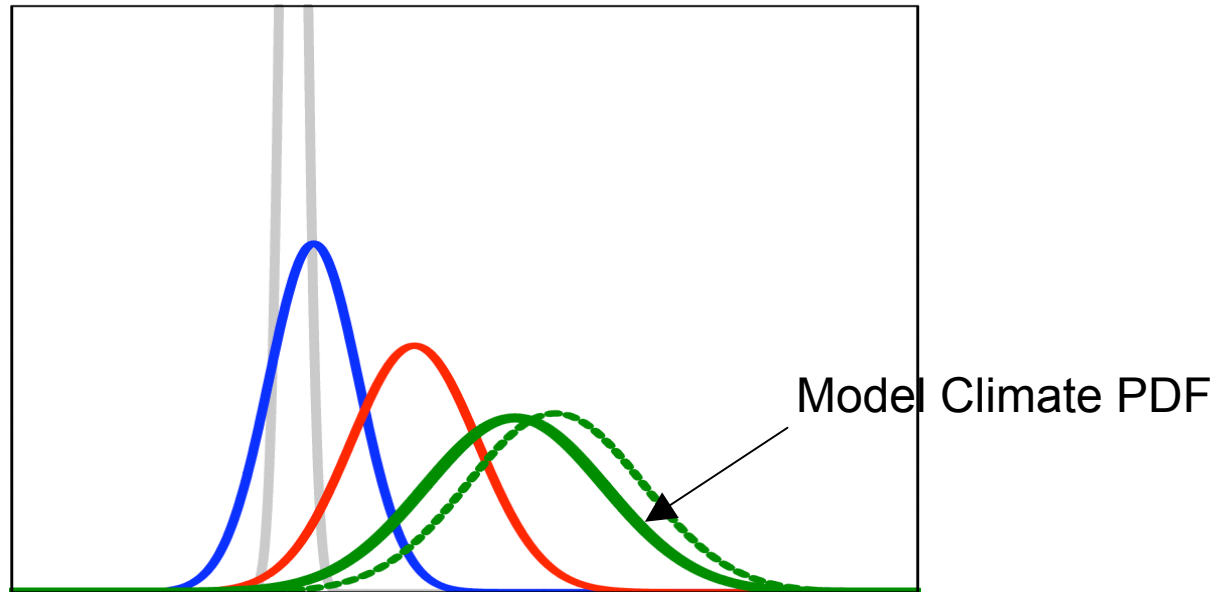


**Limits of Decadal Predictability
in CCSM3**
or
***Duration of Initial State Influence on
Decadal Forecasts of CCSM3***

***Grant Branstator & Haiyan Teng
NCAR***



Predictability

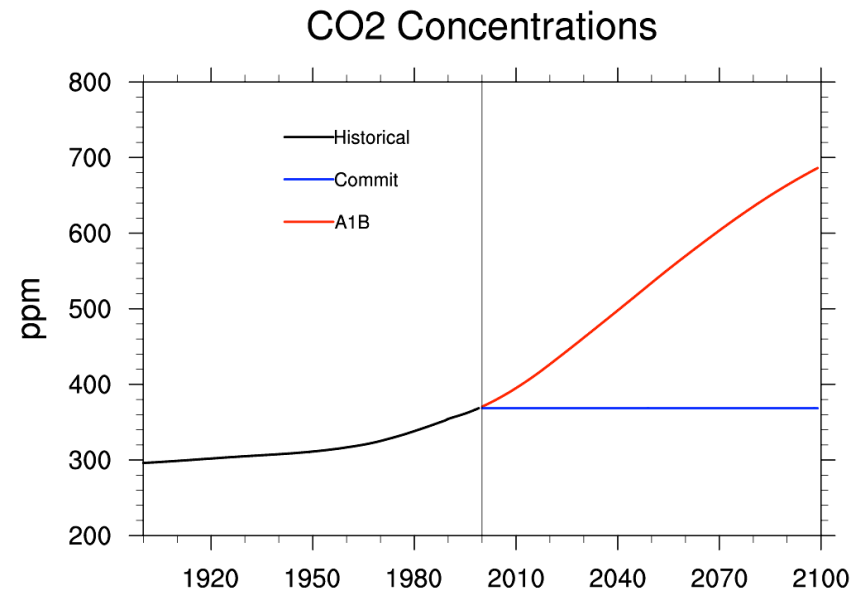


‘signal’ vs ‘dispersion’

‘initial value’ vs ‘forced’

