Biases in Global Mean SST Estimates Obtained from Gridded Data Sets

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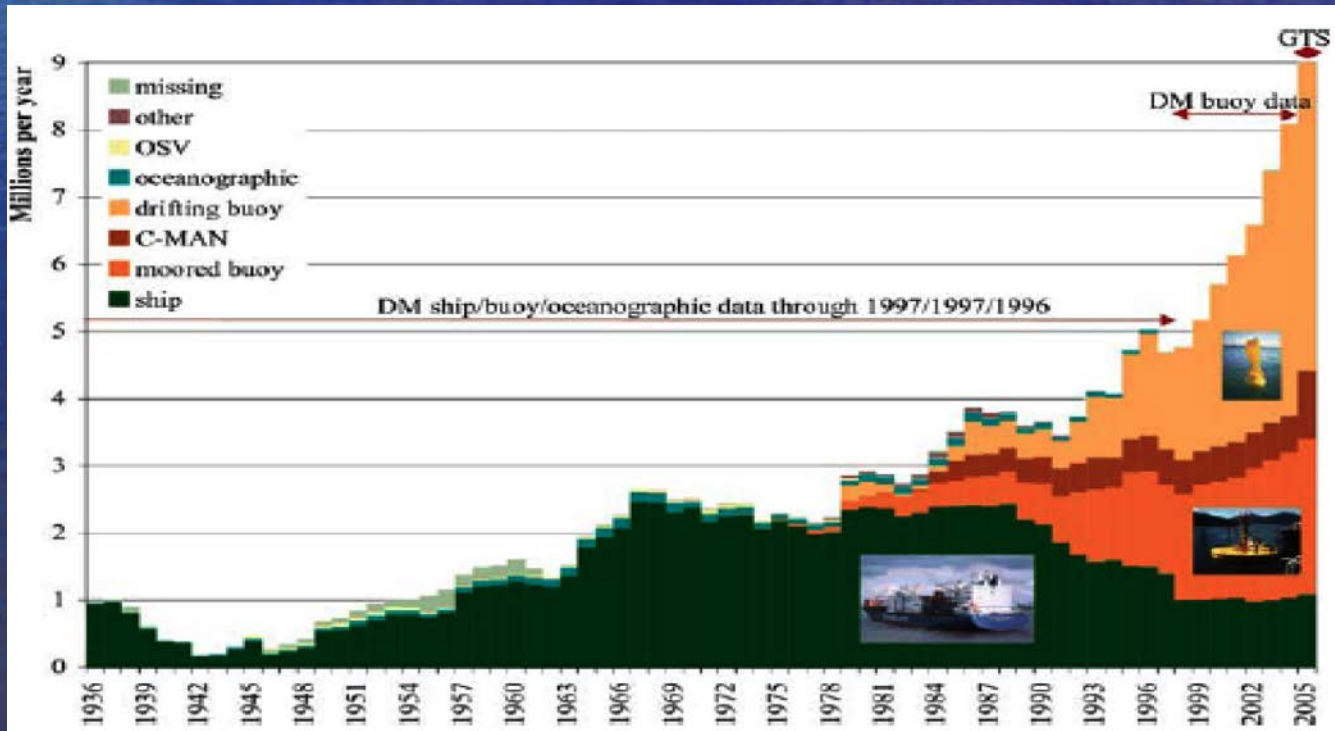
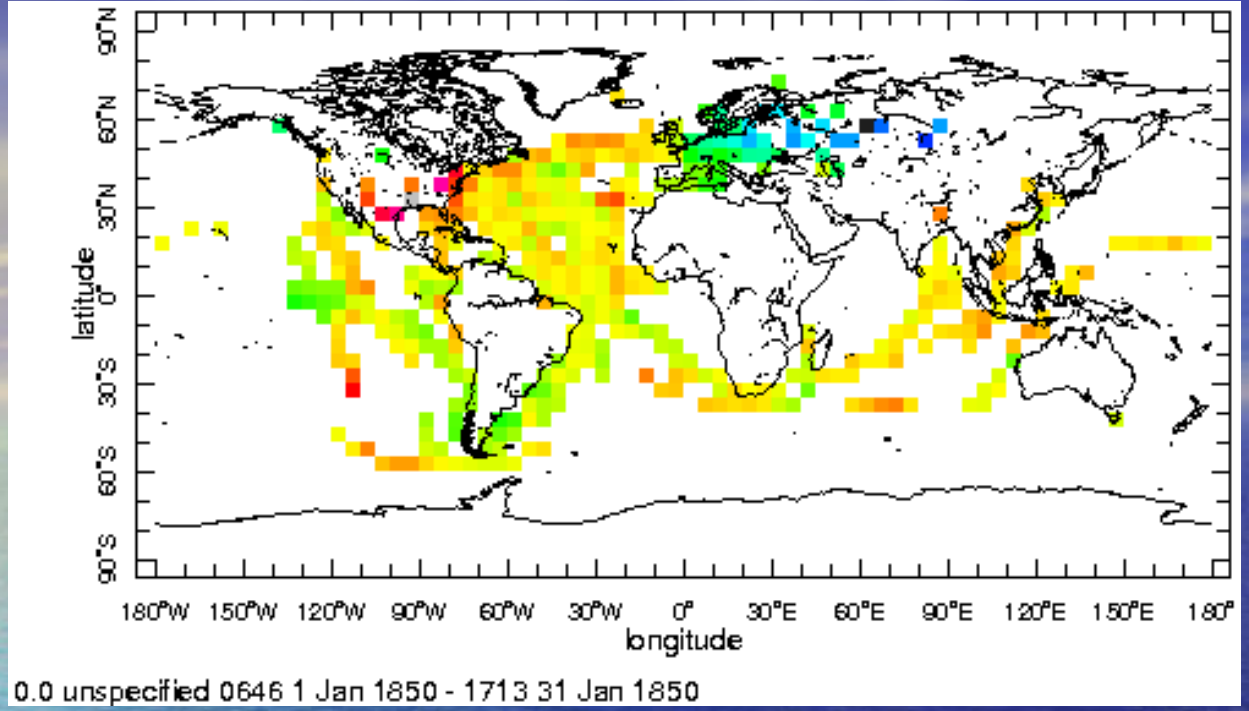
Transition to the modern Ocean Observing System

