Biases Versus Variability in Differences Between Gridded SST Products

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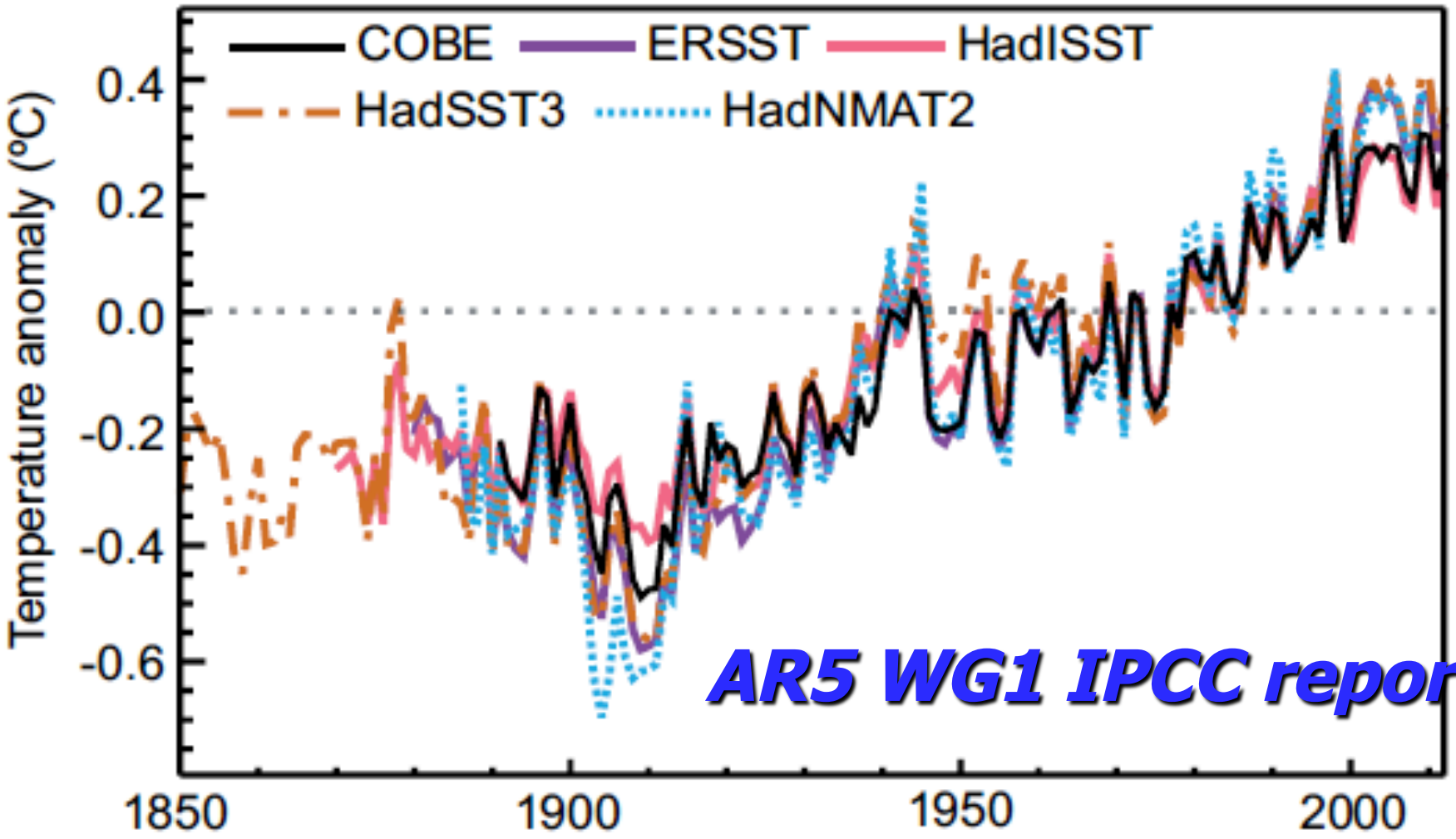
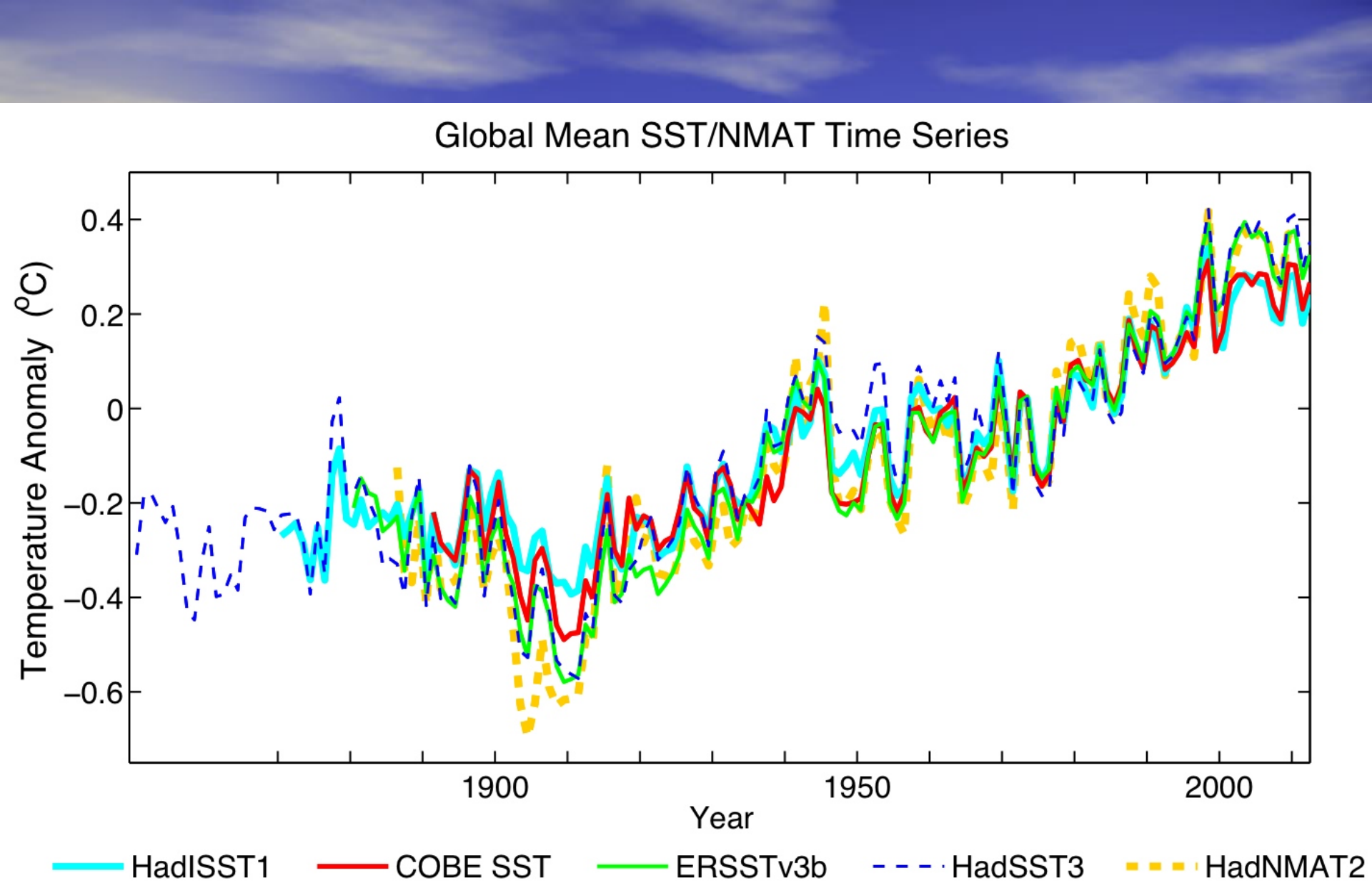
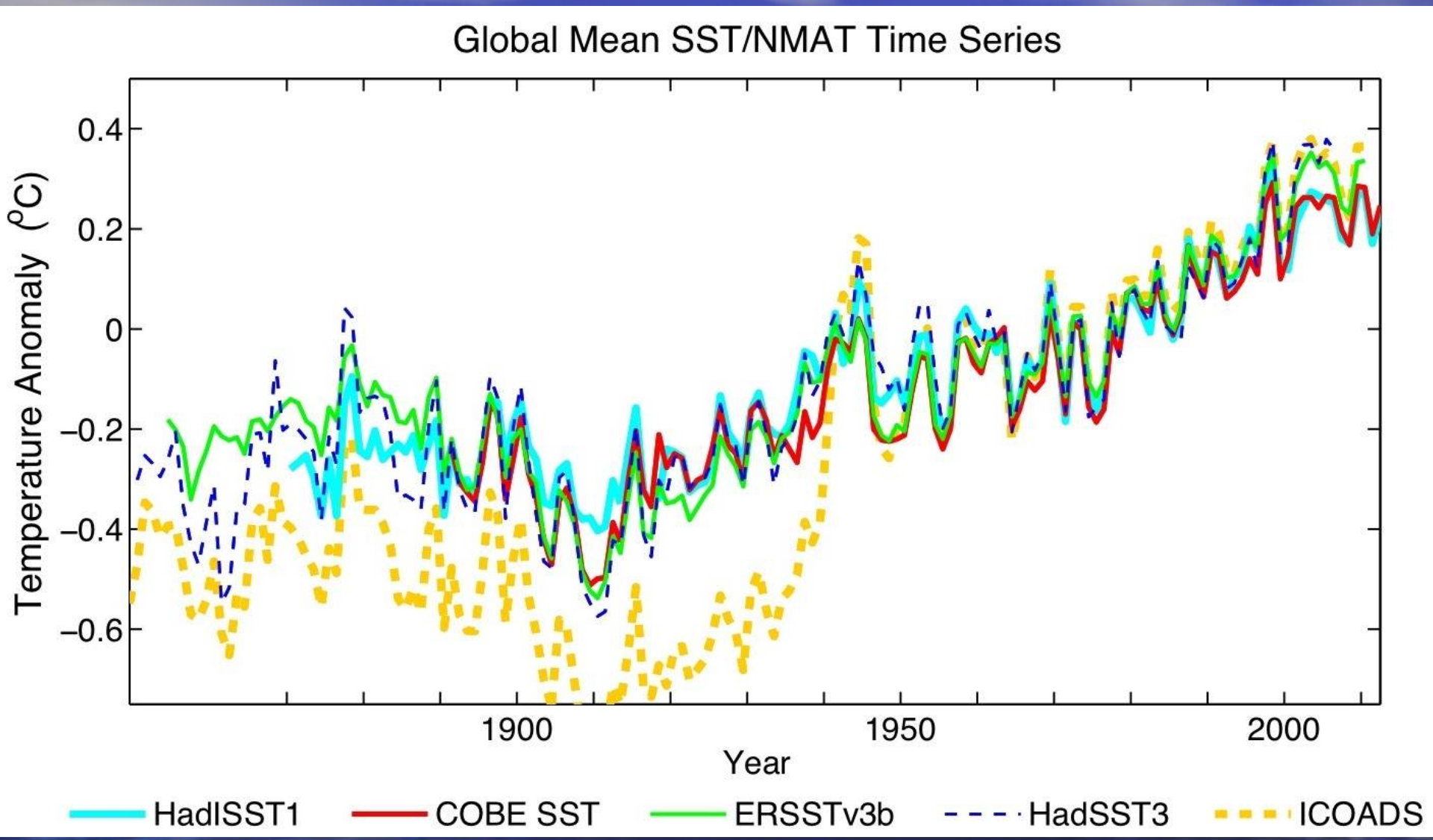


