

Separating Signal and Noise in Atmospheric Temperature Changes: The Importance of Timescale

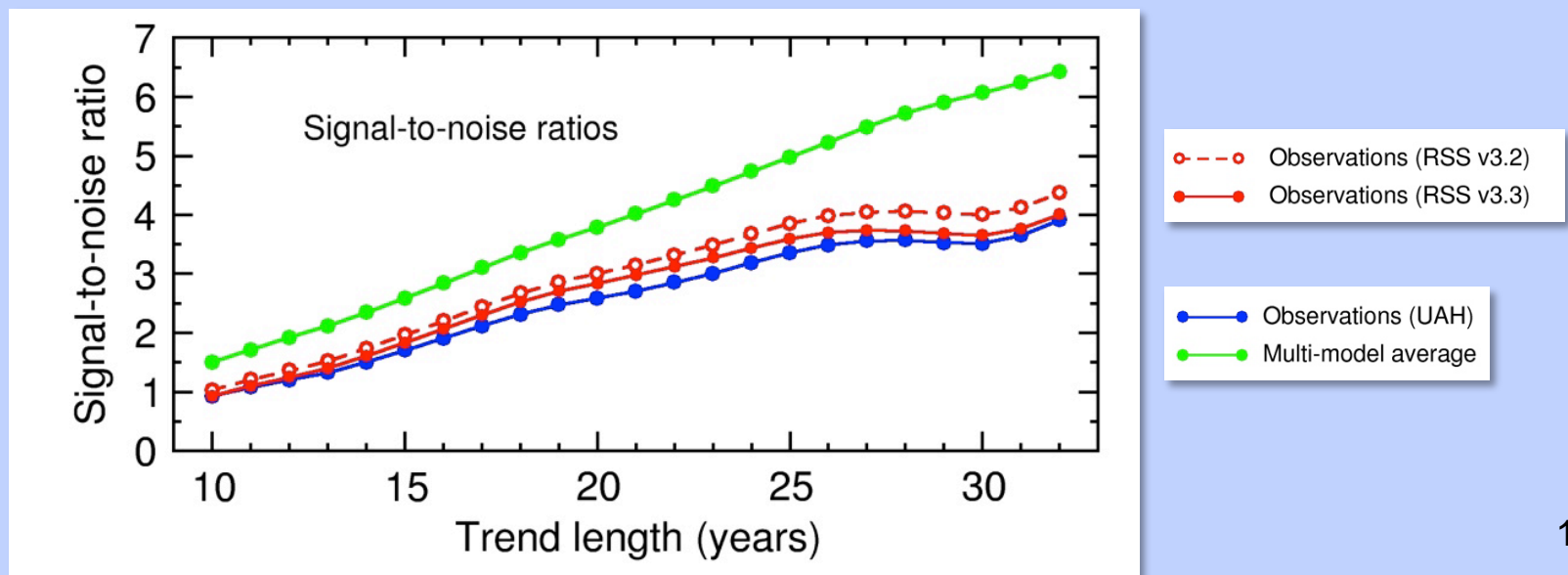


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Climate and Earth System Modeling PI Meeting, Grand Hyatt, Washington D.C.

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Fact or fiction? “Computer models can’t simulate the small warming observed over the last 10 years”

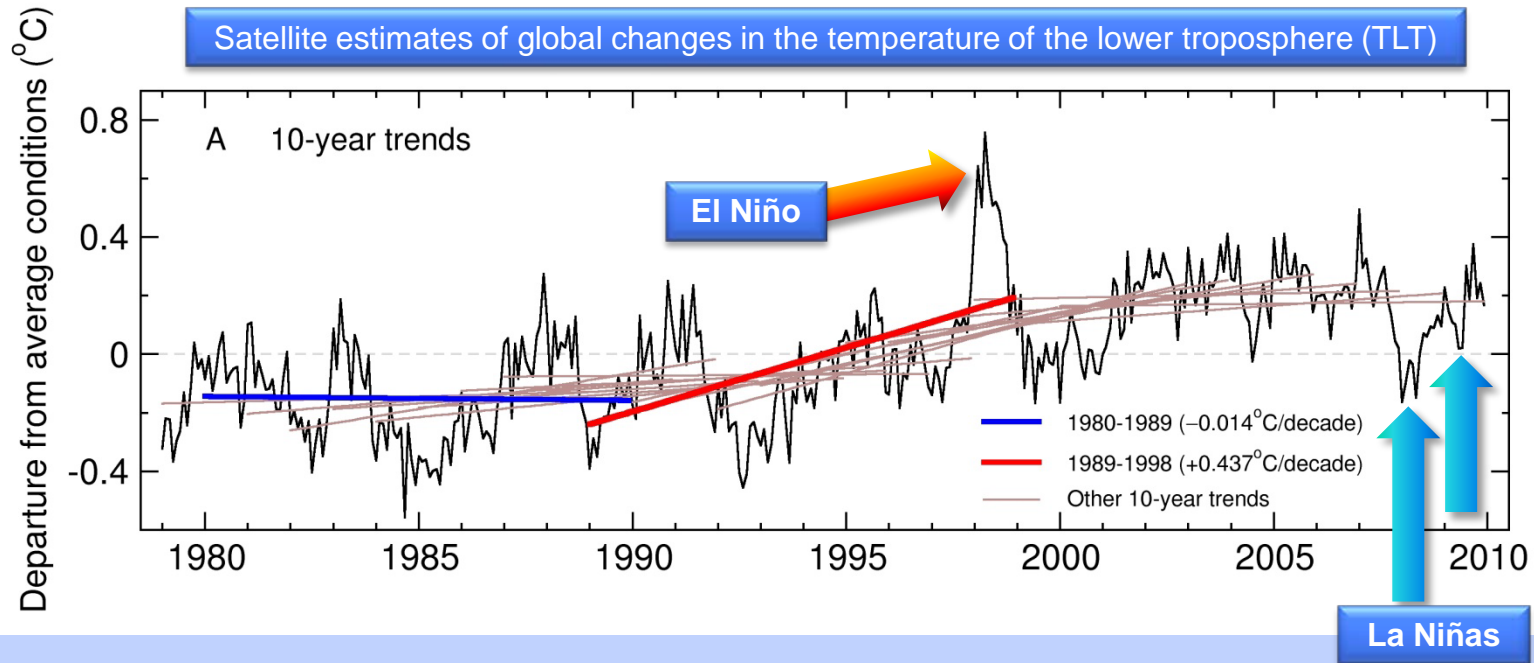


- “Over the past ten years there has been no statistically (sic) global warming. This is not at all what was predicted by the IPCC computer models”.*