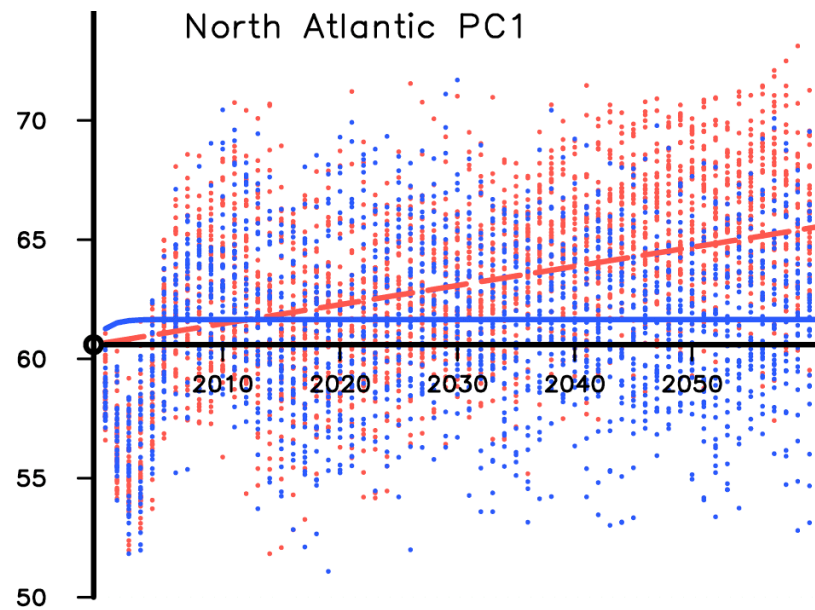
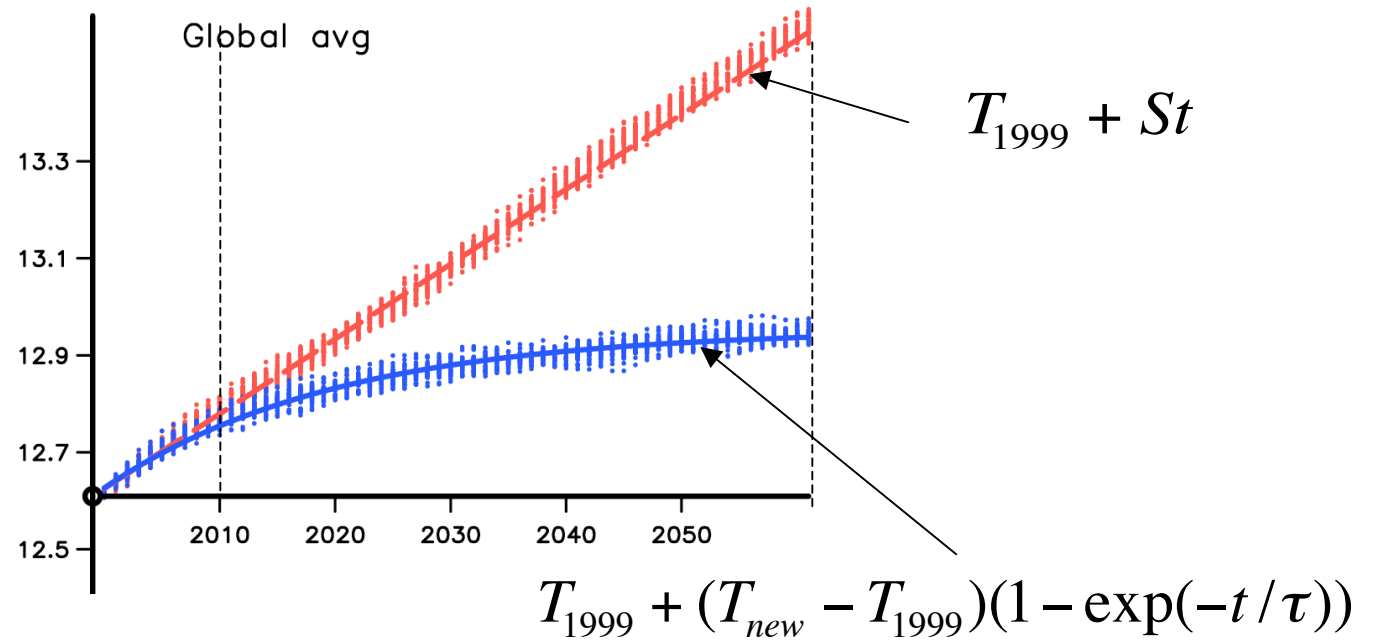
CCSM3.0 Experiments

