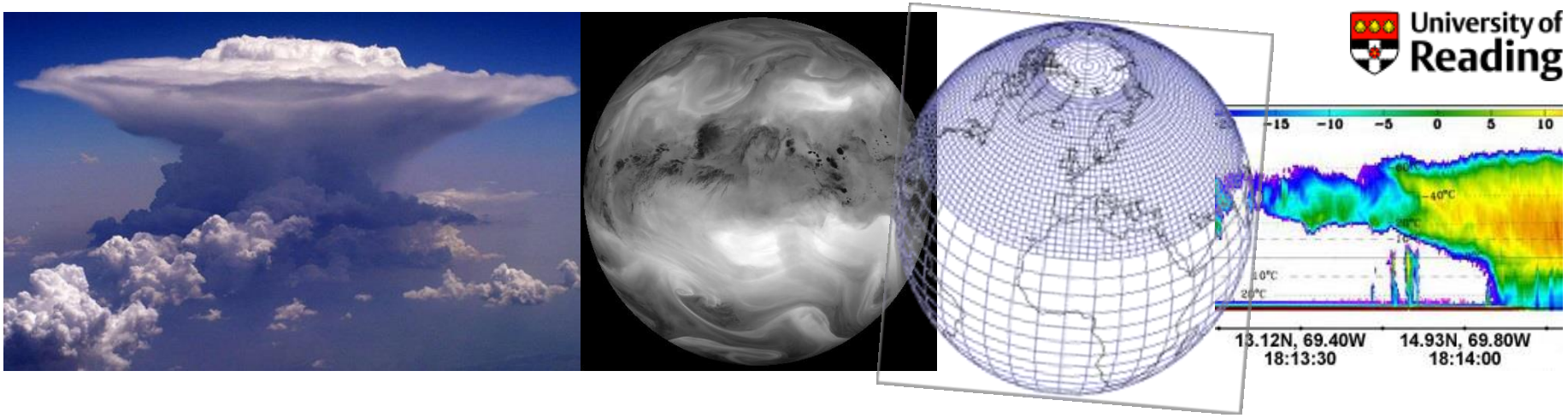

The importance of upper tropospheric water and cloud for climate change

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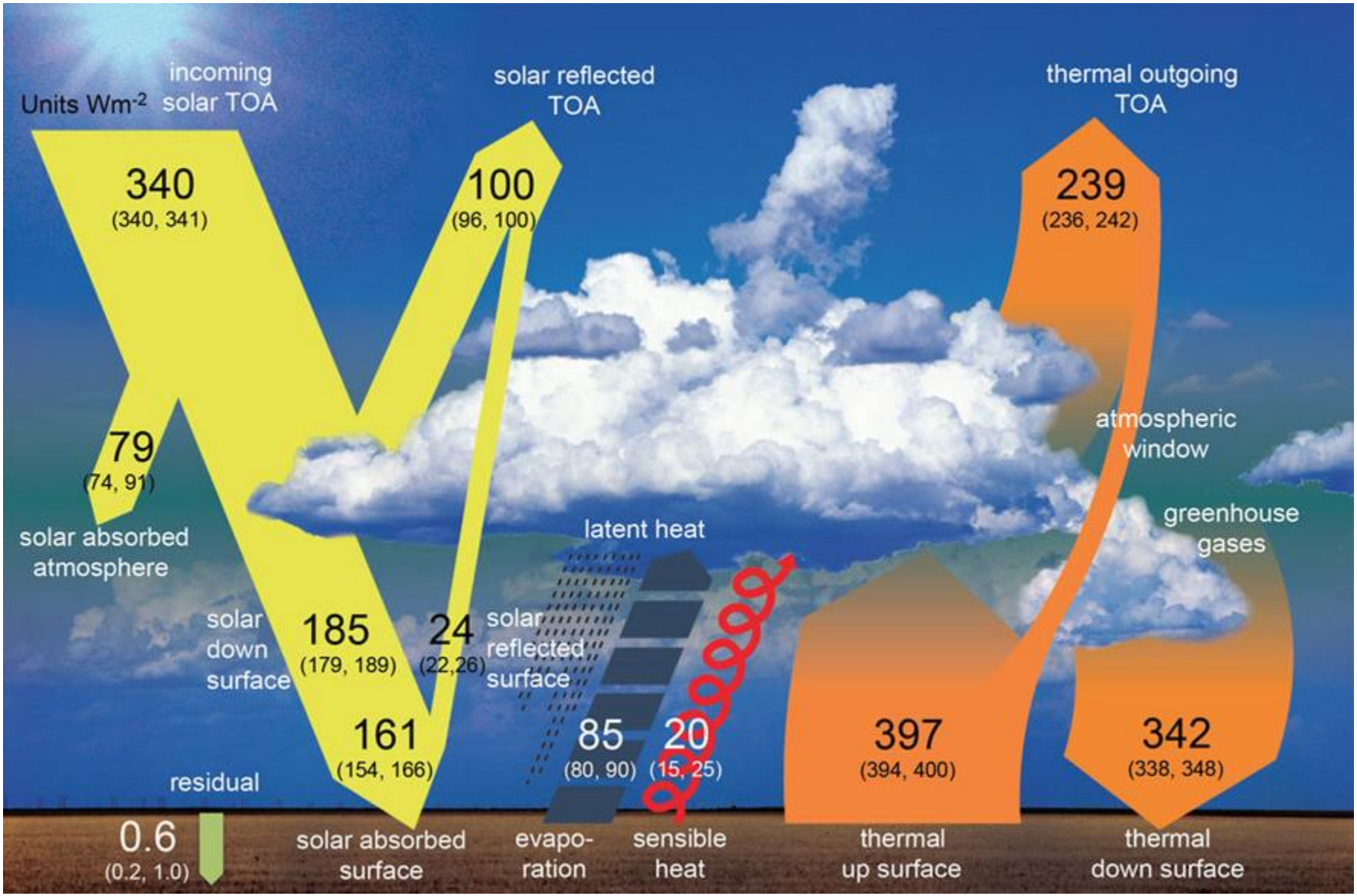