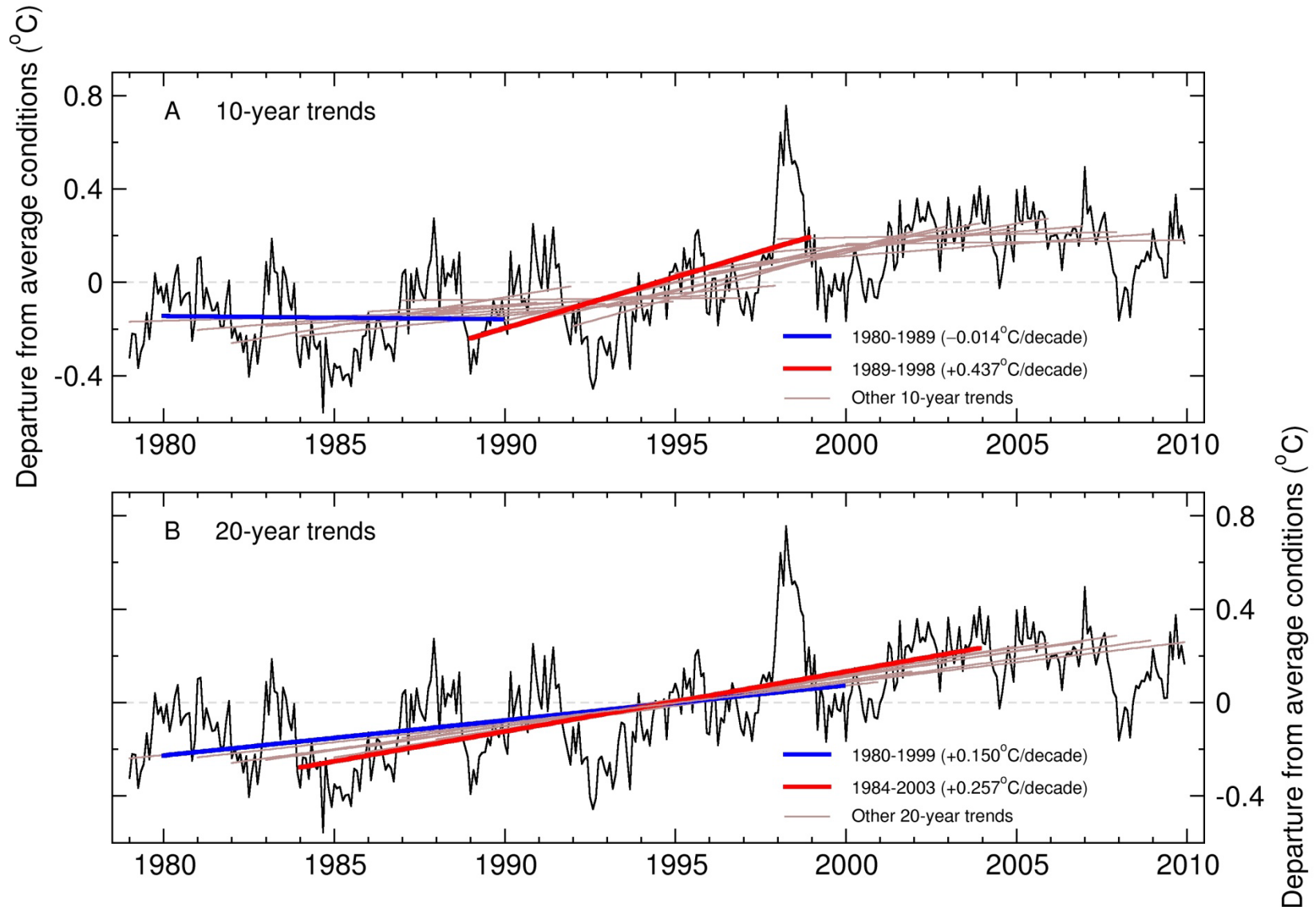
*Professor Will Happer, “Climate Science in the Political Arena”

Testimony before U.S. House of Representatives Select Committee on Energy Independence and Global Warming, May 20, 2010

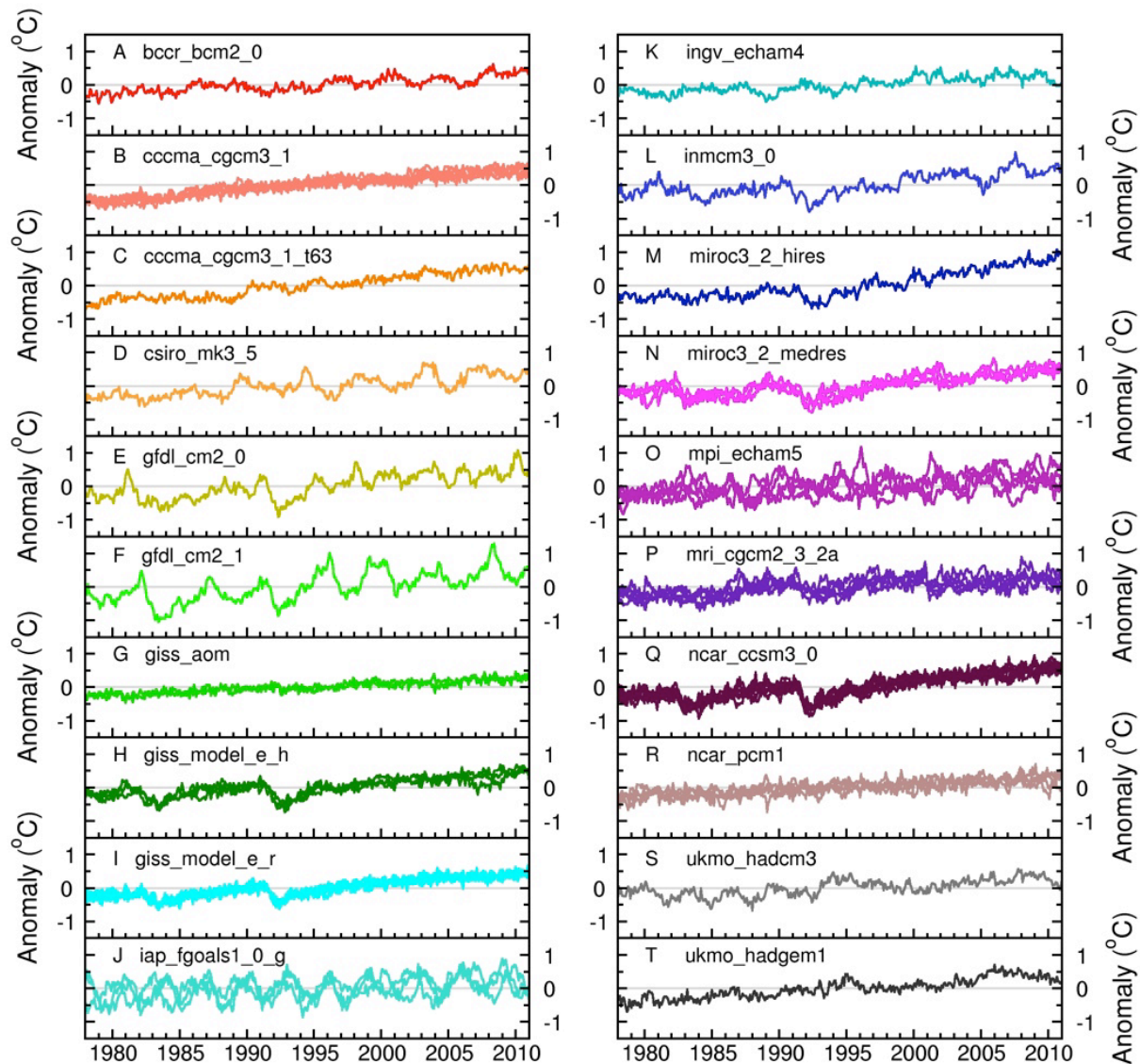
Ten-year trends are strongly influenced by interannual noise



