

Objective Analyses of SST and Marine Meteorological Variables for the 20th Century using COADS and the Kobe Collection

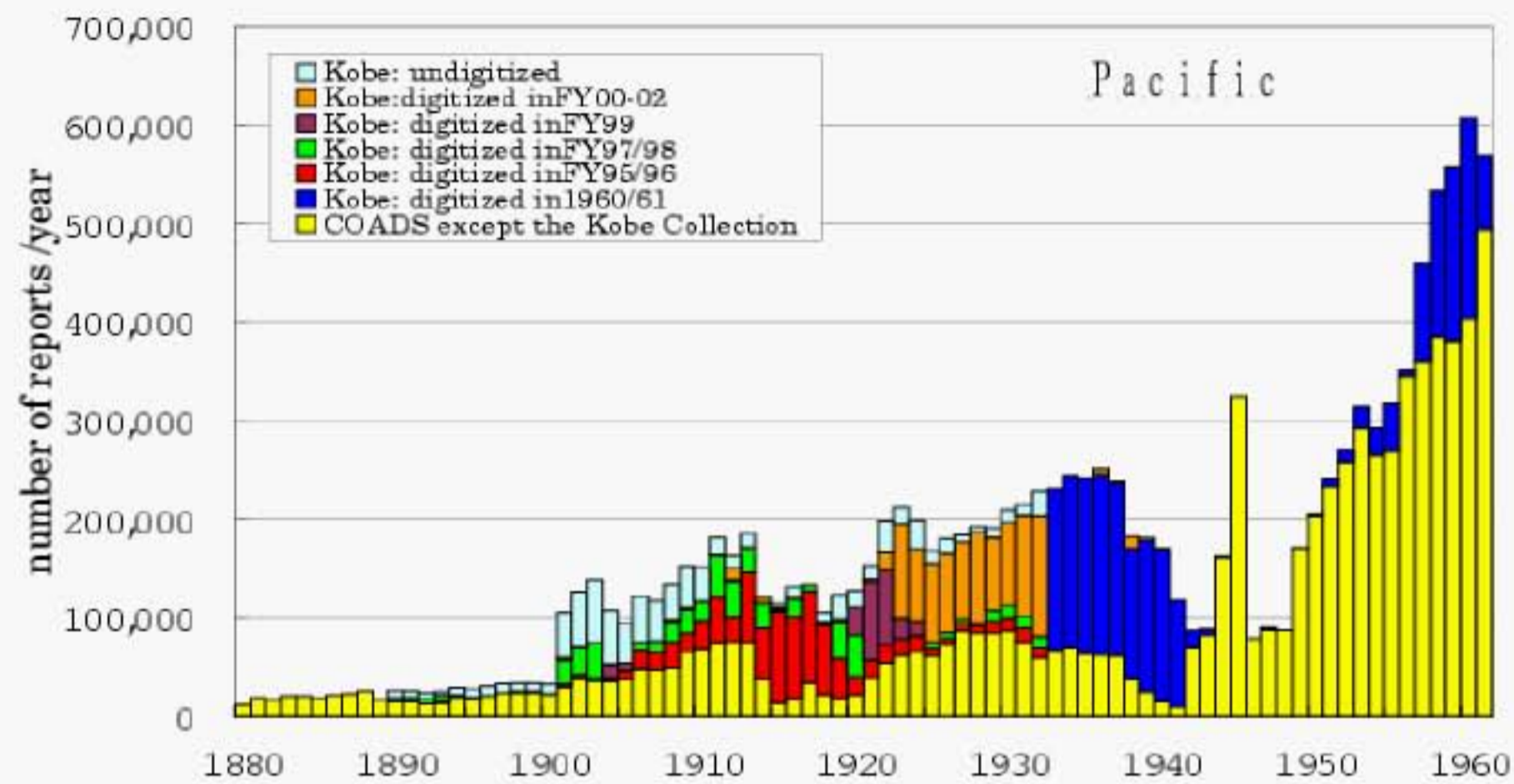
M. ISHII (MRI/JMA)

A. SHOUJI, S. SUGIMOTO, T. MATSUMOTO (HQ/JMA)

Purpose

- To obtain a "bird's-eye view" of historical marine data,
- To evaluate the Kobe Collection,
- To use for climate studies, and
- To use as inputs or boundary conditions of GCMs.

The Kobe Collection



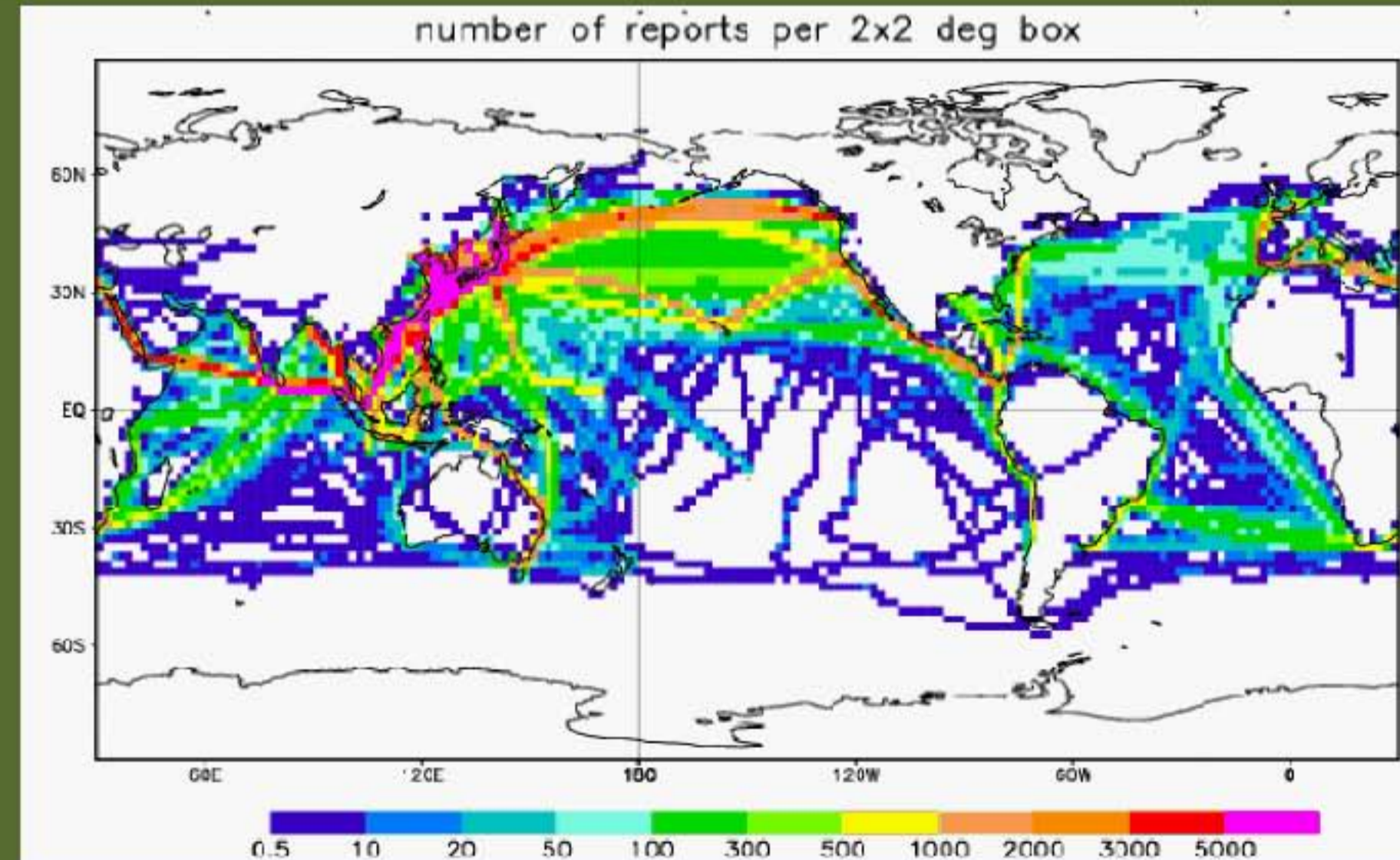
"The digitalization was completed in March 2003."