- T42, x1°
- A1B & Commitment
- 40 member ensembles

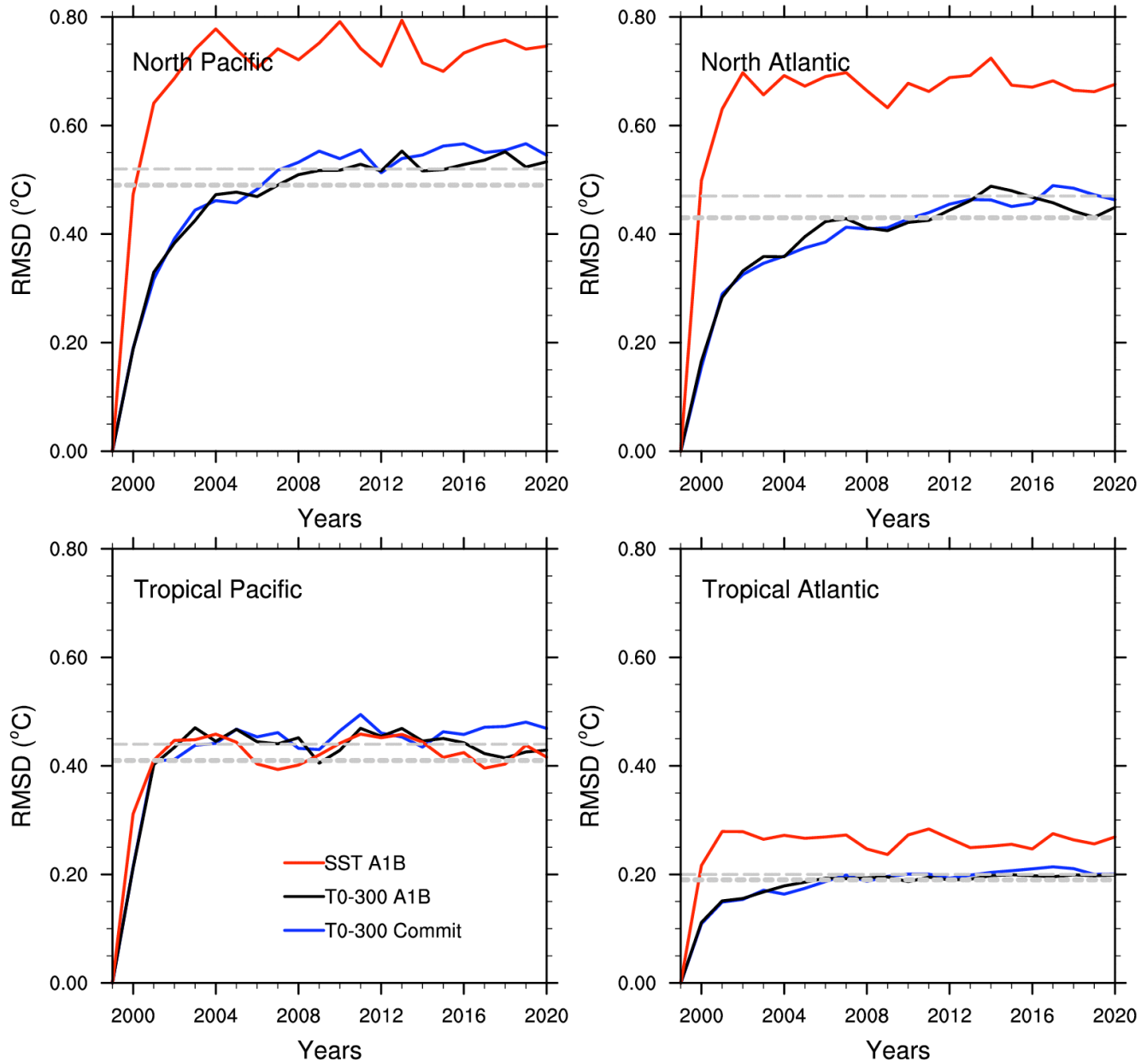


-
- o annual means
 - o T0-300m
 - o SST

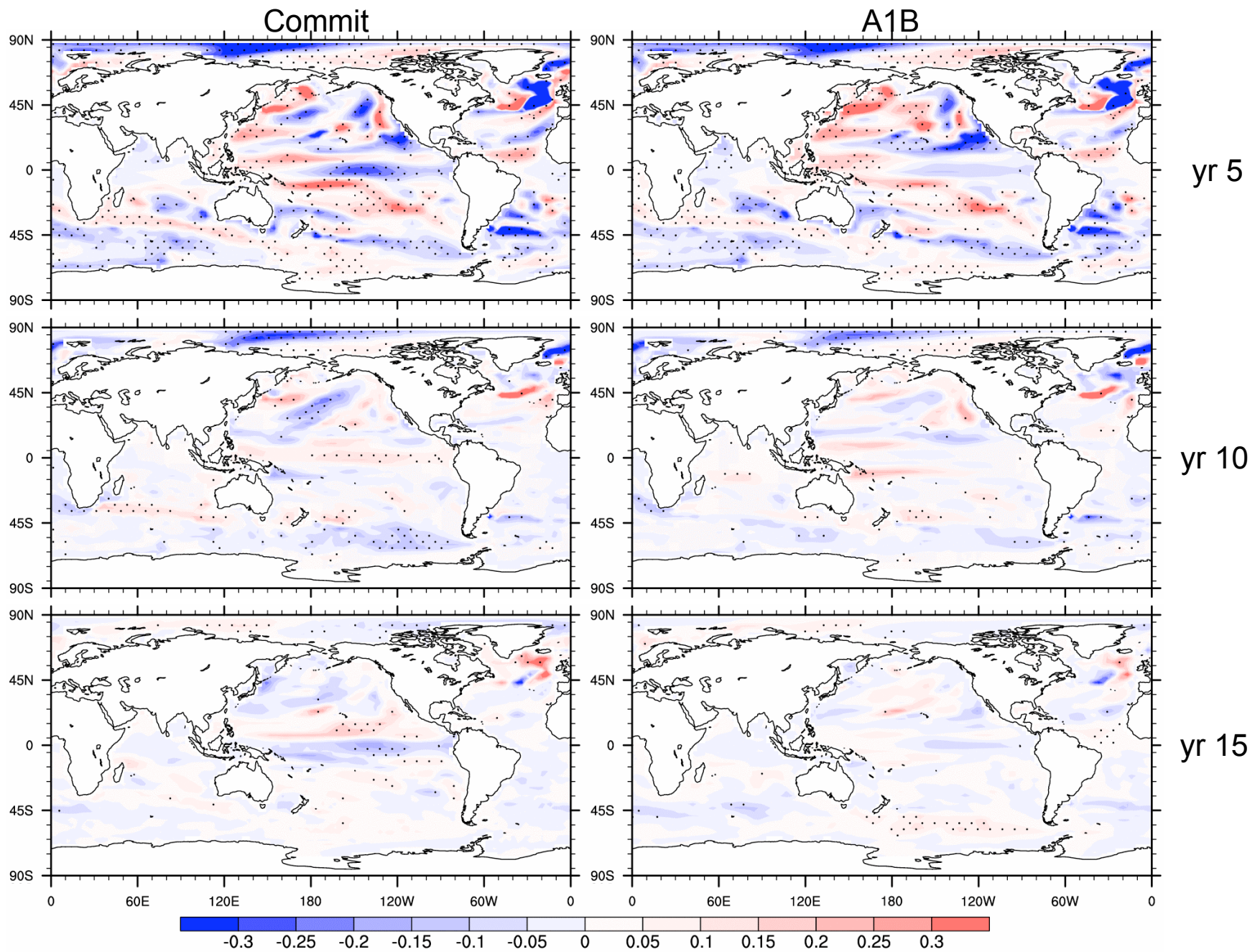
