Japan Meteorological Agency

19 October 2004
PICES XIII S7 (POC/MONITOR Topic Session)

A new daily SST product of JMA
(Merged satellite and *in-situ* data Global Daily SST)

Toshiyuki Sakurai, Yukio Kurihara, and Tsurane Kuragano
(Office of Marine Prediction, JMA)

Outline

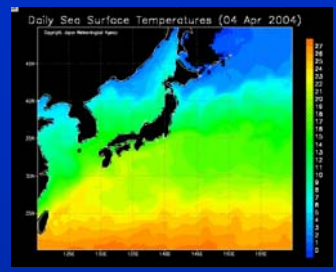
- Introduction
- Procedure of satellites' data
- Space-time scale decomposition
- Bias correction and optimal interpolation analysis
- Validation
- Summary

Introduction

- Daily SST analysis adjacent to Japan started in 1996 at Office of Marine Prediction, JMA.

  data : AVHRR/NOAA, buoy, ship

  grid resolution : 0.25 X 0.25



- A new technique of analysis was introduced in April 2004.

  MGDSST : Merged satellite and in-situ data Global Daily SST

- AVHRR/NOAA(infrared), AMSR-E/Aqua (Microwave)

  -in situ data are used to correct bias error in satellite data

- Scale Decomposed Space-Time OI
- Grid size is 0.25° x 0.25° in the Global Ocean
- Near-Real-Time Daily analysis (one day before)

Initial procedure of satellites' data

Satellite Active Archive/NOAA

GAC Level1B
AVHRR/NOAA

JAXA

Level2
AMSRE/Aqua

MSC/JMA

HRPT
AVHRR/NOAA

Office of Marine Prediction, JMA

- cloud clearing
- convert to MCSST
- quality check by AMSR-E

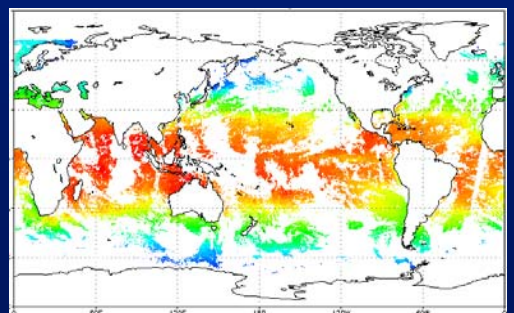
- quality check
- daily average
- 0.25 x 0.25 grid

MSC

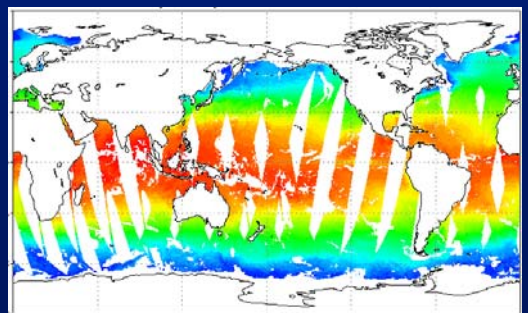
MCSST

0.25 degree grid

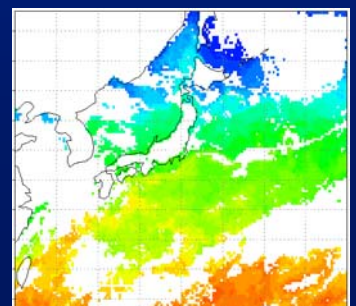
AVHRR(GAC)



AMSR-E

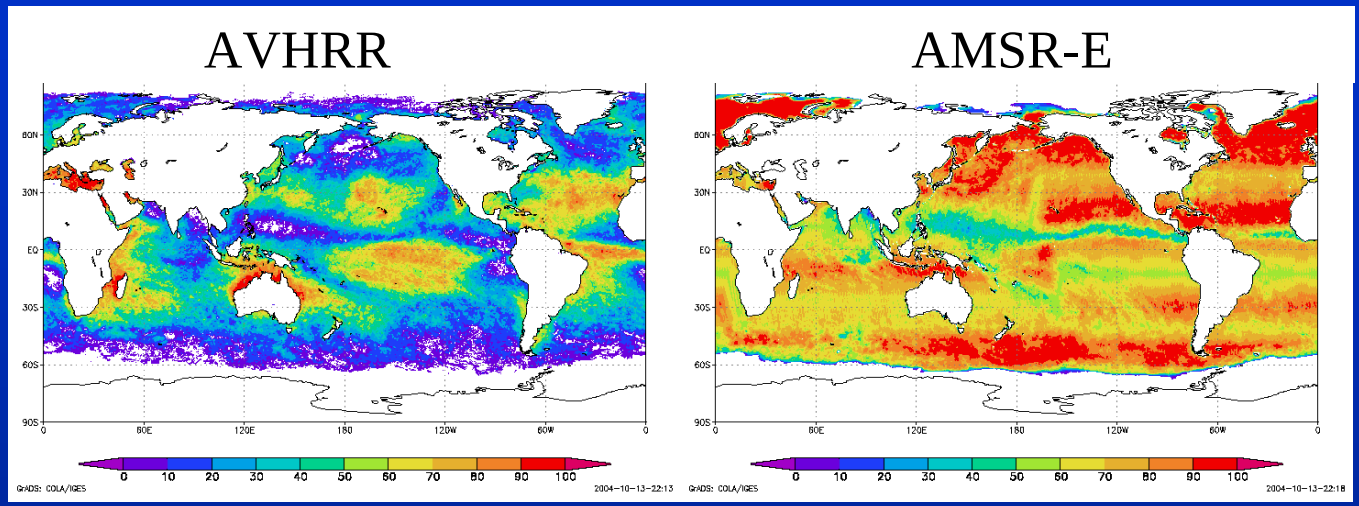


AVHRR(MSC)