Figure 2.18 | Global annual average sea surface temperature (SST) and Night Marine Air Temperature (NMAT) relative to a 1961–1990 climatology from state of the art data sets. Spatially interpolated products are shown by solid lines; non-interpolated products by dashed lines.


Global Mean SST/NMAT Time Series
Temperature Anomaly (°C)
0.4
0.2
0
−0.2
−0.4
−0.6
1900
1950
2000
Year
HadISST1
COBE SST
ERSSTv3b
HadSST3
HadNMAT2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COBE SST
ERSSTv3b
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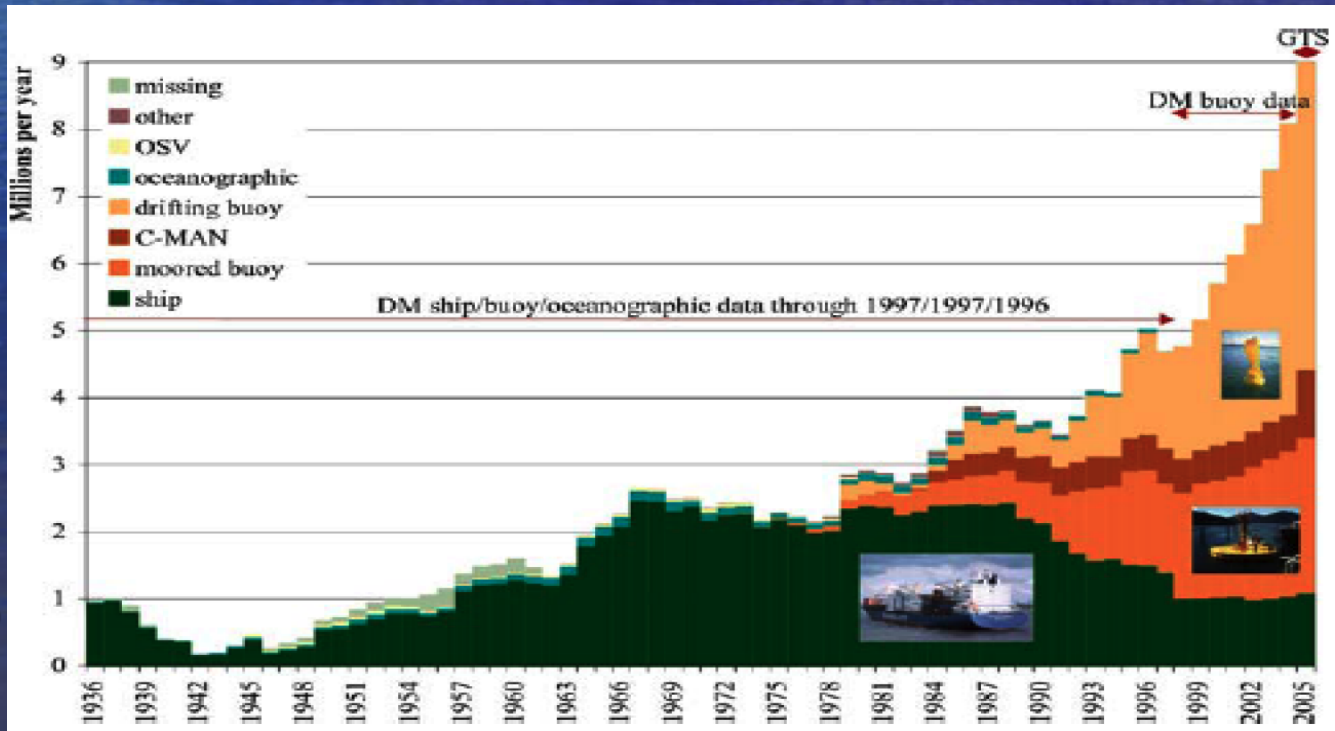
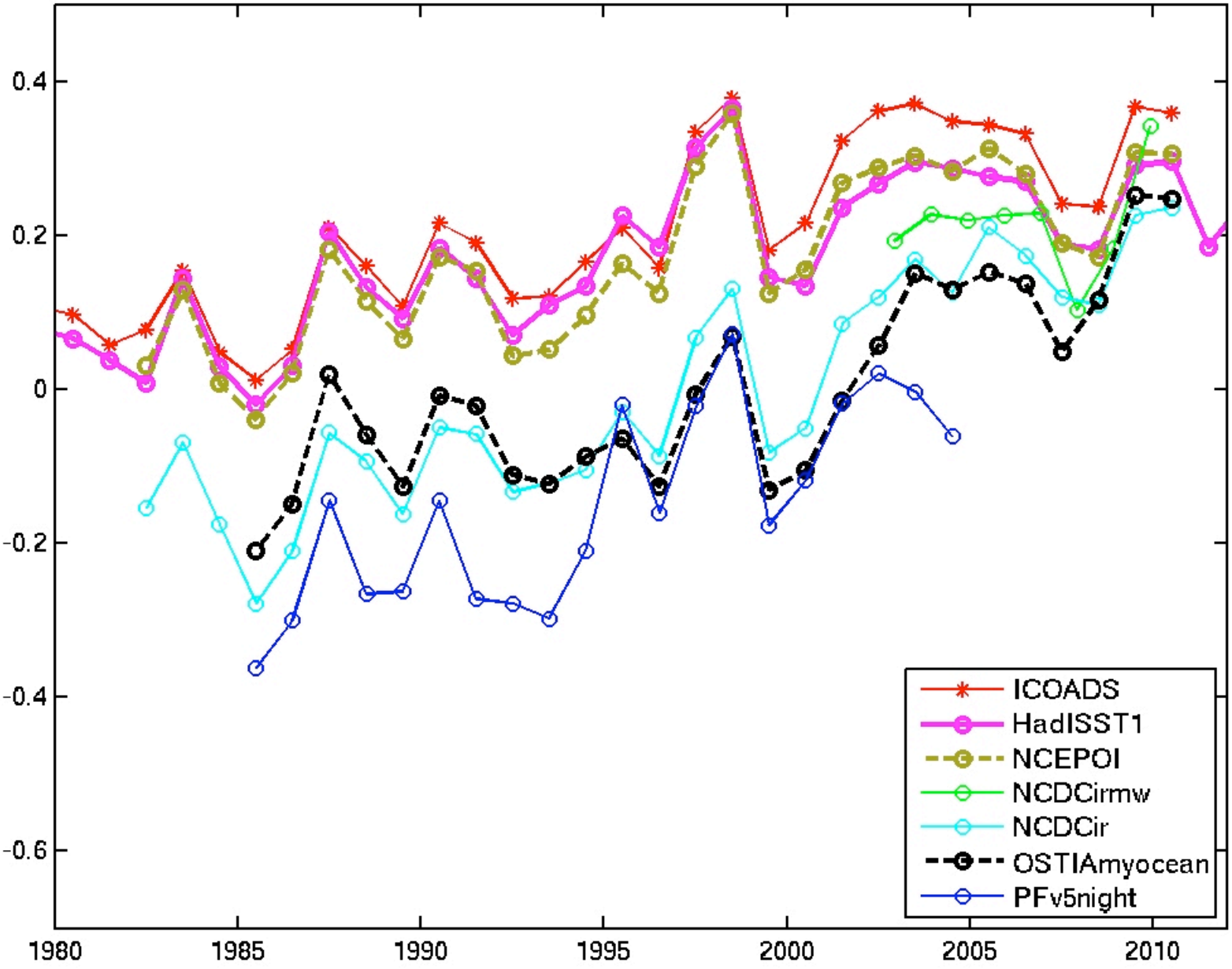
ICOADS

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.)**


0.4
0.2
0
-0.2
-0.4
-0.6
1980
1985
1990
1995
2000
2005
2010
ICOADS
HadISST1
NCEPOI
NCDCirmw
NCDCir
OSTIAmyocean
PFv5night