Computing trends over longer periods of record reduces the influence of interannual noise

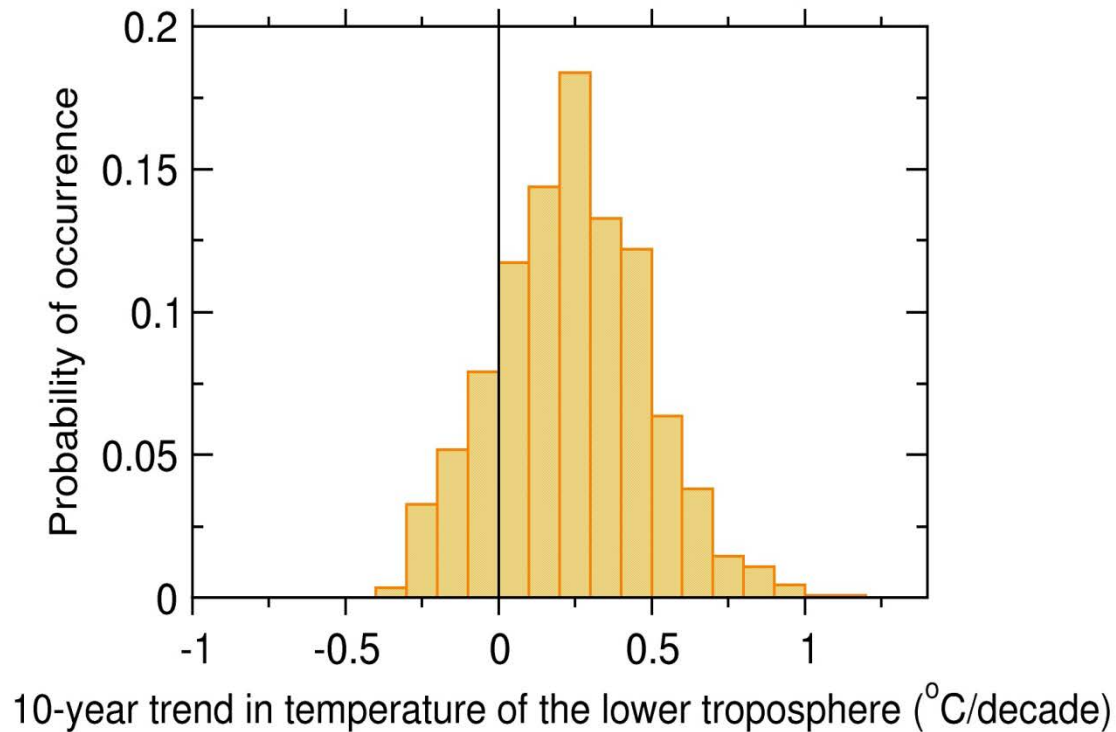


CMIP-3 simulations of TLT changes over 1979 to 2010 in “spliced” 20CEN/SRES A1B simulations