Annual Mean T0-300 A1B & Commit



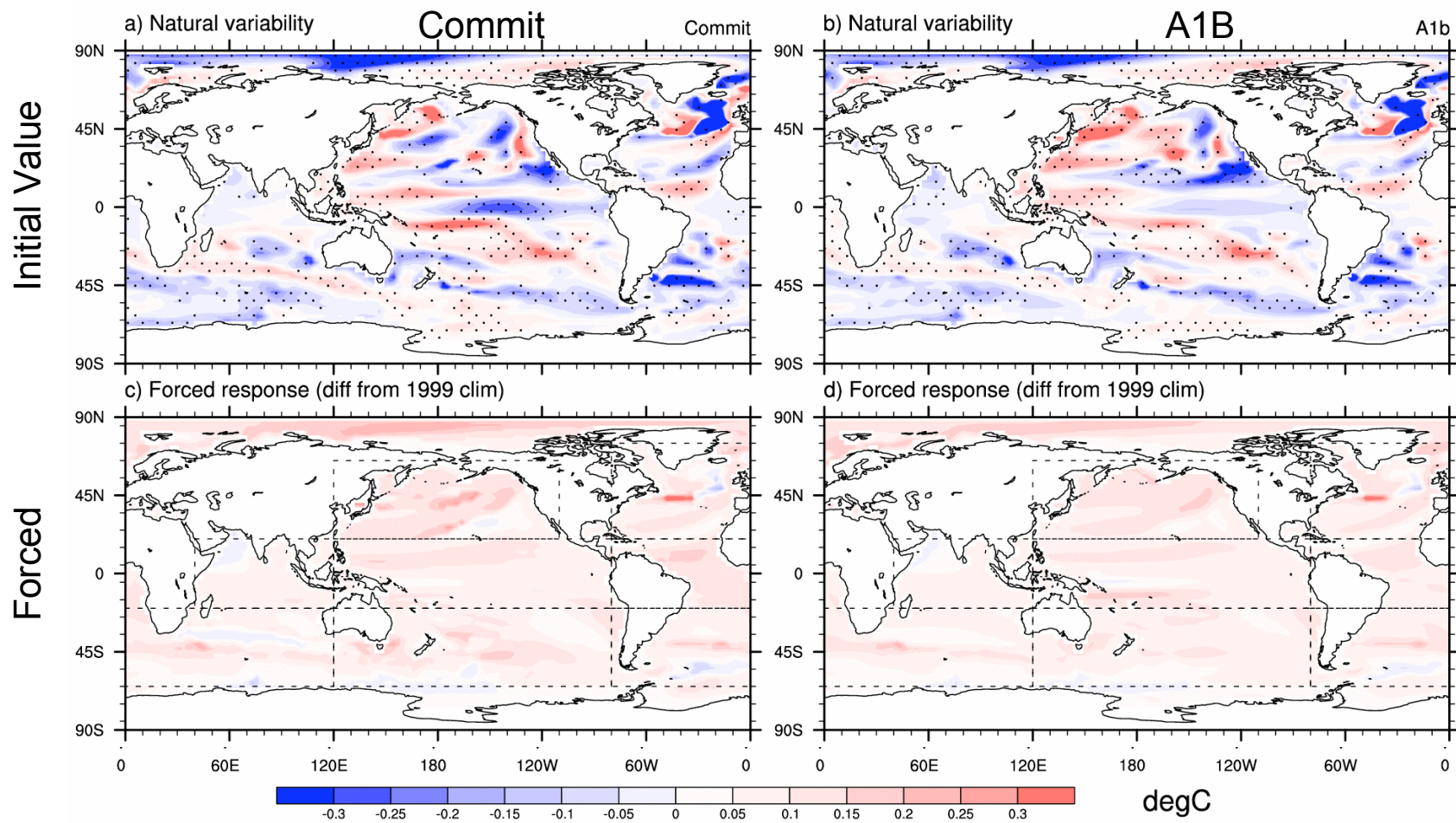
T0-300 & SST Ensemble Spread



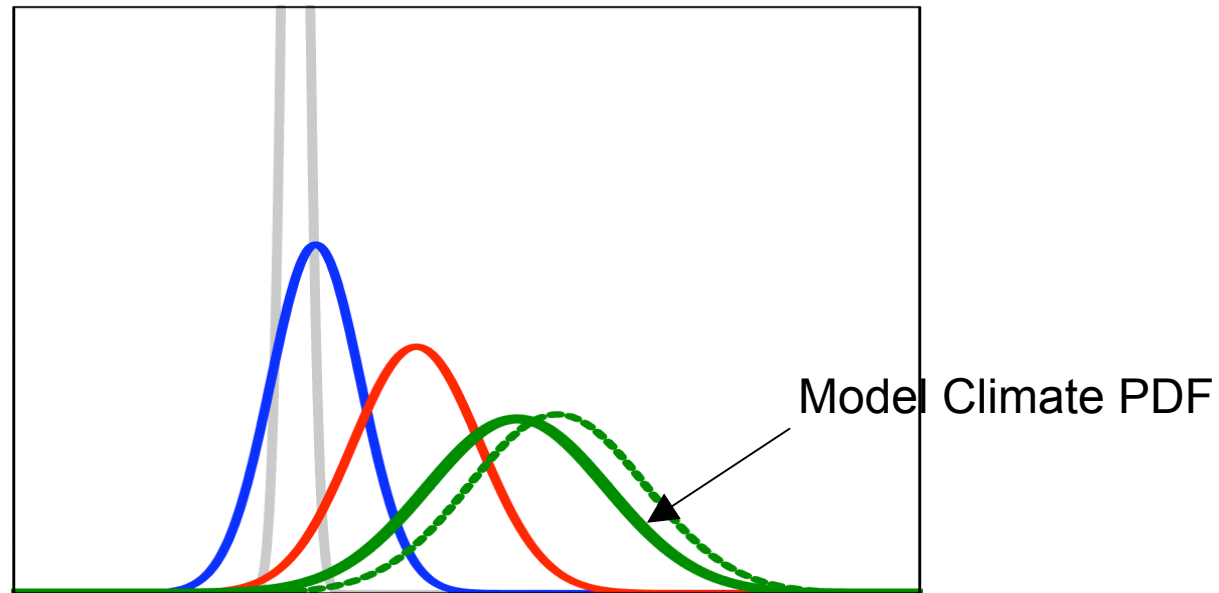
Mean Anomalies from Initial Values



T0-300 in 2004 (yr5)