daily SST

- Availability of satellite data in Aug. 2004

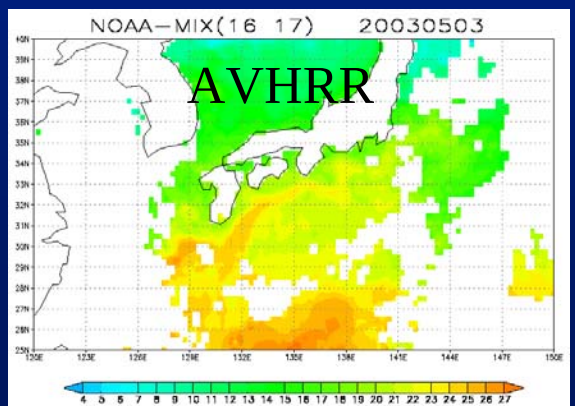


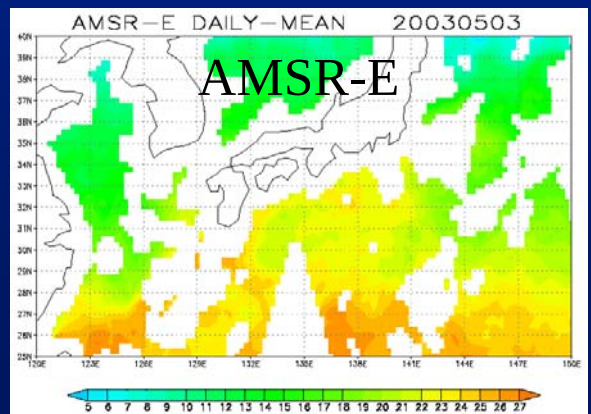
AVHRR <40%
AMSRE >60%

AMSR-E is better to detect short-period SST variations in the global area

- Spatial resolution of sensor

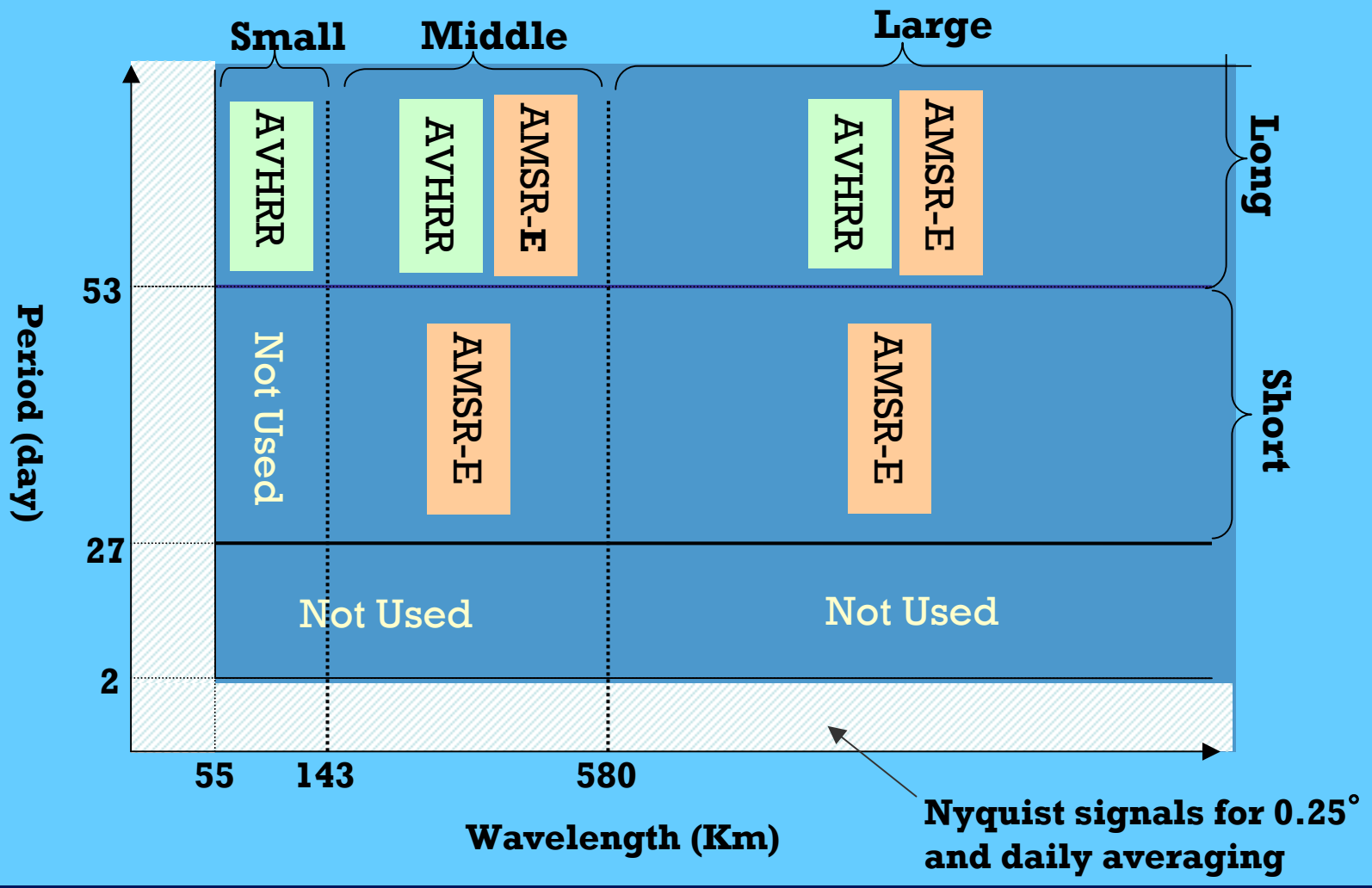
AVHRR→ high (1~4km) AMSR-E → low(40~50km)
AMSR-E is not suitable for small scale analysis