All model results are from phase 3 of the Coupled Model Intercomparison Project

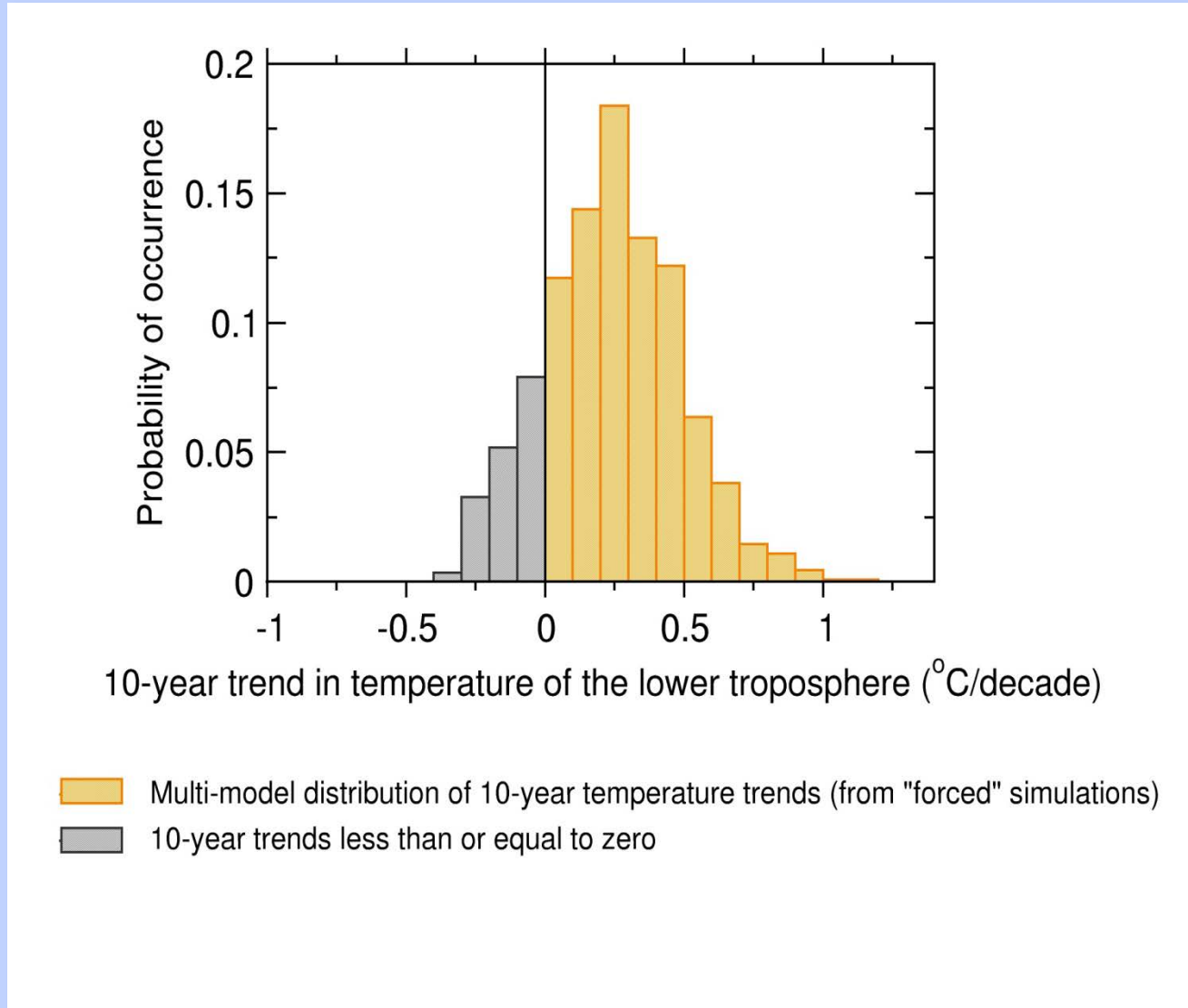
Can computer models produce 10-year periods with little or no warming?*



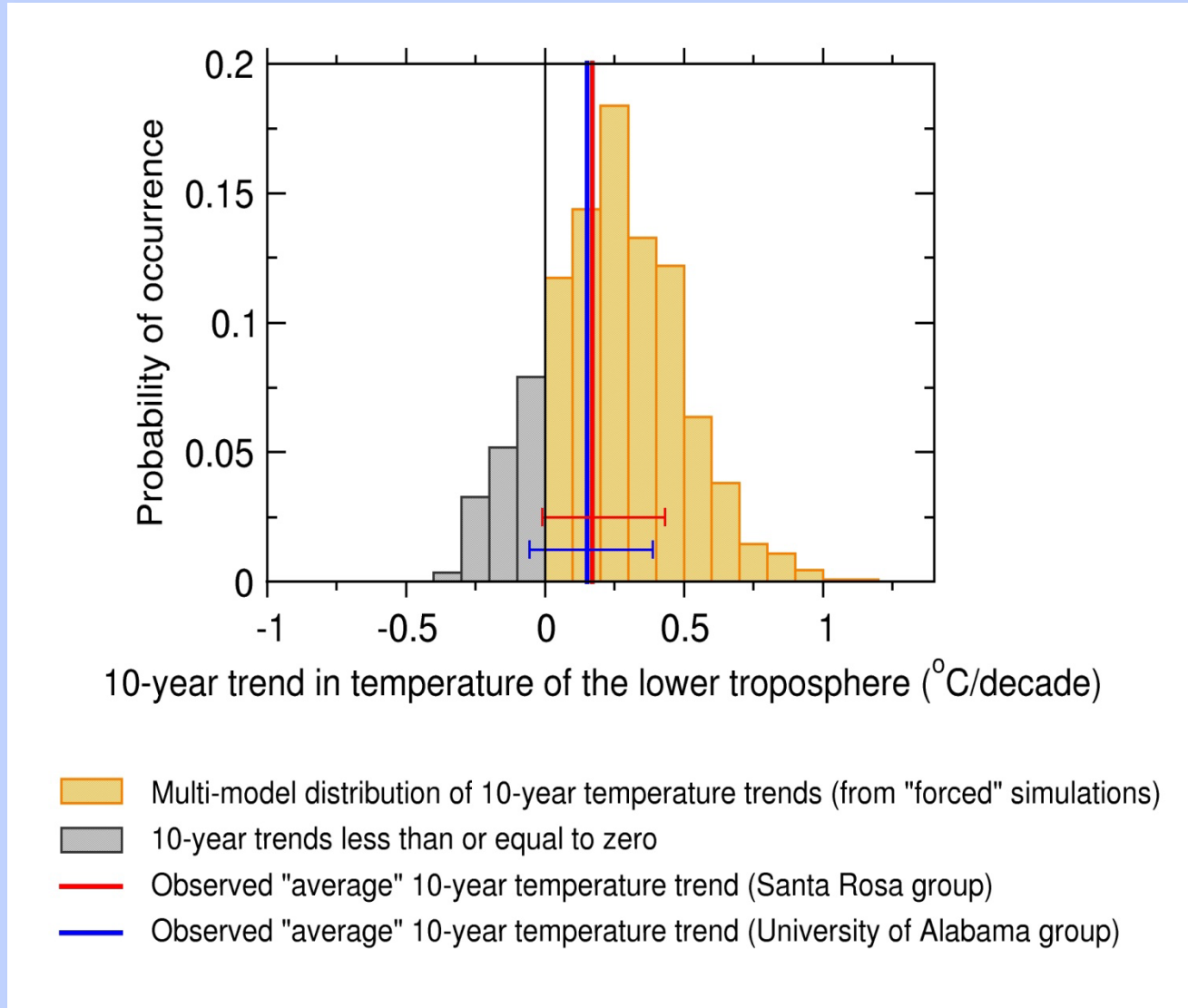
Multi-model distribution of 10-year temperature trends (from "forced" simulations)

*When run with human-caused changes in greenhouse gases, aerosols, etc.

