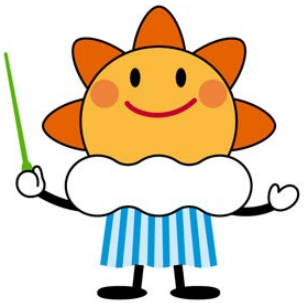
Estimating Uncertainty of Historical SST Analyses by a Cross Validation Technique

Yoshikazu Fukuda *

Masayoshi Ishii **

Shoji Hirahara *

** CPD/JMA, ** FRCGC/JAMSTEC*



Outline

1. Overview of the next COBE
2. Uncertainty estimation studies for the next COBE
   - Sampling error by Cross validation
   - Analysis error by measuring sensitivity of analysis parameters
3. Conclusion & Future plan

Outline

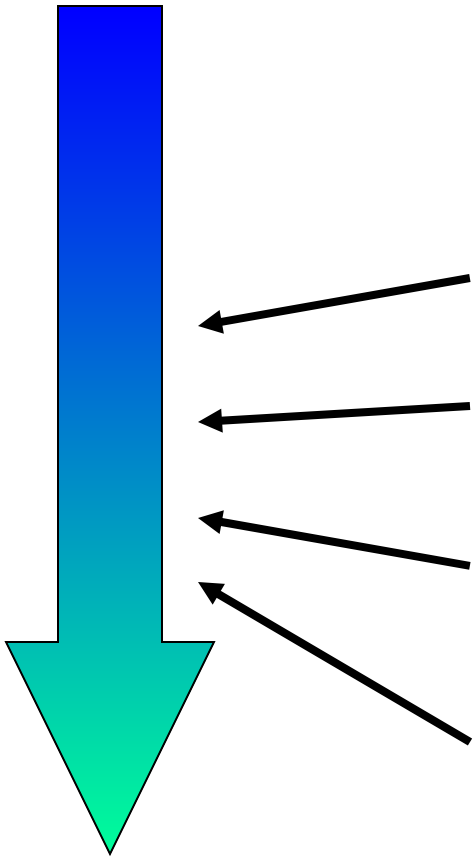
- Overview of the next COBE
- Uncertainty estimation studies for the next COBE
  - Sampling error by Cross validation
  - Analysis error by measuring sensitivity of analysis parameters

3. Conclusion & Future plan

Overview of the next COBE

COBE (Ishii et al. 2005)

Objective analyses of SST and other marine meteorological variables using ICOADS v2.0 + Kobe collection



Satellite Data

Enriched Meta Data

More Accurate or Another Comprehensive Uncertainty Estimation

... More Other Improvements

Next COBE (????)