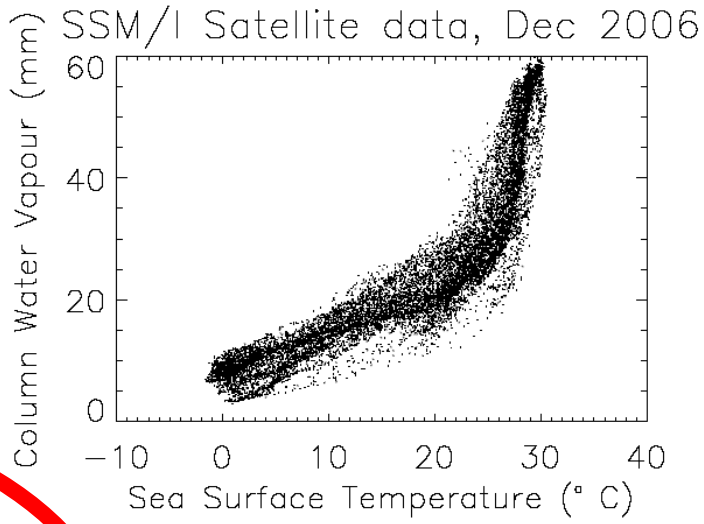
Earth's Global Annual Average Energy Balance



Wild et al. (2012) Clim. Dynamics. See also: Trenberth et al. (2009) BAMS

Water Vapour amplifies climate change

But what about cloud?