Data distribution in time
Yellow: COADS
Others: The Kobe Collection

"KC contains 5.8million, and roughly speaking, double the number around WW-I and in the Pacific Ocean in I-COADS. (see Shouji et al.'s poster for details)"

Spatial data distribution for 1890

-32



OA of SST and Marine-Met. Variables: COBE

- **Period: 1900-2000**
- **Elements: SST, SLP, AT, NAT, TD, U, V, IUI, CLOUD**
- **Resolution: Global 1 x 1 grid.**
- **Climatology: Original, plus JMA's global analysis for the polar regions and NCEP OI v2 for closed seas.**
- **Daily Objective Analysis by OI**
 - **Analysis error estimation**
 - **SLP-U simultaneous analysis with a geostrophic assumption**
 - **Sea-ice-to-SST conversion by a quadratic function of SIC.**
- **Monthly Reconstruction with EOFs (1961-2000) by 2DVAR**
- **Database: Analyzed values, analysis errors, and data distribution.**

Quality Control (QC)

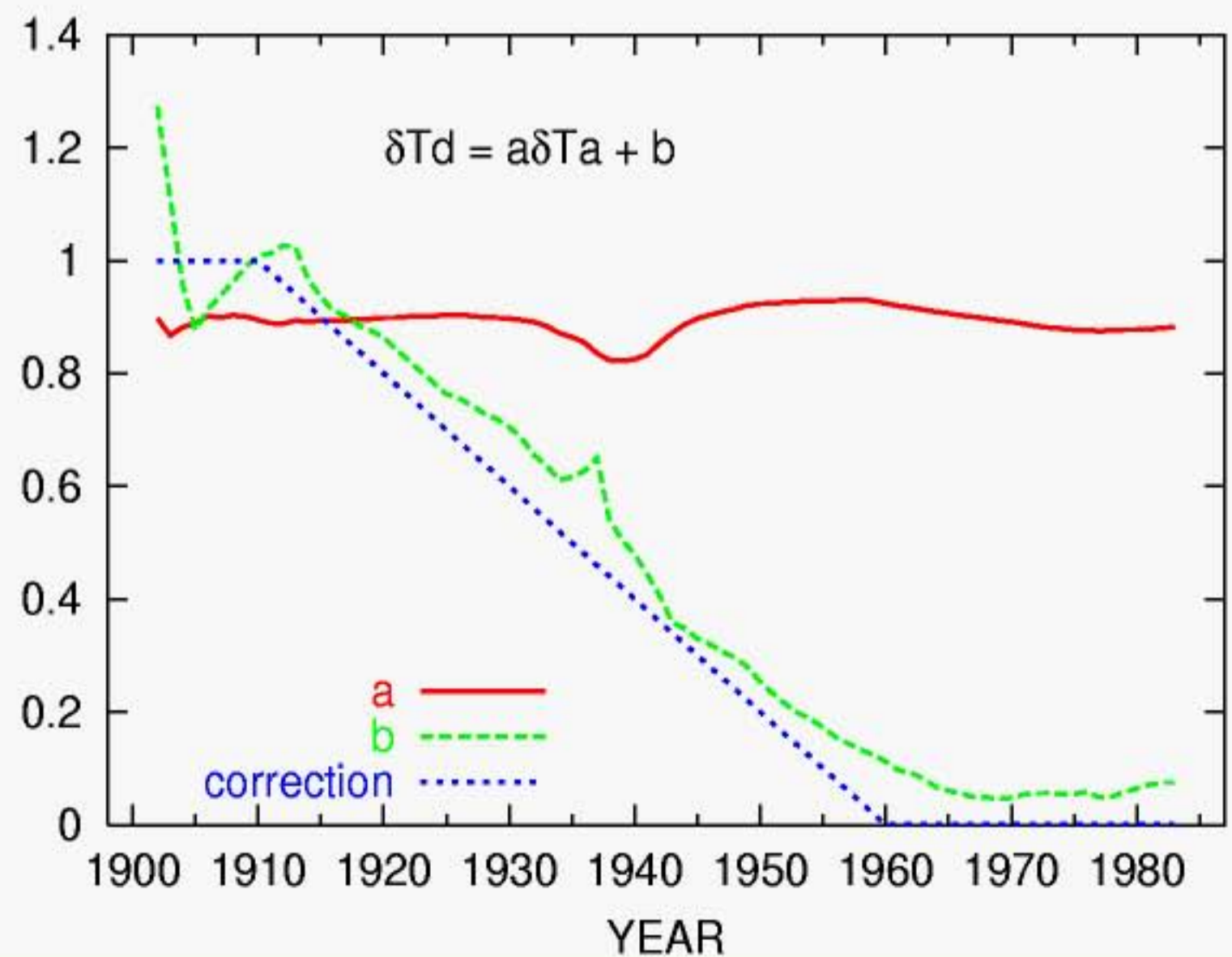
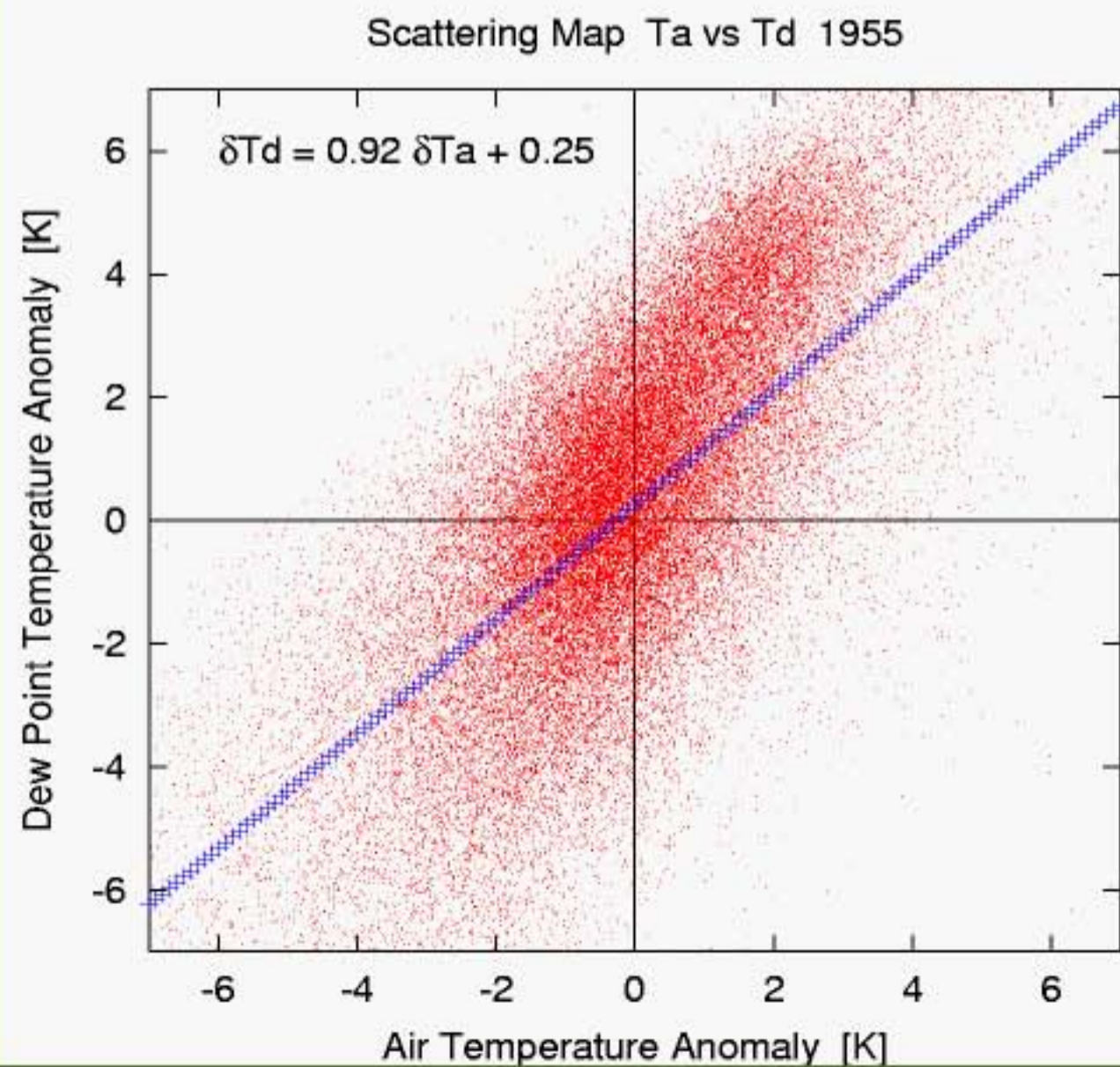
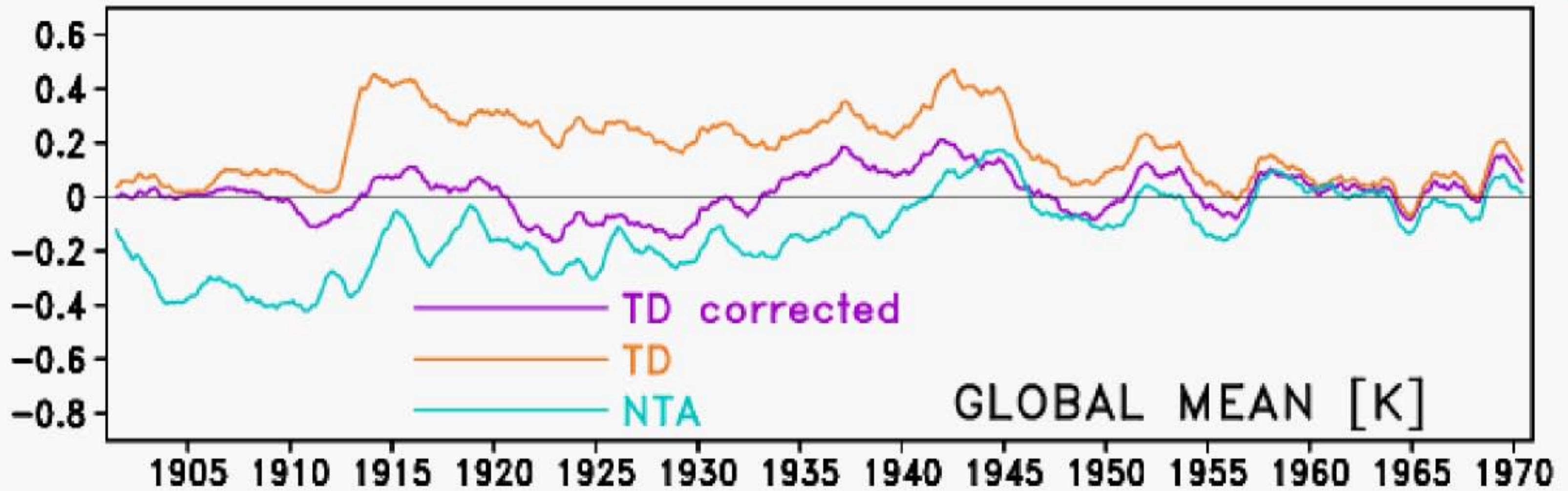
- Before OA

