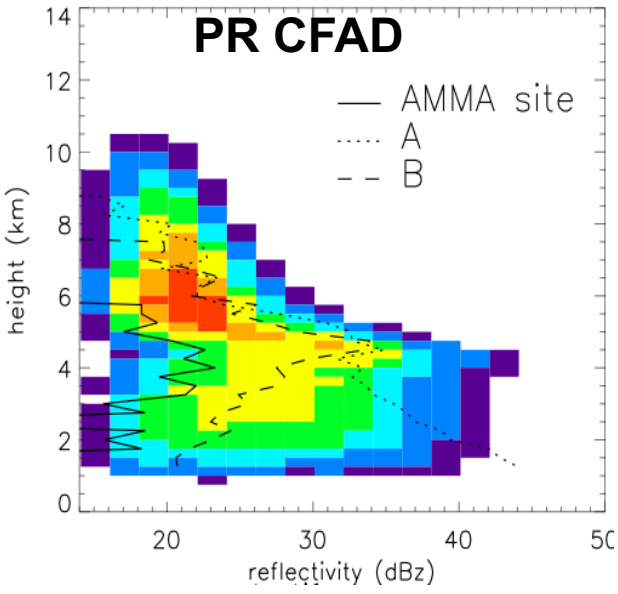
(Machado et al., 1998)

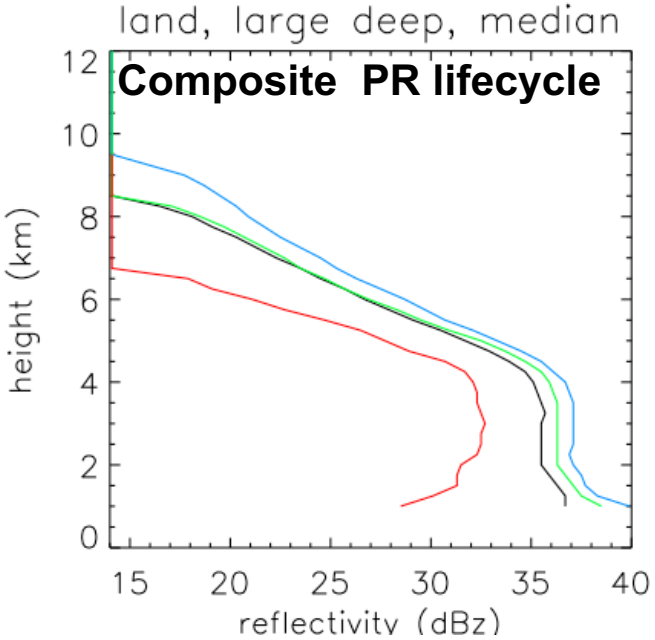
Composite lifecycle information from non-GEO data







