Recent Developments in Climate Information Services at JMA

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Topics

1. Diagnosis of the Northern Hemispheric circulation in December 2005

2. The Japanese 25-year Re-Analysis project (JRA-25)

3. A new global surface temperature analysis scheme for monitoring the Global Warming

Topic 1

Diagnosis of the Northern Hemispheric circulation in December 2005

- Severe cold weather over East Asia and significant convective activities in SE Asia
- Atmospheric circulation anomalies
  - Linkage of AO and tropical convection
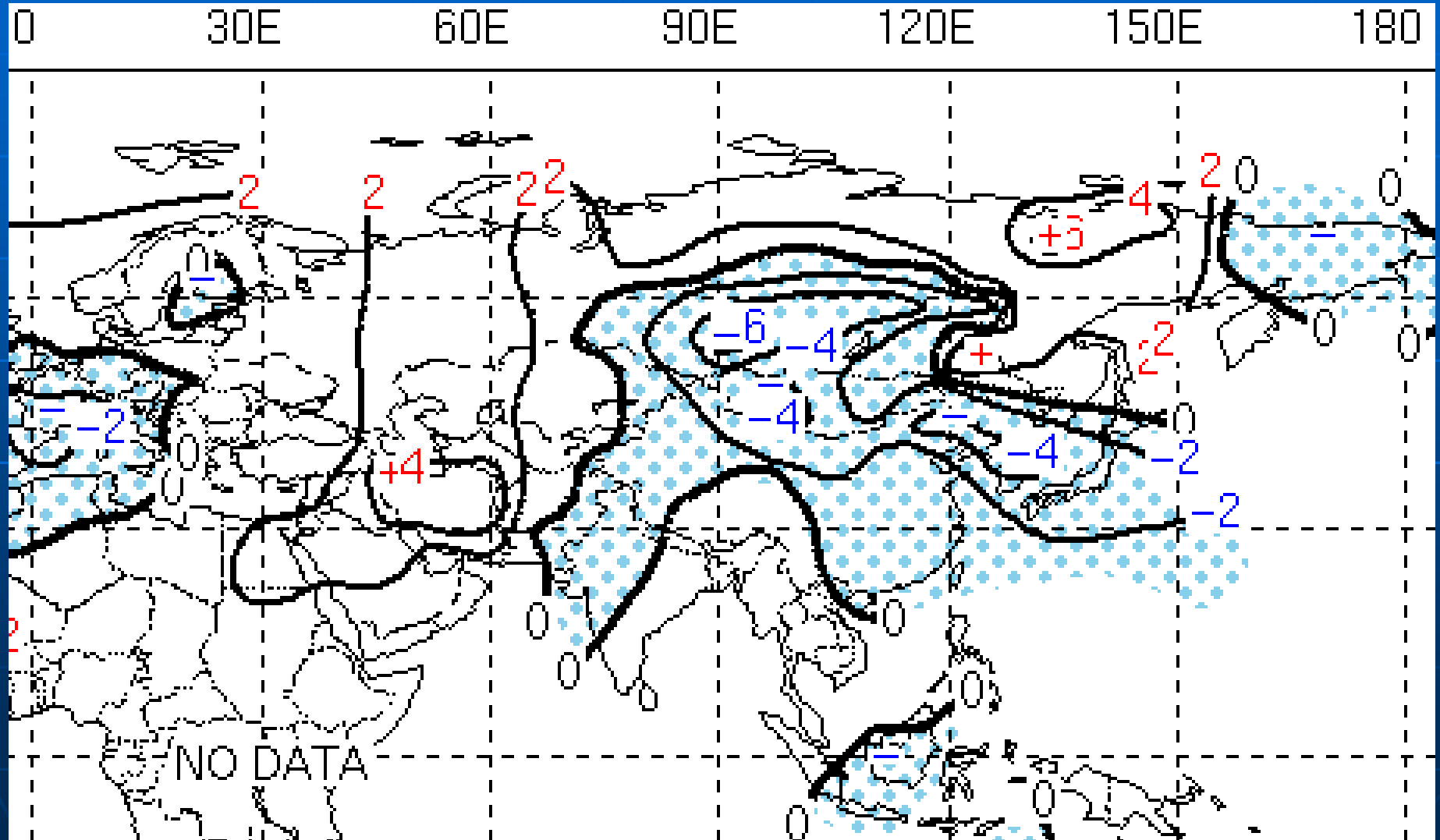- Review of the operational forecast
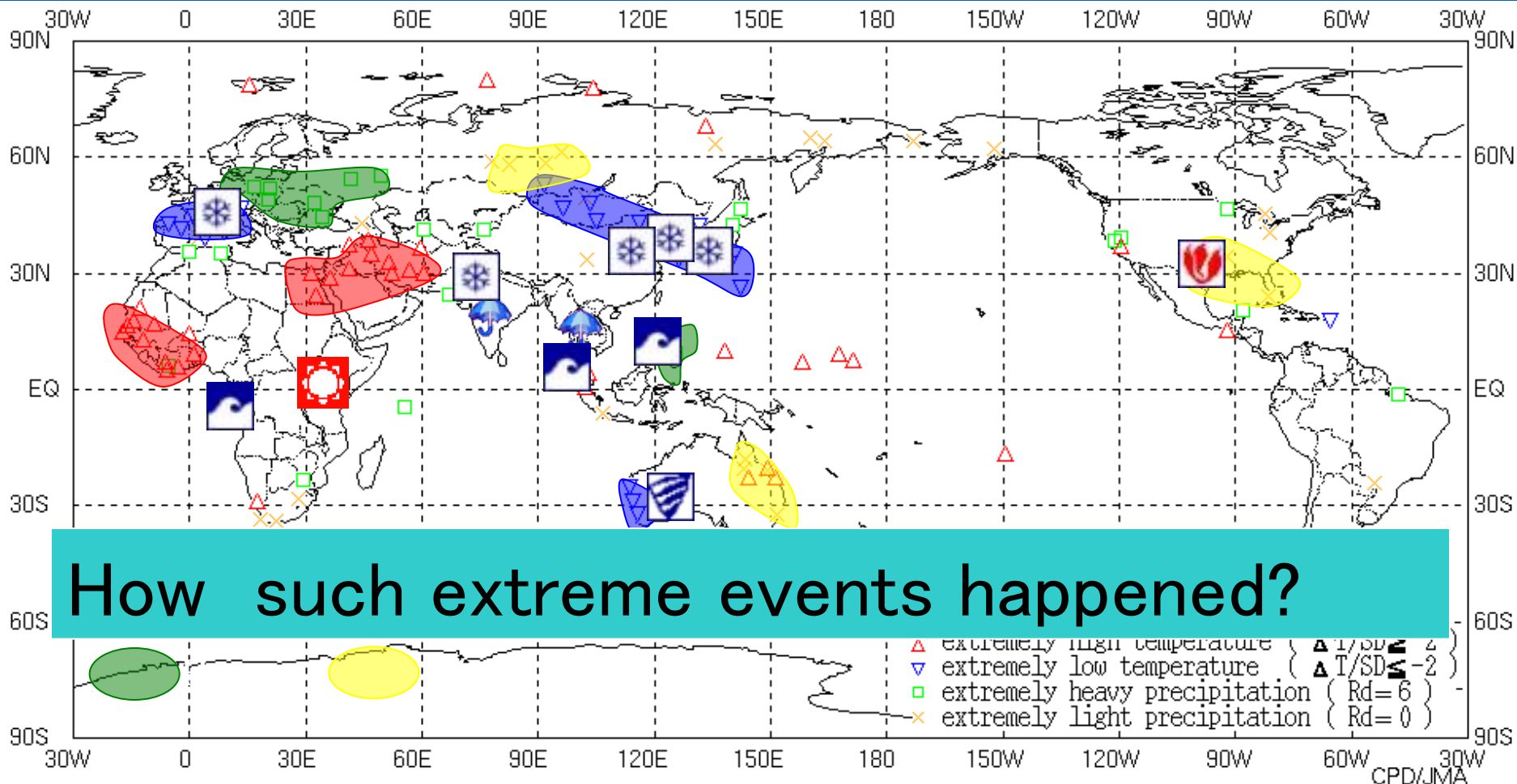- Summary