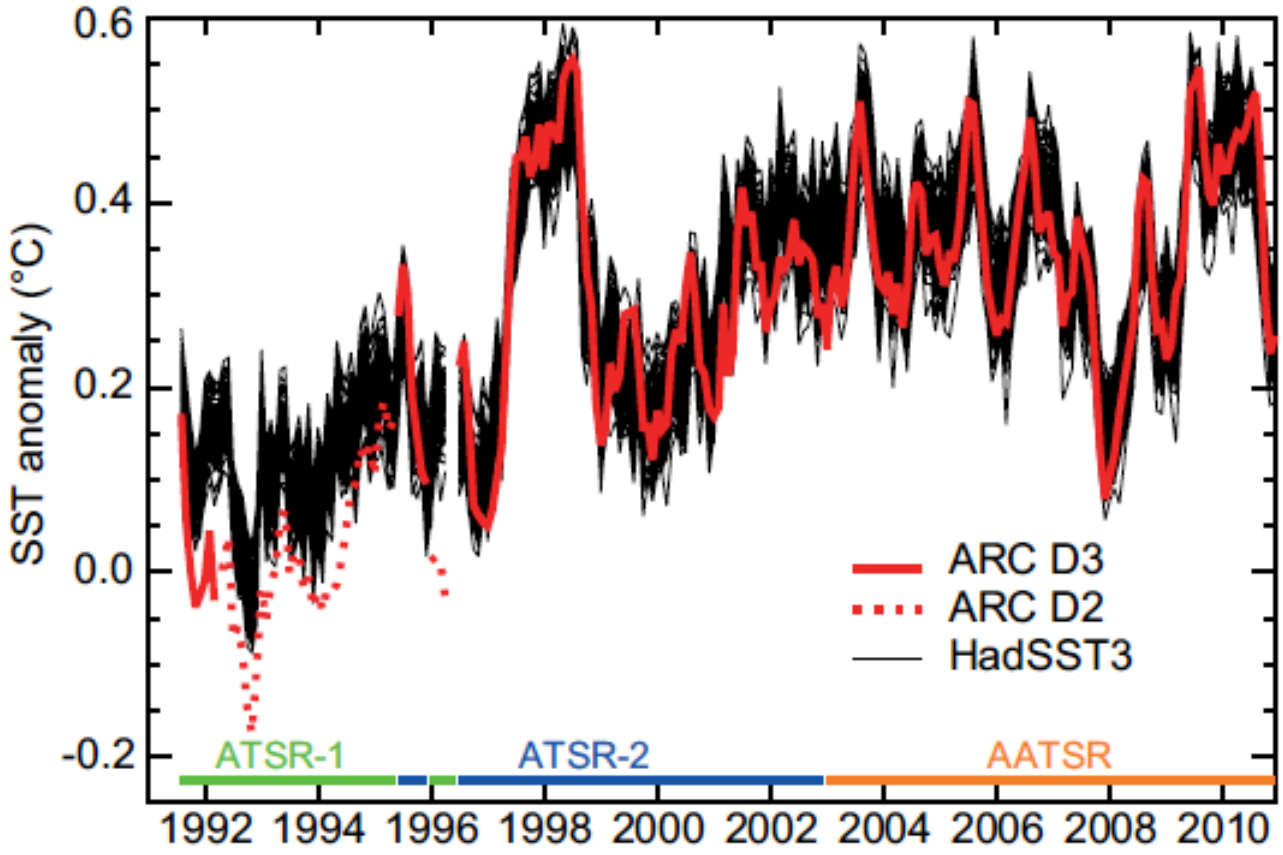
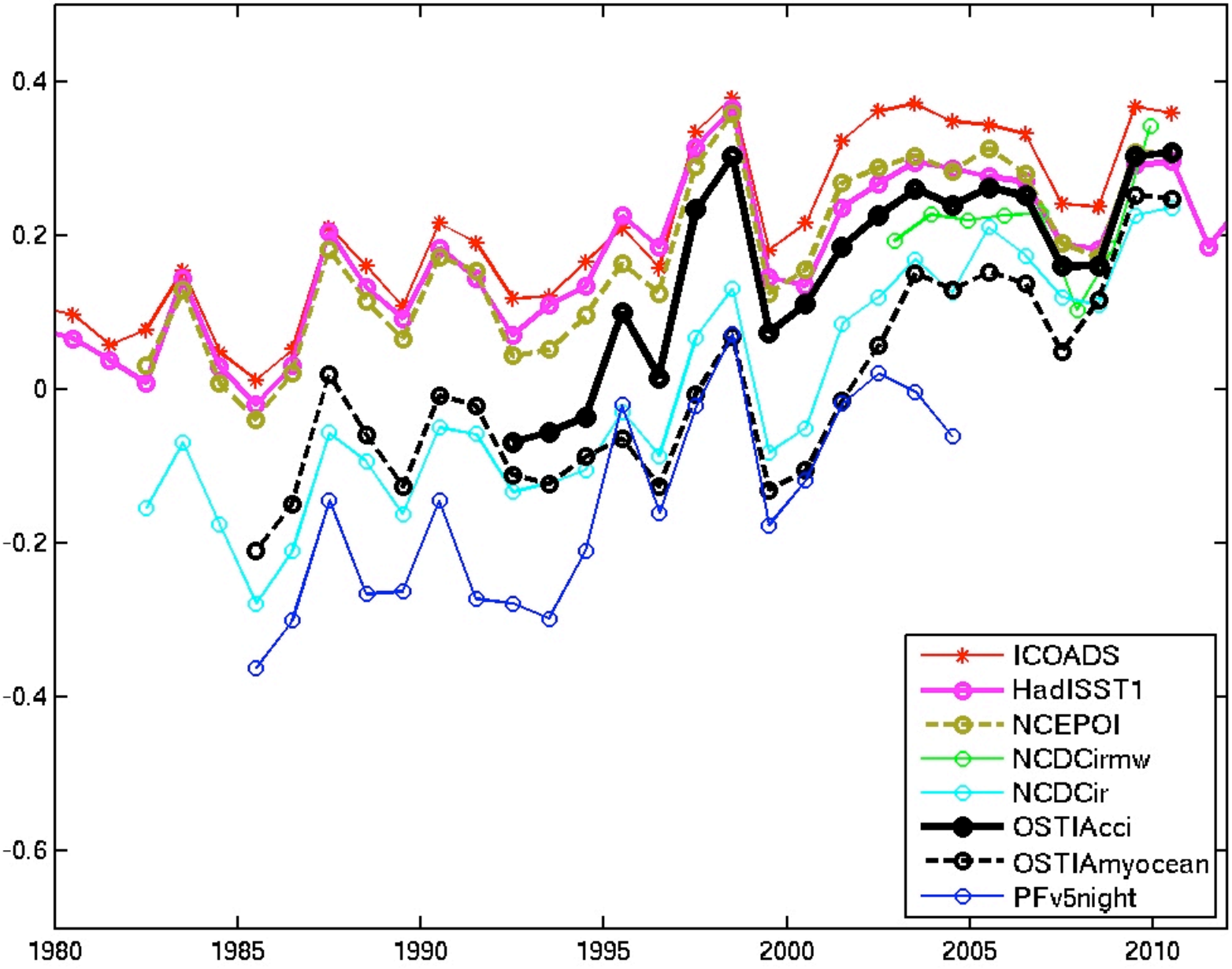