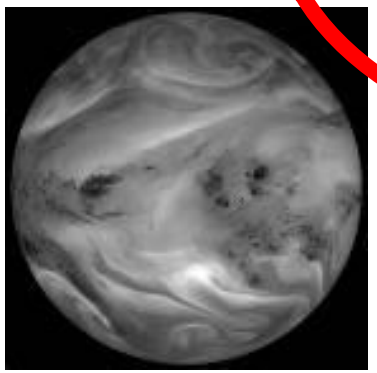
↑ CO_2

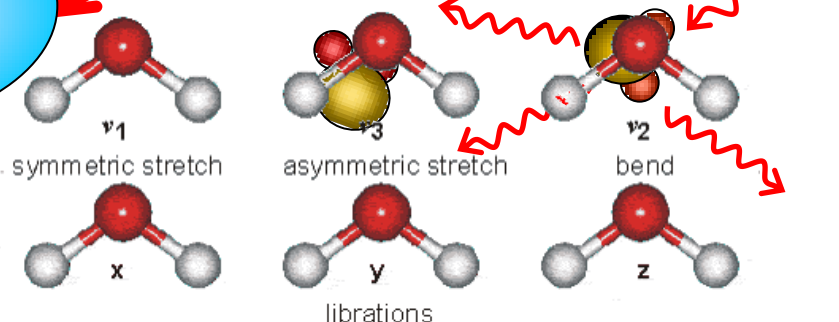
↑ Water vapour

↑ Temperature