Space-time Scale Decomposition

Satellites' SSTs are decomposed using a Gaussian filter in view of features of satellite's data and scale of SST variations



Bias correction of satellites' data (1)

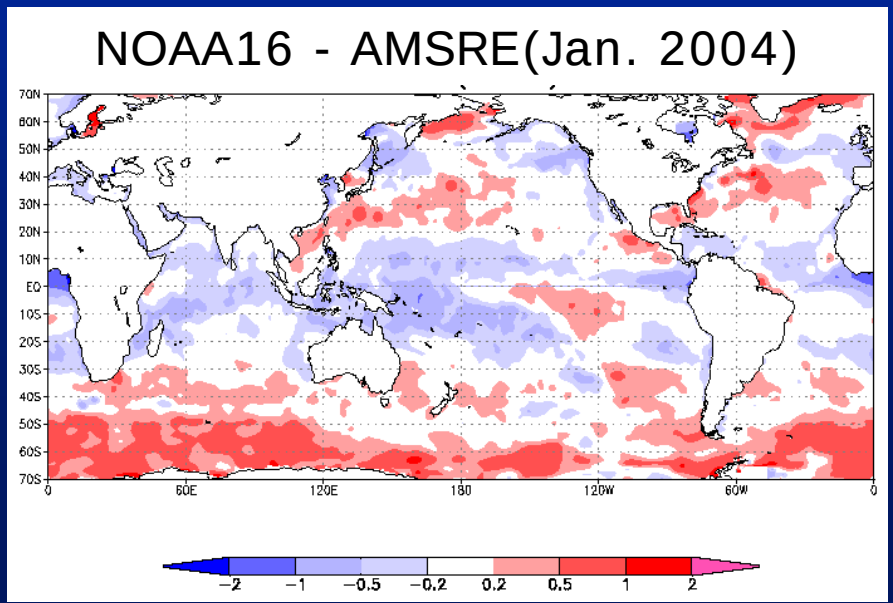
- Long-term and large-scale bias among satellites and between satellite and in-situ data exist