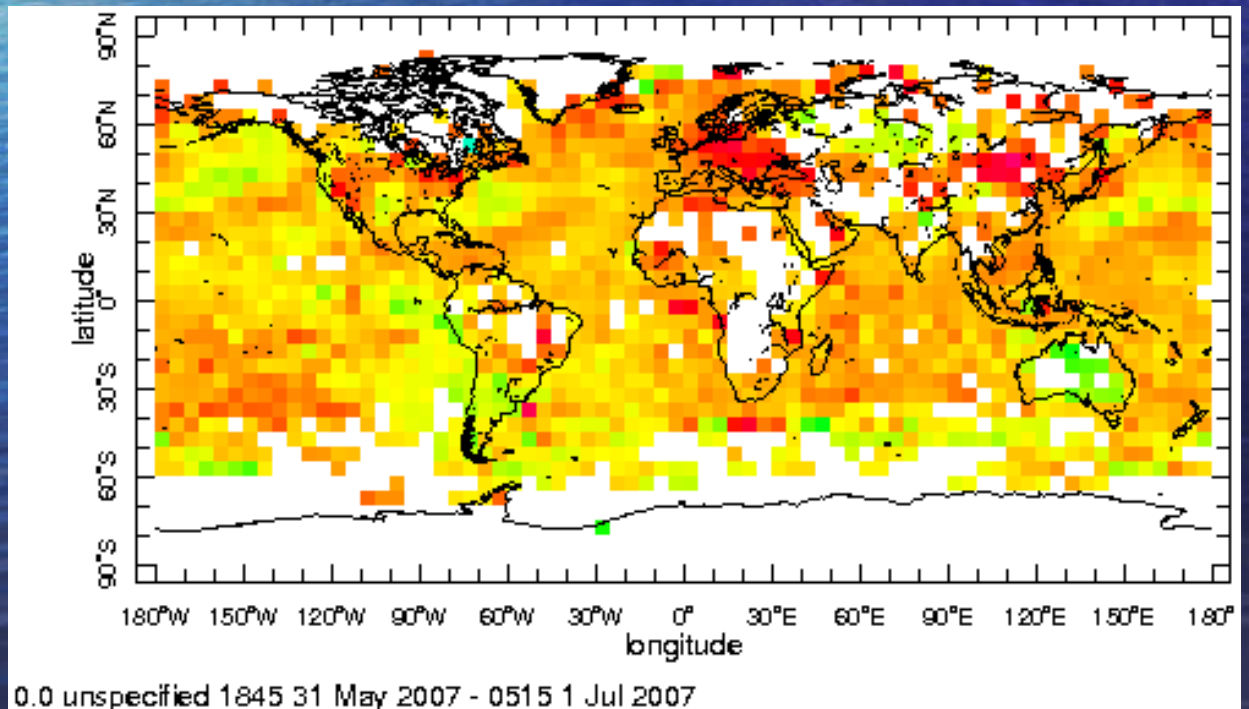


From *Woodruff et al.* [2008], In *Climate Variability and Extremes during the Past 100 