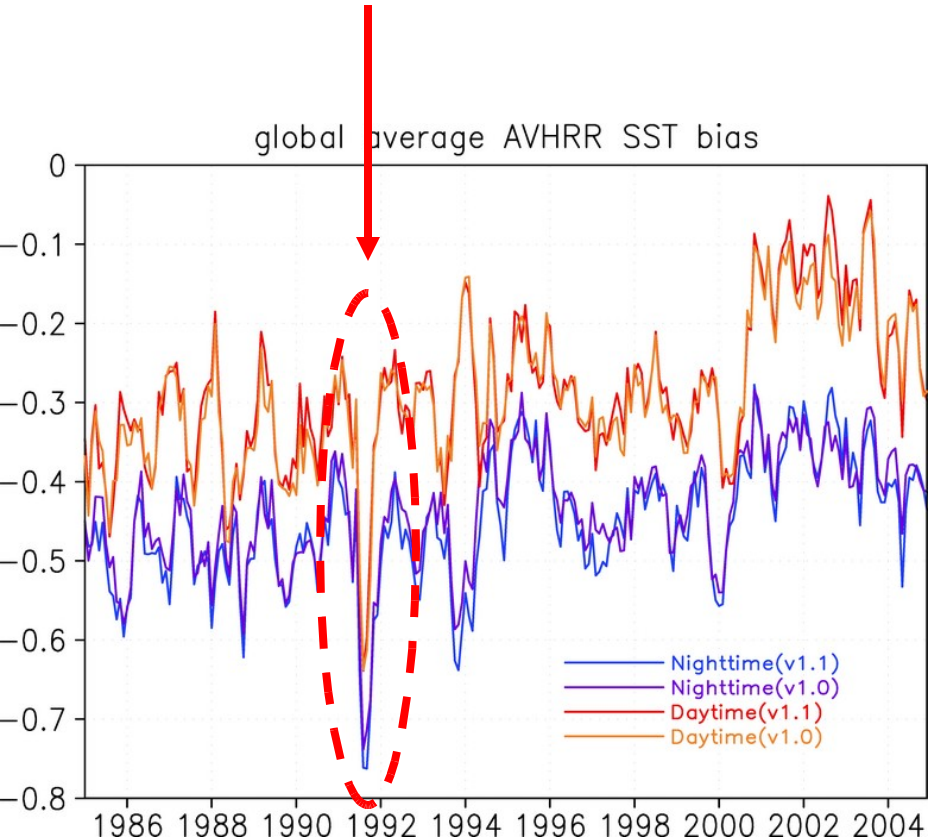
Introduction of Satellite data

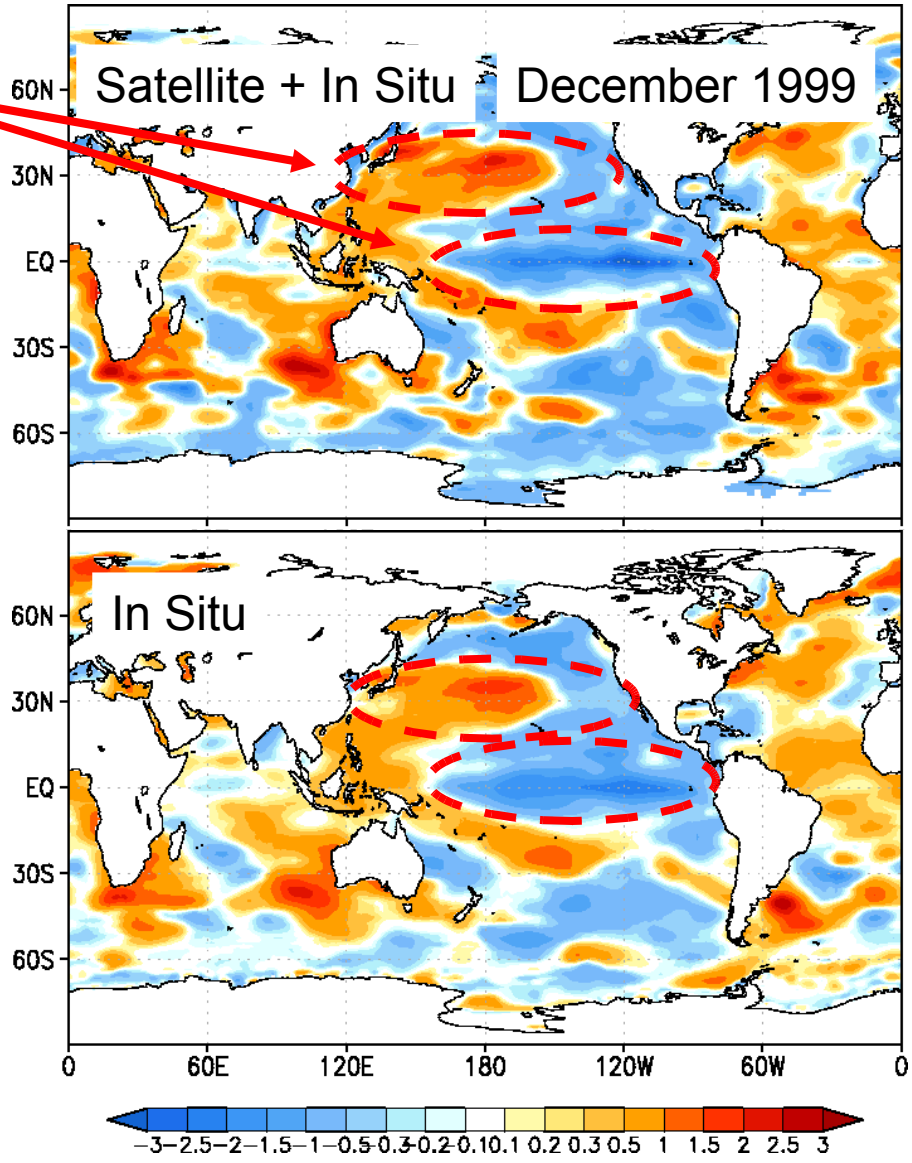
Refine analysis

=Sharp and Fine anomaly pattern

OI-estimated biases

ex. related to eruption of Mount Pinatubo





Outline

- Overview of the next COBE
- Uncertainty estimation studies for the next COBE
  - Sampling error by Cross validation
  - Analysis error by measuring sensitivity of analysis parameters