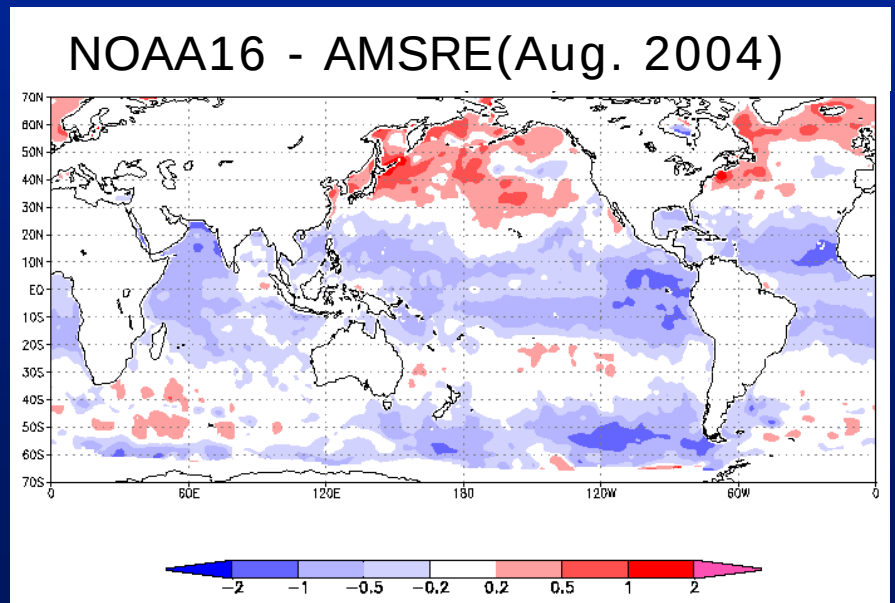
The bias between AMSR-E and AVHRR --->

1: More than 1 degree Celsius

2: Seasonal and regional difference

Difference of monthly mean long period and large scale anomalies



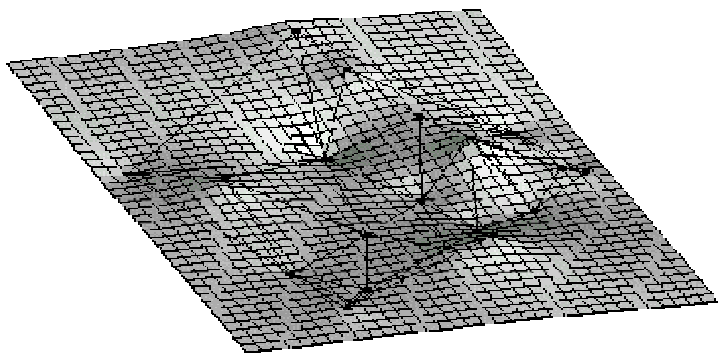


Bias correction of satellites' data (2)

• Bias of each satellite's SST against in-situ SST is corrected for long-period and large-scale fields.

STEP 1 : Solving Poisson equation

$$\nabla^2 T_{cor} = \nabla^2 S$$



$$\nabla^2 = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}$$

T_{cor} : corrected SST fields

S : satellite's SST fields

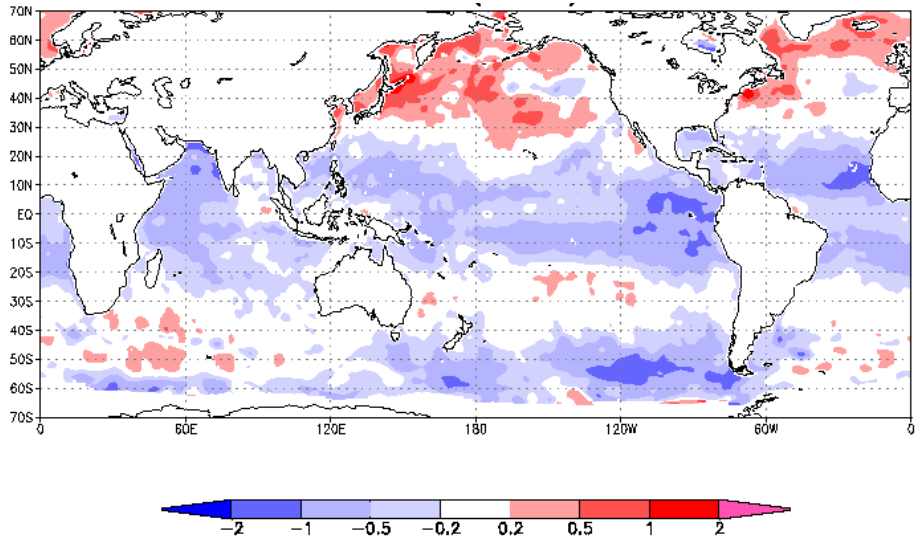
Internal boundary condition
: In-situ SST

STEP 2 : Filtering bias fields
(to retrieve long-period and large-scale component)

- Difference between NOAA16 and AMSR-E
  for monthly mean long period and large scale anomalies

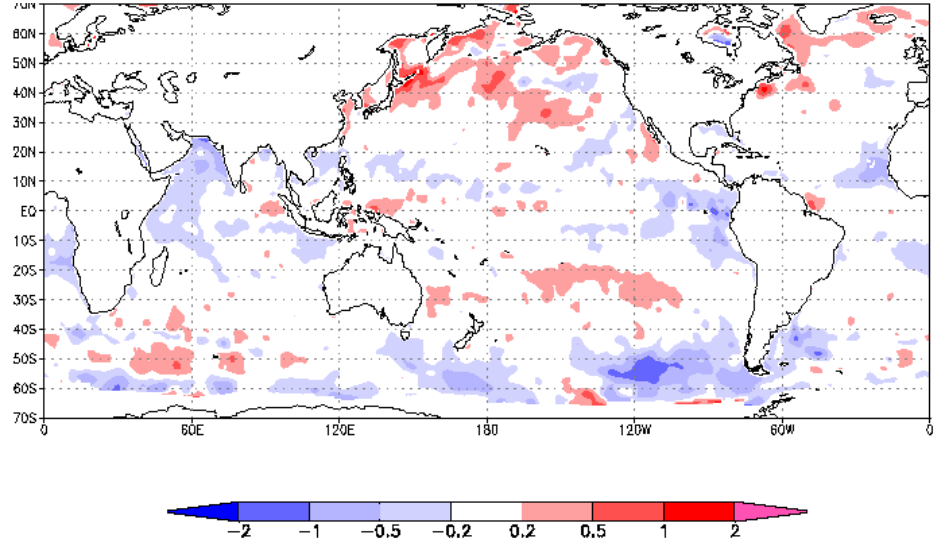
Not bias corrected

NOAA16 - AMSRE(Aug. 2004)



Bias corrected

NOAA16 - AMSRE(Aug. 2004)