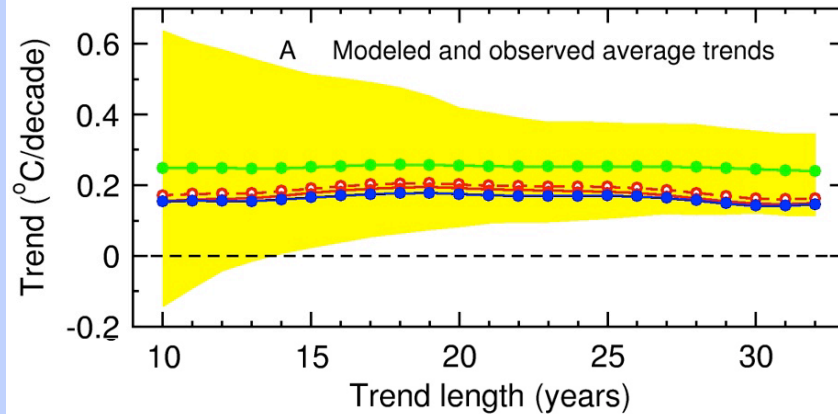
Can computer models produce 10-year periods with little or no warming?



Can computer models produce 10-year periods with little or no warming?



Putting it all together: Estimating S/N ratios as a function of timescale



○ - - - Observations (RSS v3.2)

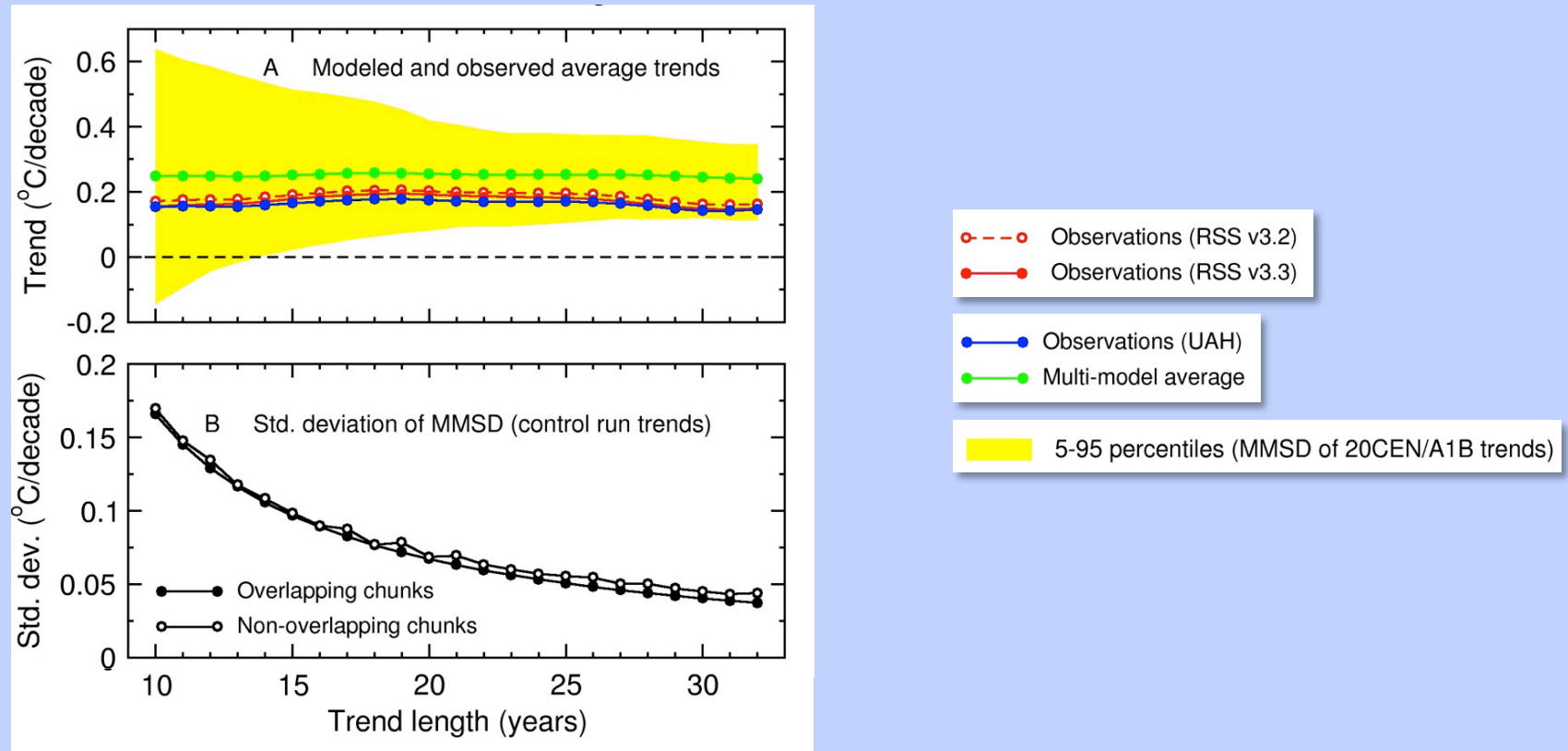
● — Observations (RSS v3.3)

● — Observations (UAH)