The coldest December in 60 years in Japan

December anomalies of average surface temperature over Japan
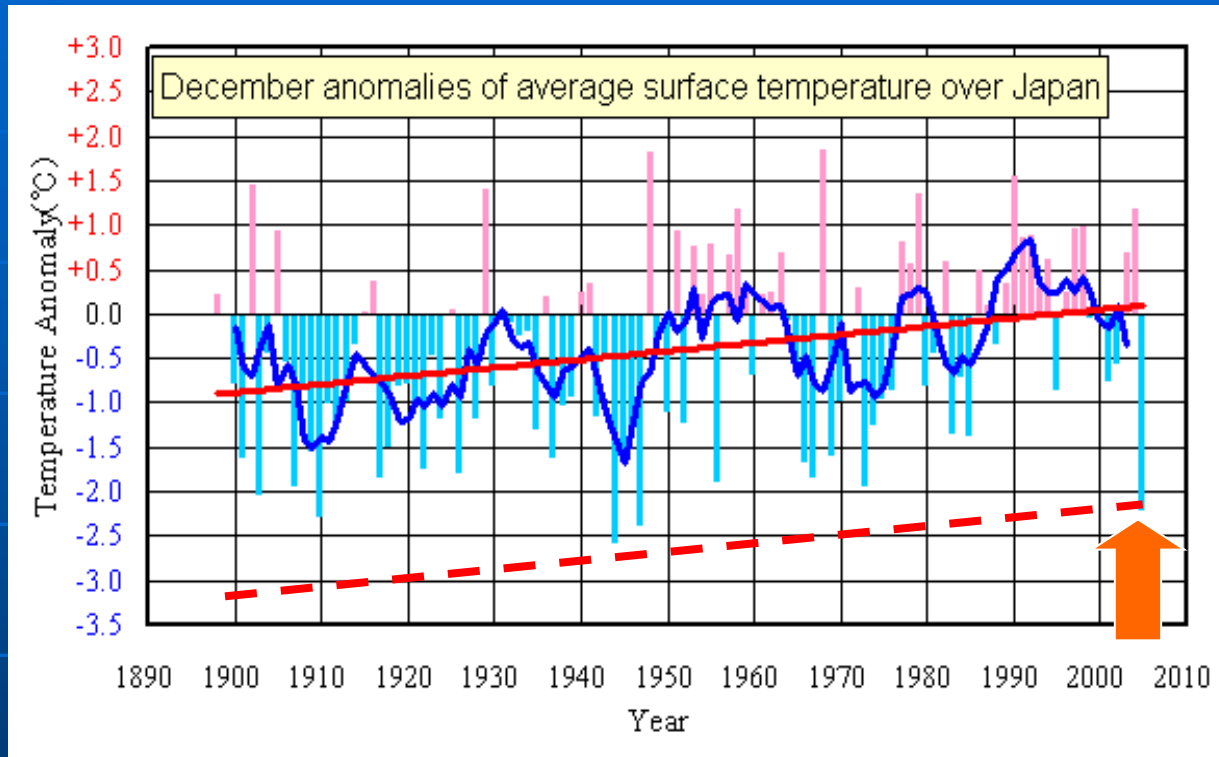
 Maximum snow depth observed at the 106 stations

(total 339 stations) [4]

Monthly Mean Temperature Anomaly (Dec 2005)
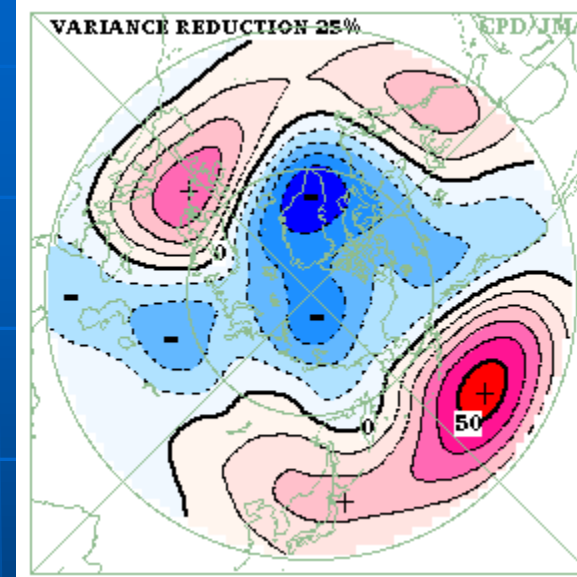
Extreme Climate Events :Dec.2005
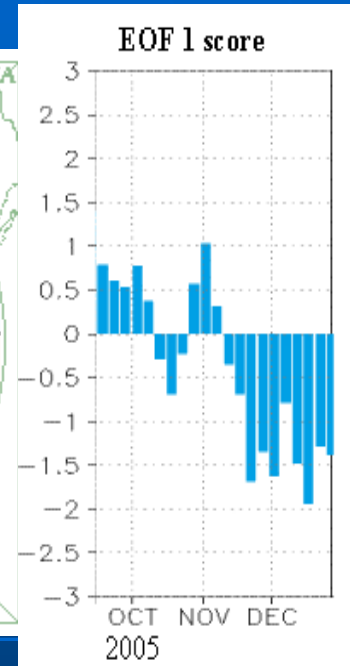

How such extreme events happened?