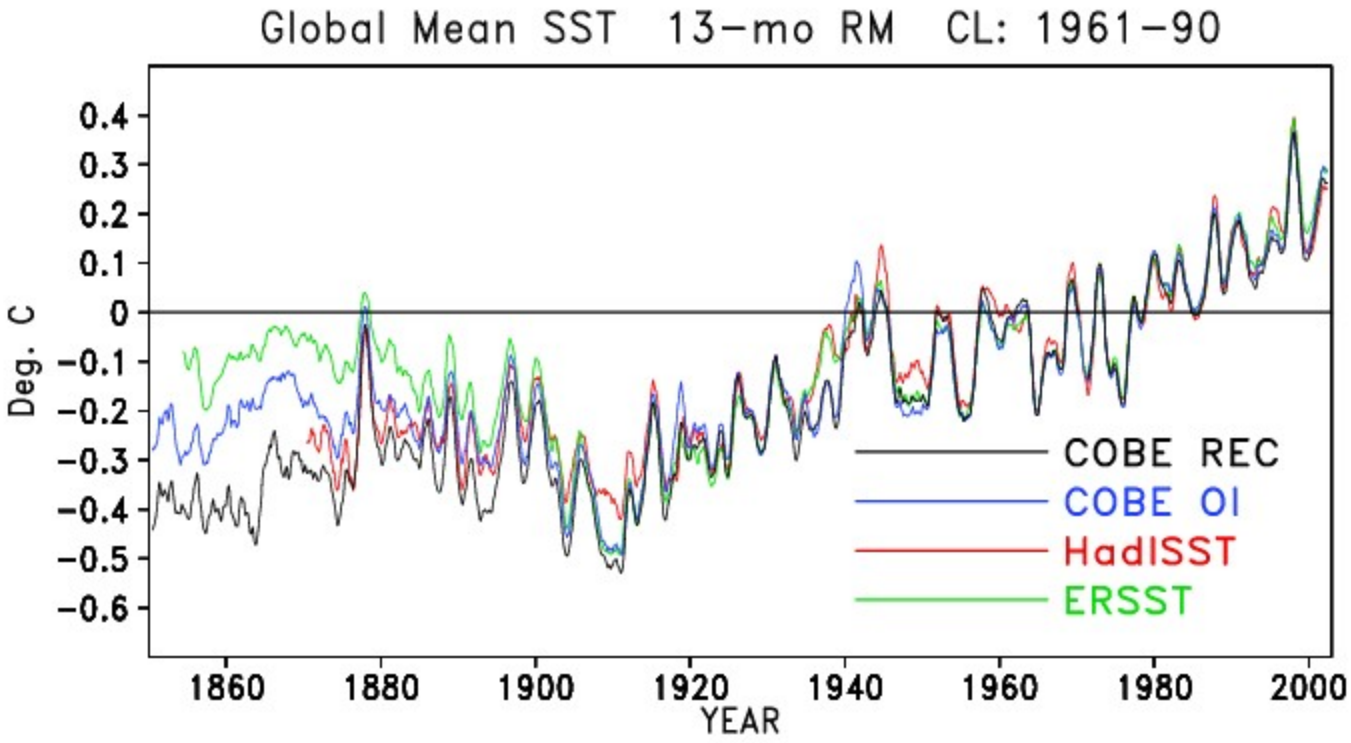
3. Conclusion & Future plan

Estimating Uncertainty

- There are differences among SST analyses especially before 1950.

uncertainty

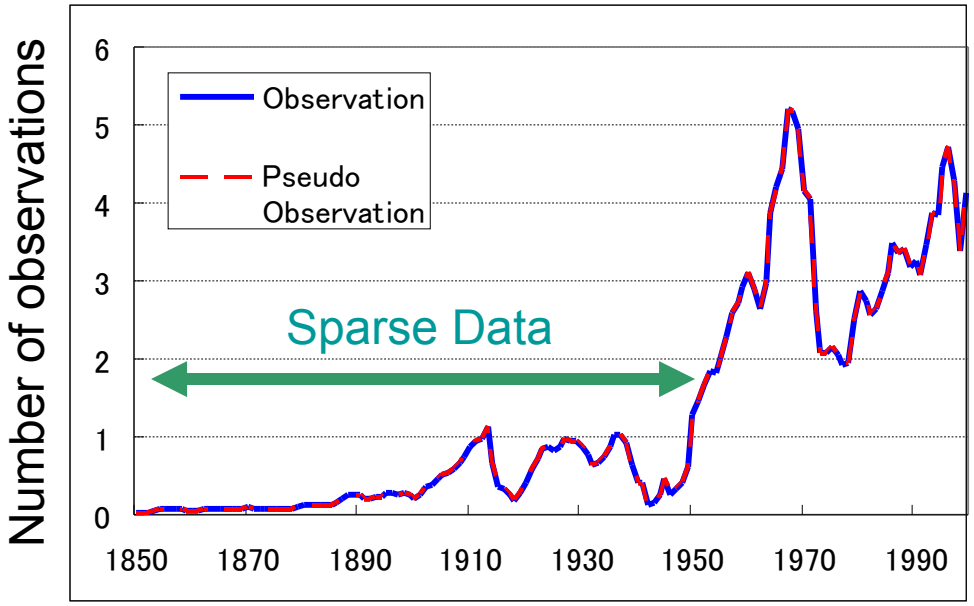
- observation
- data sampling
- bias correction
- analysis method



Outline

1. Overview of the next COBE
2. Uncertainty estimation studies for the next COBE
   - Sampling error by Cross validation
   - Analysis error by measuring sensitivity of analysis parameters
3. Conclusion & Future plan