- Ship Tracking Check
- Monthly Black List

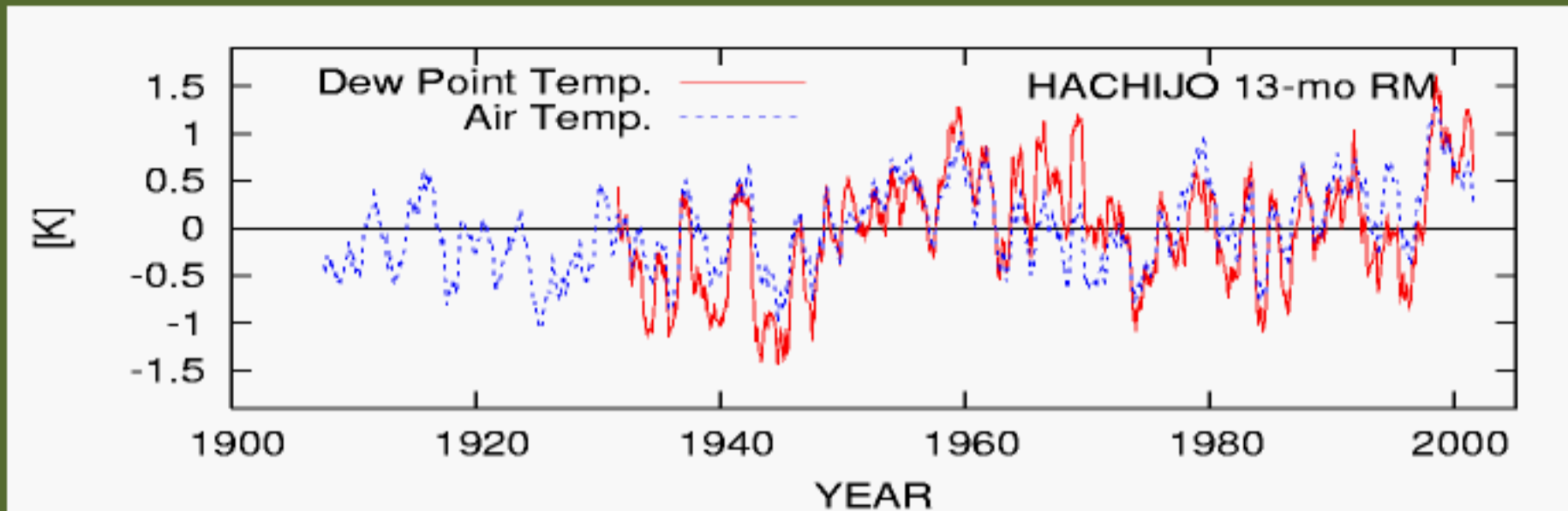
- At OA

- Basic procedures by Ishii et al. (2003)
- Day-night bias reduction
- Bias and trend correction
 - ▶ SST: cold bias in bucket obs. (by Folland and Parker 1995)
 - ▶ Wind Speed: anemometer height correction (WMO Publication No.47, barometer height in KC, Kutsuwada 1998)
 - ▶ Air Temp.: extreme warmth around WW-II (Folland et al. 1984)
 - ▶ Cloudiness: clear-sky check (by Harn 1999)
 - ▶ Dew-Point Temp: spurious trend before 1960 removed by consistency with air temp.