Monthly mean 500-hPa height and anomaly
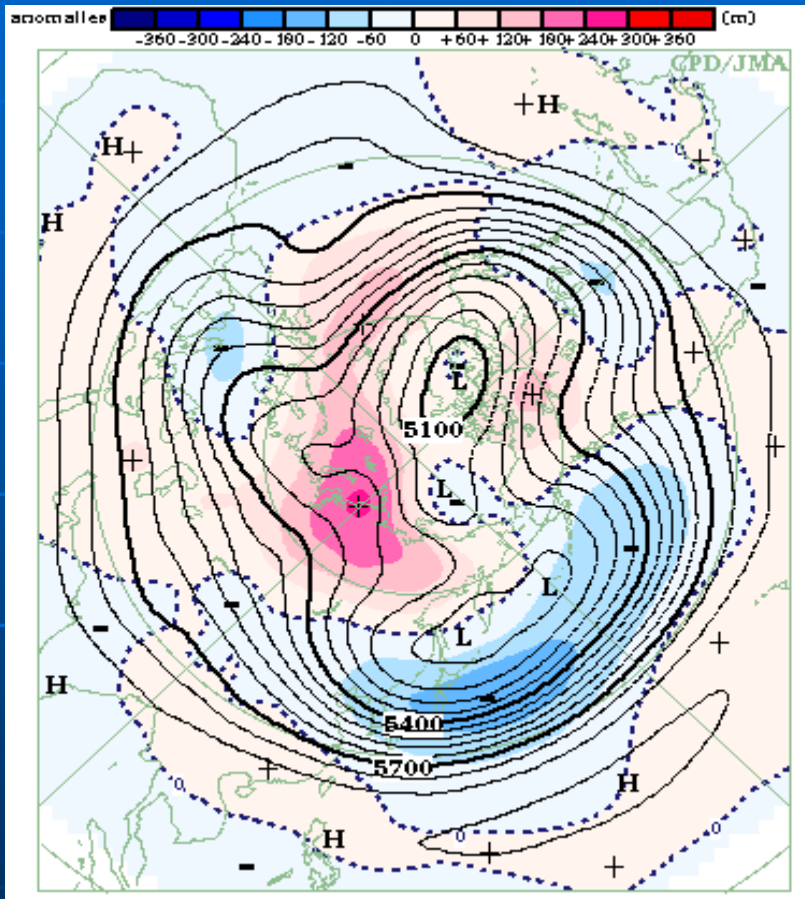
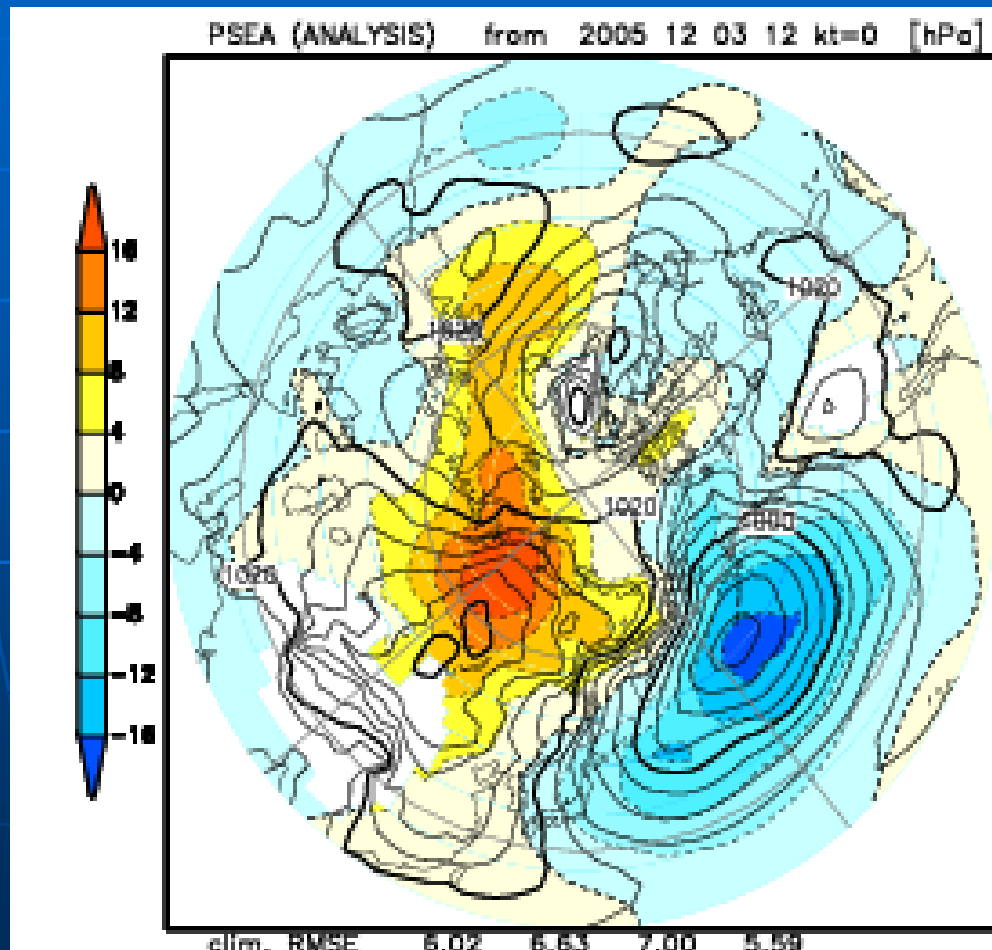500hPa Height & Anomaly
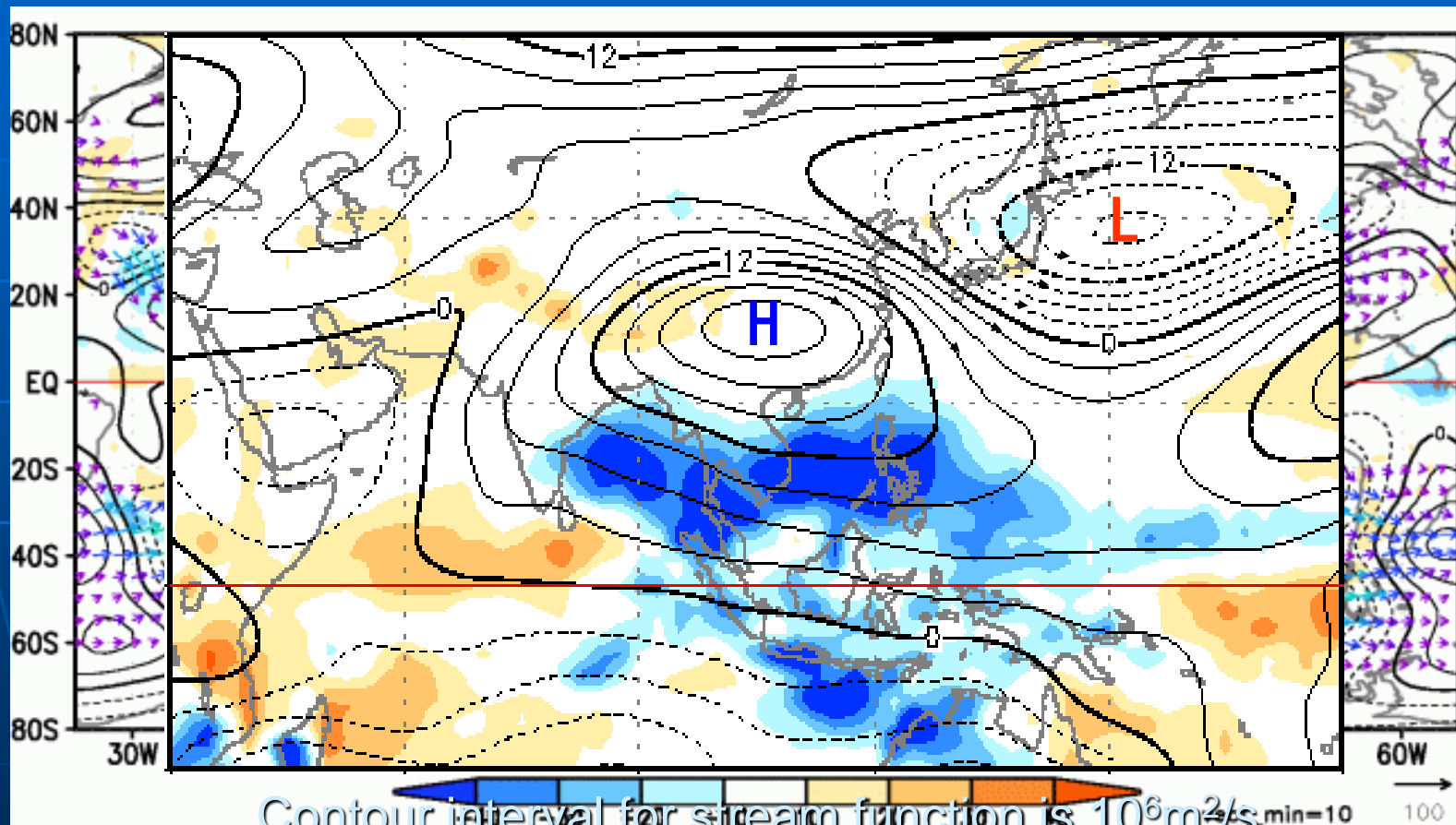
'AO (Arctic Oscillation)'

Distribution of Eigen vector -1

'AO'INDEX
Time series of EOF-1 scores

NH Surface pressure and Anomaly

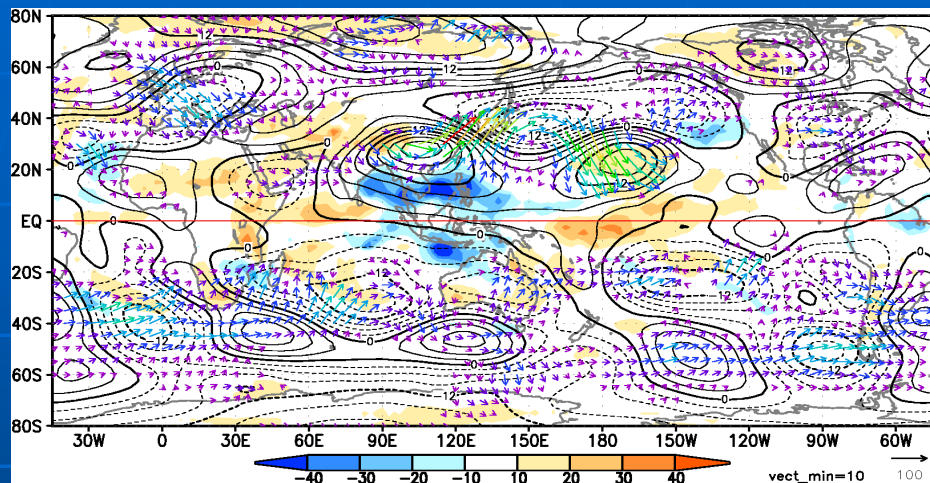# OLR anomalies and 200-hPa stream function anomalies

Contour interval for stream function is $10^6 m^2/s$.
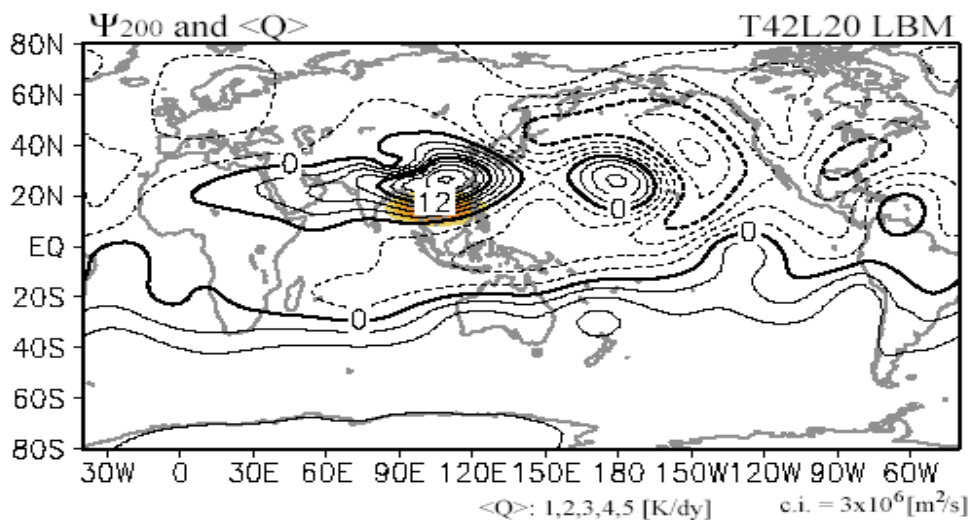"H" and "L" designate ant-cyclonic and cyclonic anomaly, respectively.
"Blue" areas indicate negative OLR anomalies (more active than normal).