Aim of the Cross Validation



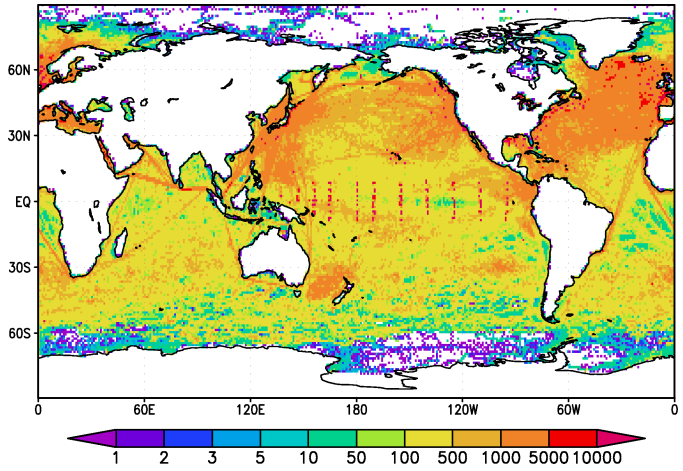
Relatively few data

especially earlier than 1950

Larger sampling error

estimate by a cross validation technique

Method

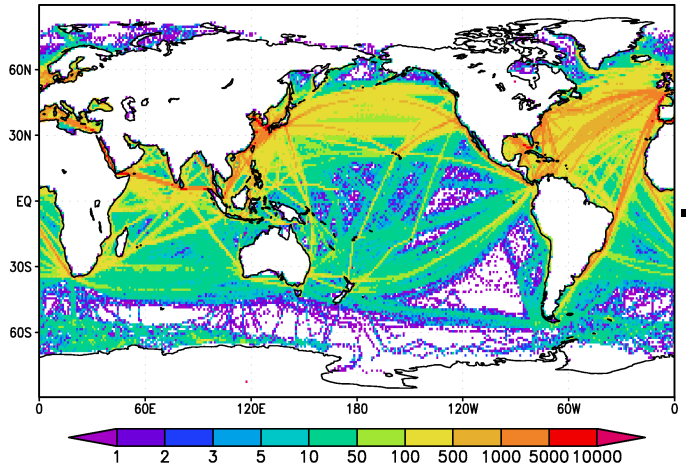


Observations in 1990s

Original analysis
(assuming to be true)