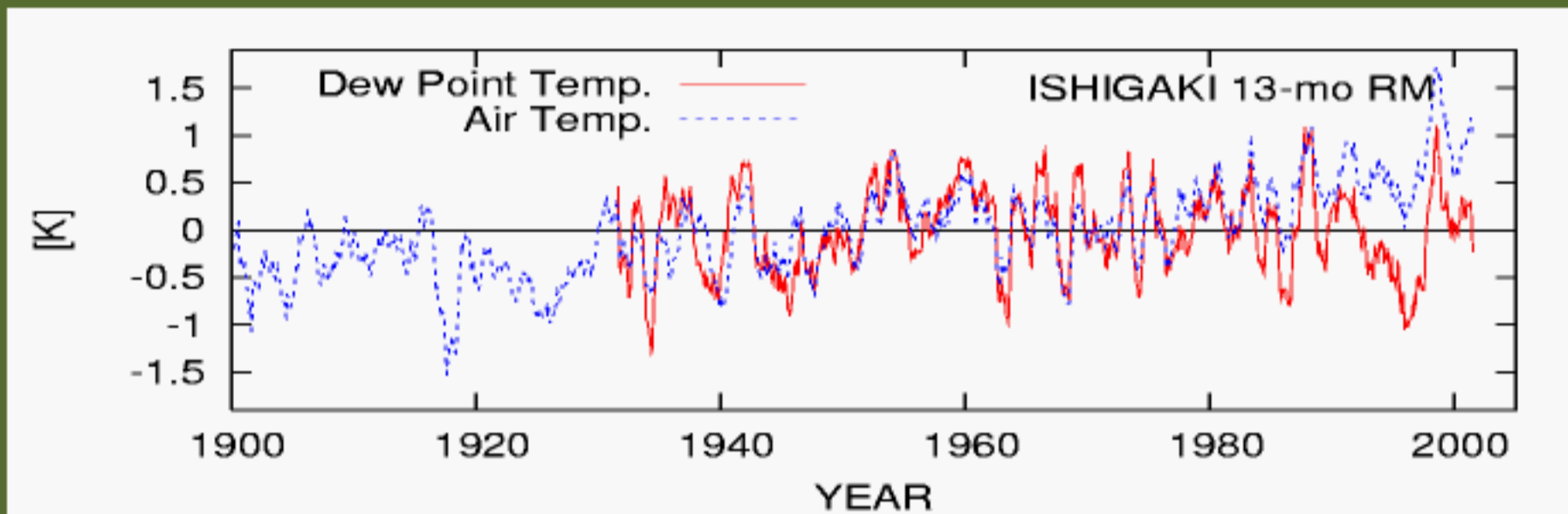
Spurious Trend in Dew Point Temperature



Trend in Dew Point Temperature at Islands

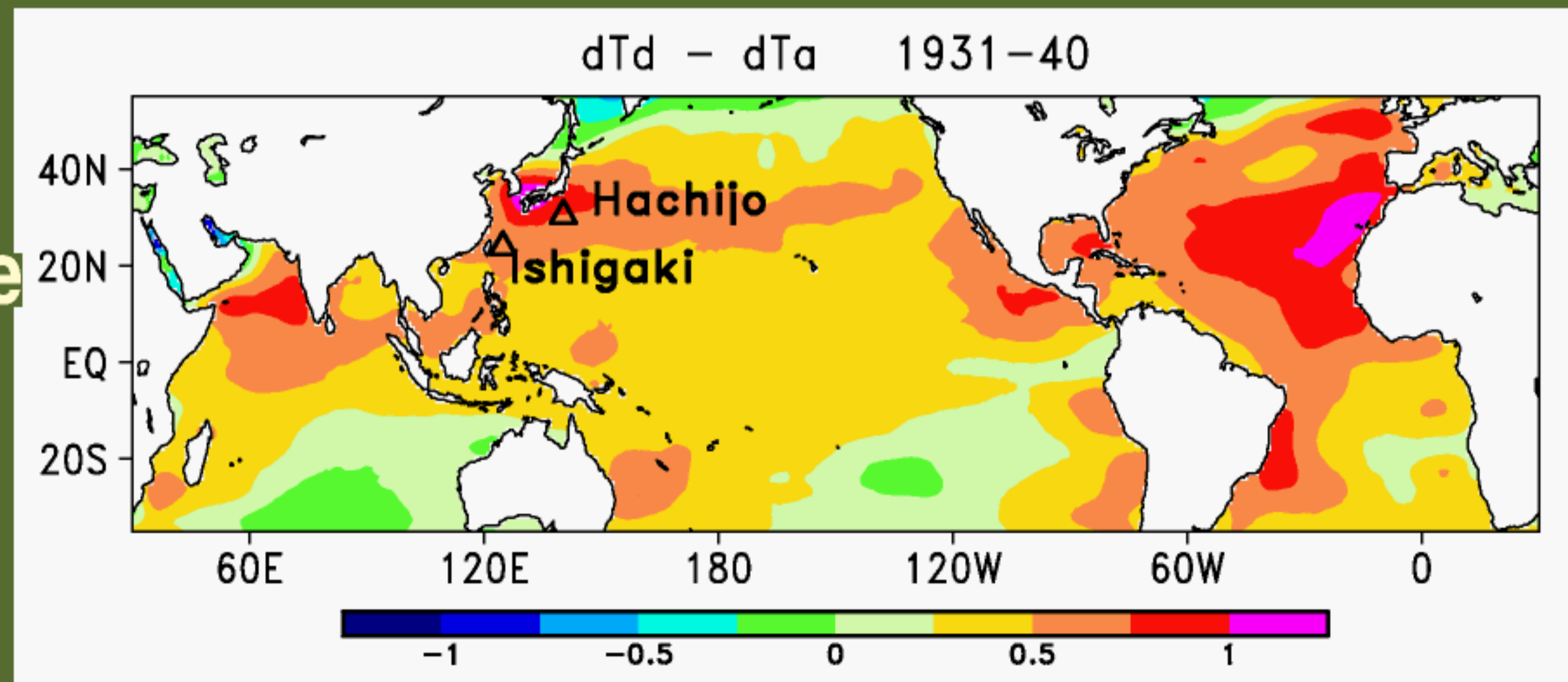


Hachijo

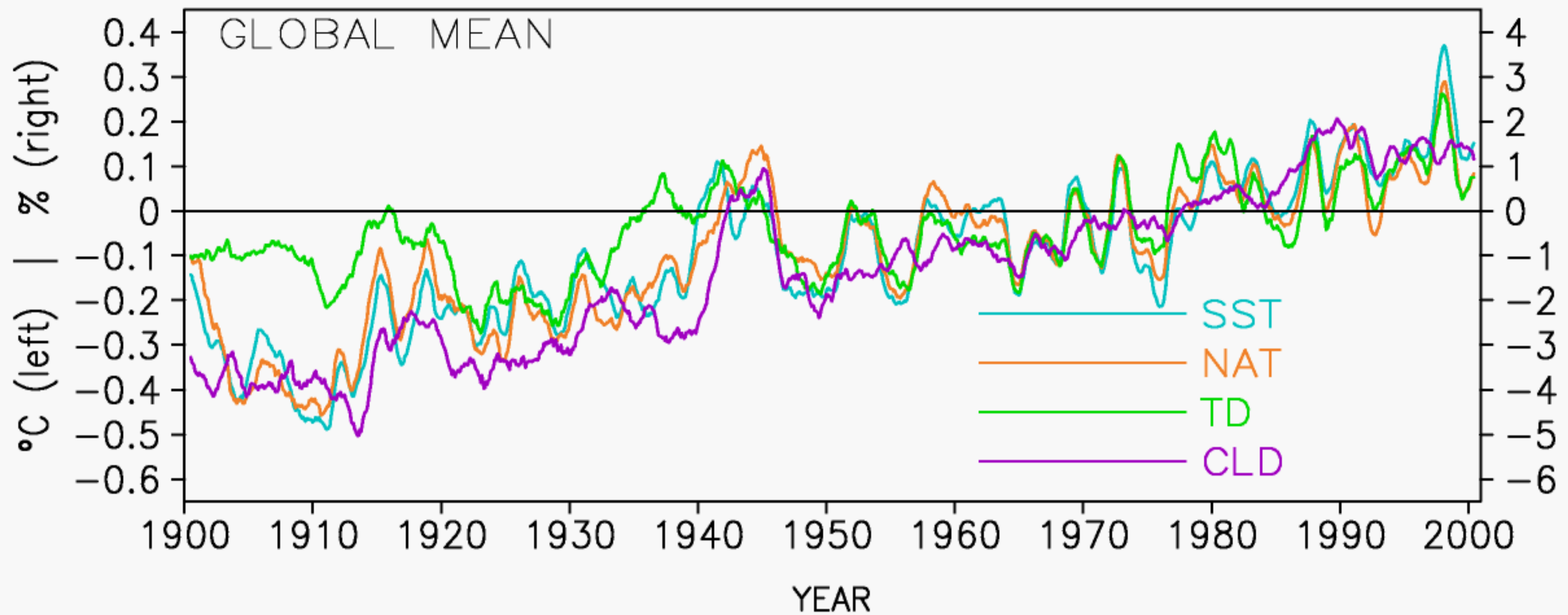


Ishigaki

Diff. between
TD & AT anomalies
S.