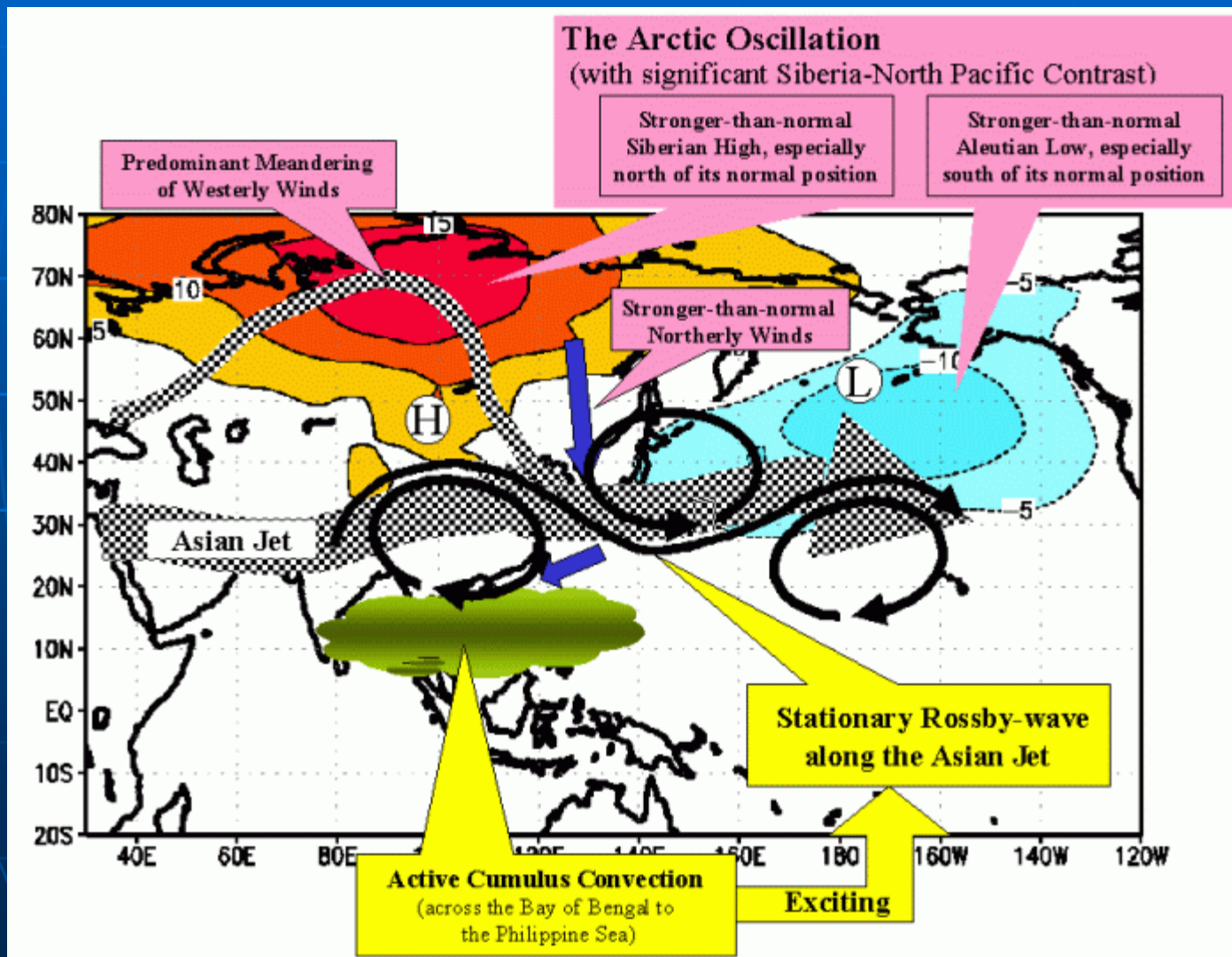# Steady linear response to the anomalous heating

Steady linear response to the South China Sea heating

Steady linear response of a linealized baroclinic model to the anomalous heating over the S. China Sea and the Bay of Bengal

By M.Watanabe

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Atmospheric circulation related to the extremely cold weather in Japan during December 2005

One-month prediction for Dec. 2005
Initial: 1st Dec, 28-day mean (day:2-29)

500hPa Height & Anomaly

SLP & Anomaly

Observed — forecasted
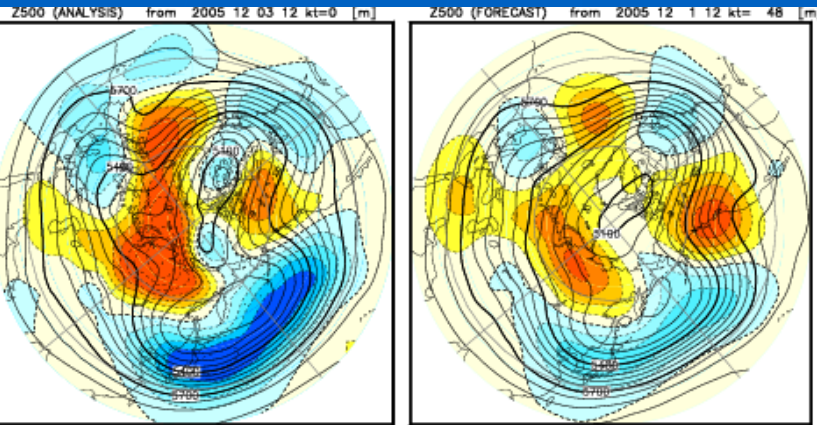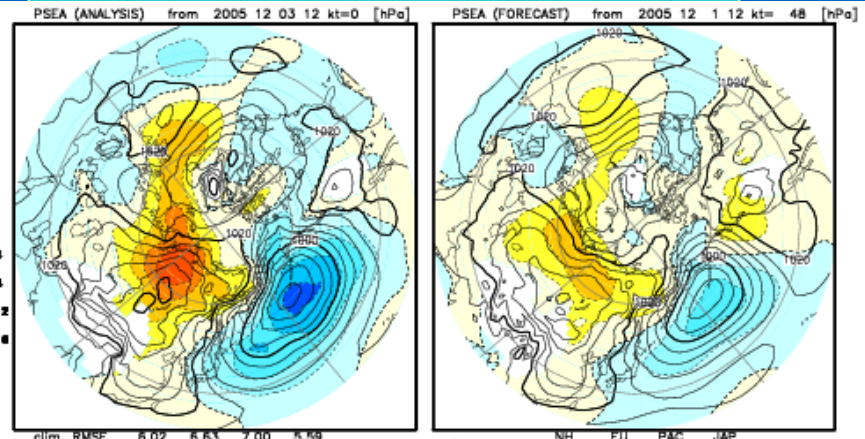
Observed — forecasted