Optimal Interpolation

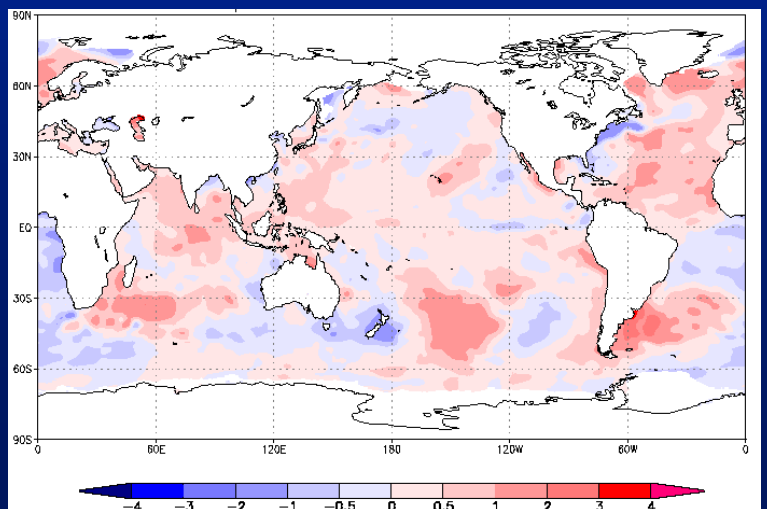
1) Space-time OI (Kuragano T. and M. Kamchi, 2000) is applied to analyze SST for each component,

2) First guess is zero anomaly value

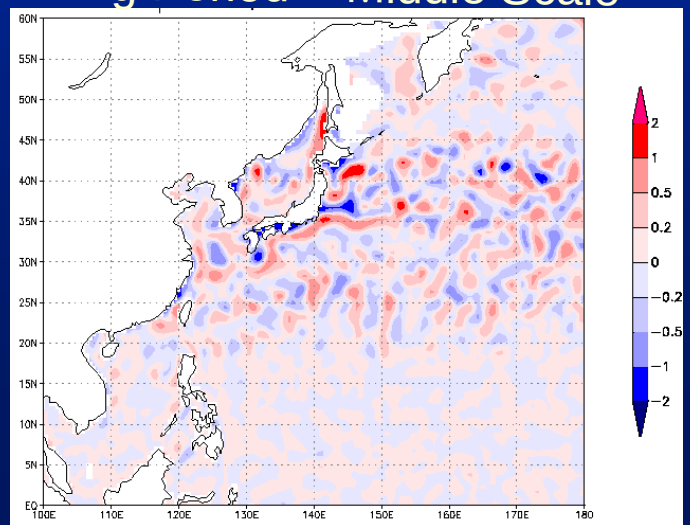
3) Sum of the analyzed values and climatology