Information & Predictability



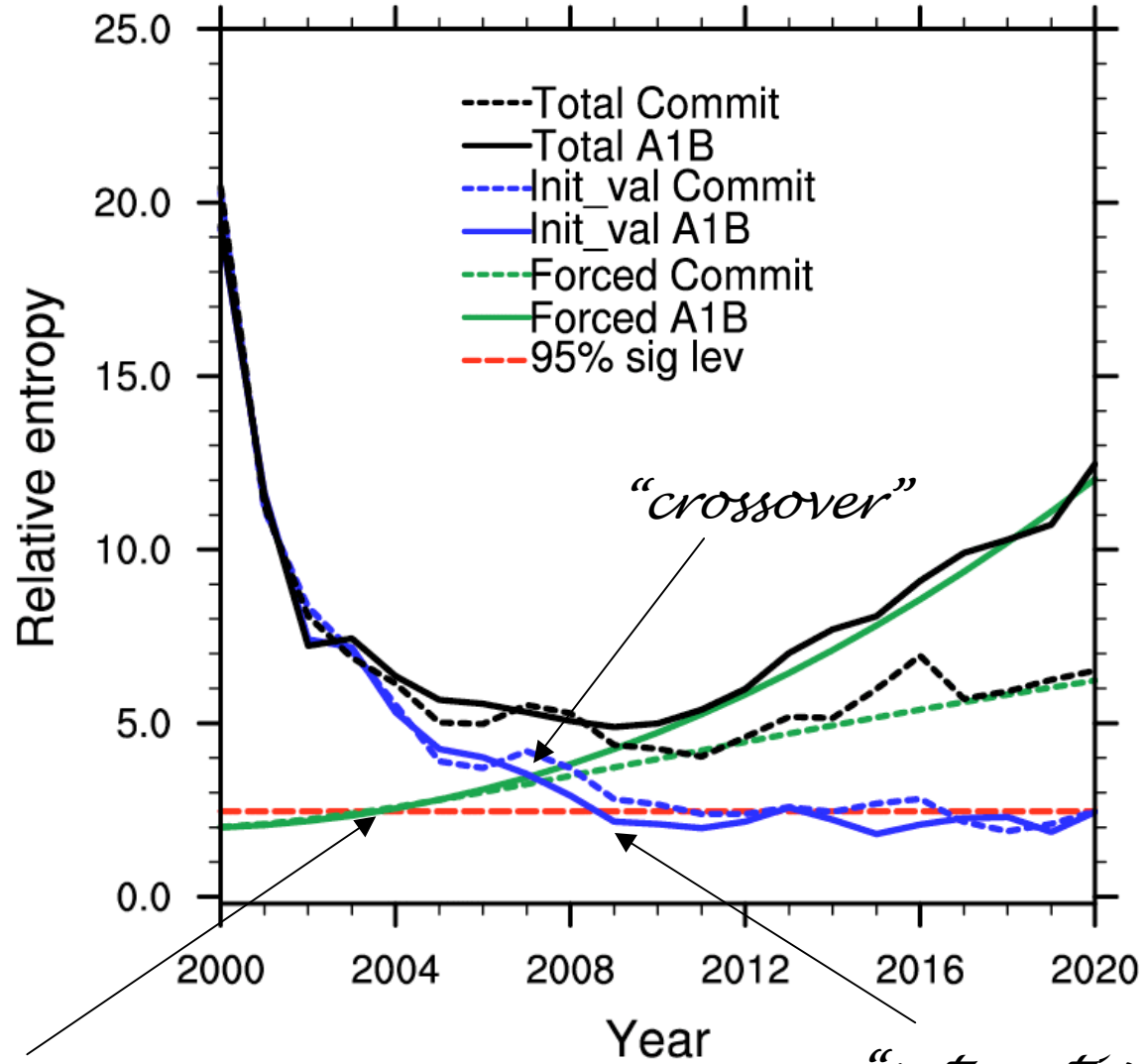
Relative Entropy

$$R = \int p_e \ln \left(\frac{p_e}{p_c} \right) = R_{signal} + R_{dispersion}$$