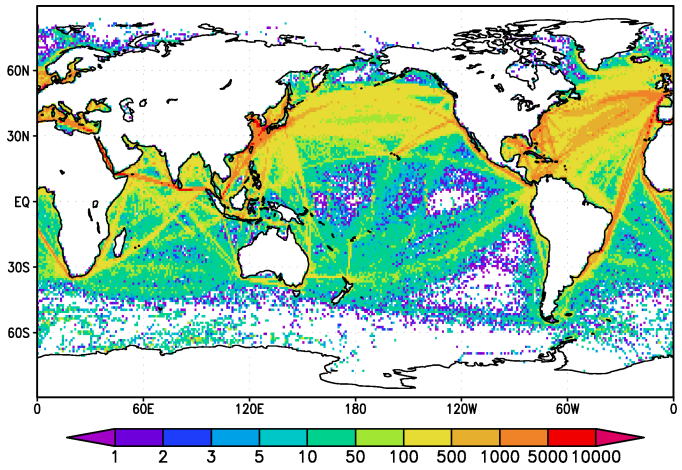
Compare

pick up
input data



Observations in 1930s

distribution



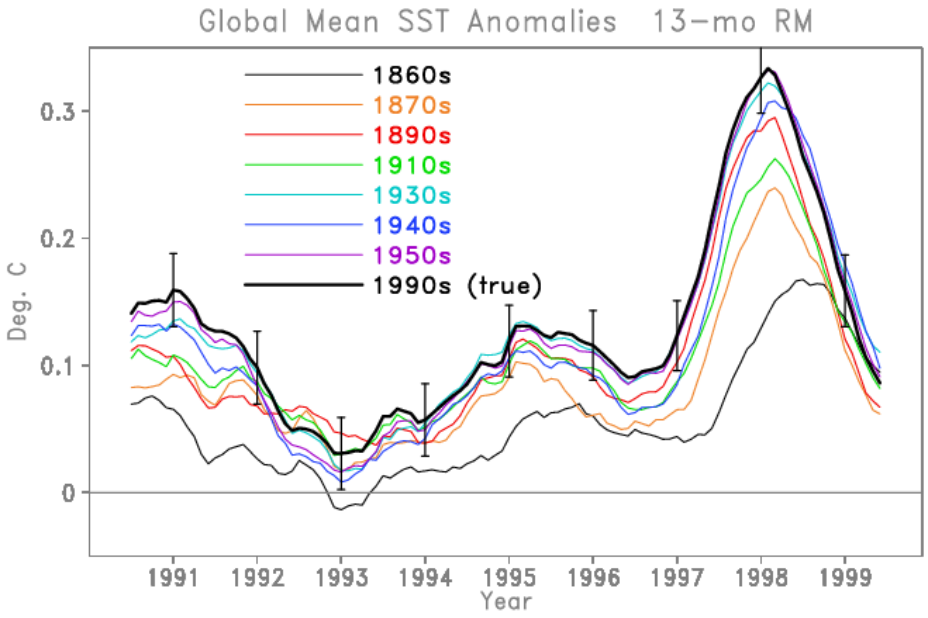
Pseudo Observations

Pseudo analysis

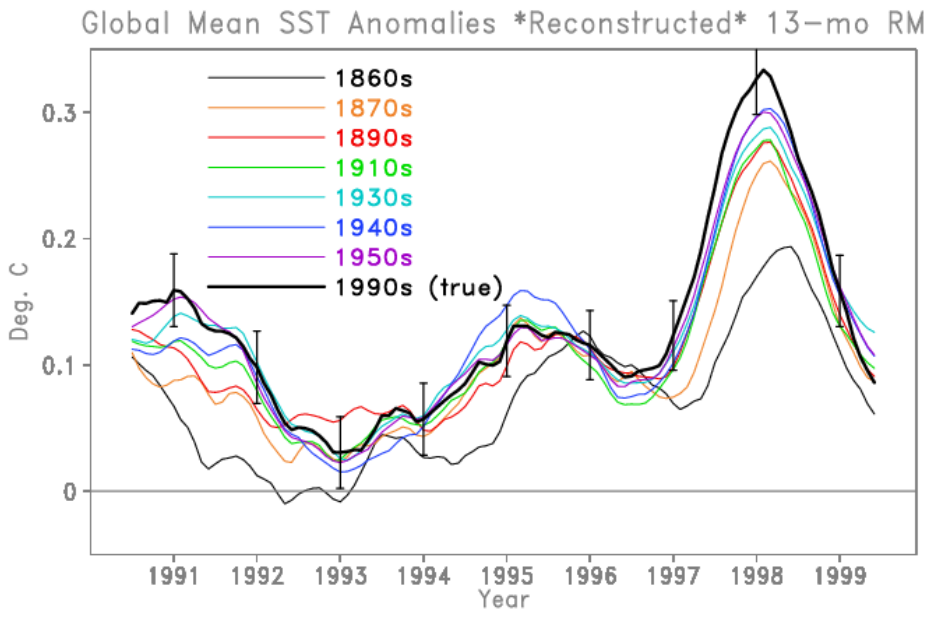
Result - Global Mean

- We can reproduce global mean SSTs by OI after the 1890s.
- It may be difficult to calculate “accurate” global mean SSTs by OI before the 1860s.
- Reconstruction improves the reproducibility.