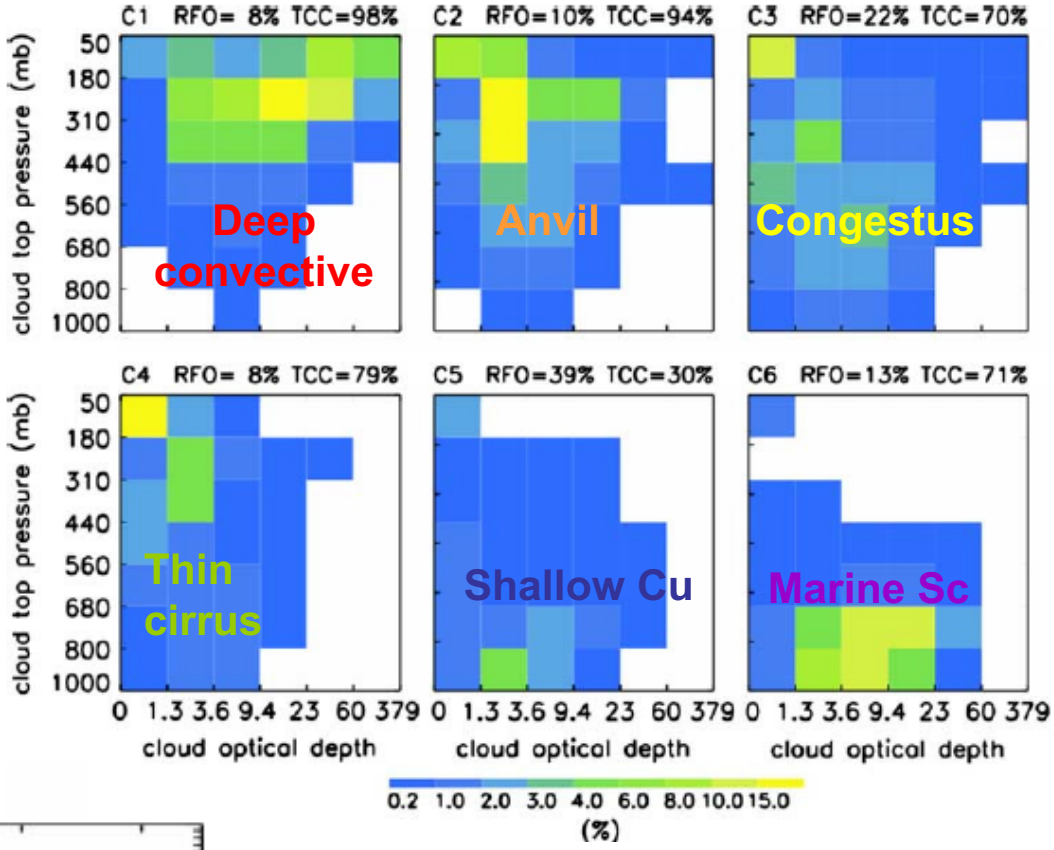


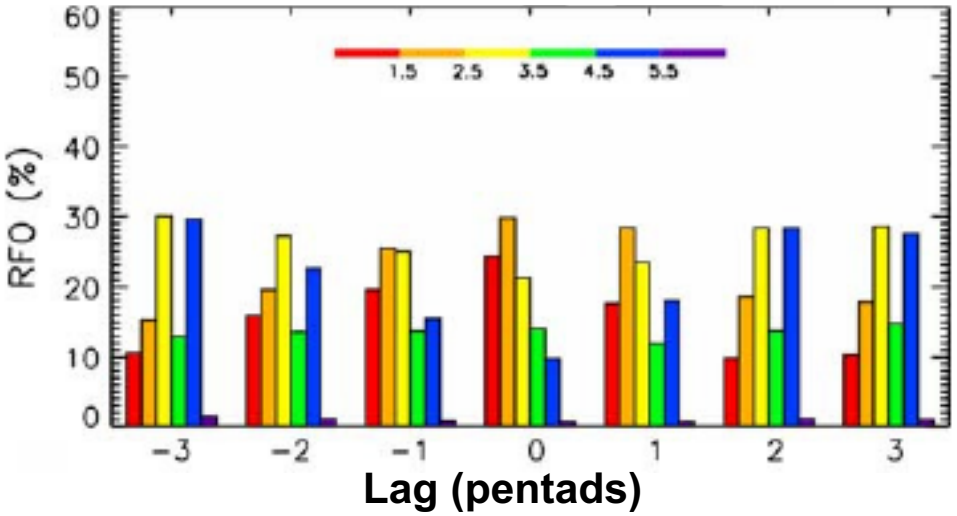


1+2 **Developing**
3 **Mature**
4
5 **Dissipating**

(Futyan and Del Genio, 2007)