Years*, Bronniman et al. (eds.)



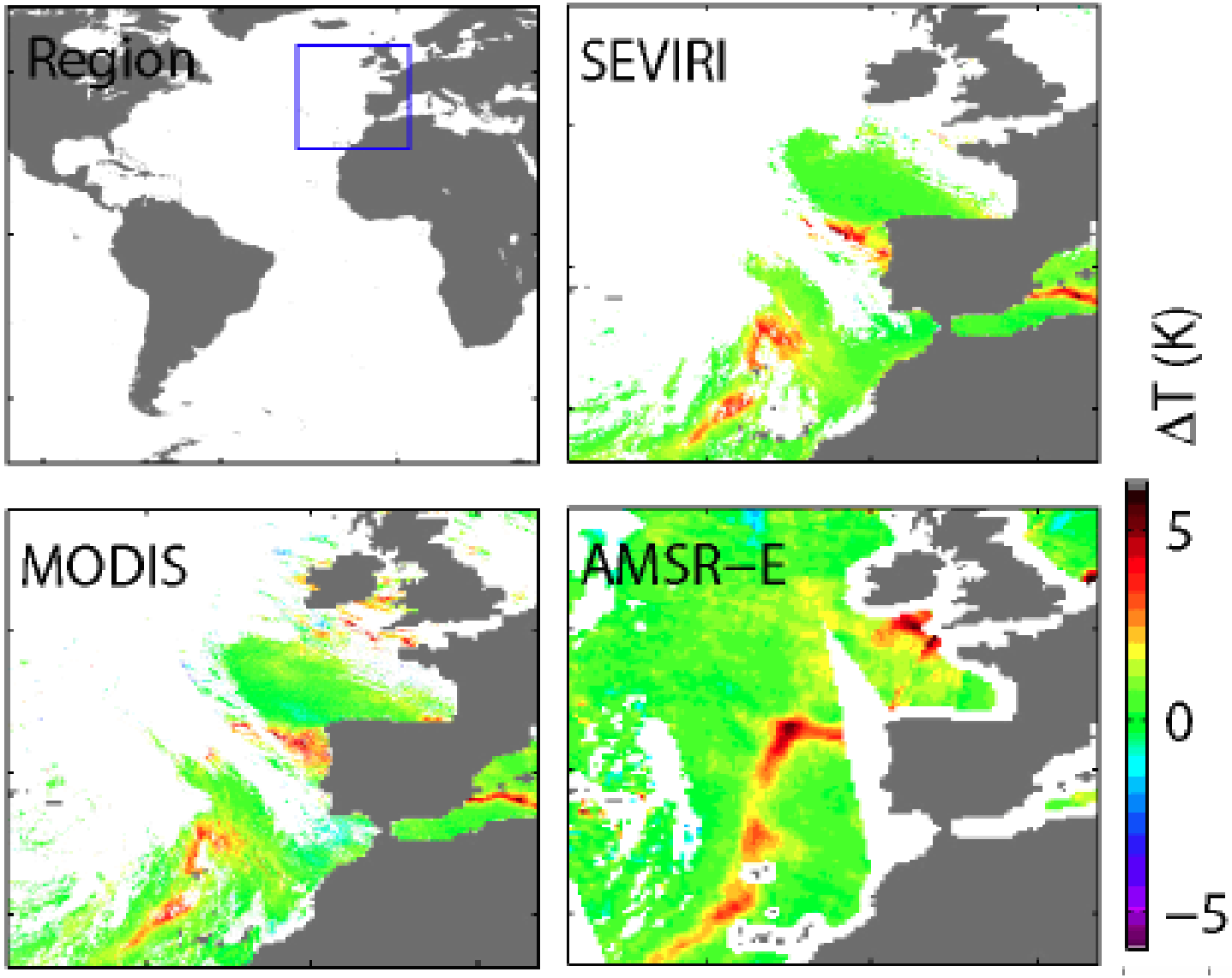
Jan 1850

In situ data:
HadSST2
[Rayner et al., 2006]