Figure 2.17 | Global monthly mean sea surface temperature (SST) anomalies relative to a 1961–1990 climatology from satellites (ATSRs) and *in situ* records (HadSST3). Black lines: the 100-member HadSST3 ensemble. Red lines: ATSR-based nighttime subsurface temperature at 0.2 m depth ($SST_{0.2m}$) estimates from the ATSR Reprocessing for Climate (ARC) project. Retrievals based on three spectral channels (D3, solid line) are more accurate than retrievals based on only two (D2, dotted line). Contributions of the three different ATSR missions to the curve shown are indicated at the bottom. The *in situ* and satellite records were co-located within 5° × 5° monthly grid boxes: only those where both data sets had data for the same month were used in the comparison. (Adapted from Merchant et al. 2012.)


0.4
0.2
0
-0.2
-0.4
-0.6
1980
1985
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ICOADS
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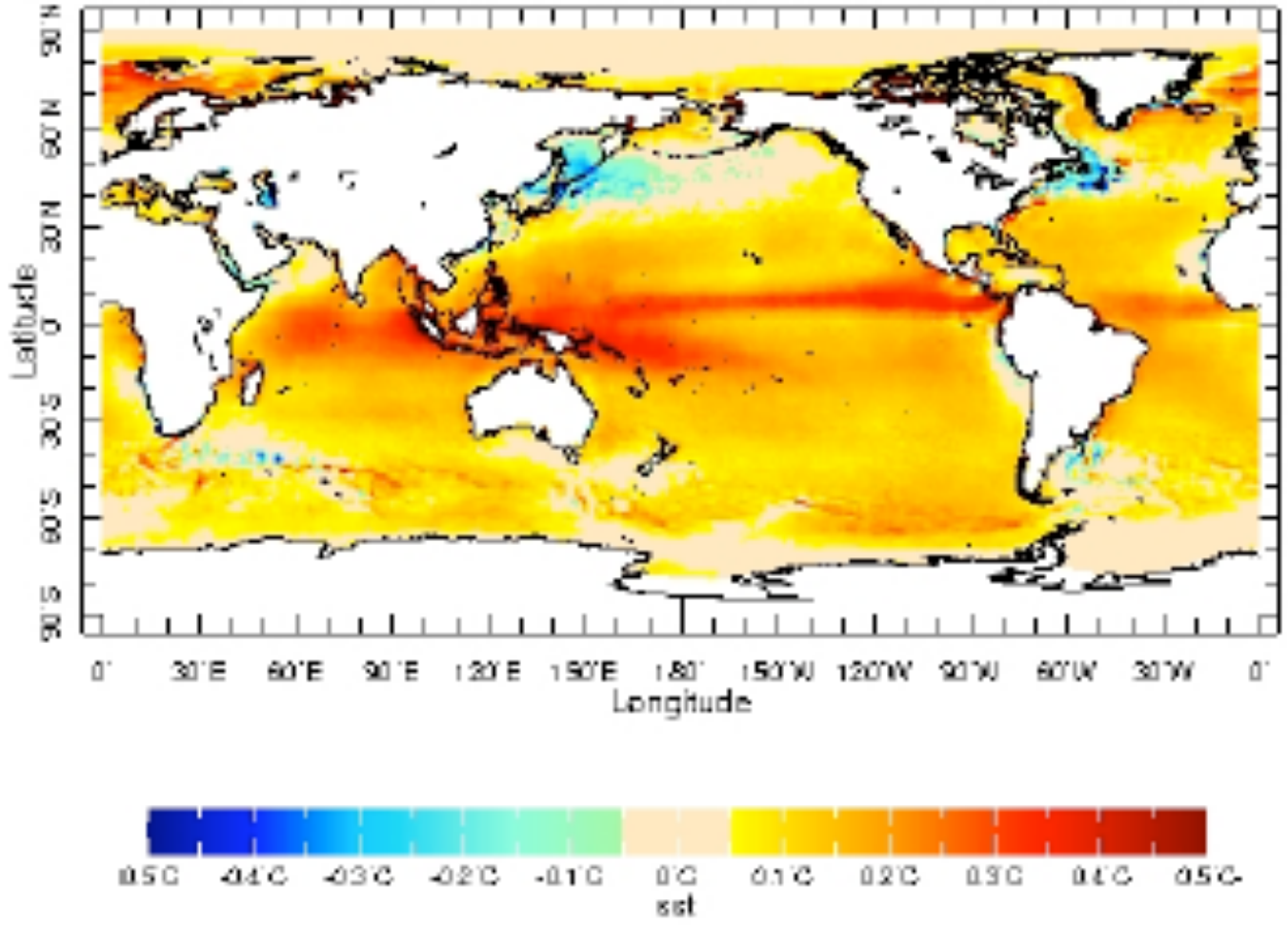