Monthly Mean of OI analysis



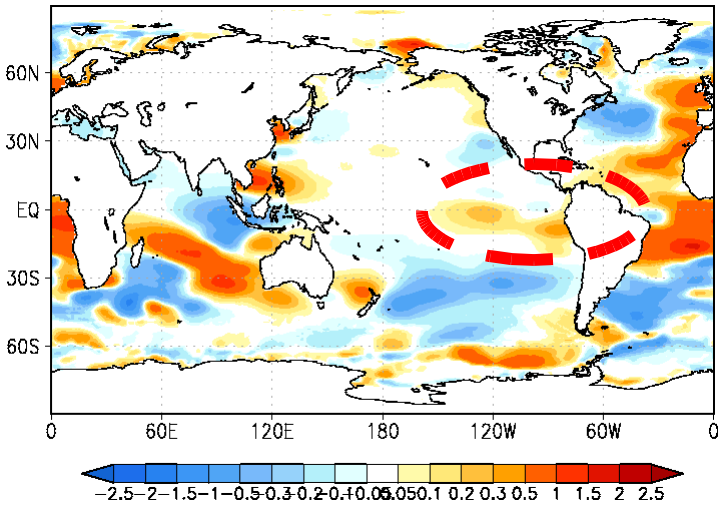
Reconstructed analysis

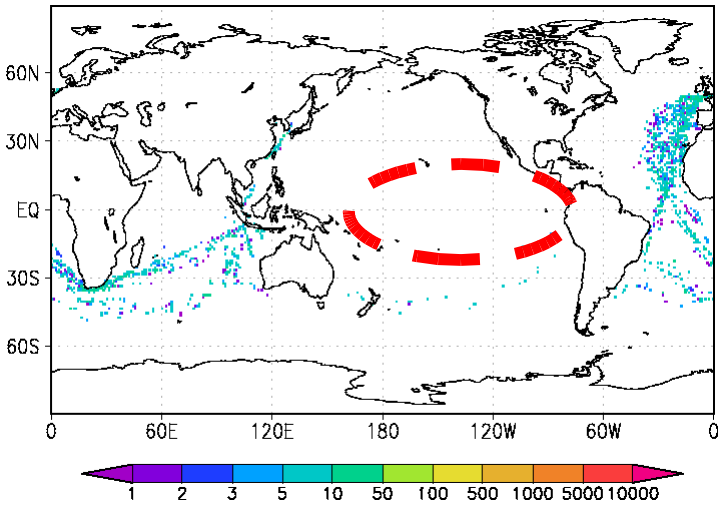


Result - El Nino Reproducibility

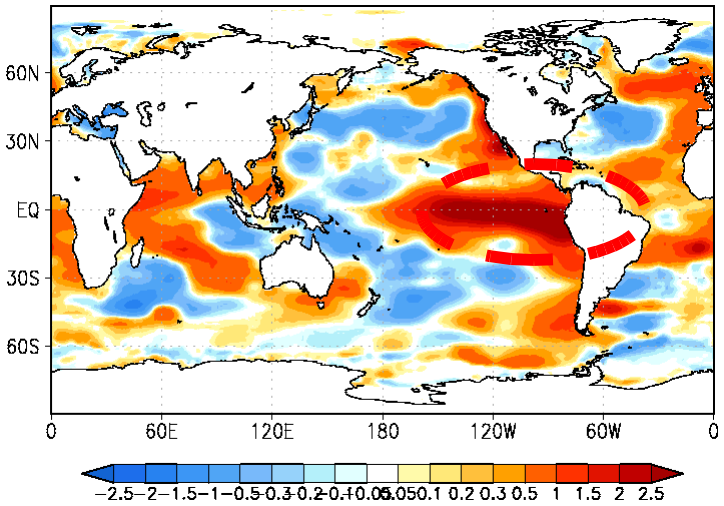
Pseudo analysis November 1997

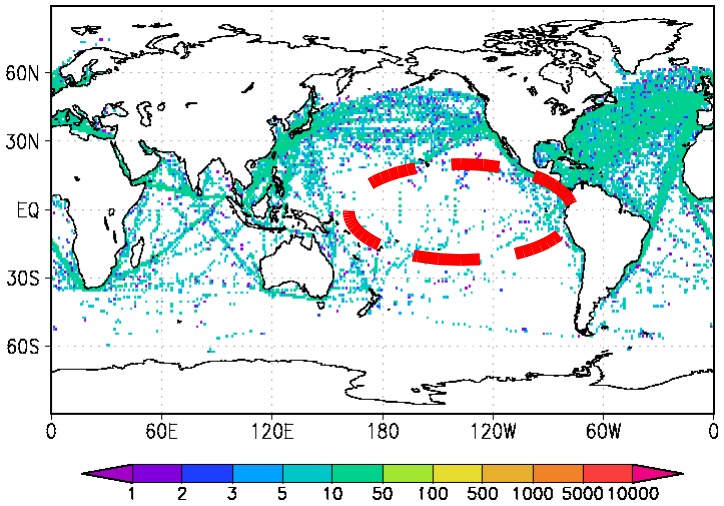
1860s





1930s





Outline

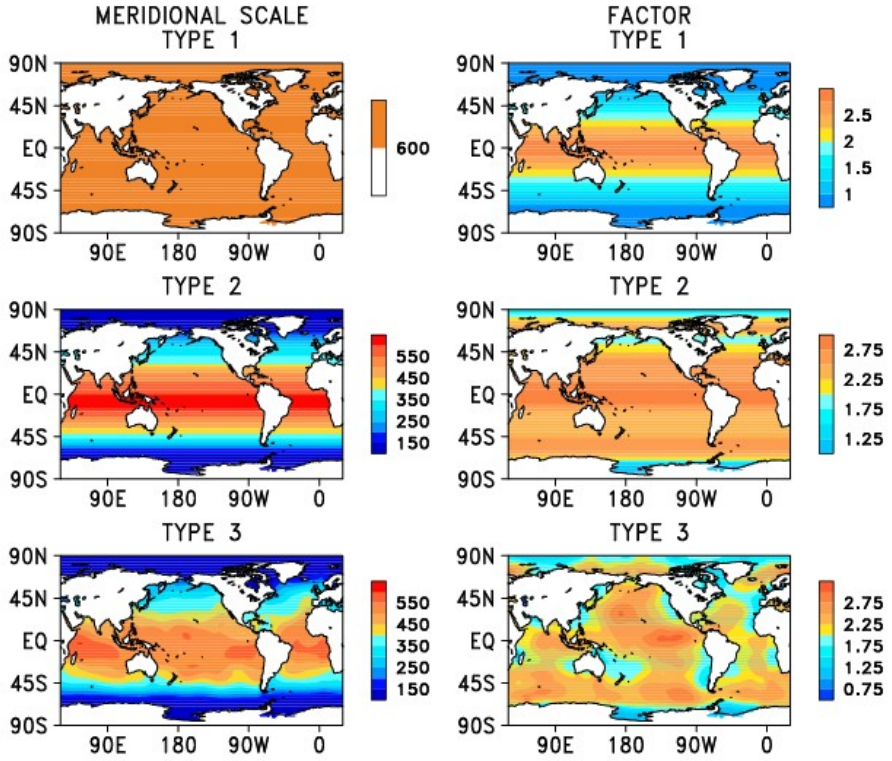
1. Overview of the next COBE
2. Uncertainty estimation studies for the next COBE
   - Sampling error by Cross validation
   - Analysis error by measuring sensitivity of analysis parameters
3. Conclusion & Future plan

Another Attempt
– Sensitivity of analysis parameters

Experiment A: Adding random noise to observations

Make 8 ensemble members by adding random noise to observations.