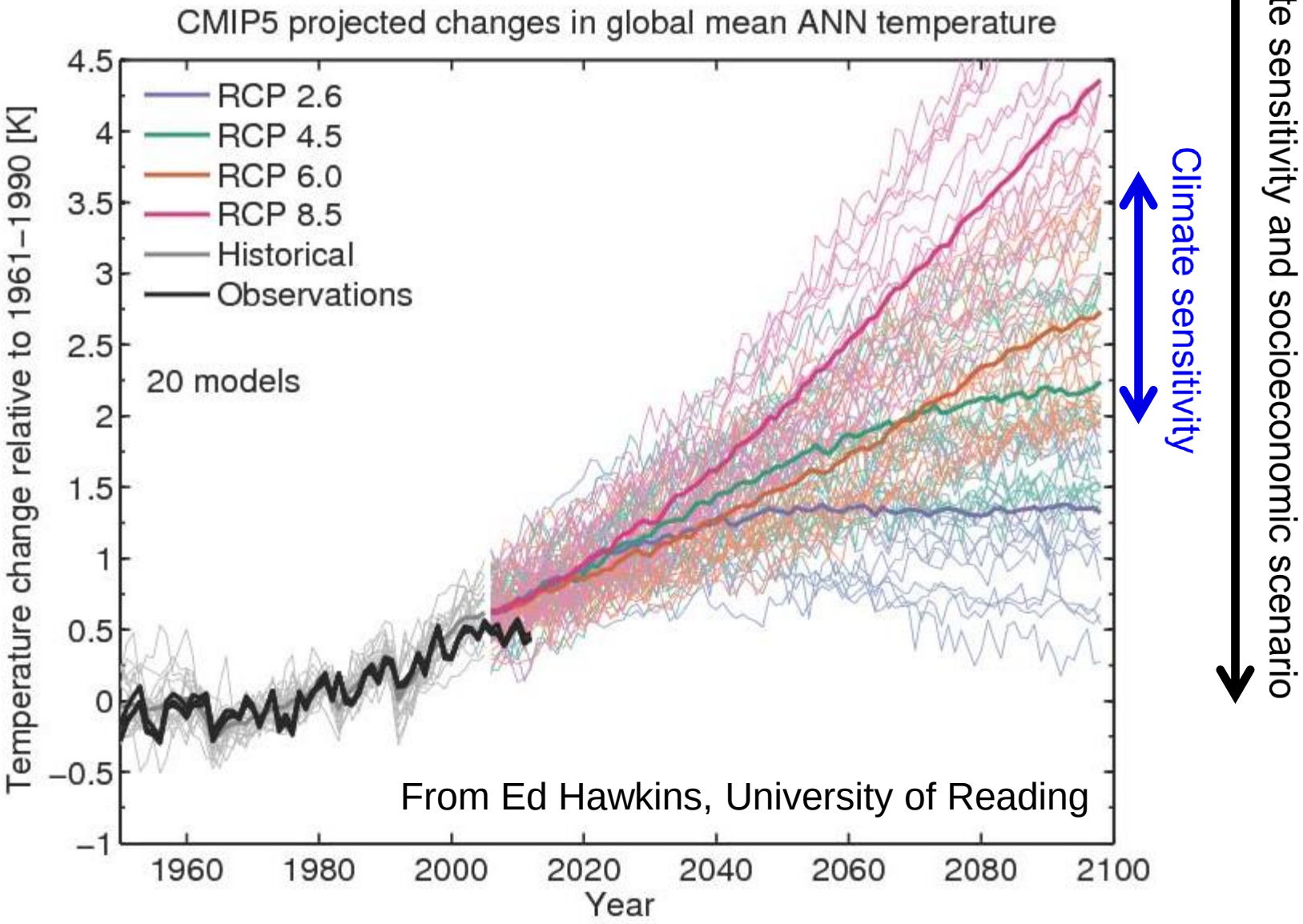
↑ Greenhouse effect

↑ Net Heating

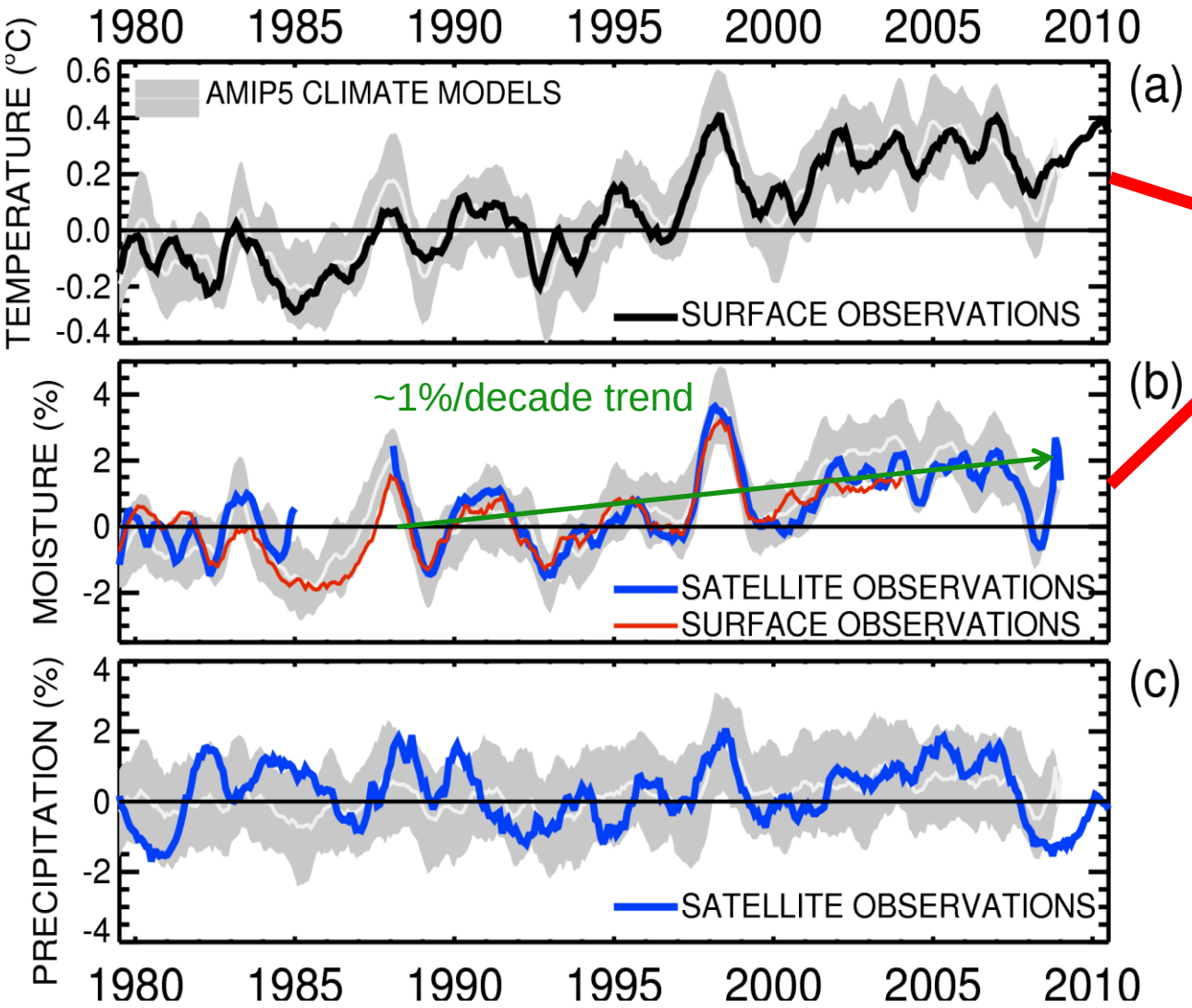




How much will the planet warm?