Figure 1. Mean difference <OSTIA-CCI minus OSTIA-myocean> (Sep 1991 to Dec 2010 period)

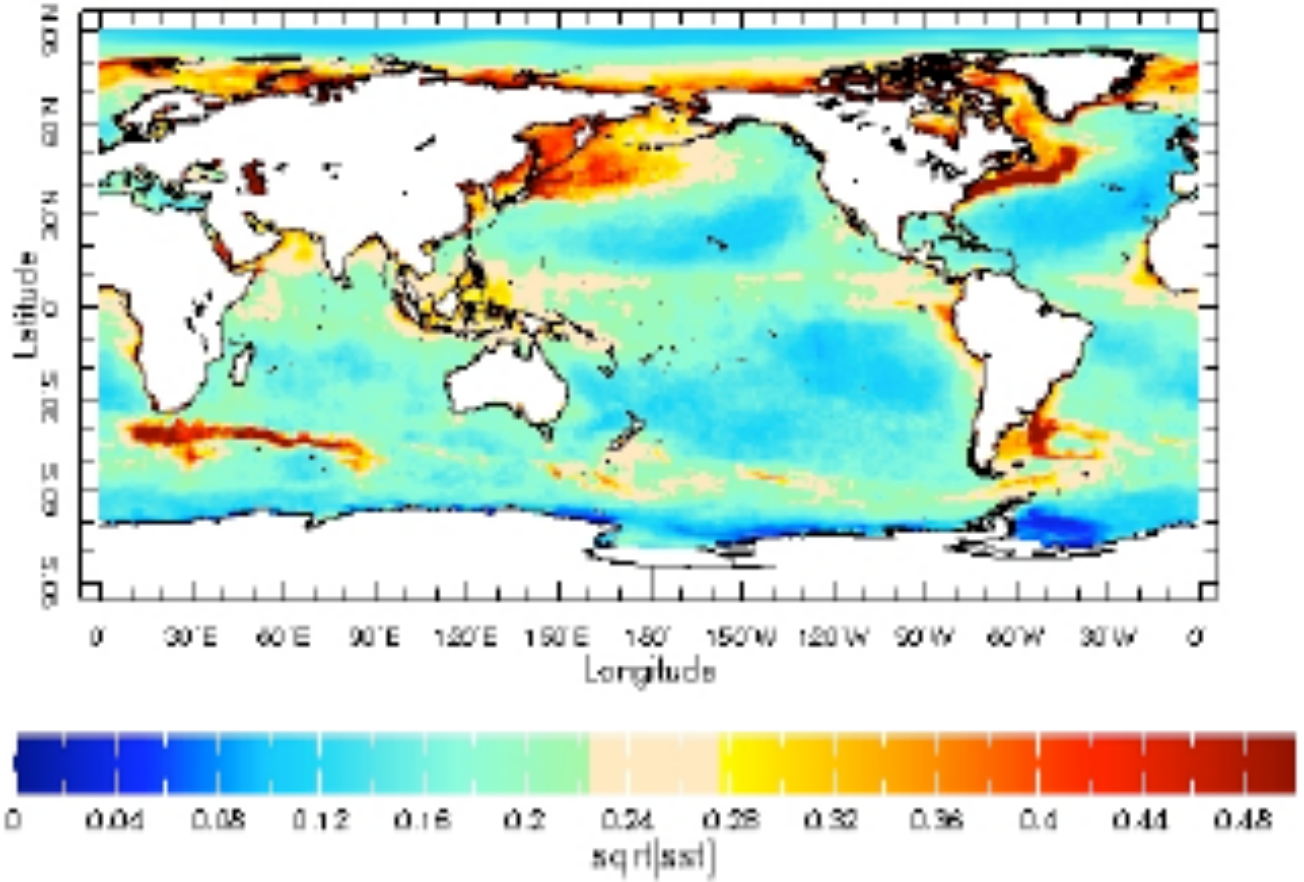

Figure 2. Standard deviation of (OSTIA-CCI minus OSTIA-myocean) for Sep 1991 - Dec 2010 period