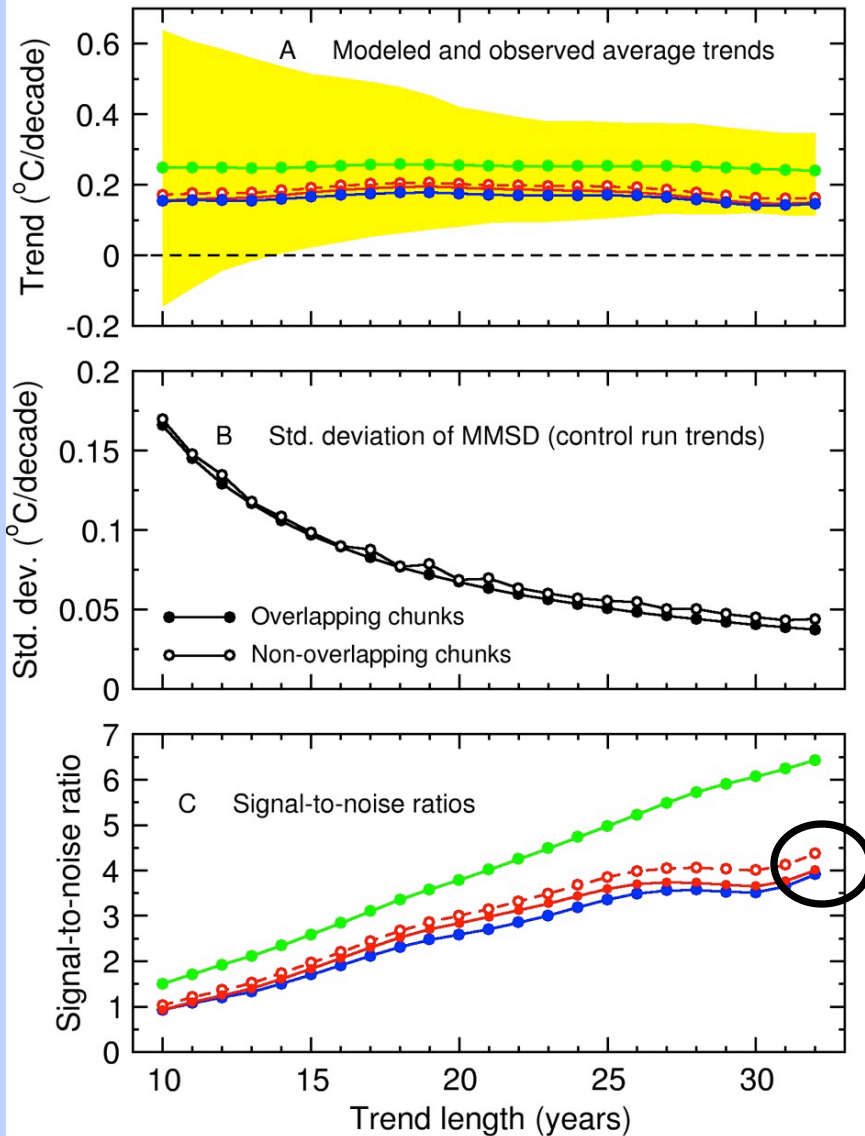
● — Multi-model average

■ 5-95 percentiles (MMSD of 20CEN/A1B trends)

Putting it all together: Estimating S/N ratios as a function of timescale

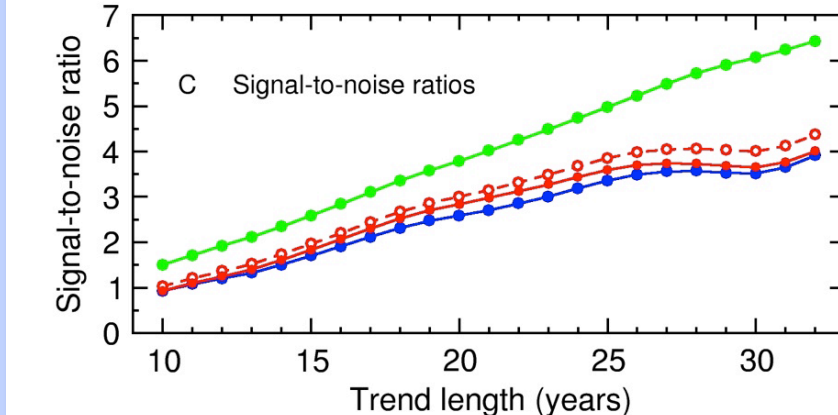
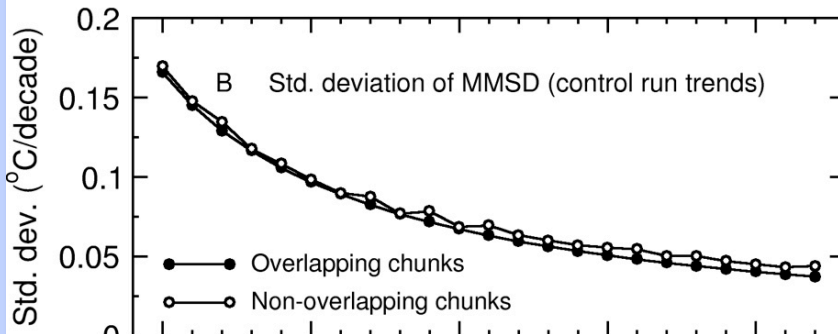
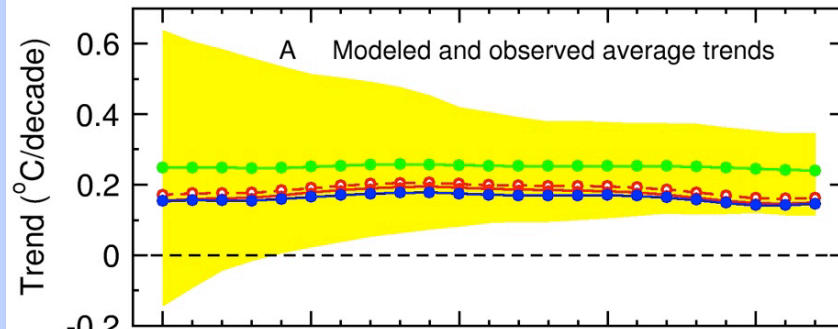


Putting it all together: Estimating S/N ratios as a function of timescale

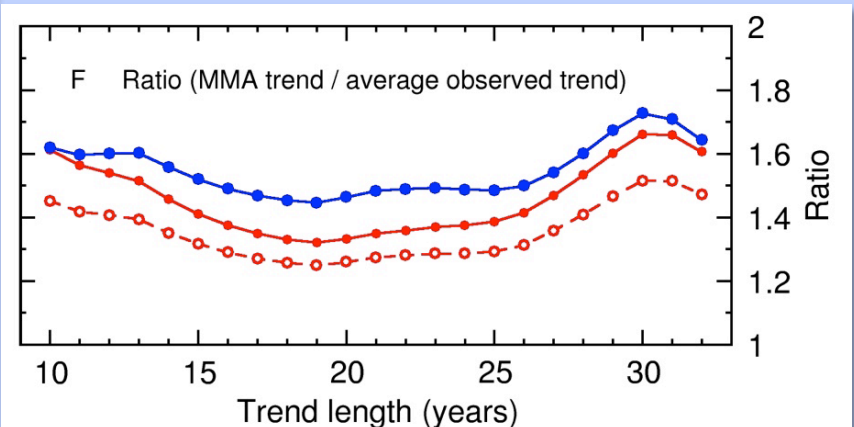


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- 5-95 percentiles (MMSD of 20CEN/A1B trends)