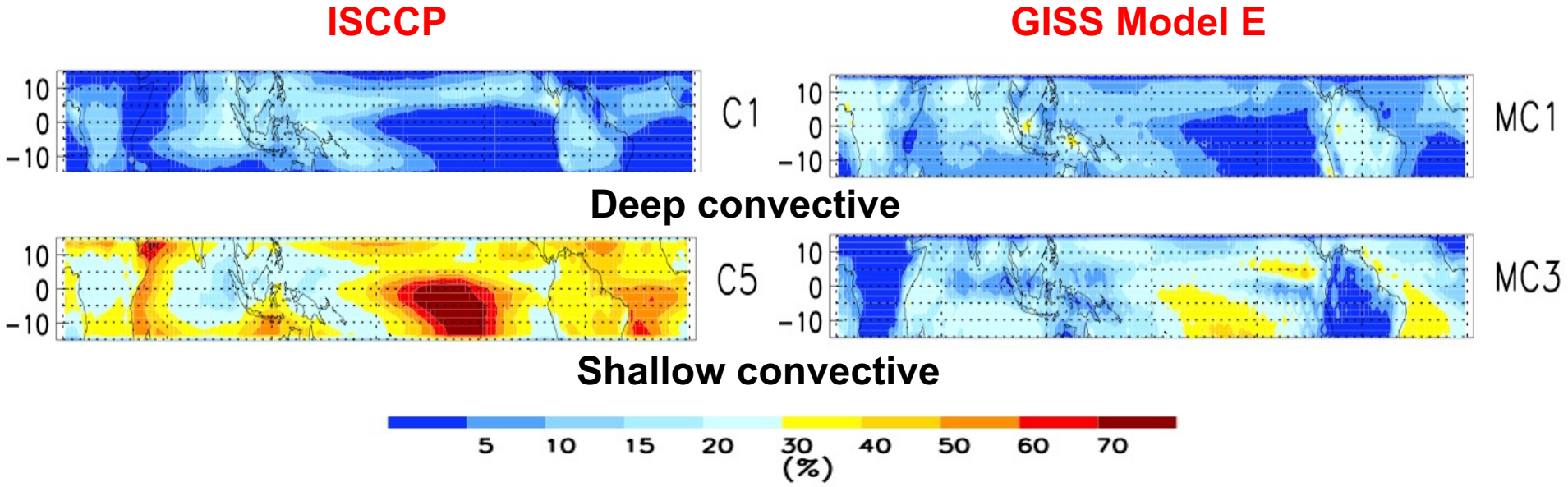
ISCCP "cloud regimes" defined by K-means clustering algorithm for 15°N-15°S (Rossow et al., 2005) applied to optical thickness – cloud top pressure histograms

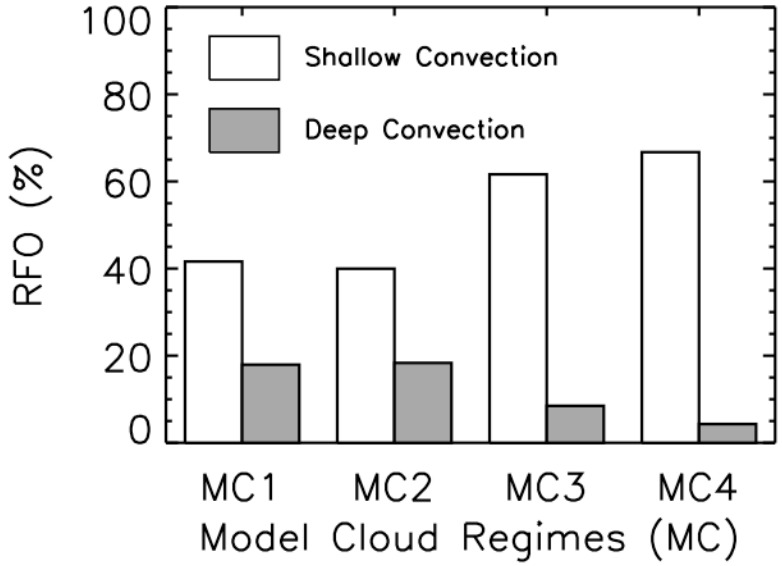




MJO variability of cloud regimes (red = deep convective, orange = anvil, yellow = congestus, green = thin cirrus, blue = shallow Cu, violet = marine Sc)

(Chen and Del Genio, 2008)