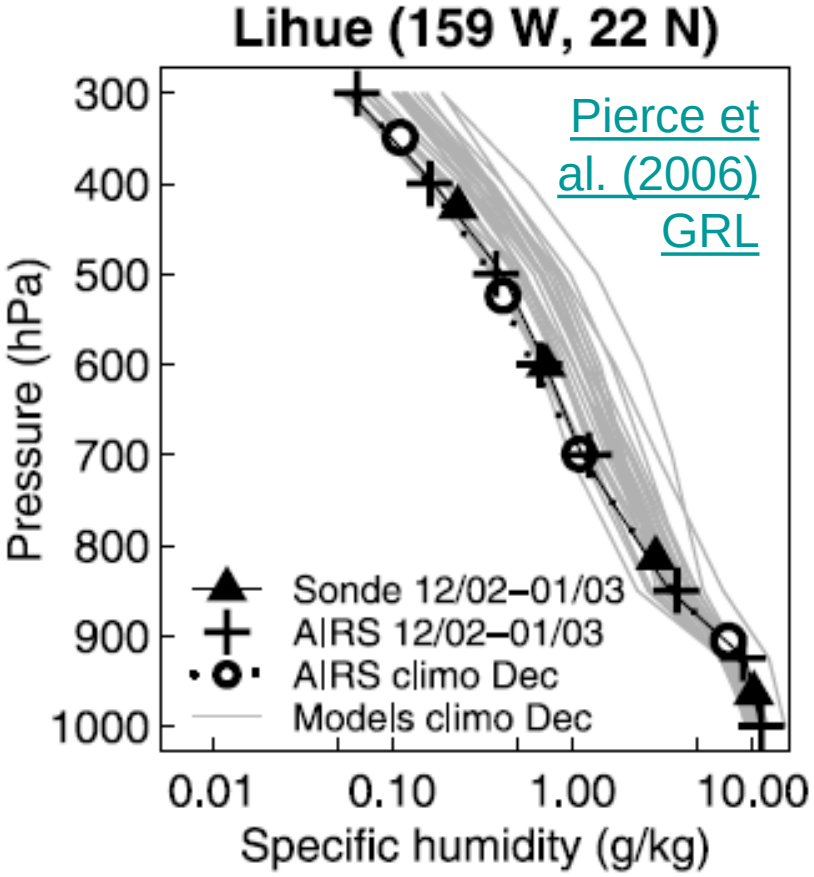
Current changes in global water cycle



Co-variation:
dW/dTs ~ 7%/°C

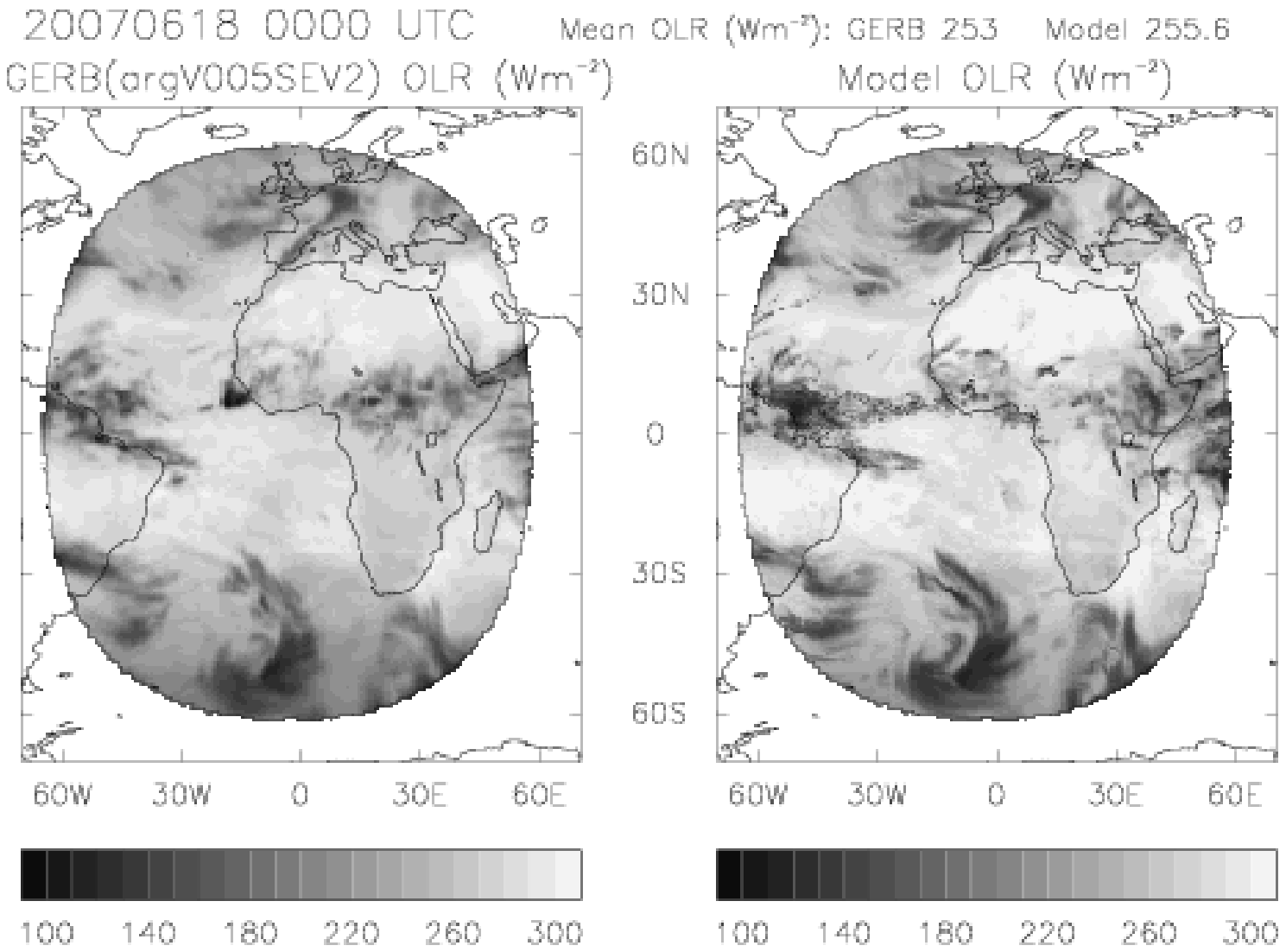
Adapted from:
Allan et al. (2013) Surv. Geophys