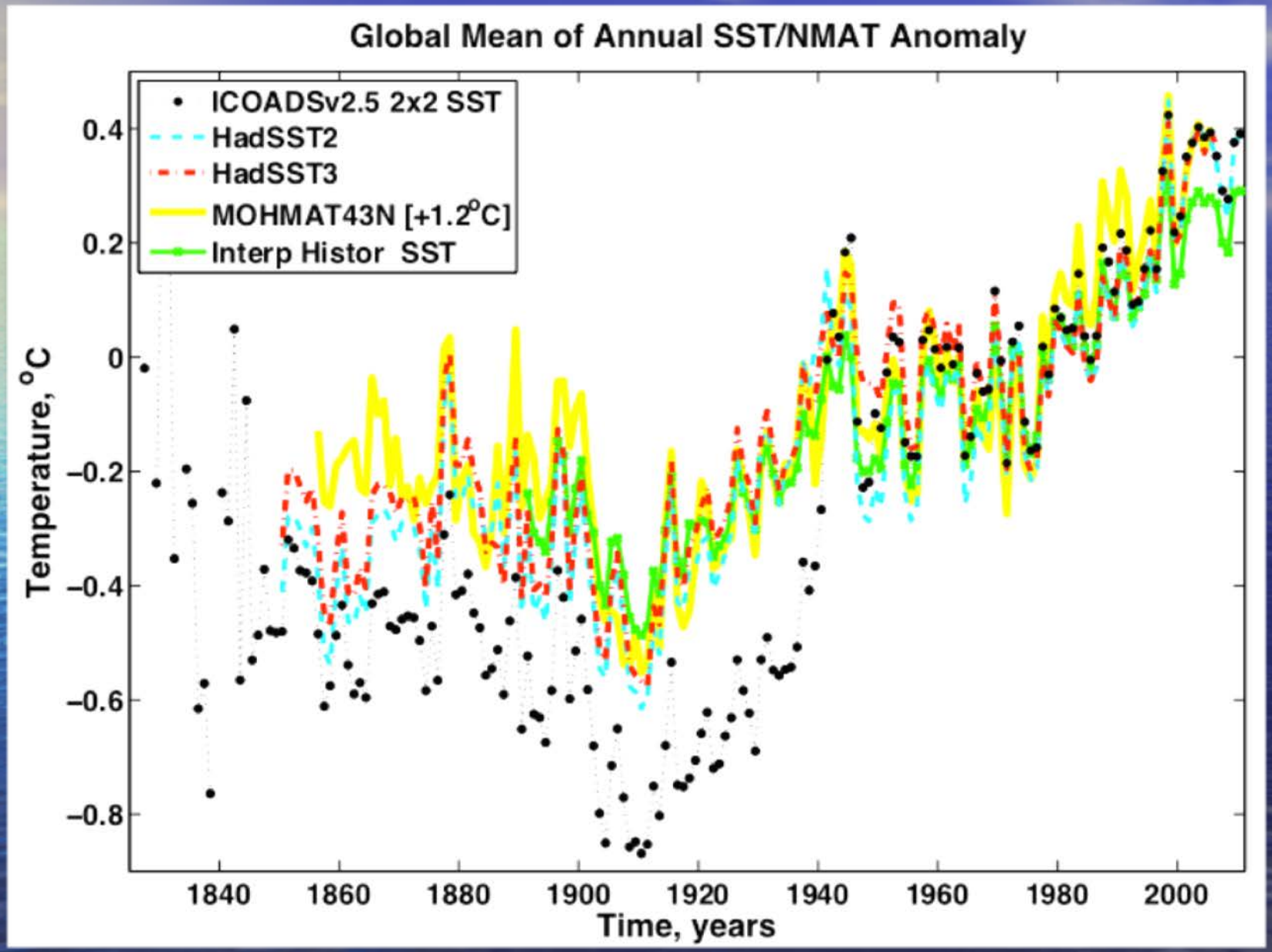


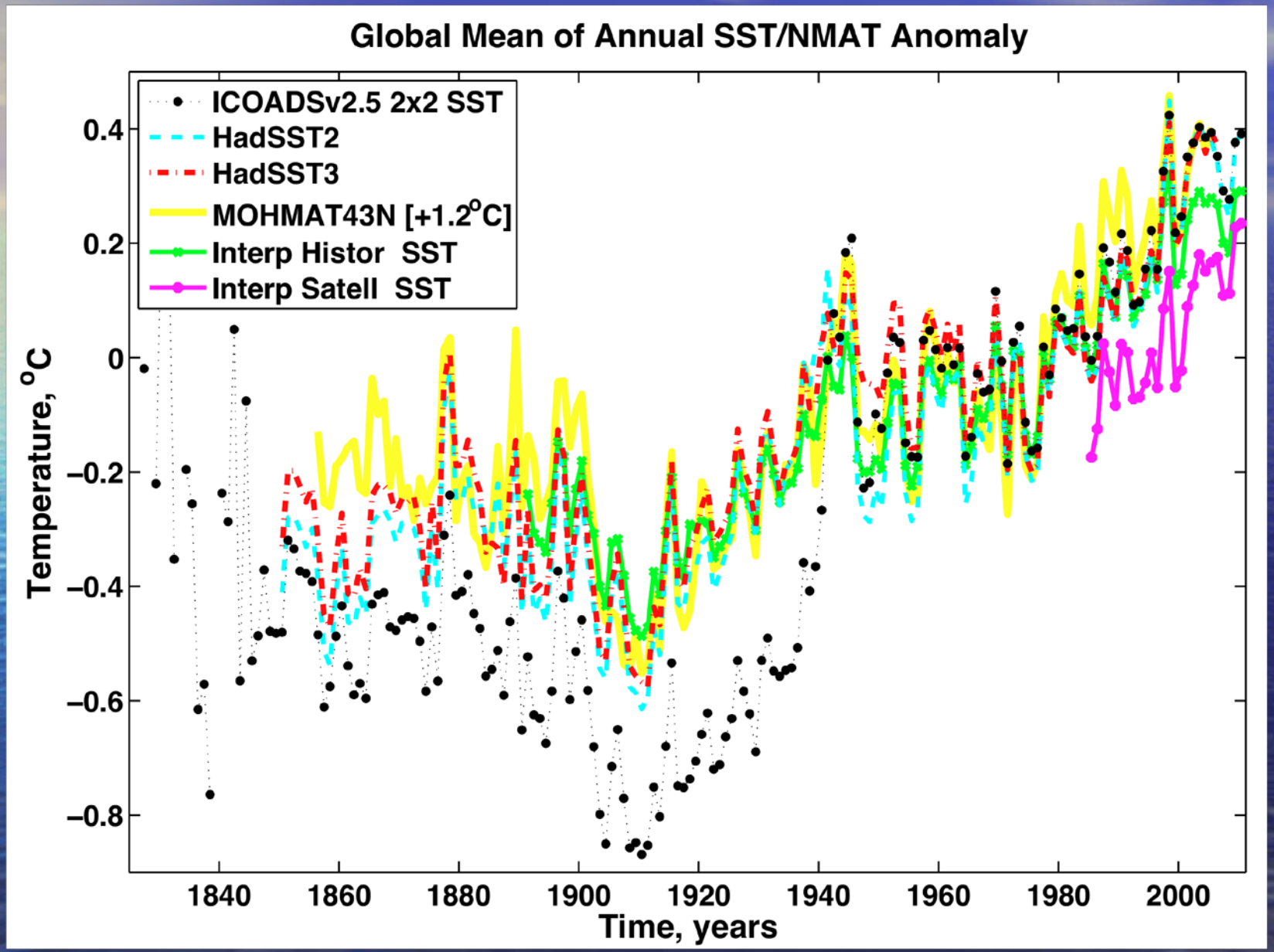
Jul 2007

Satellite Observations



Donlon et al. [2010], *OceanObs'09, Community White Paper*


Global Mean of Annual SST/NMAT Anomaly
ICOADSv2.5 2x2 SST
HadSST2
HadSST3
MOHMAT43N [+1.2°C]
Interp Histor SST
Temperature, °C
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
1840
1860
1880
1900
1920
1940
1960
1980
2000
Time, years