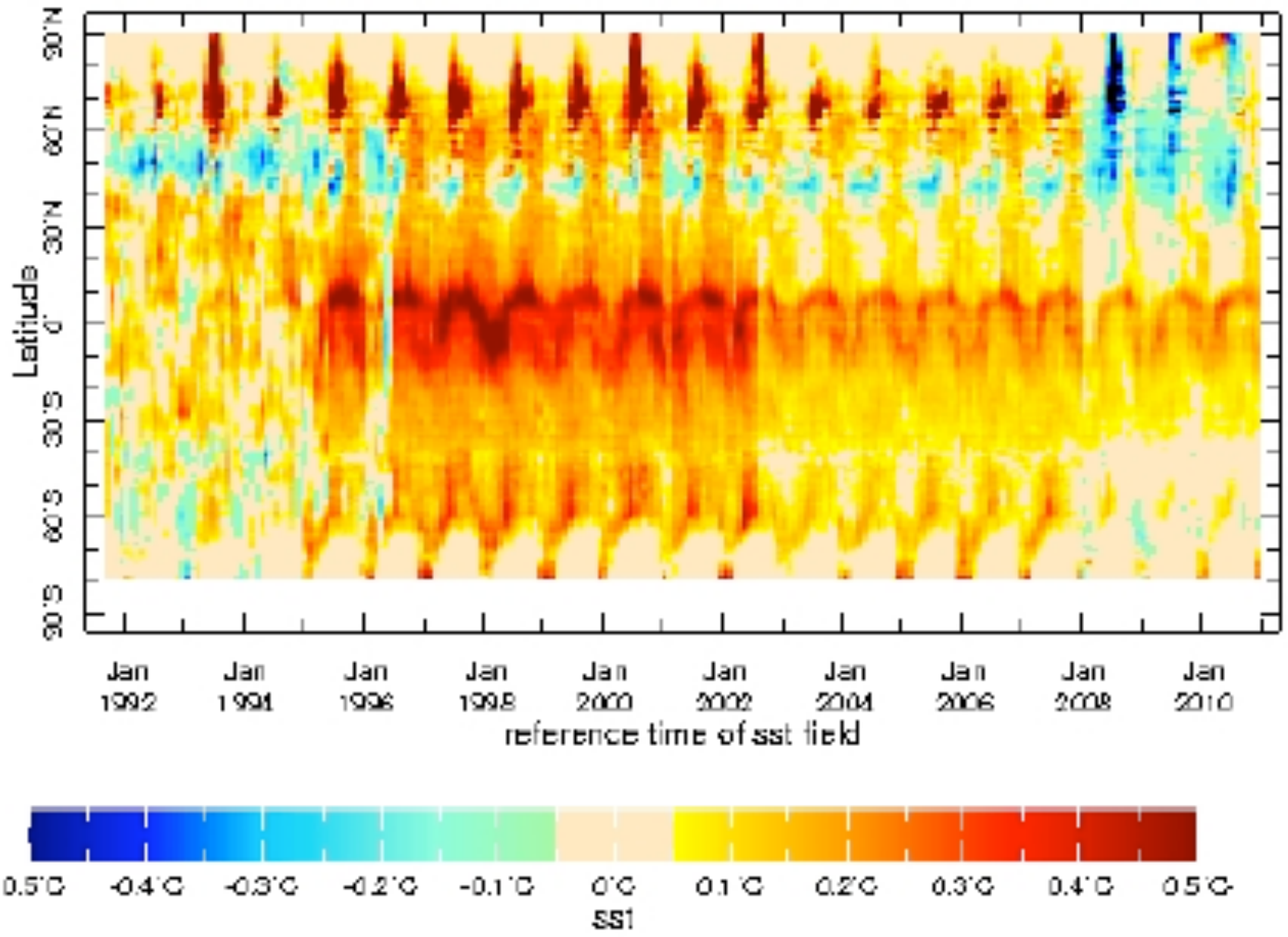

Figure 3. Zonal mean monthly difference <OSTIA-CCI minus OSTIA-myocean> (Sep 1991 to Dec 2010 period)

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 0.25° AVHRR-only OI data set by about 0.1°C, while the latter is colder than the same estimated from the (older) NCEP monthly 1° 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 1° 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 0.1°C 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.
- OSTIA CCI is a right step forward (but details of how corrections happen need to be understood).

- 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