Is simulated upper tropospheric water realistic?



See also John and Soden (2007) GRL

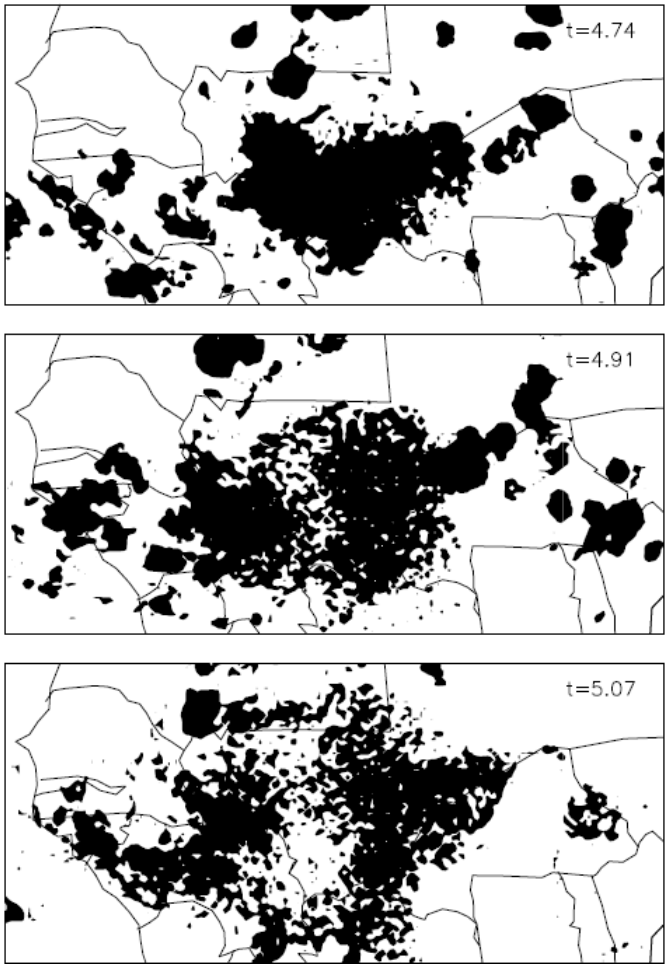
Observed and simulated clouds from space