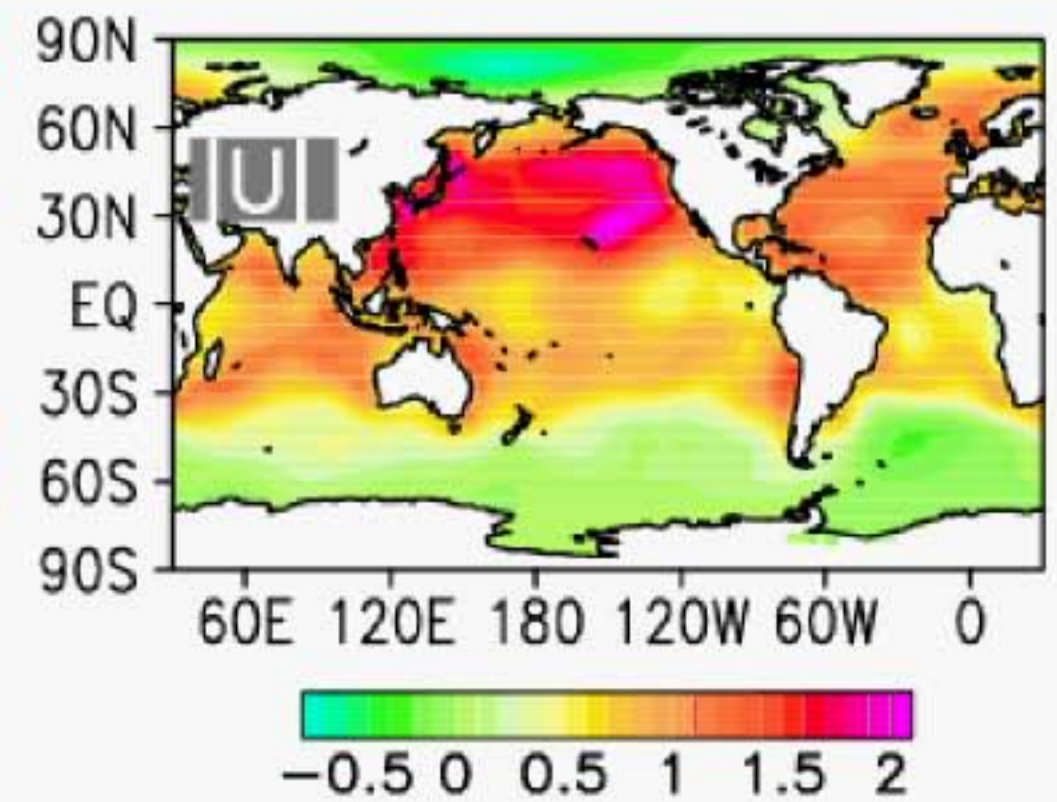
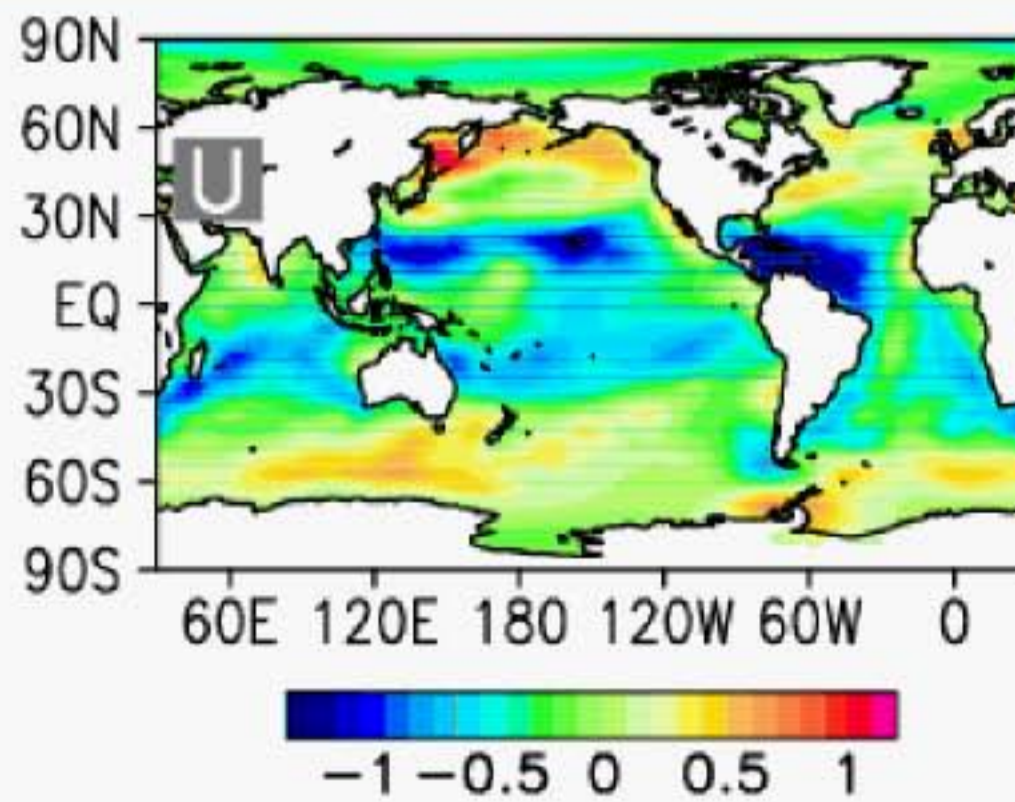