Global Mean of Annual SST/NMAT Anomaly
ICOADSv2.5 2x2 SST
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Interp Histor SST
Interp Satell SST
Temperature, °C
0.4
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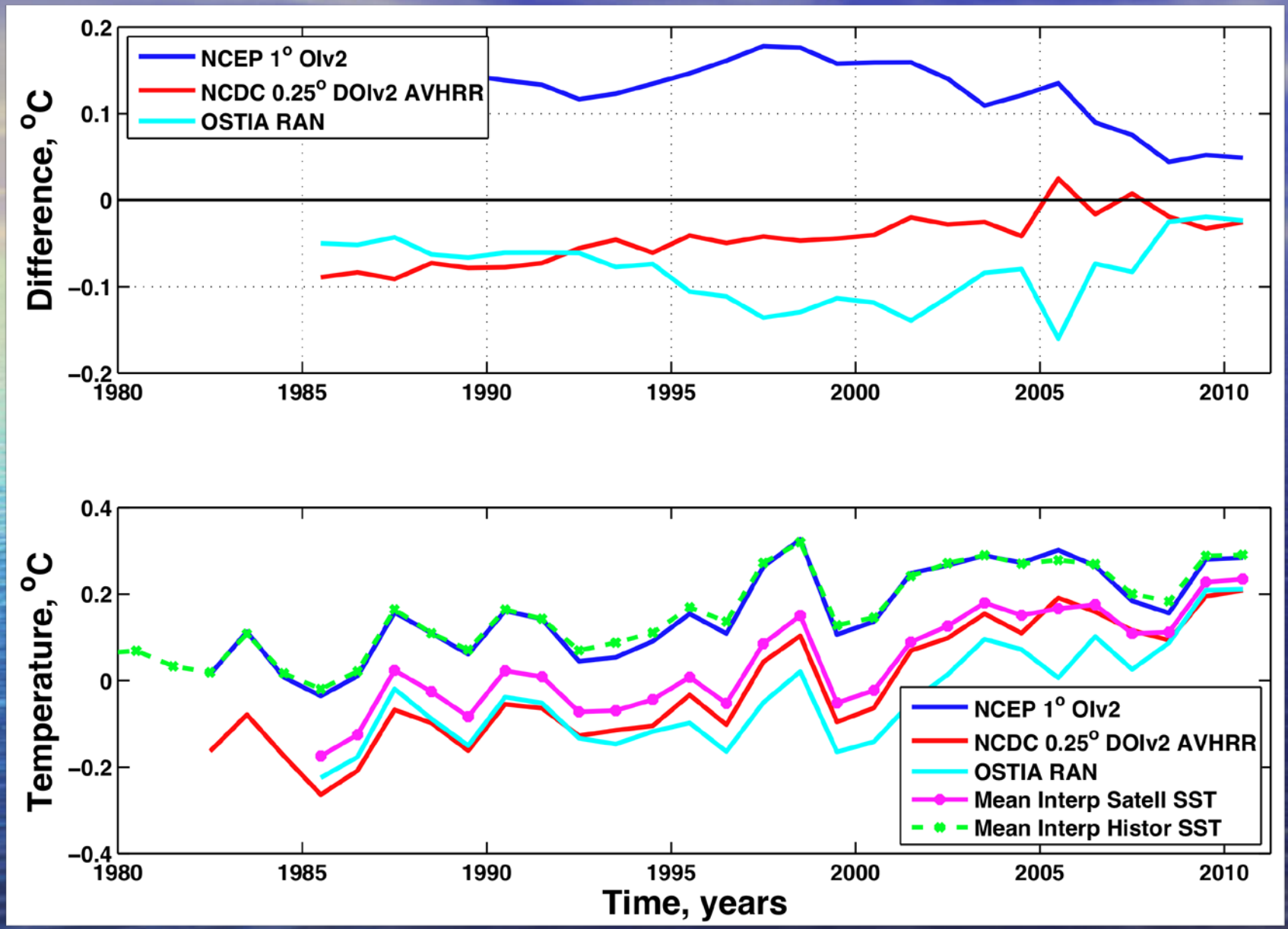
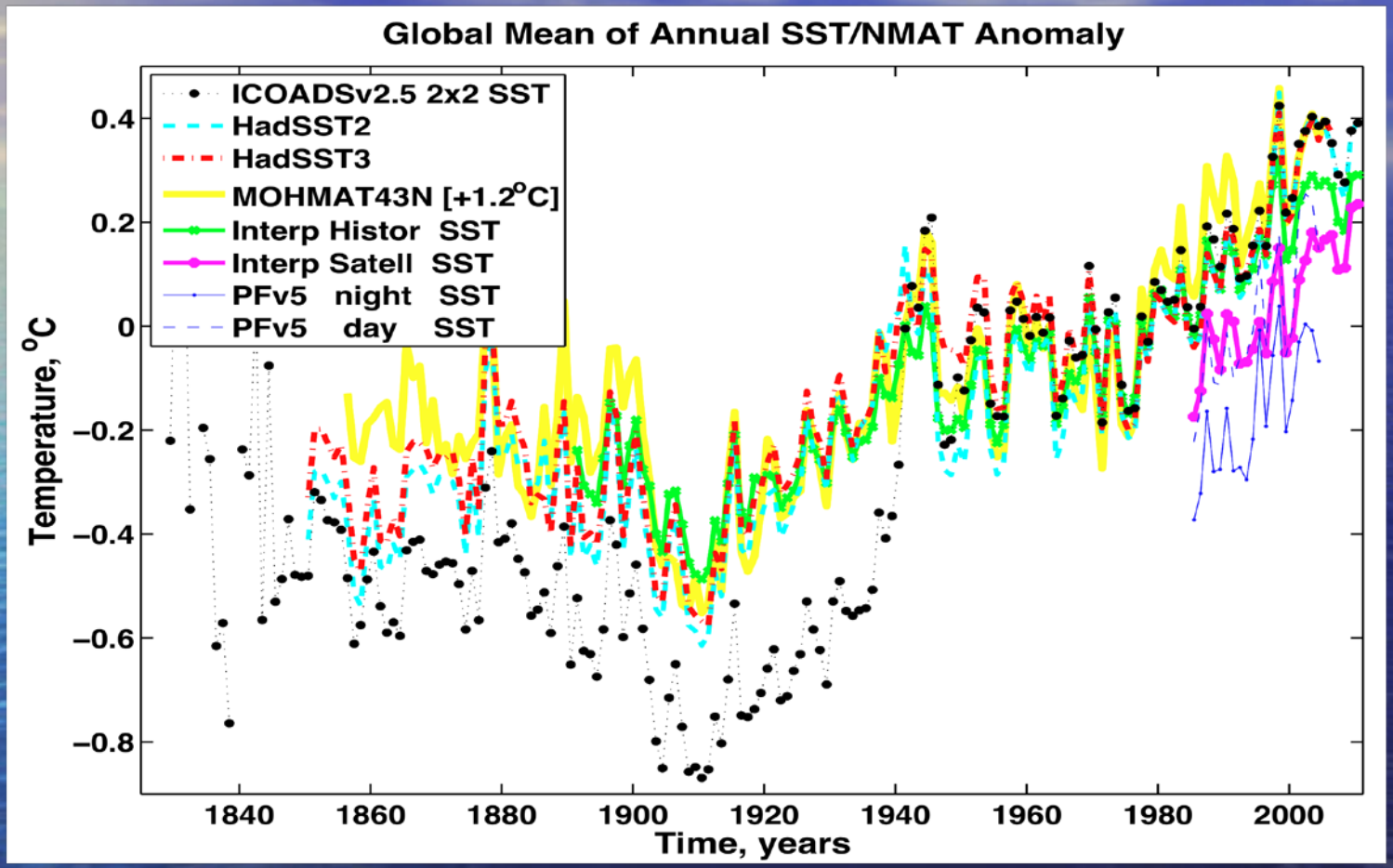
Time, years