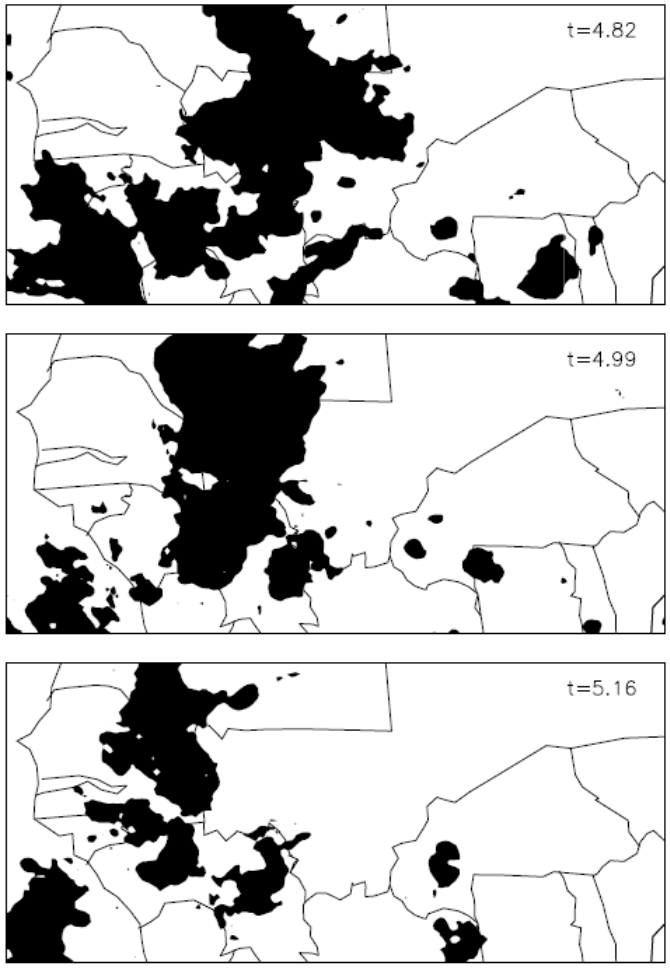
e.g. Allan et al. (2007) QJRMS **CLICK FOR ANIMATION ON PDF**

Evaluating model cloud convective processes

Model (12km resolution)