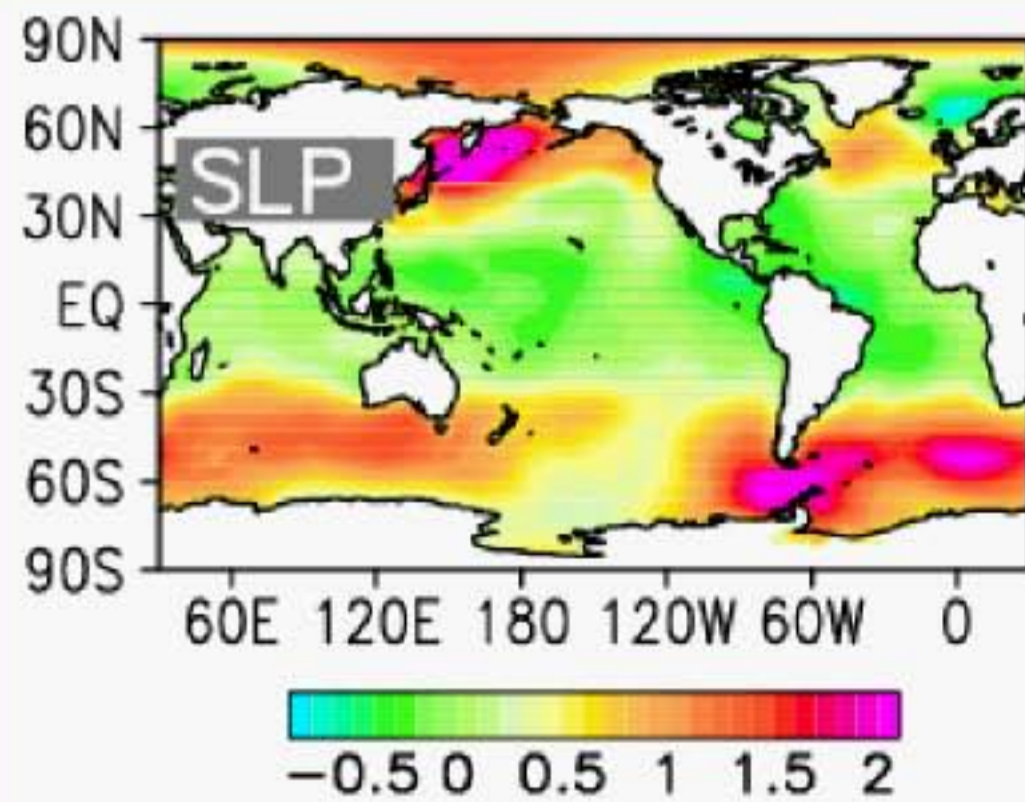
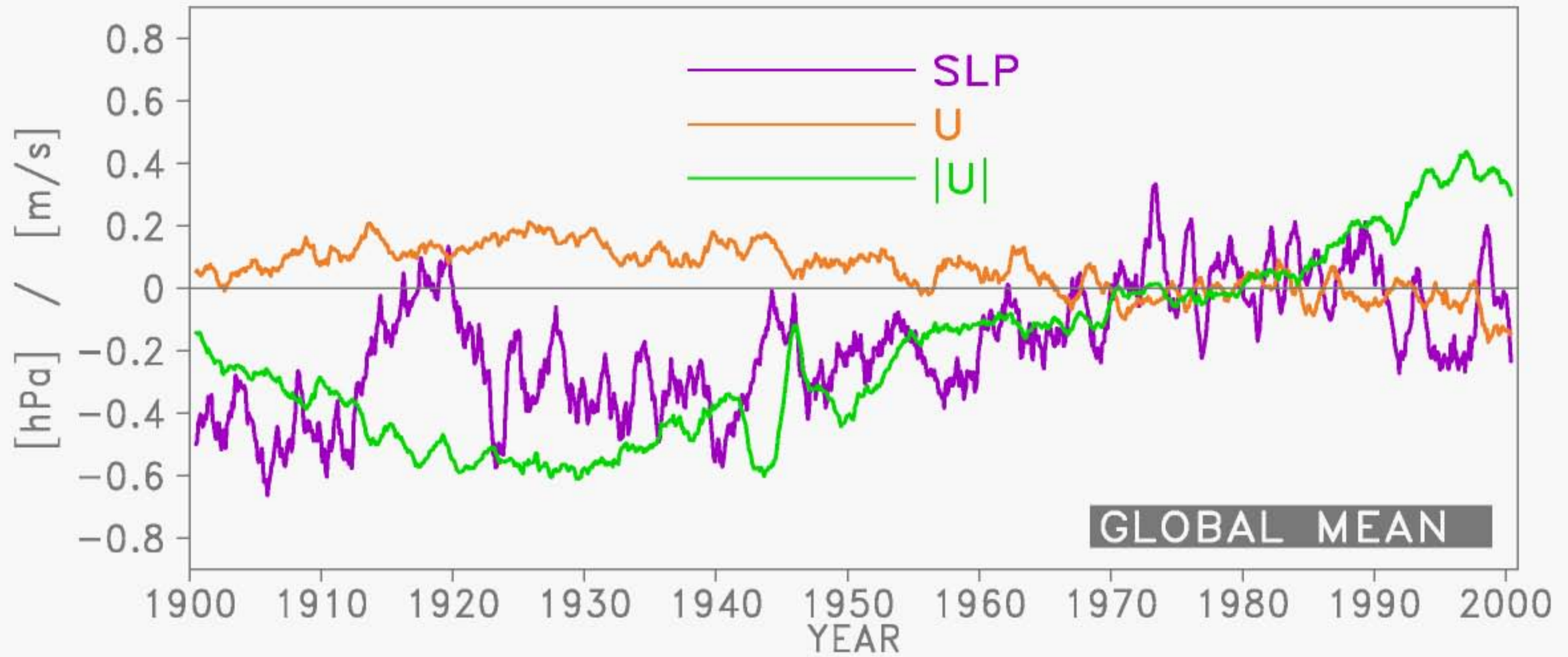
Trends of Global Means