Experiment B: Changing analysis parameters



Make 9 ensemble members by using 3 patterns of analysis parameter (related to decorrelation scale) over adding 3 sets of random noise to observations.

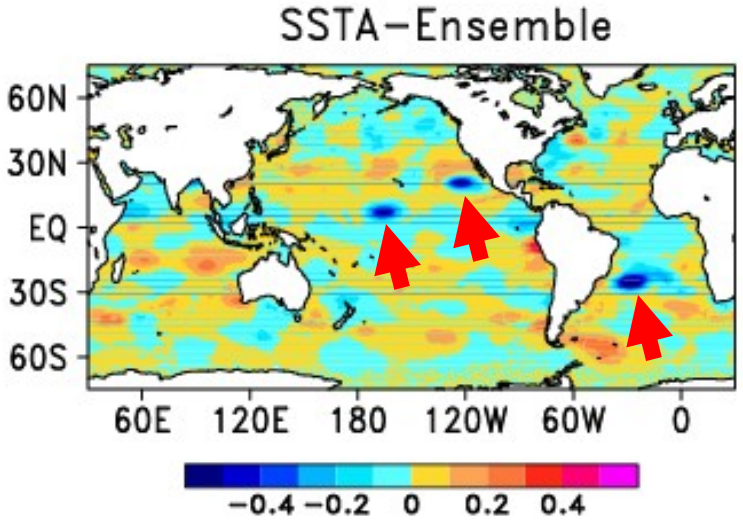
Result of Exp A

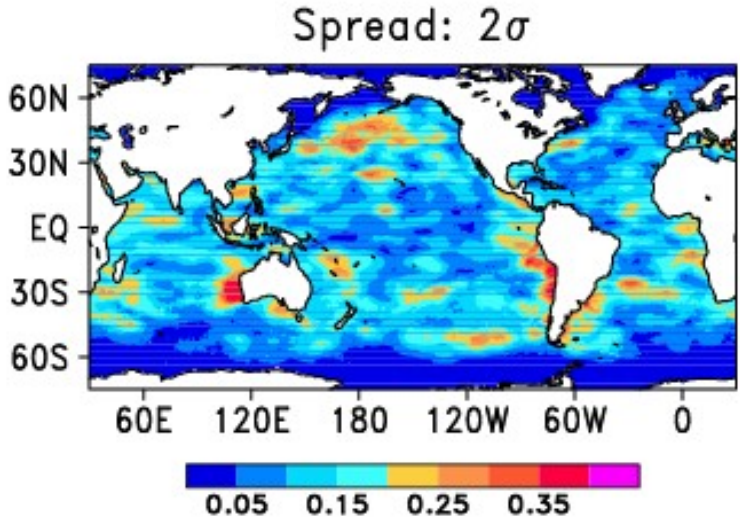
Adding random noise to observations

- At some points, large difference between SSTA and mean. → result of QC
- Spread is larger in data sparse periods. → a measure of uncertainty