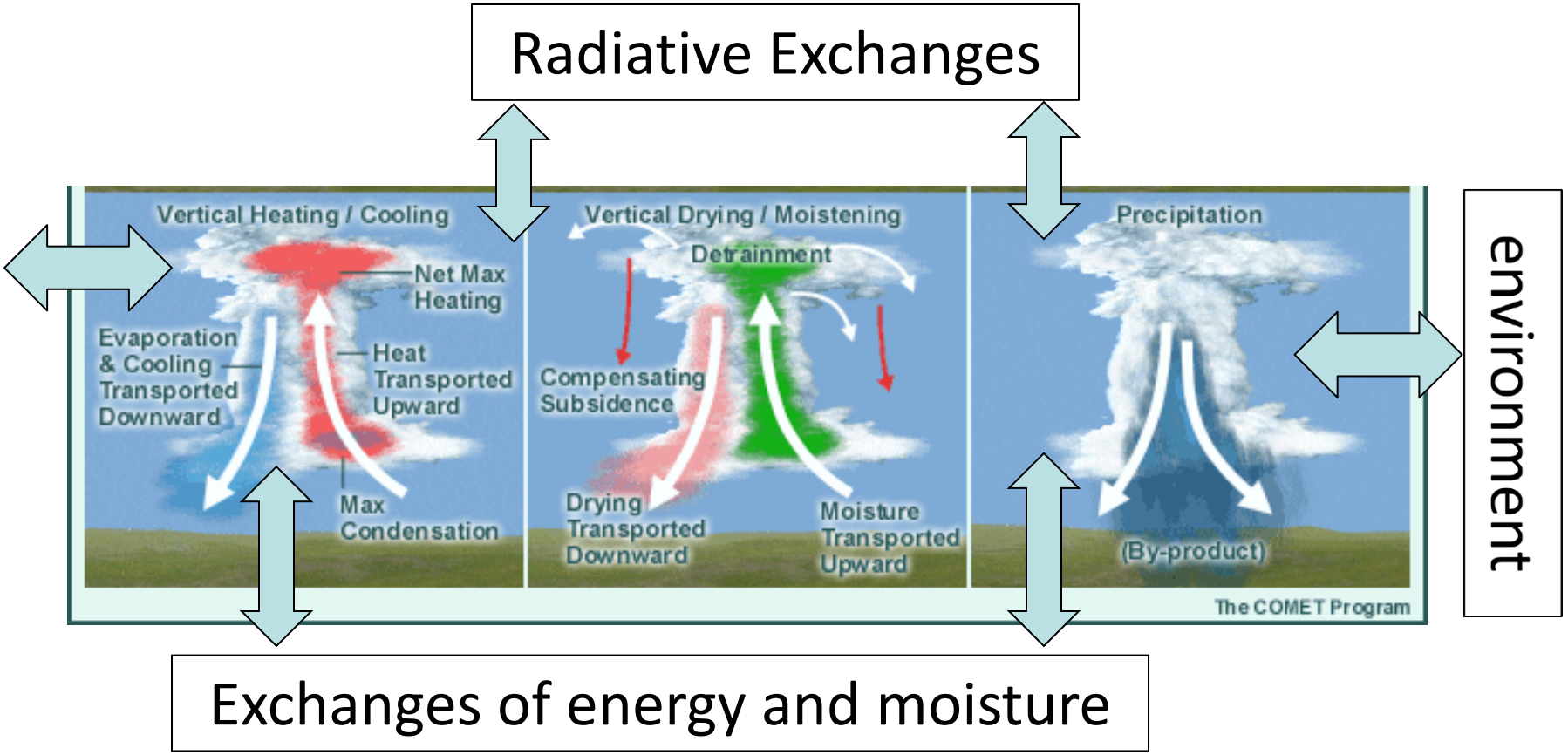


GERB satellite data



Pearson et al. (2010, 2014) QJRMS

Are the most important deep convective processes well represented by models?

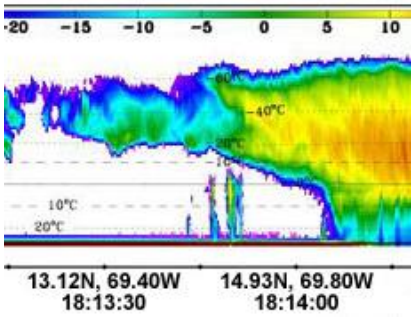


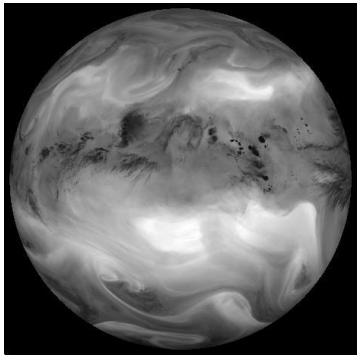
From Figure 4.6 of thesis, after The Comet Program

"Evaluating Tropical Upper-tropospheric Water in Climate Models Using Satellite Data" by Marston S. Johnston

Guiding Questions:

- Will clouds amplify or reduce climate change in response to greenhouse gas increases?
- How realistic are simulated moist processes & what are implications for their global water cycle





Novelty:

- Multiple New Satellite Datasets (active/passive)
- New methods to focus on the processes contributing to deep convective systems to aid model improvement