Stream function & Anomaly
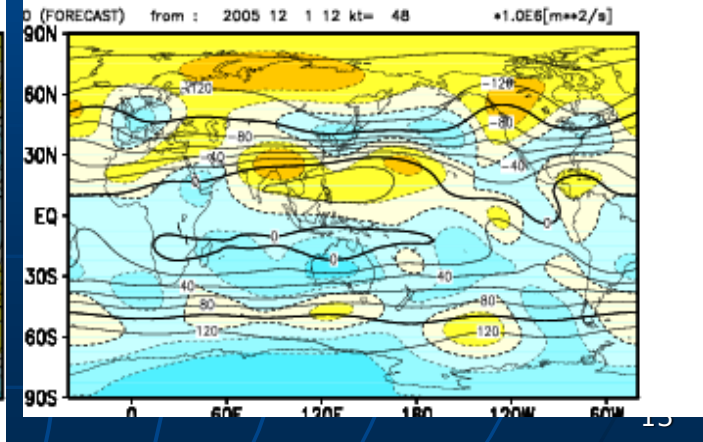
Observed — forecasted

One-month prediction of the AO
Initial: 1ˢᵗ Dec, 7-day running mean

init: 2005.12.01
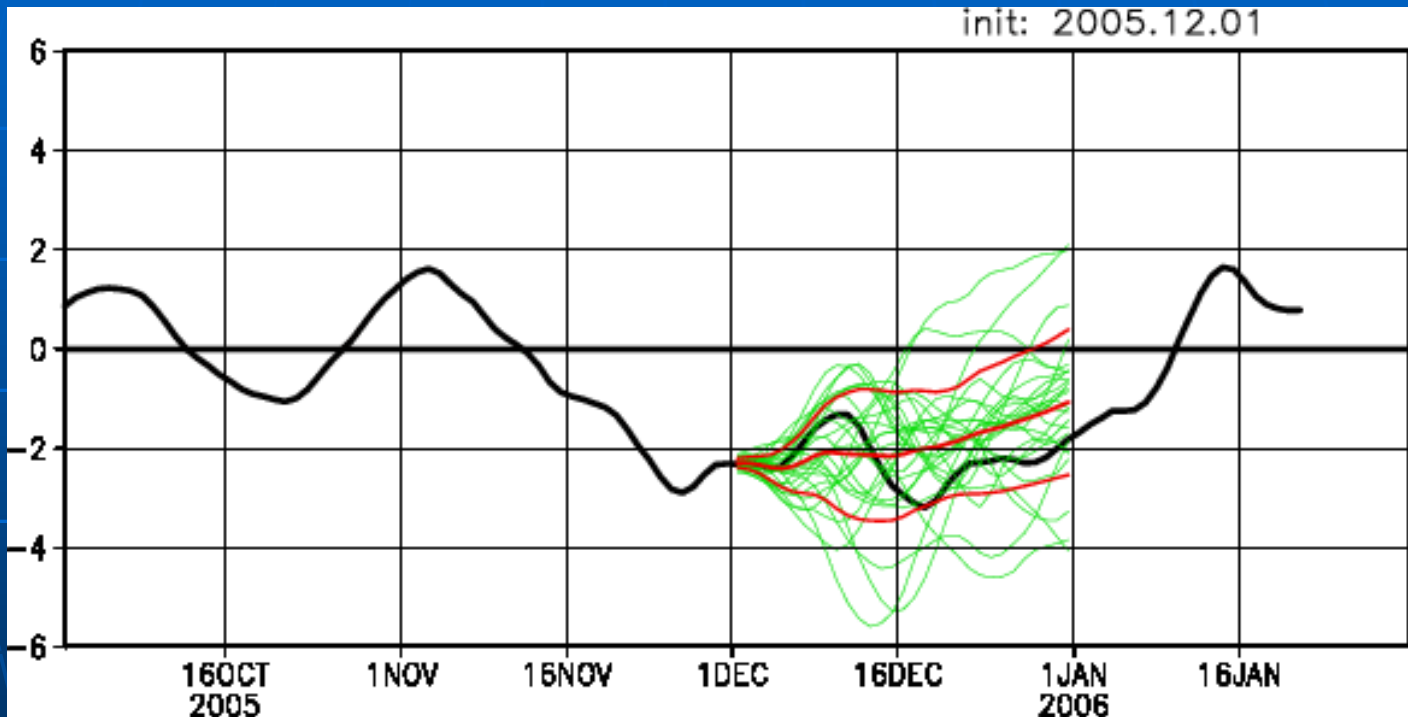
Time series of the AO Index
Ensemble forecast of the Index(26member)

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Probabilistic forecast guidance

Terciles of 2nd Week (day:9-15) temperature in Western Japan

A A N N A N B A B B B B B B : Observed category
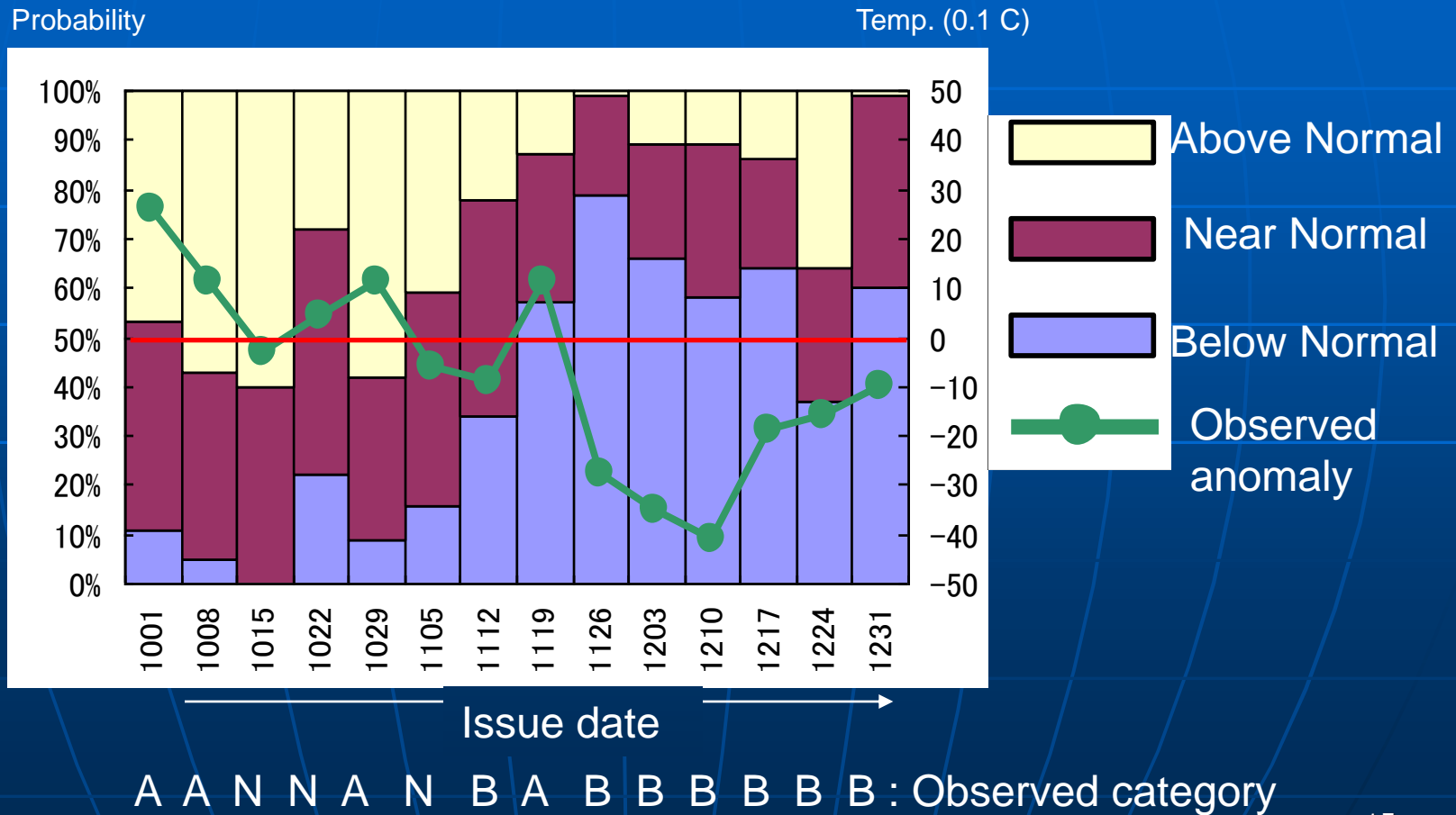
Summary

1. ## Diagnosis

   ◆ Predominantly negative phase of the AO

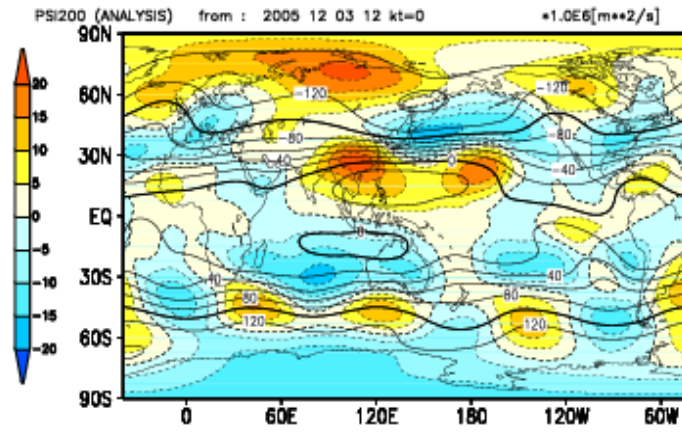   ◆ Strong convective activity over the Bay of Bengal, the South China Sea, and the Philippine Sea

   ◆ Stationary Rossby wave along the Asian Jet forced by the convection

   ◆ A quick diagnosis report issued

Summary (cont.)