Example of OI result

Long Period - Large Scale

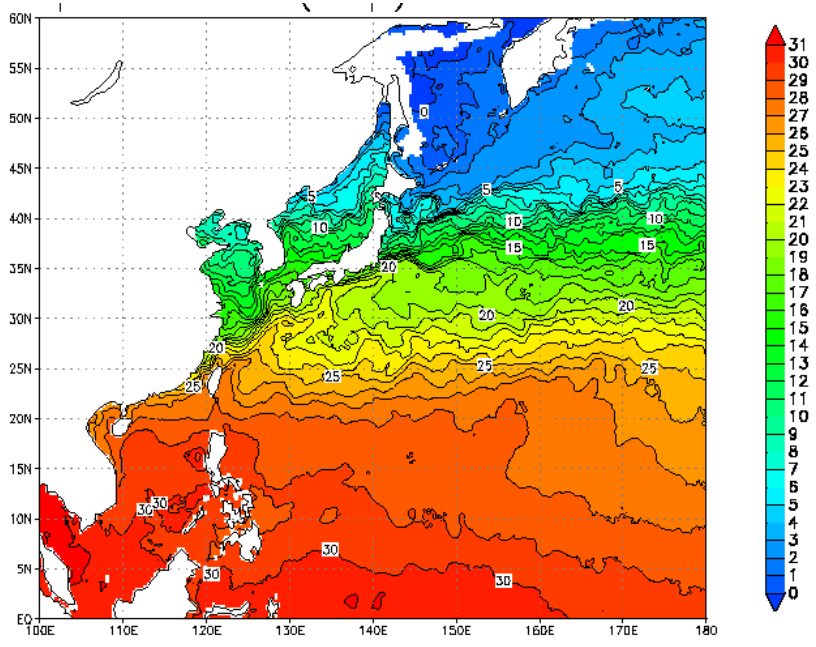


Long Period - Middle Scale

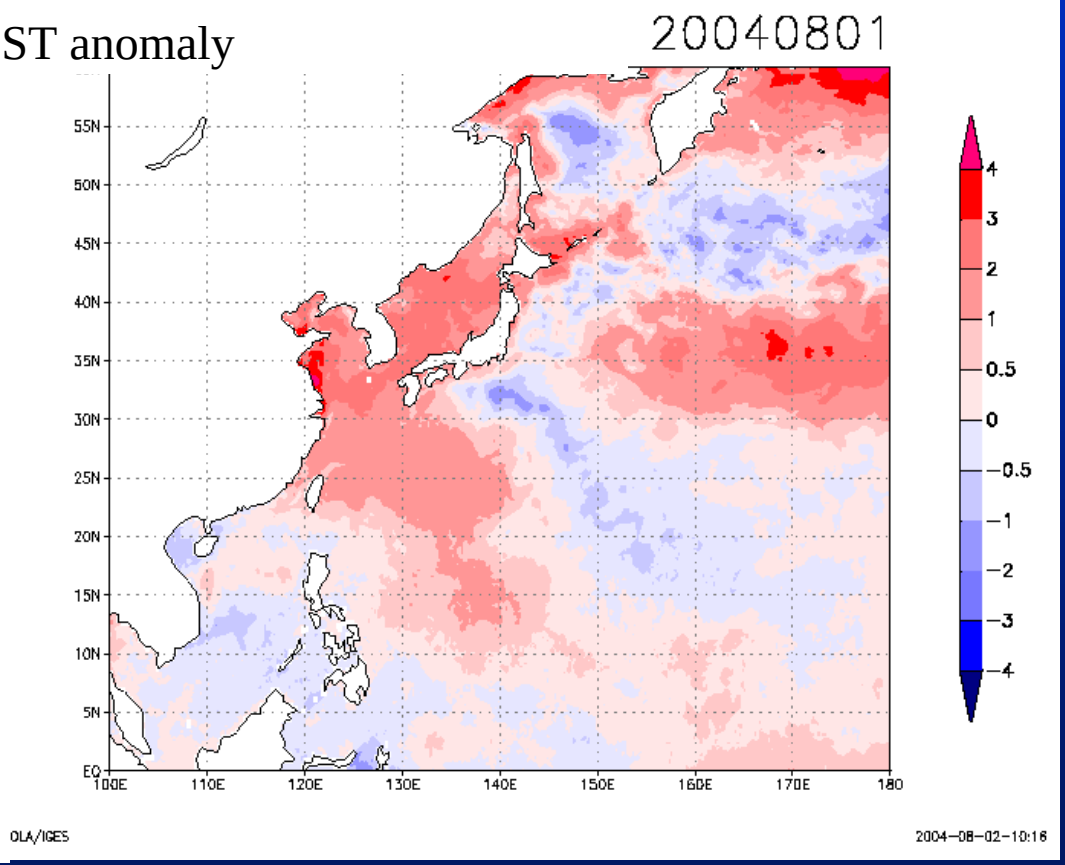


Products of MGDSST

SST 03 May 2004

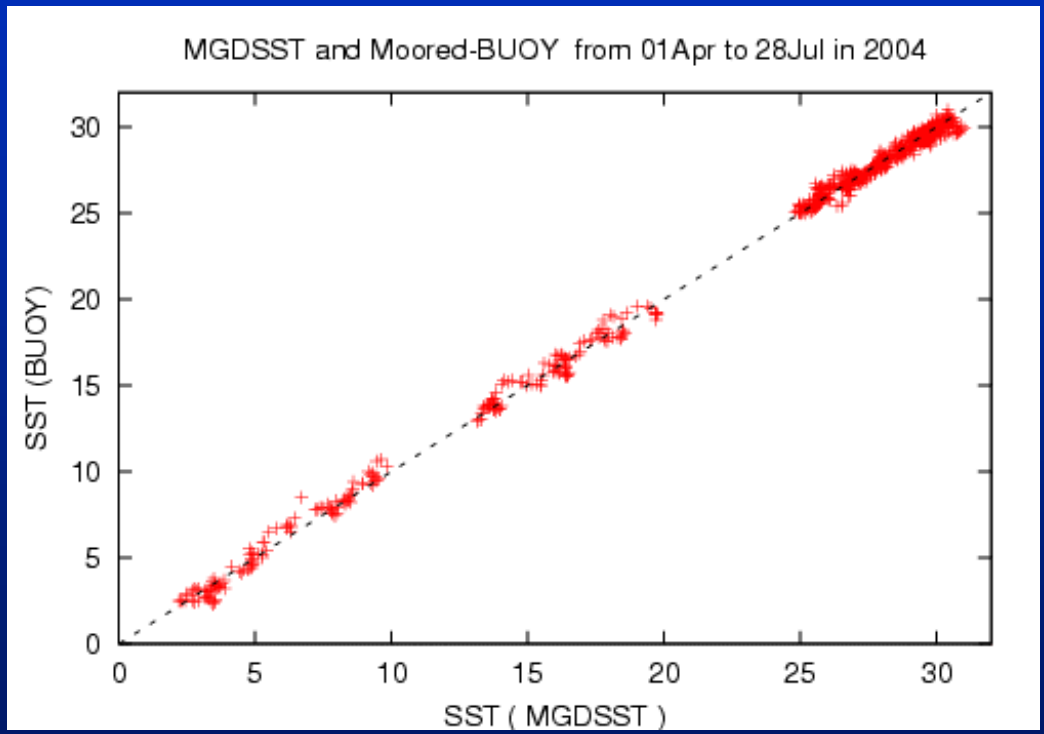


SST anomaly



Validation of MGDSST

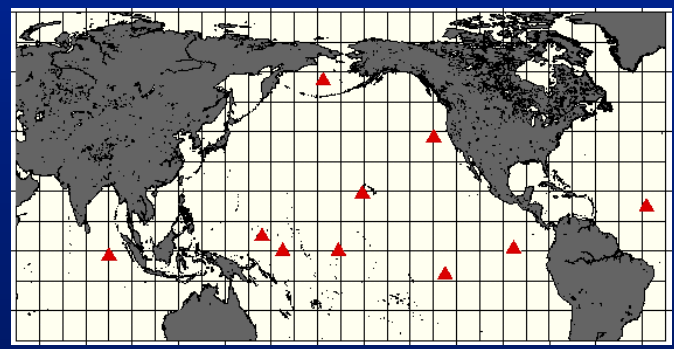
match-up with buoy which did not used in the analysis
(April 2004 ---- July 2004)