➔ 15 PCs per subdomain

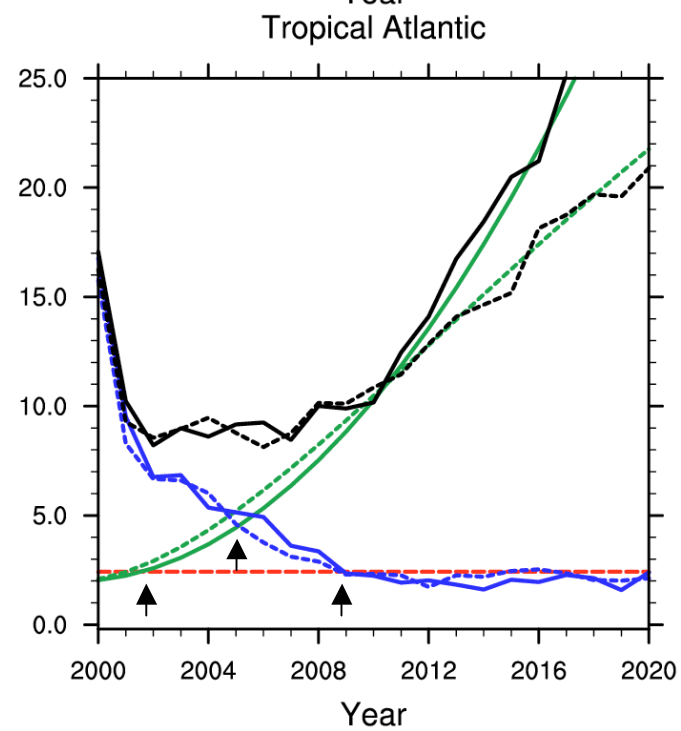
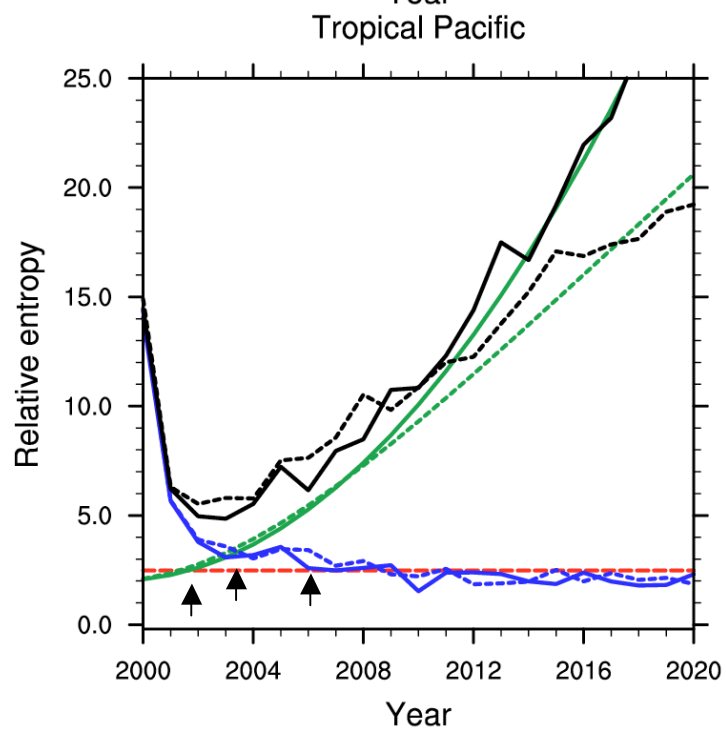
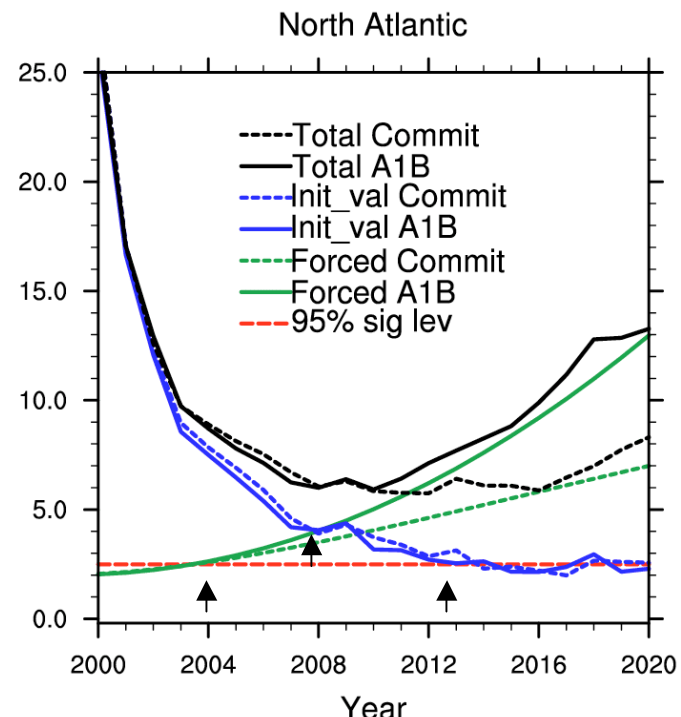
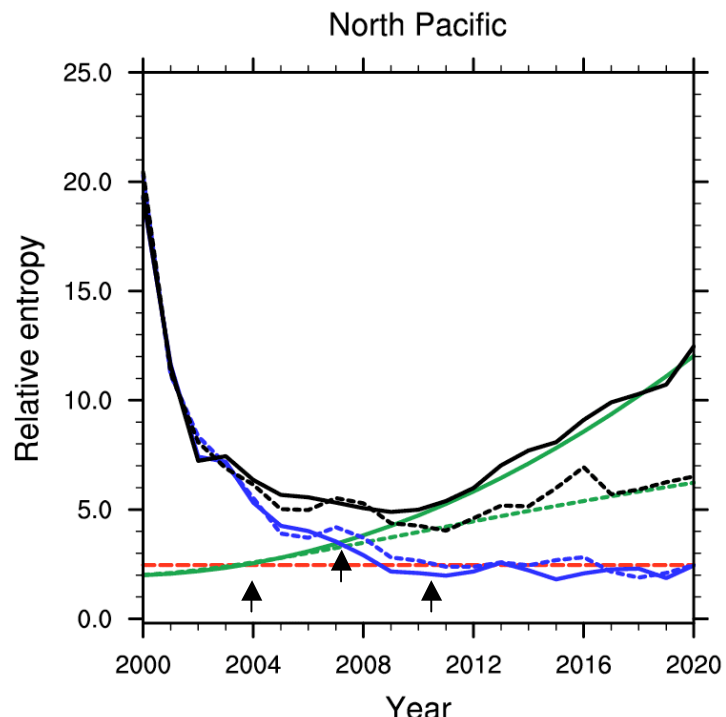
T0-300