2. One-month Prediction

◆　General features of the anomalous circulation forecasted properly with a few weeks lead time

◆　Probabilistic forecast guidance for second week (day:9-15) showed high probability around 60% of below normal temperature in Western Japan

Summary (cont.)

3. Future improvement

◆ Diagnosis of the extreme event

  # maintenance mechanisms of the active convection
  # interaction between the AO and the active convection
  # influence of La Nina like SSTA

◆ One-month prediction

  # improvement of the EPS

◆ Publicity activities for use of the forecast

Topic 2

The Japanese 25-year Re-Analysis Project

(JRA-25)

JRA-25 Annual Precipitation (1979-2000)
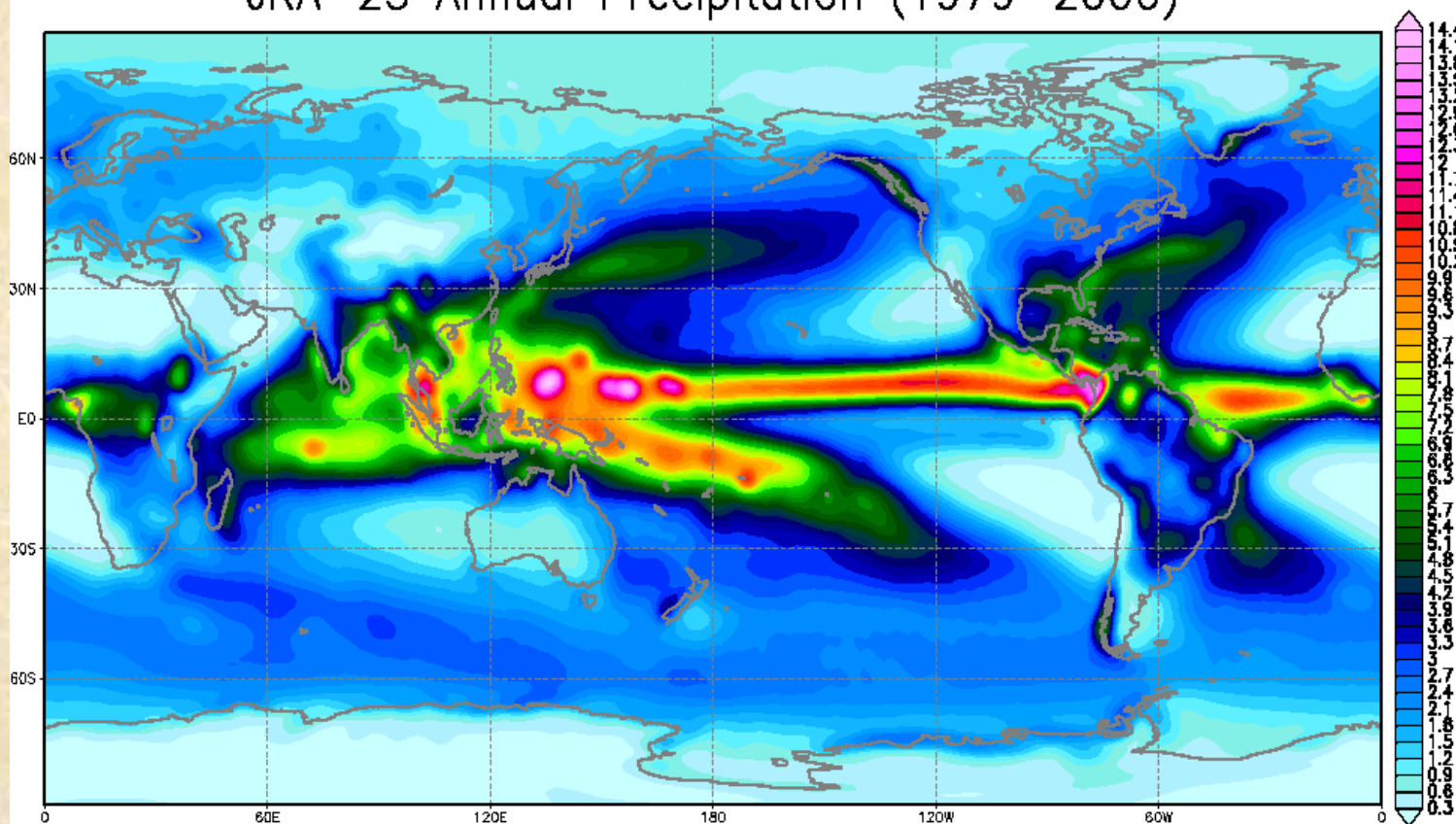
Reanalyses [1990's～]

■ECMWF　　　　ERA-15　　　　1979-1993　　　EU
■NCEP/NCAR　Reanalysis-1　1948-Present　　USA
■NASA/DAO　　GEOS1　　　　1980-1996　　　USA
■NCEP/DOE　　Reanalysis-2　1979-Present　　USA
■ECMWF　　　　ERA-40　　　　1957.9-2002.8　EU

JMA/CRIEPI * 　JRA-25　　1979-2004　　　Japan

*Central Research Institute of Electric Power Industry

Japanese 25-year Reanalysis Project (JRA-25 Project)

- 6-hourly assimilation with JMA operational scheme
- Target Period : 1979-2004 (26 years)
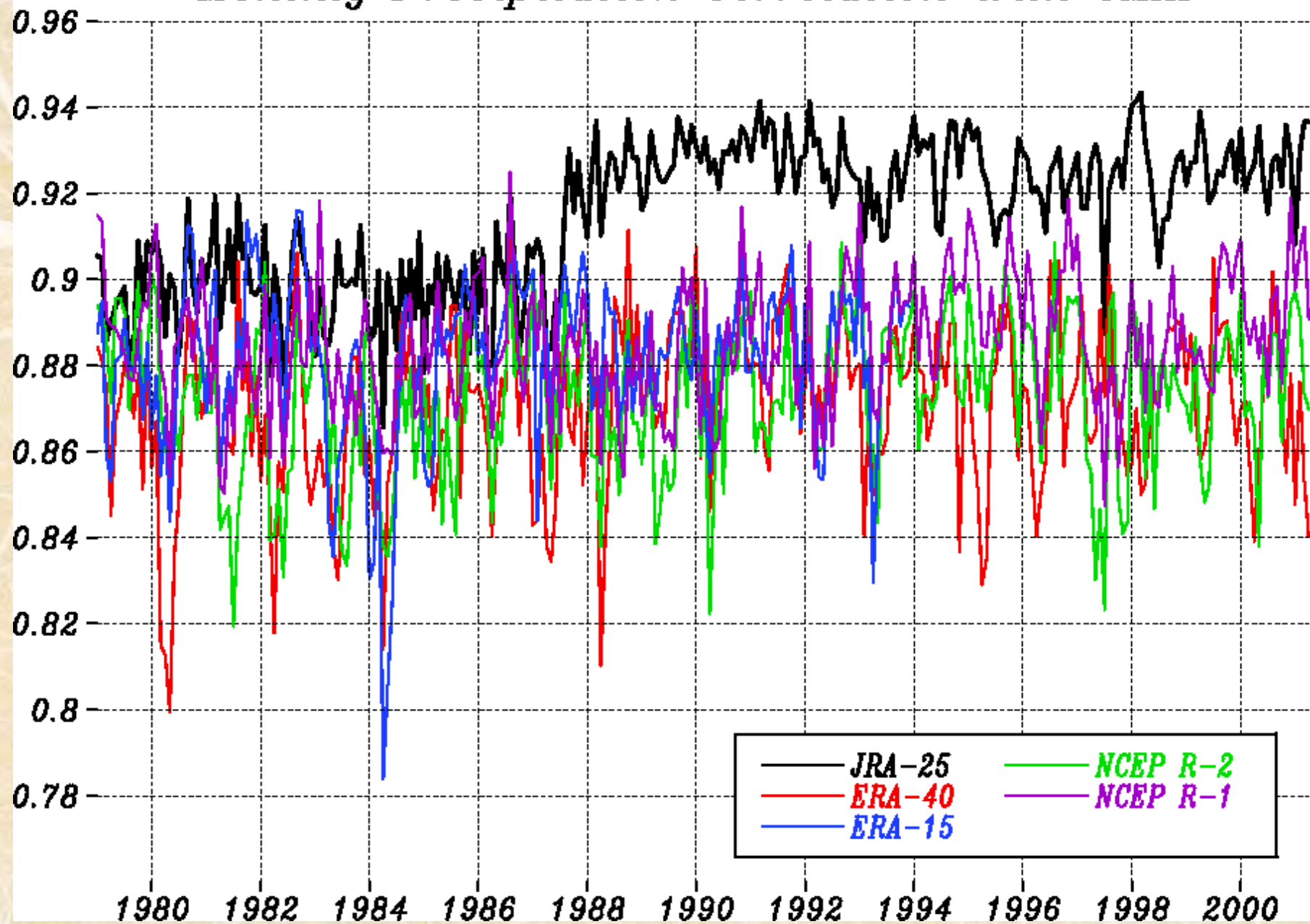
Objectives
to provide a fundamental dataset for