RMSE : 0.37 degree Celsius

Bias : +0.05 degree Celsius

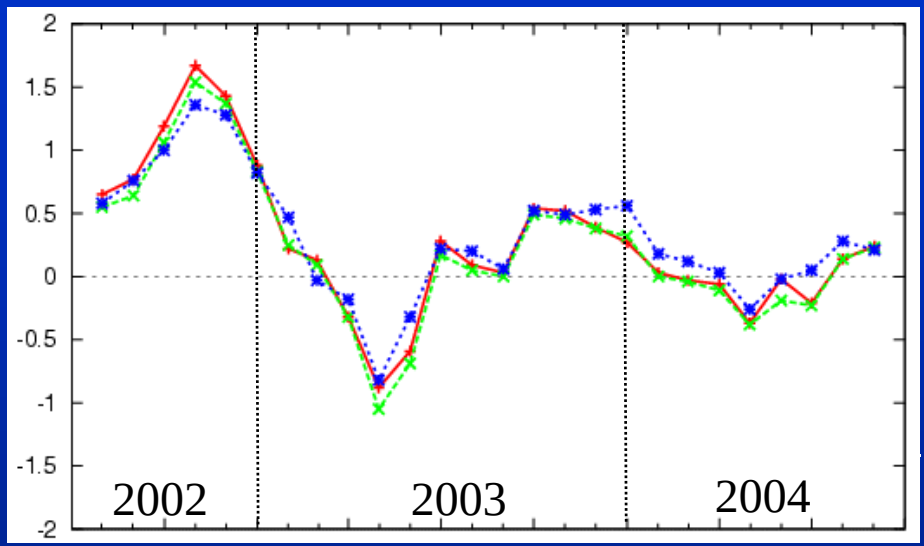
Number of data : 879



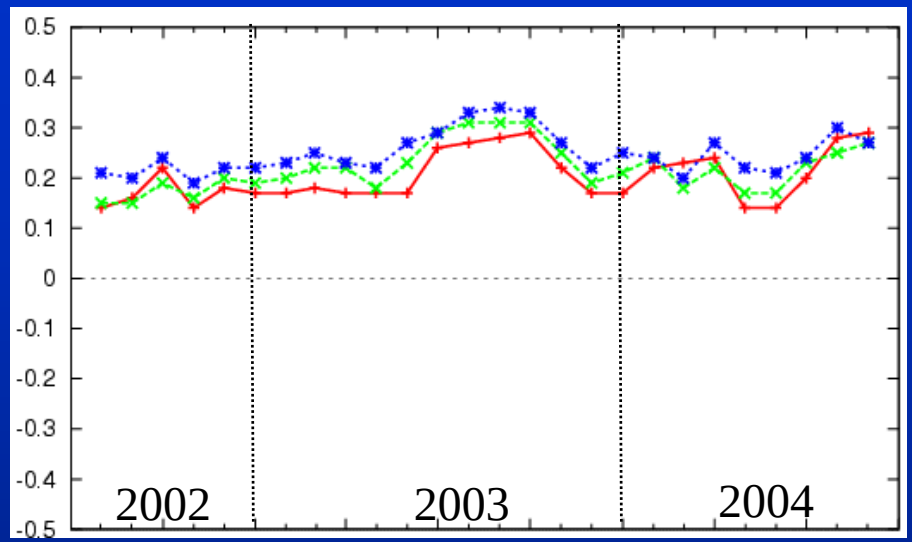
▲ moored buoy

Comparison with other products

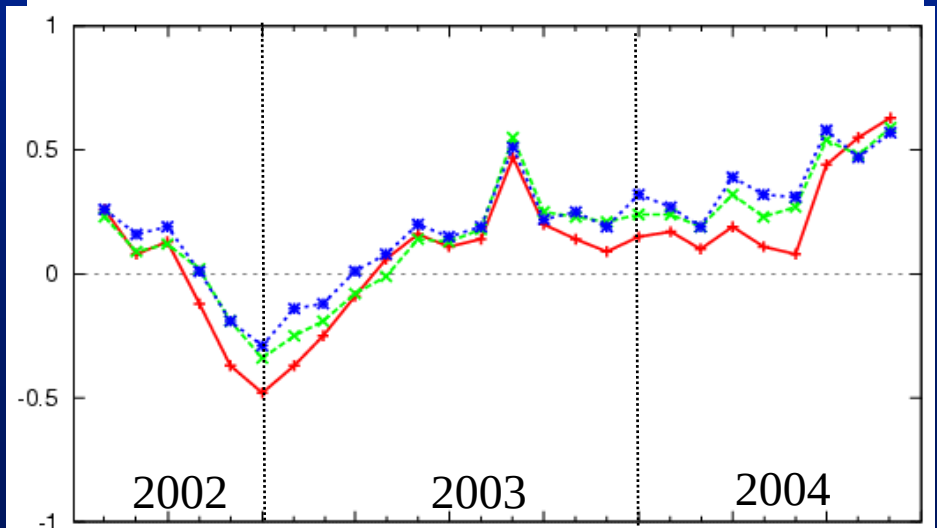
Region B 4S-4N 150W-90W



Global 80S-80N



Central North Pacific 20N-50N 150E-140W



Monthly mean MGDSST

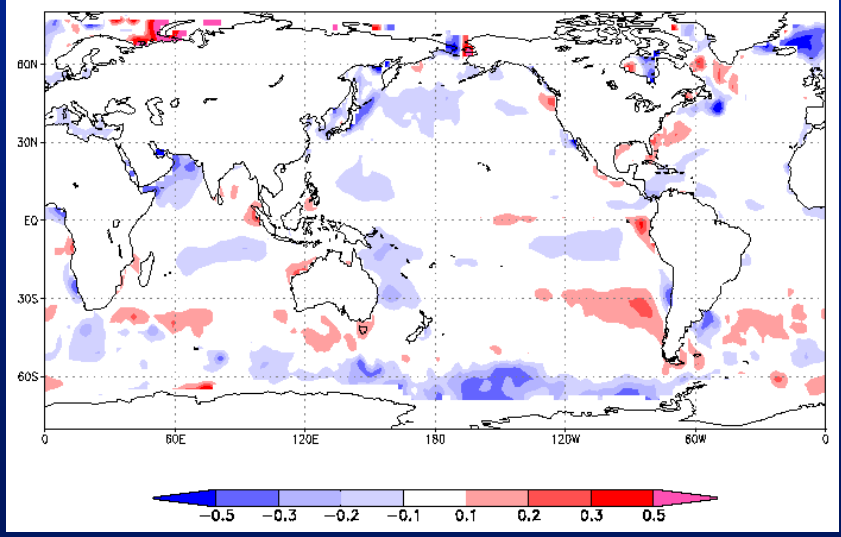
NCEP(OISSTver2）

GLBSST(JMA)

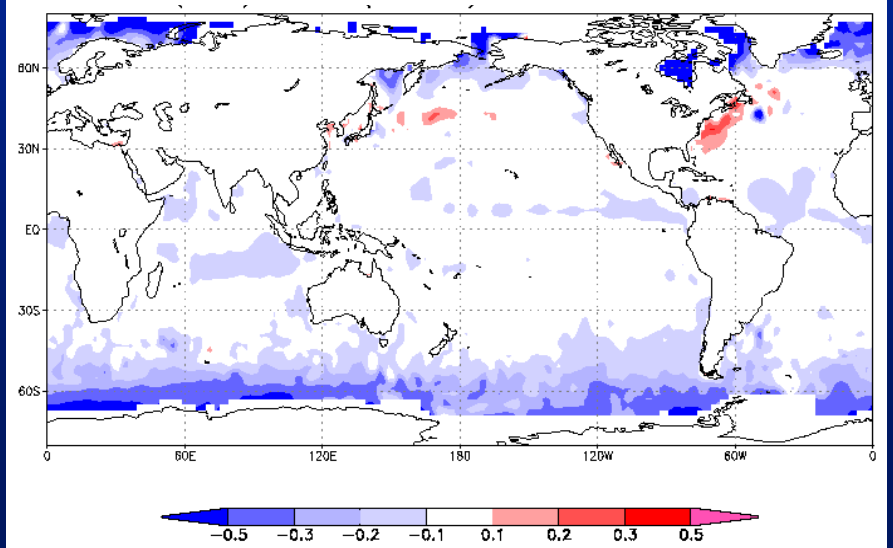
Comparison with other products (2)

- Difference between MGDSST and NCEP.OISSTver2 and Difference between NCEP_RTGSST and NCEP.OISSTver2 for Aug. 2002-Sep. 2004
- NCEP.RTGSST is the daily global SST product provided in real-time.
- MGDSST is consistent in almost all region, but lower in the western north Pacific.
- NCEP.RTGSST has considerable negative bias at high-latitude

MGDSST - NCEP.OI.Ver2



NCEP.RTGSST - NCEP.OI.Ver2



Product distribution

- NEARGOOS Regional Real Time Data Base

  http://goos.kishou.go.jp/

- JMA Japan-GODAE LAS server

  http://godae.kishou.go.jp/

Summary

- MGDSST analysis started in April 2004
- Analysis in global area with ¼ degree grid resolution in real time.
- Biases among sensors are well-corrected.
- Microwave sensor and infrared sensor data are merged by optimal interpolation for several space-time scales.
- +0.05 Celsius degree higher than buoys' SSTs, but lower than other products, especially in the western north Pacific.