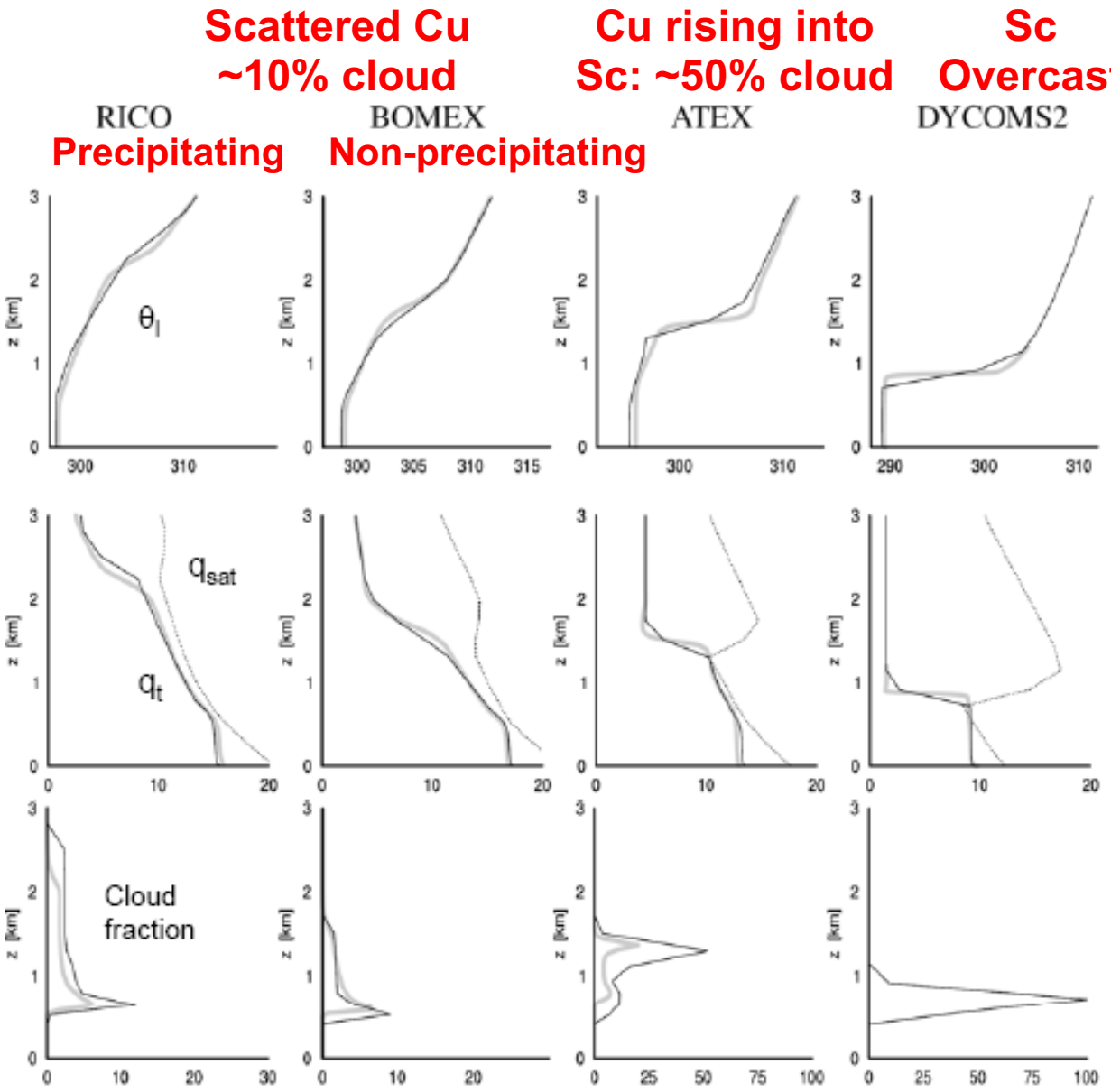




Chen and Del Genio (2008)

GCM has cloud clusters that resemble ISCCP "deep" and "shallow" convective clusters

But actual deep/shallow convection occurrence in GCM is spread across clusters



(Siebesma, 2008)

Ultimately, we should cluster on thermodynamic structure and dynamical characteristics of the atmosphere and see what clouds we get… not clear that reanalyses are up to the task in the tropics yet

Summary

- Many things we now take for granted about the global behavior of convective cloud systems are the result of ISCCP
- Approach to dataset not fully appreciated at the beginning, now a staple of GCM evaluation efforts
- Long time series invaluable for comparisons with other climate parameter records, characterizing climate variability: ENSO, soon PDO?
- Innovative data analysis techniques strengthening the link with dynamics – much more to be done in providing temporal evolution context for non-GEO datasets