· Consistent initial conditions and validation for dynamical seasonal prediction,

· Operational climate monitoring services,

· Climate system and global warming studies, and

· Boundary condition of an OGCM or input for a chemical transport model.

Data Assimilation and Forecast System

- **Model spec: T106L40** (top: 0.4 hPa)
- **Assimilation scheme : 3D-Var**
  - JMA archived observation, ECMWF & NCEP merged data (ERA-40 observation)
  - TOVS 1d / ATOVS 1c, SSM/I PW, scattrometer, ….
- **Tropical cyclone wind retrieval from best tracks by Dr. M. Fiorino at LLNL/USA**
- **GMS atmospheric motion vectors (AMV)**
- **COBE SST and sea ice** (daily data)
  - COBE:Centennial comprehensive marine dataset by JMA
- **Daily 3D-ozone profiles produced by JMA model**
- **Snow coverage retrieved from SSM/I data**

Features of JRA-25

- **Best performance of 6-hour precipitation**
    Spatial correlation with CMAP
    Annual mean distribution
    Long-term stability of global total precipitation

- **Good tropical cyclone analysis**
                (Special thanks to Dr. Mike Fiorino)
        Impact of Fiorino's TC Wind Data
        Tropical cyclone detection

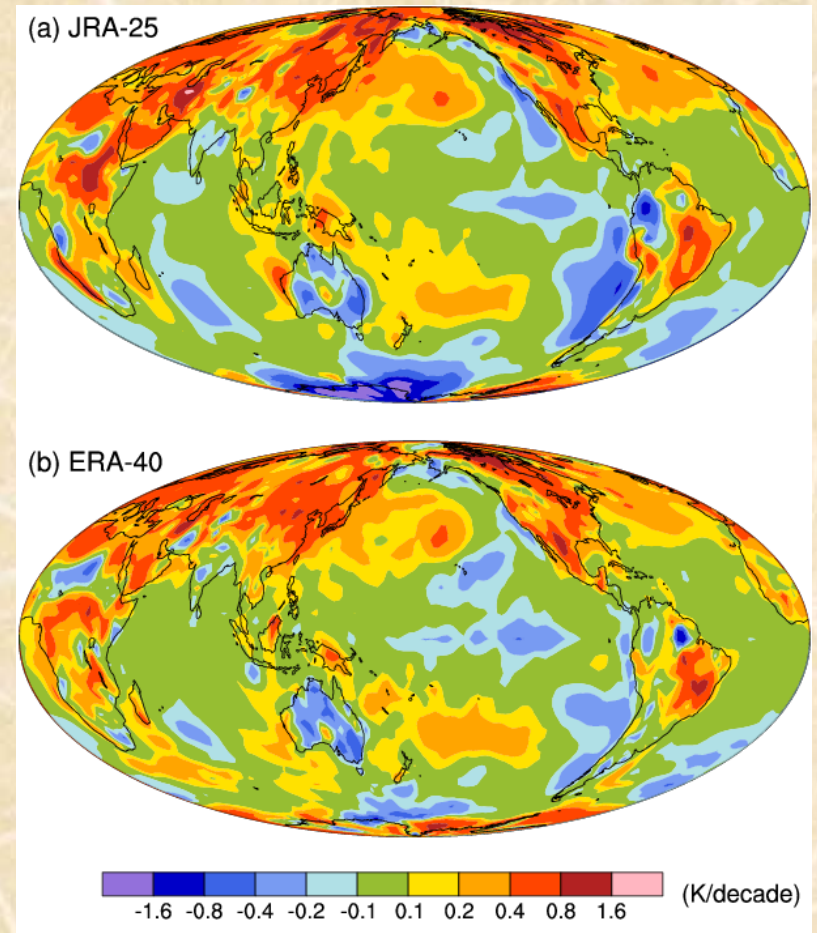- **Good global surface temperature analysis**
        Long-term variability

Onogi et al., 2005

Monthly Precipitation Correlation with CMAP

Legend:
- JRA-25 (black)
- ERA-40 (red)
- ERA-15 (blue)
- NCEP R-2 (green)
- NCEP R-1 (purple)

Long-term Change in Surface Temperature

~ Comparison between JRA-25 and ERA-40 ~
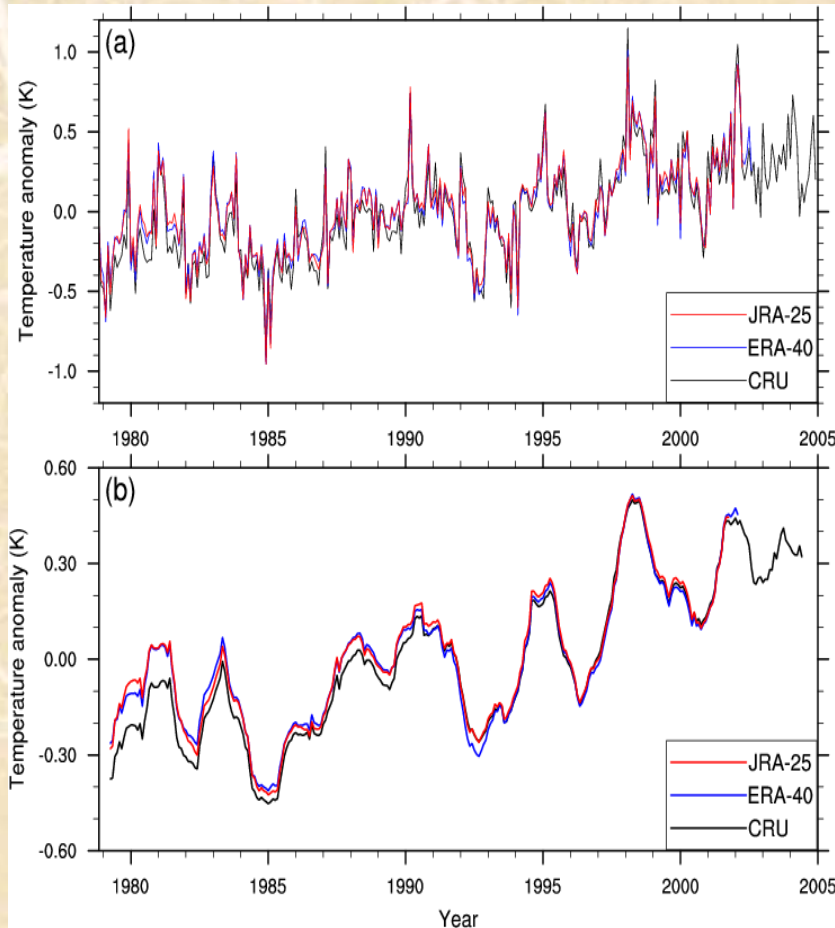
Change of Surface Temperature Upper: Monthly Mean, Lower: Five-year Running Average

Trend of Surface Temperature (K/10y)

JRA-25 Product available via internet

Basic products available (Present) :
Resolution : 2.5 x 2.5 Lat. Lon. Grid (144x73)
23 pressure levels (surface, 1000, 925, ····· 1hPa).
Factor : Z,T, U, V, RH,
            2D-physical monitor (Precip. Cloud, Radiation, etc)

http://www.jreap.org/download/download-e.html

All final products of JRA-25 will be available to NMHSs and
Research Institutes at the JMA web site.