North Pacific



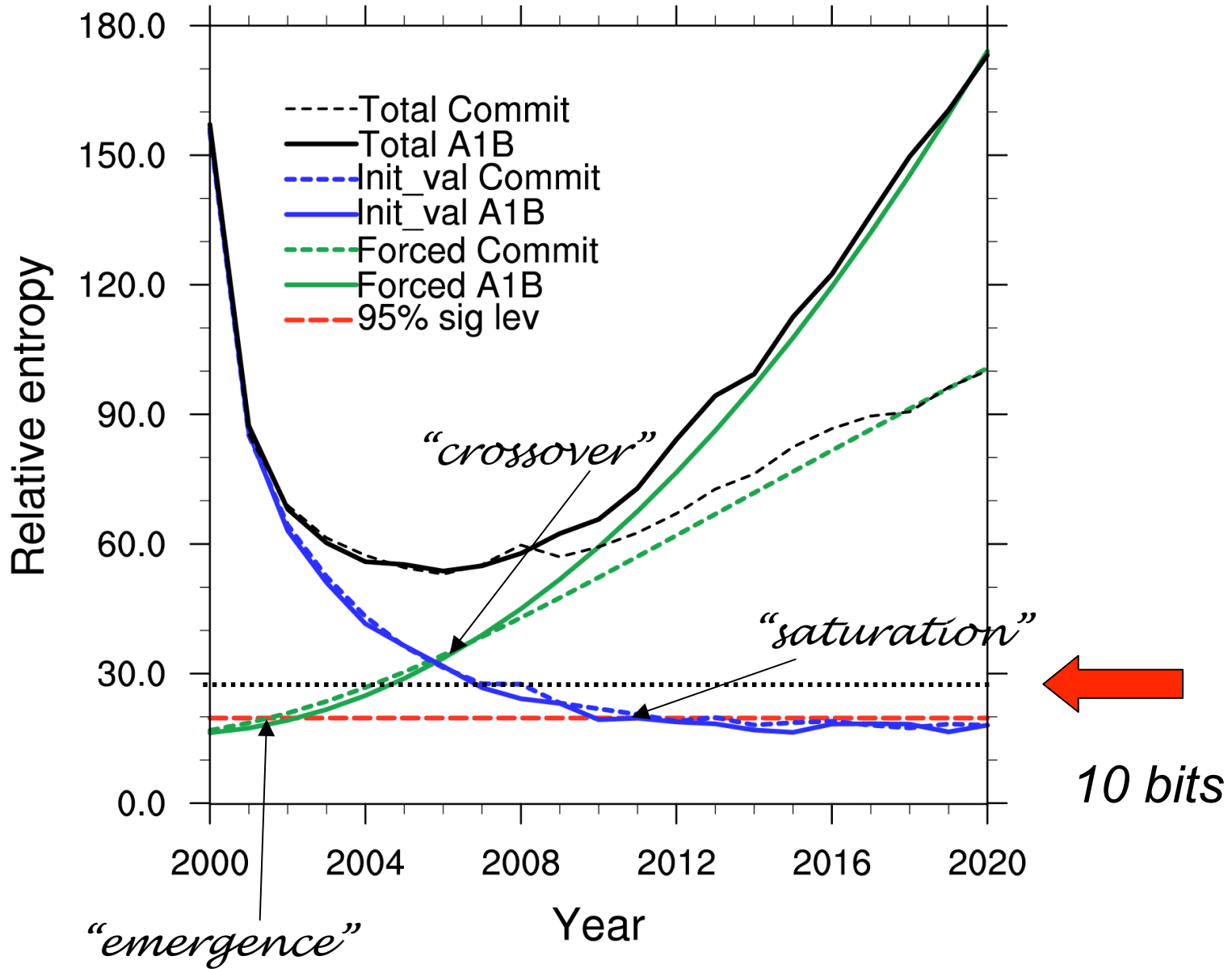
“emergence”

“saturation”