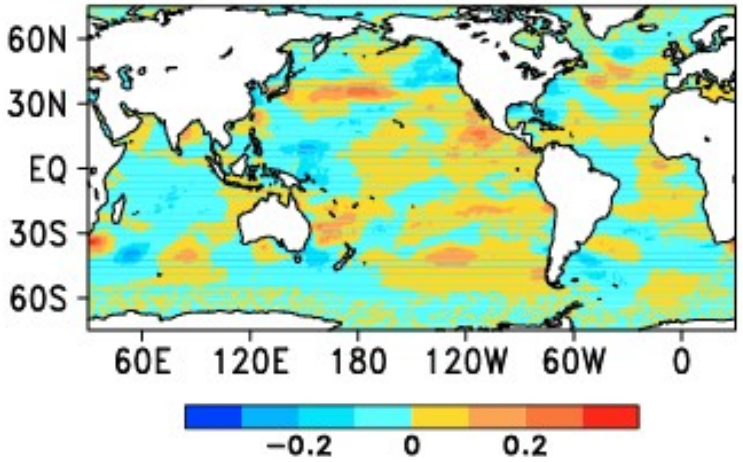
Analysis for

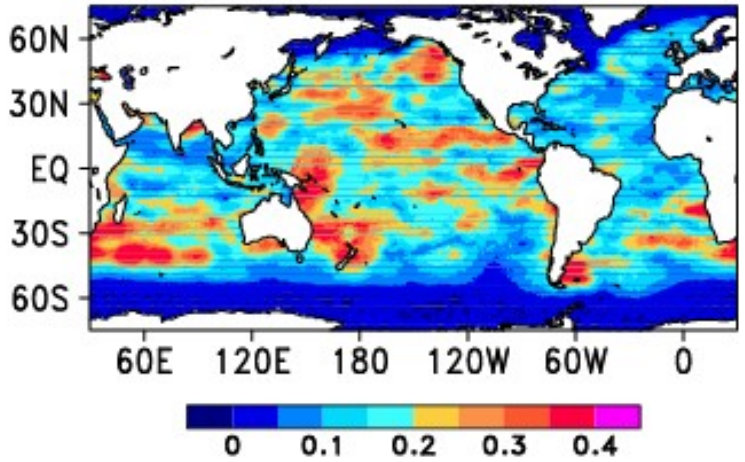
20Mar2000





21Mar1931

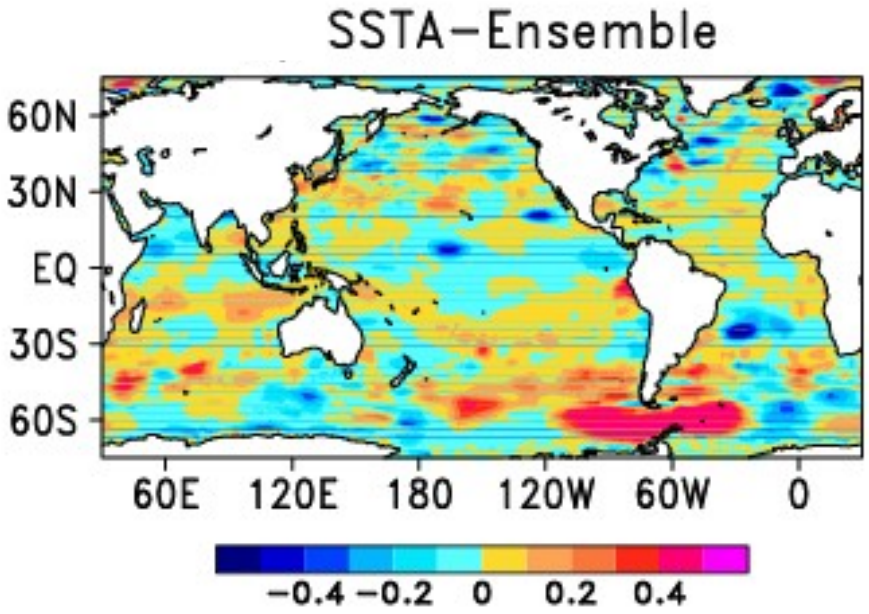


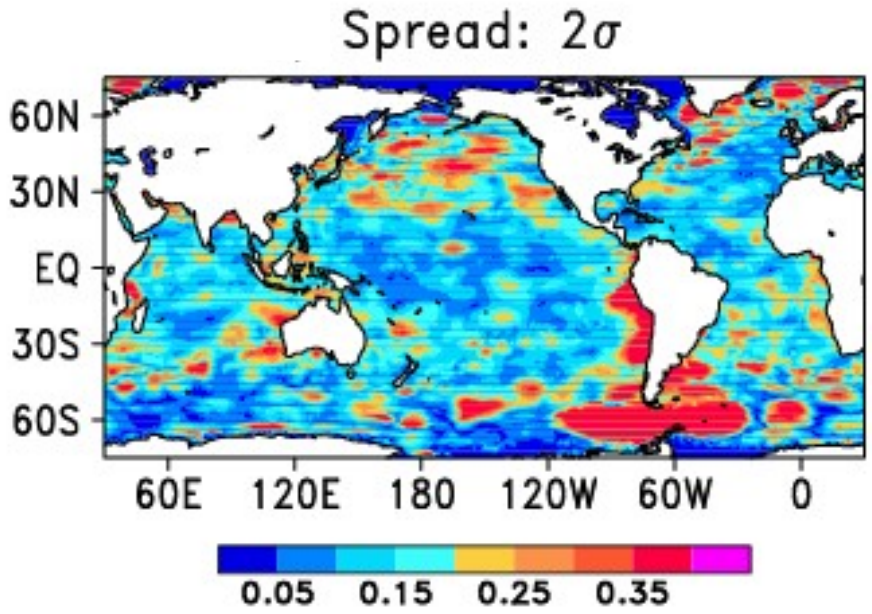


Result of Exp B

Changing analysis parameters

- In fewer observation area differences are relatively large.
  → more susceptible to individual observations.
- In low latitudes spreads are relatively small.
  → too strong filtering?





Conclusion &Future plan

For the next COBE

Approaches & Conclusions

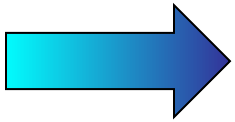
- Introducing satellite data
- Estimating Uncertainty

  by Cross Validation
    - Global mean SST can be reproduced 1890s observation distribution
    - 1930s observation distribution reproduce SST anomalies well.

  by measuring the sensitivity of analysis parameters
    - Analysis results are depend on stochasticity of observations or analysis parameters.

Future plan

- Cross Validation using satellite data
- Other patterns to make ensemble members

...and other improvements  COBE v.2