NCEP 1° OIv2
NCDC 0.25° DOIv2 AVHRR
OSTIA RAN
Difference, °C
0.2
0.1
0
−0.1
−0.2
1980
1985
1990
1995
2000
2005
2010
NCEP 1° OIv2
NCDC 0.25° DOIv2 AVHRR
OSTIA RAN
Mean Interp Satell SST
Mean Interp Histor SST
Temperature, °C
0.4
0.2
0
−0.2
−0.4
Time, years


Global Mean of Annual SST/NMAT Anomaly
ICOADSv2.5 2x2 SST
HadSST2
HadSST3
MOHMAT43N [+1.2°C]
Interp Histor SST
Interp Satell SST
PFv5 night SST
PFv5 day SST
Temperature, °C
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
1840
1860
1880
1900
1920
1940
1960
1980
2000
Time, years

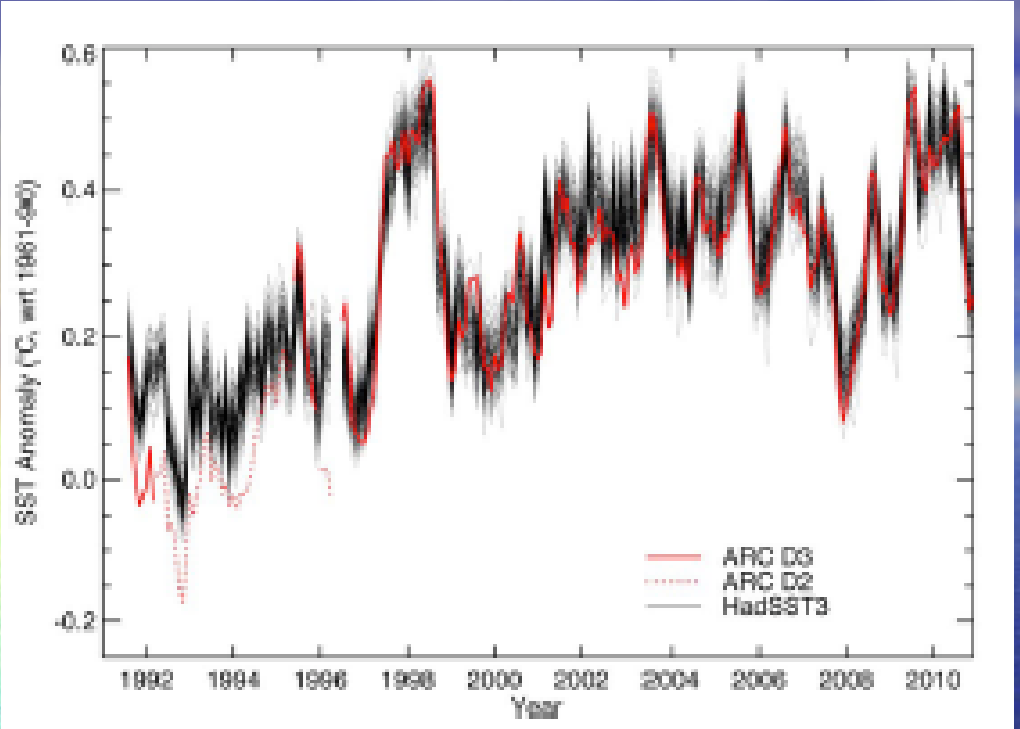


Figure 14. Global mean SST anomaly (°C, relative to 1961–1990). Red lines indicate ARC nighttime $SST_{0.2m}$ time series: solid red indicates D3 retrievals, used when available, and dotted red indicates D2 retrievals used during the ATSR-1 period with no D3. Black lines indicate the 100-member HadSST3 ensemble. Data were first averaged on to a 5° latitude by 5° longitude monthly grid, according to the method used by *Kennedy et al.* [2011a]. Only grid boxes where measurements/retrievals were available in both data sets were used.

Merchant et al., JGR, 2012

Despite the efforts to correct inter-platform biases in the SST data used for producing gridded data sets, the remaining biases are significant enough to create easily discernible differences between global means estimated from such gridded data sets.

- Global means from annually averaged OSTIA SST is systematically colder than that from the NCDC Daily 0.25º AVHRR-only OI data set by about 0.1ºC, while the latter is colder than the same estimated from the (older) NCEP monthly 1º OI by approximately the same amount.
- While historical SST data sets that make use of the AVHRR data (HadISST1 and COBE SST) show very good consistency with the NCEP monthly 1º OI, they are colder than the products that use only *in situ* data (ERSST v3b, HadSST2, HadSST3, ICOADS).

- The global mean difference between these two groups of gridded historical data sets becomes especially prominent after 2000, exceeding 0.1ºC in some years. All these differences are **not** due to differences in the domains of the data sets (they appear in co-located calculations as well) or can be reasonably explained by random error effects on global annual SST averages.

- Systematic differences between ship and buoy data and remaining cold biases in the AVHRR data seem responsible for the global mean differences between historical data sets during the satellite period. Global mean differences between individual L4 products have to be traced to their input data sets and their inter-platform bias removal procedures.
- Homogenization of historical data sets in terms of a common reference across satellite and pre-satellite periods is yet to be satisfactorily resolved in the community, even with regards to the annual global SST means