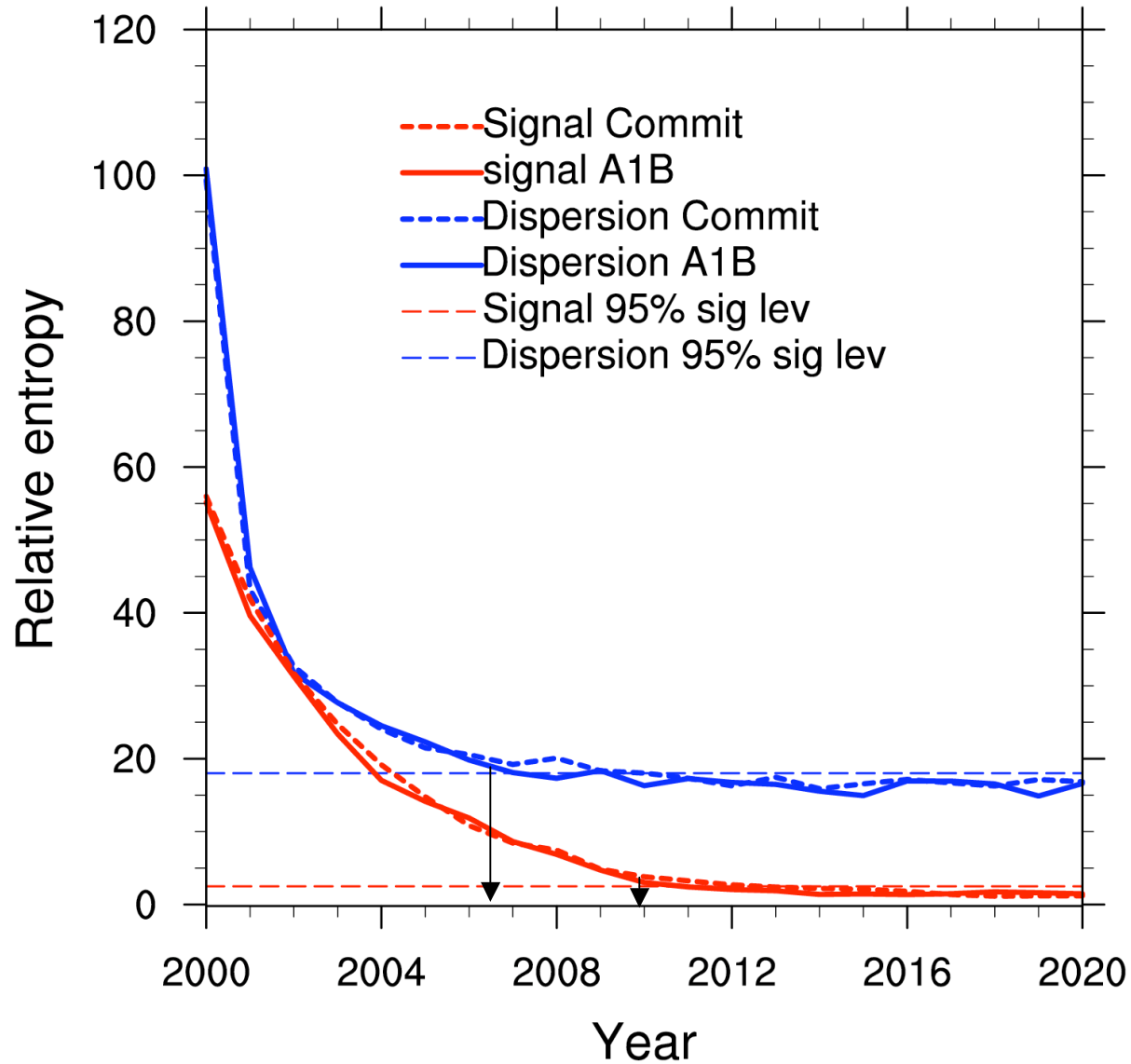
Global T0-300

Sum of R15 at 8 Subdomains



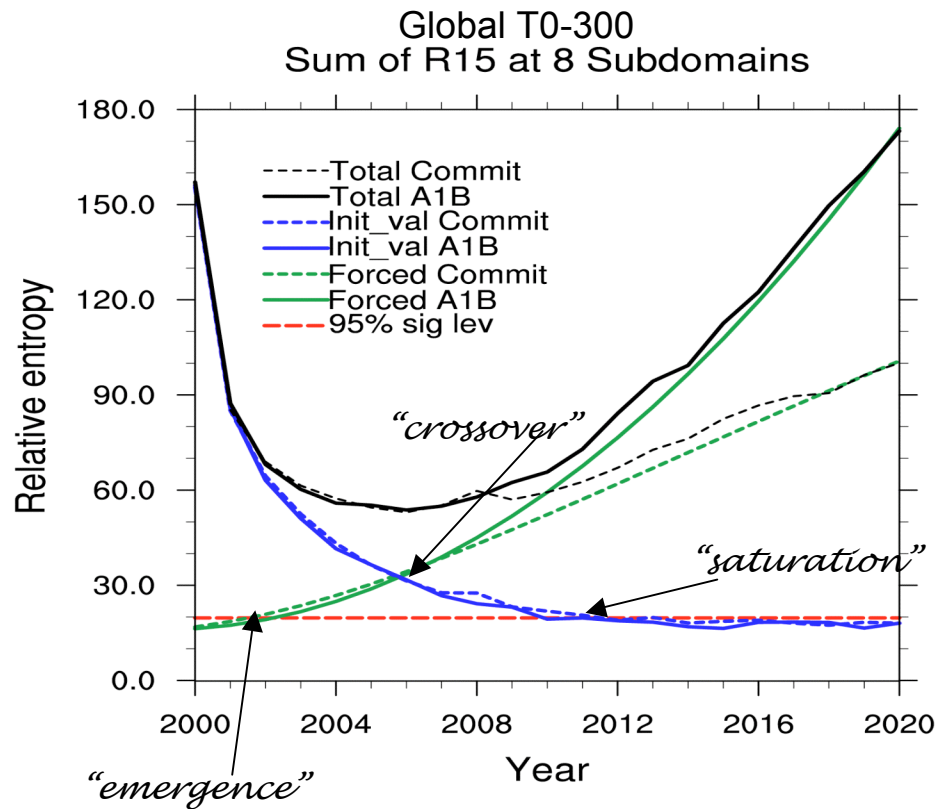
Global Signal & Dispersion Rel Entropy

Sum of R15 at 8 Subdomains



Lessons

- **Subsurface temp** more predictable than SST
- Predictability limits vary substantially **regionally**
- Both **mean** & **spread** contribute to predictability
- **Relative entropy** is useful measure
- Average predictability ranges:
 - Initial value **“saturation”** : 11yr
 - Forced **“emergence”** : 3yr
 - **“Crossover”** from initial value to forced: 7yr
- Particular GHG **scenario has little impact** on initial value predictability



- Basin-to-basin variations
- Sub-basin variations
- Initial condition dependence
- Influence on atmosphere?