Monthly, 13-month running averages,
relative to 1961-90 averages, NOT reconstructed.

<i>Elem.</i>	<i>Trend (1901-2000)</i>	<i>Trend (1951-2000)</i>
SST	0.51°C/100yr	0.29°C/50yr
NAT	0.47°C/100yr	0.21°C/50yr
TD	0.23°C/100yr	0.23°C/50yr
CLD	5.8%/100yr	3.3%/50yr

Trends in SLP and Wind



Positive and Negative Aspects of KC

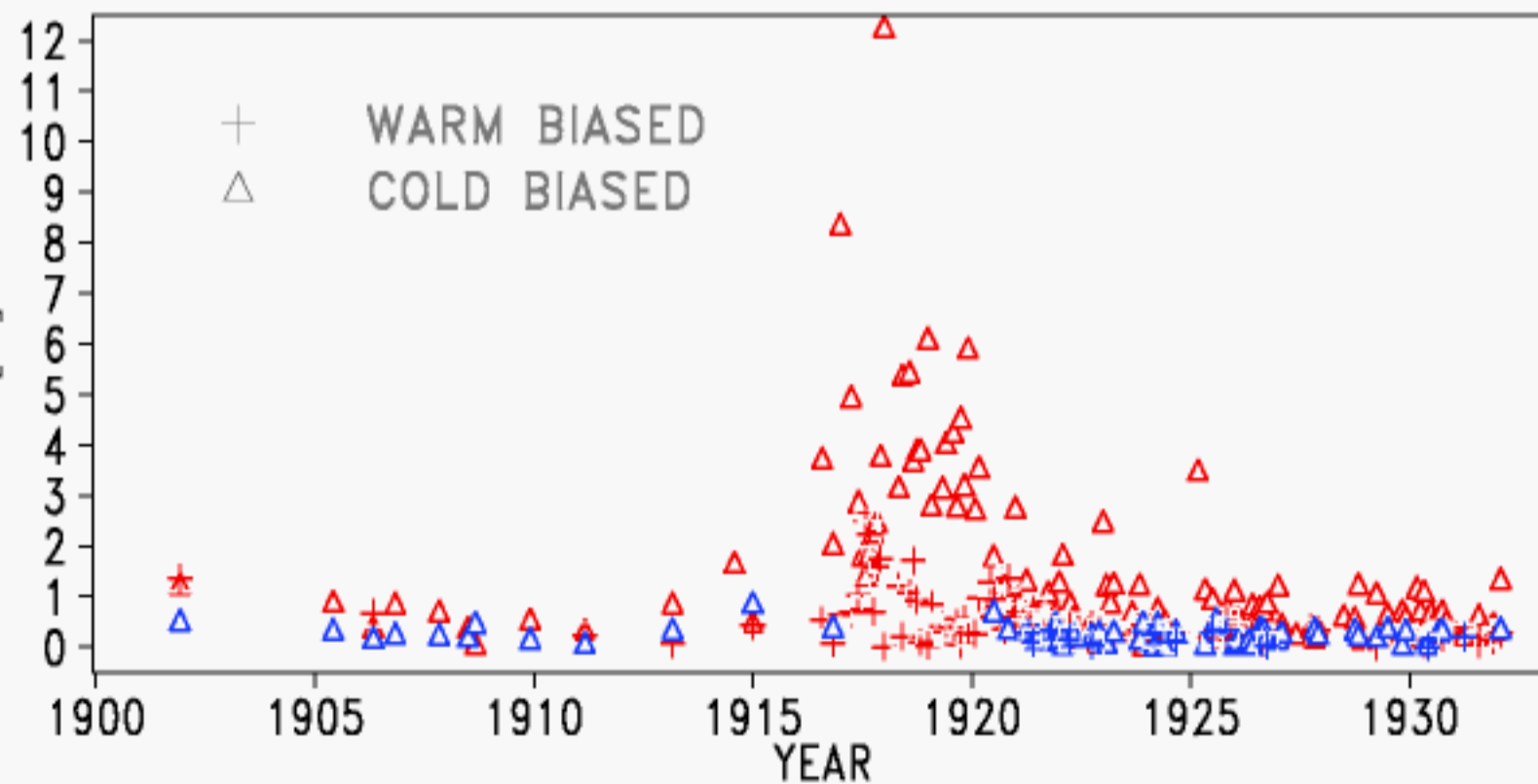
● Positive

- ▶ No. of Data increased around WW-I and in the Pacific (Manabe 1999).
- ▶ KC has some meta data, e.g., barometer height.
- ▶ By use of KC in OA, variability becomes large over the North Pacific.

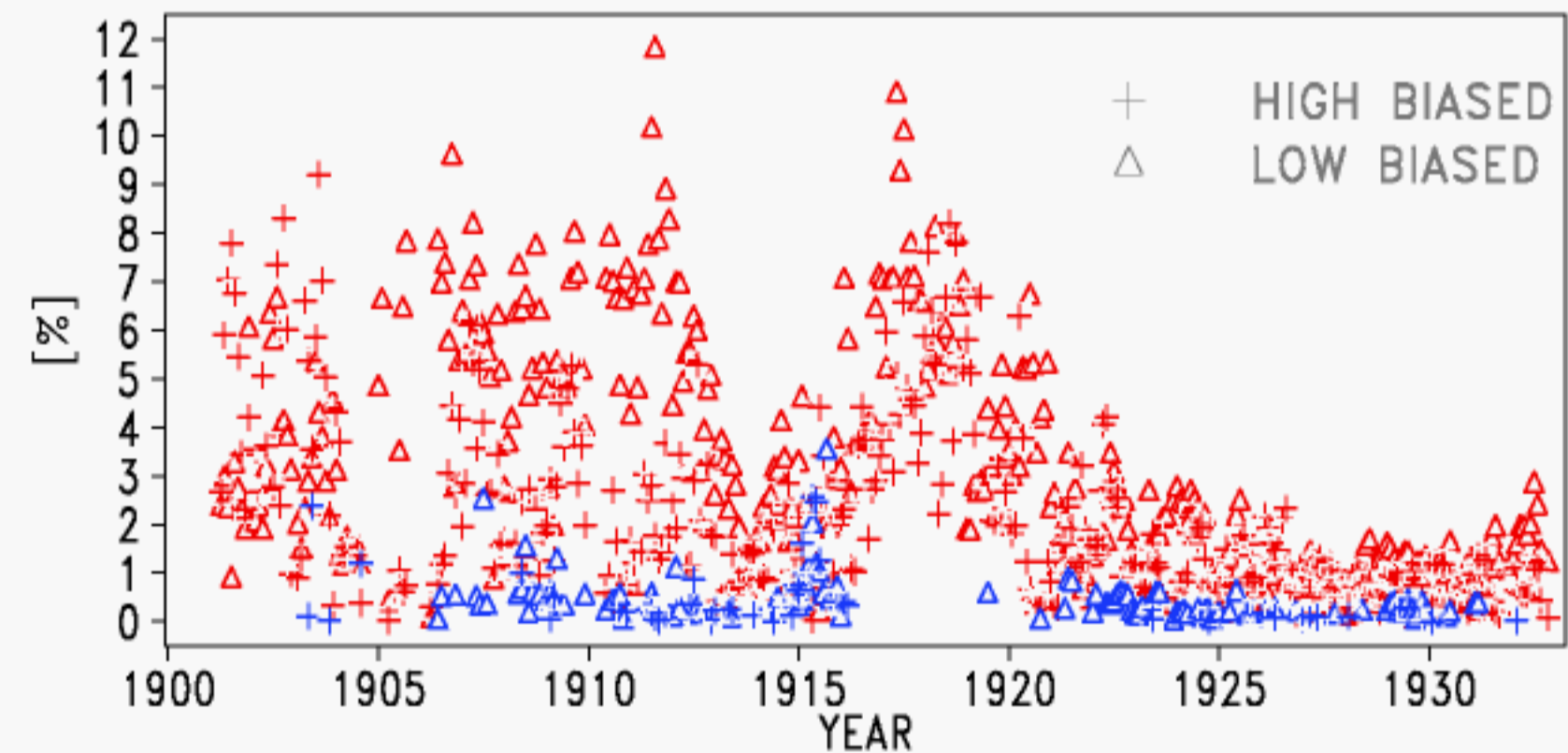
● Negative

- ▶ KC includes severely biased data, especially, in the SST and SLP observations.

Monthly biased data counts: Kobe Collection (red) & COADS (blue)