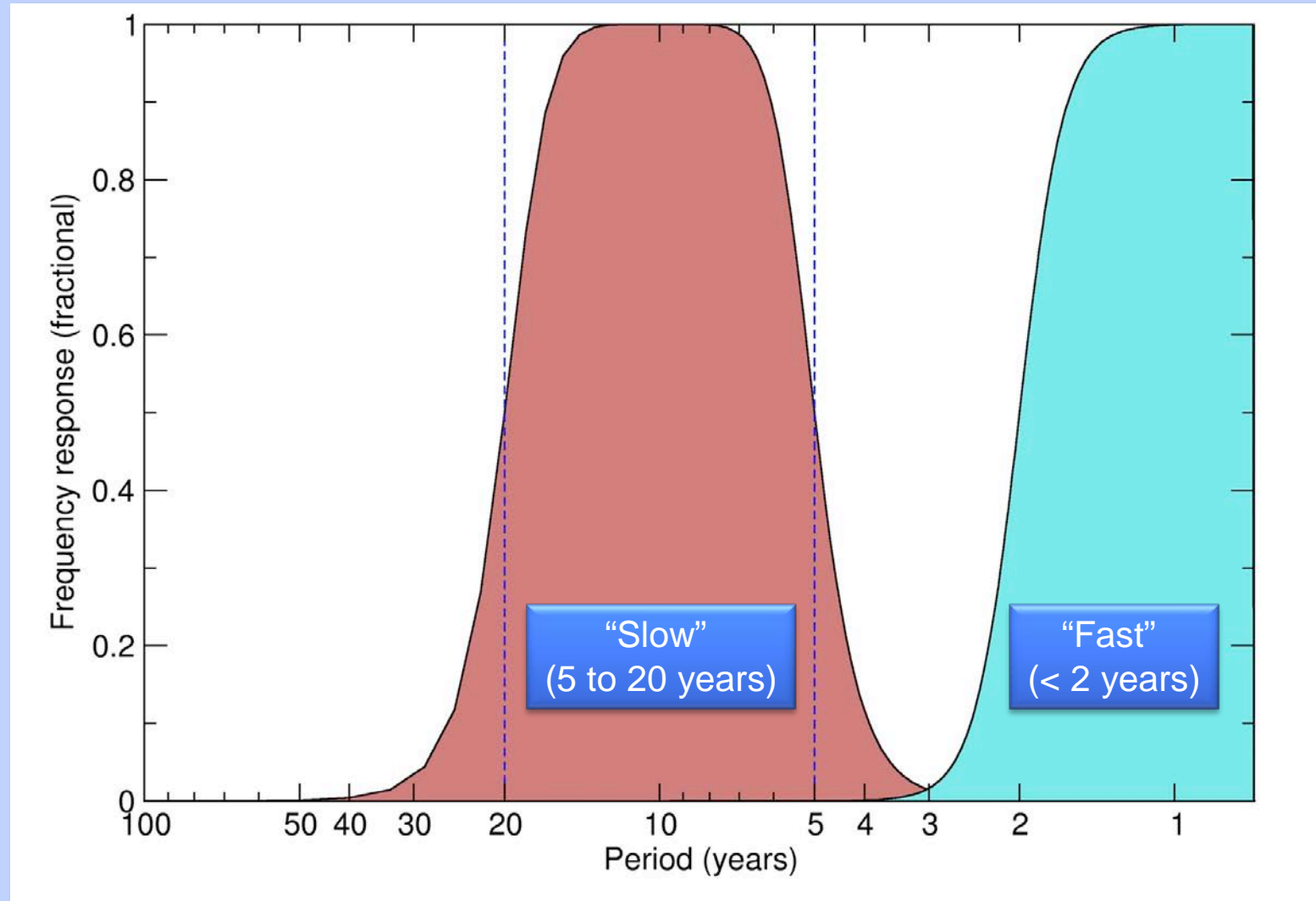
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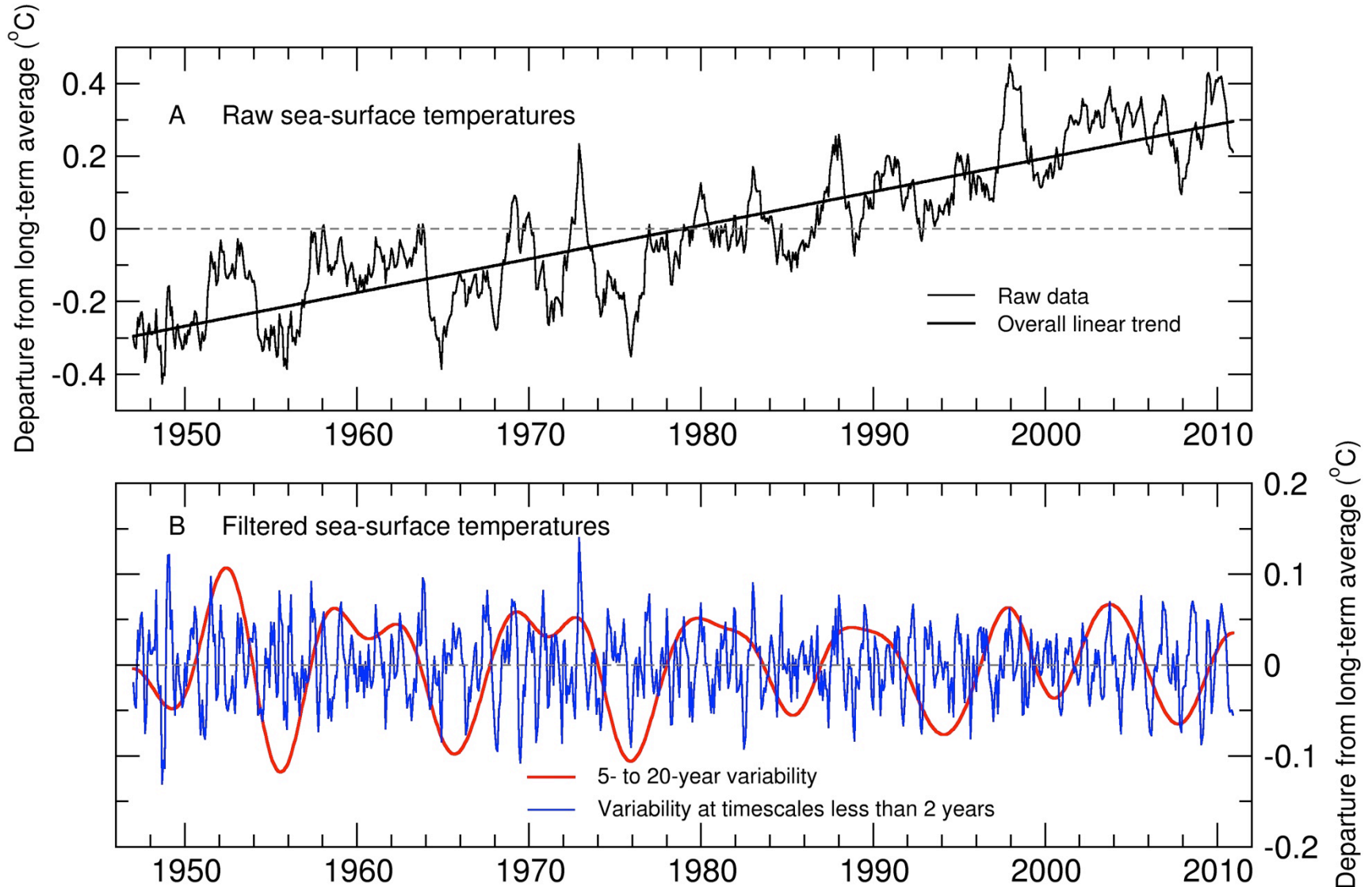


Are the estimated S/N ratios too large on multidecadal timescales?

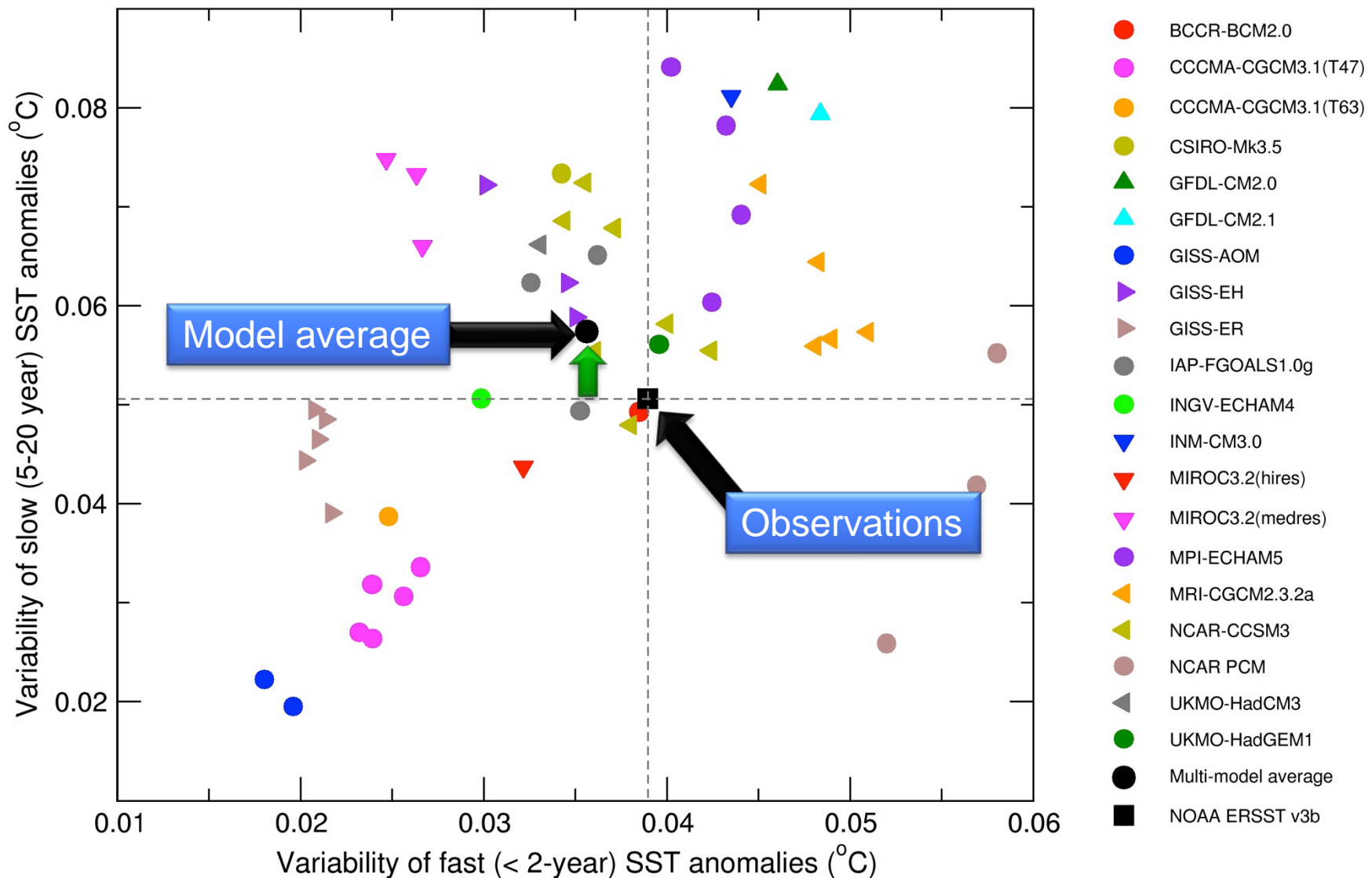




Band-pass filtering of SST data



On average, model “slow” sea-surface temperature variability is slightly *larger* than in observations





Conclusions

- Even when run with human-caused changes in greenhouse gases and aerosols, climate models can simulate 10-year periods with minimal warming of the lower troposphere
 - ➔ Claims to the contrary are demonstrably incorrect
- TLT records must be at least 17 years long in order to discriminate between internal climate “noise” and the “signal” of human-caused changes in atmospheric composition
- The S/N ratio for the global-scale TLT increase over 1979 to 2010 is ≥ 4
 - ➔ The lower tropospheric warming signal over the last 32 years is at least four times larger than model estimates of climate noise on the 32-year timescale
 - ➔ We found no evidence that the CMIP-3 models systematically underestimate the amplitude of observed SST or TLT variability on decadal timescales
 - ➔ Natural internal variability is highly unlikely to explain the observed TLT trend