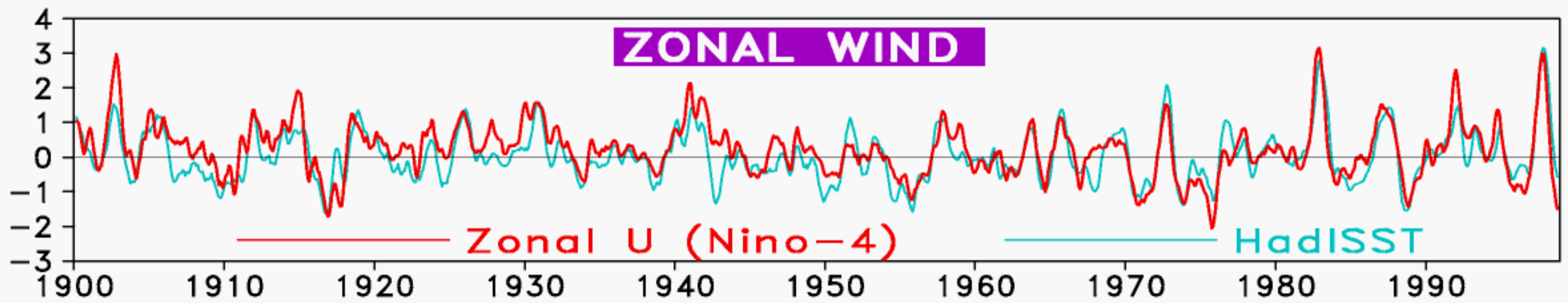
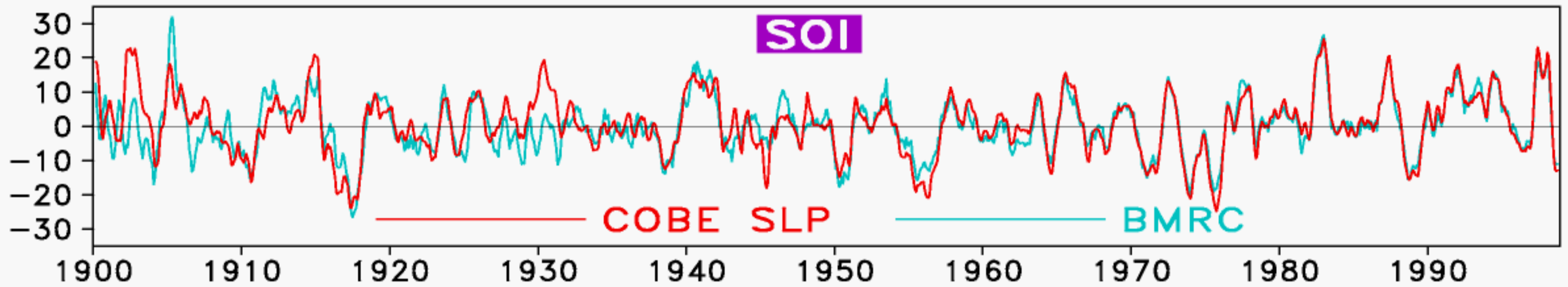
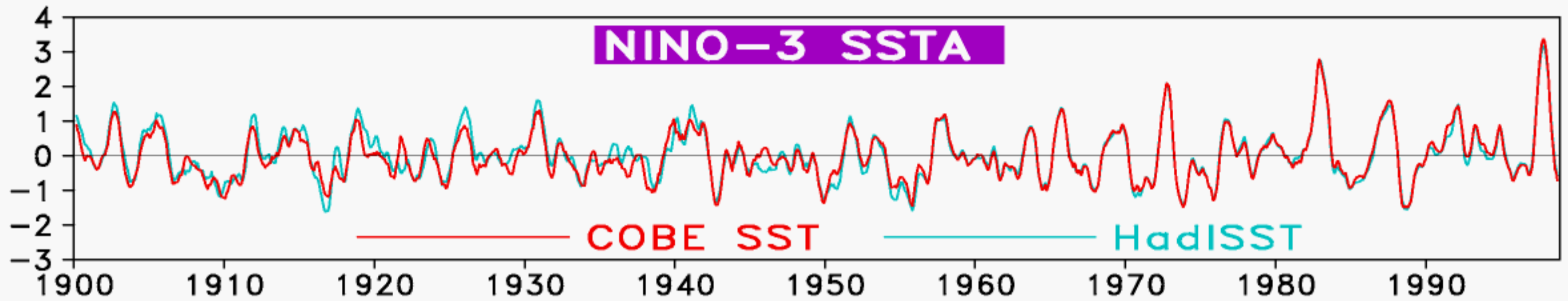


Monthly biased data counts: Kobe Collection (red) & COADS (blue)



Black List: More than 80% of N data are positive/negative biased; $> 1\sigma$ when $N \geq 100$, $> 2.5\sigma$ when $N \geq 75$, 3σ when $N \geq 30$). Moving $> 30/60$ deg. lat./lon. is required for SST. Data in -1, 0, and +1 months are used.

ENSO indices



SOI: sign reversed. 5-mo running mean, relative to 1961-1990 means.

TAV (0-300m) anomalies -- EQ --

CONTROL:

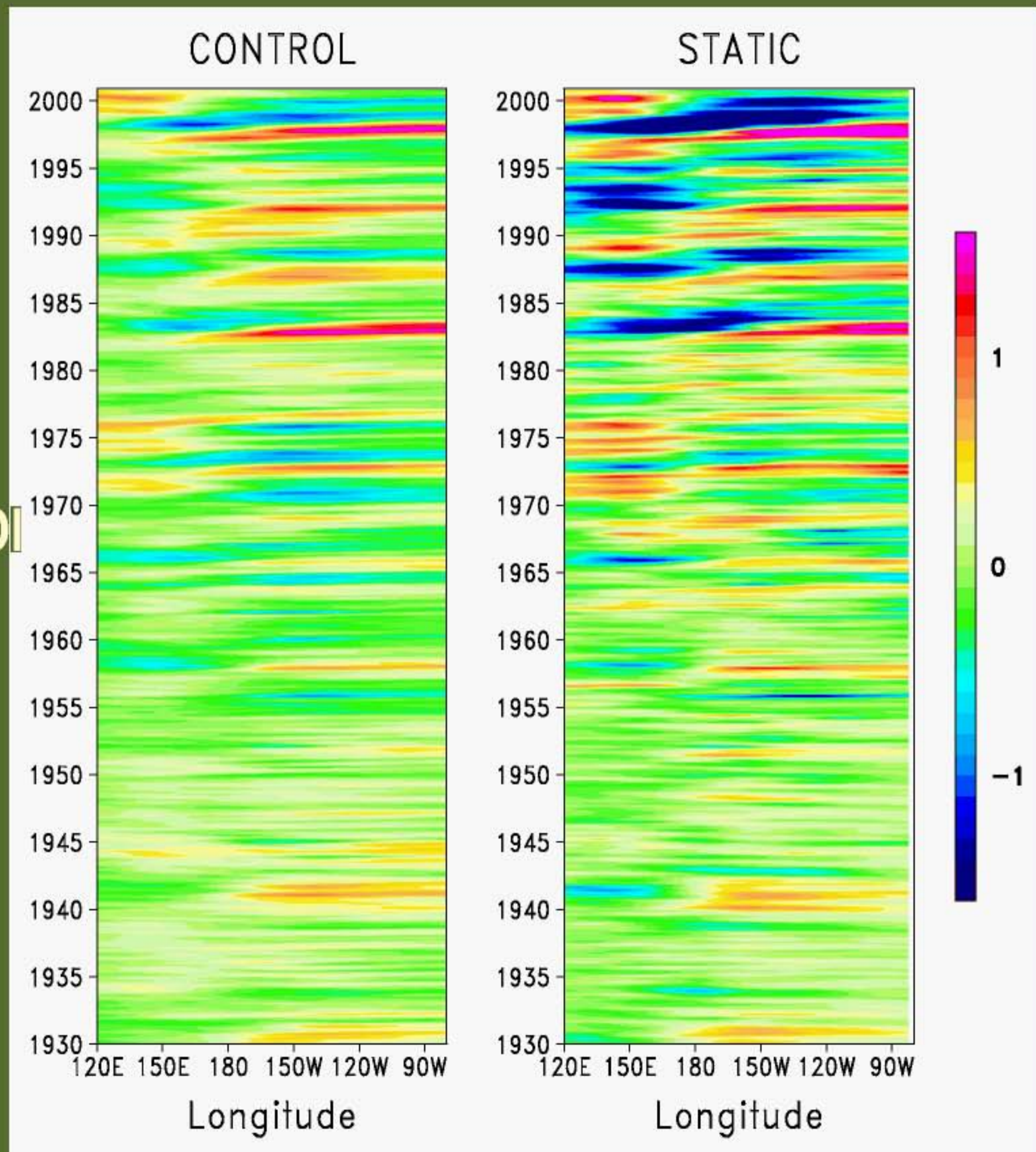
- OGCM
- COBE air-sea fluxes

STATIC:

- WOA01 T & S profiles
- Daily T & S analysis by OI

RESOLUTION:

- 2.5 lon x 0.5-2 lat.
- 18 levels upper 1000m



Conclusion

Summary

- ▶ Historical analyses of marine meteorological elements have been carried out for the 20th century using COADS and the Kobe Collection.
- ▶ Tendencies toward global warming are confirmed in global mean marine temperatures and total cloudiness.
- ▶ Biases in dew point temperature are subtracted by comparing with air temperature. Small trends in SLP and scalar wind still remains. Further understanding of historical data (((separately for each data sources!))) is necessary.
- ▶ ENSO indices of COBE agree well with those of other data sets and thermal changes in the equatorial Pacific are well reproduced by OGCM with COBE air-sea fluxes.

Projects

- The Japanese Reanalysis (JRA-25; 1979-2004) with COBE SST.
- Verification of COBE sea surface fluxes with high-resol OGCM.
- Ocean Data Assimilation for the 20th century.