Summary and Future Plan

- JRA-25 has advantages in the performance of precipitation and tropical cyclones.

- Long-term variability of the global mean surface air temperature of JRA-25 is comparable to that of other datasets.

- JRA-25 and the succeeding JMA CDAS will be available via Internet.

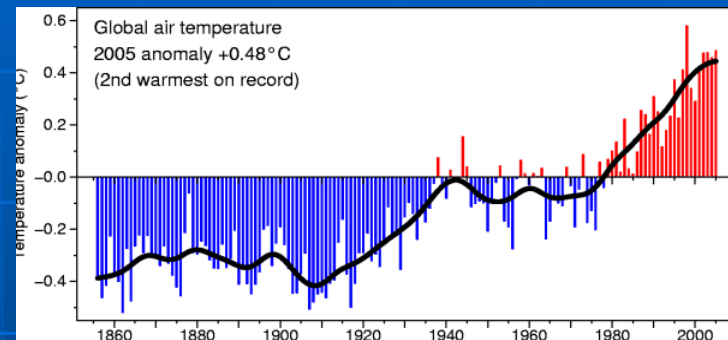- JRA-25 was succeeded by JMA CDAS (quasi real time analysis) .

JRA-25 and JCDAS will be a fundamental datasets for real-time forecast and hindcast verifications as well as climate monitoring and climate research.
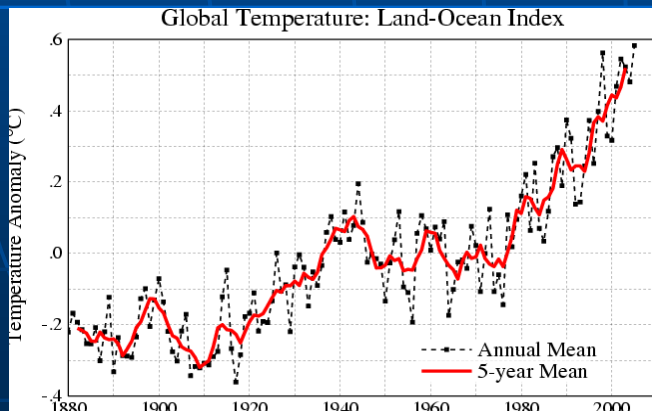
Topic 3

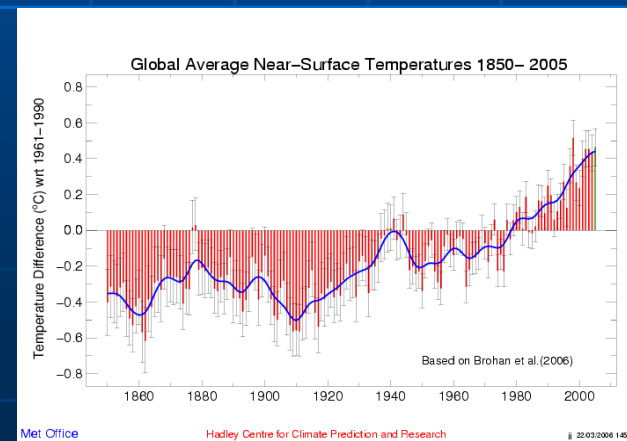## A new global surface temperature analysis scheme for monitoring the Global Warming
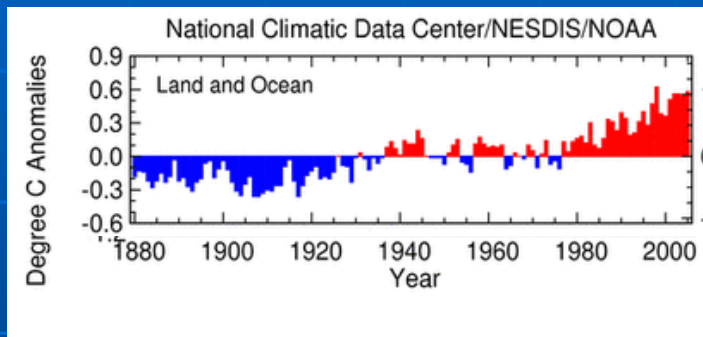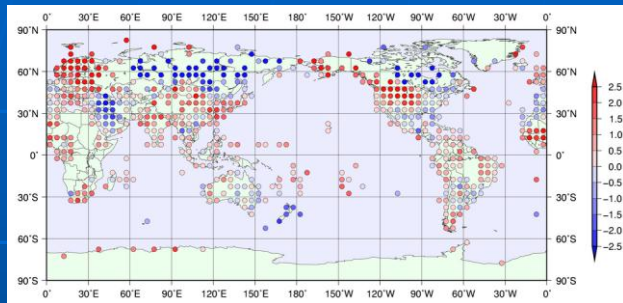

NCDC

CRU

GISS

UKMO

JMA's New Method

Present Method

New Method

Station data over land

Sea surface temperature (COBE-SST)

5° × 5° grid anomaly

5° × 5° grid anomaly

Anomaly of global average surface temperature (1880 −)
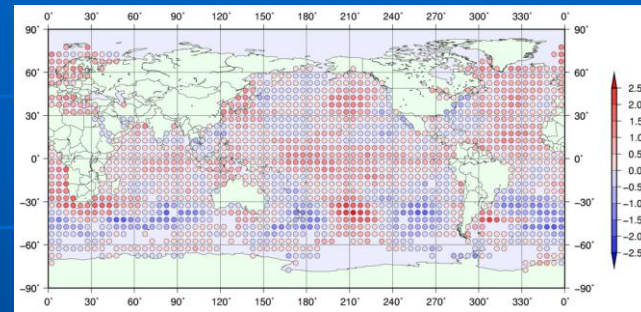
Combined 5° × 5° grid anomaly

Weighted Average based on grid area size

Anomaly of global average surface temperature (1891 −)
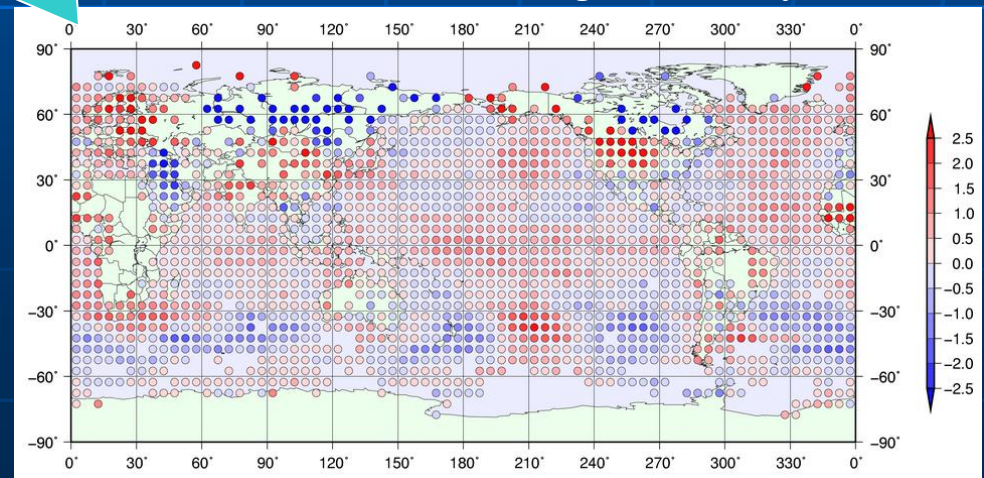
Annual anomalies of
global average surface temperature
(over land and ocean)

2005：+0.32℃
(2nd warmest)

Trend：+0.66℃/100 years

Temperature Anomaly（℃）

+1.0
+0.5
0.0
-0.5
-1.0

1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010

Year

Warmest Year
①1998(0.37℃)
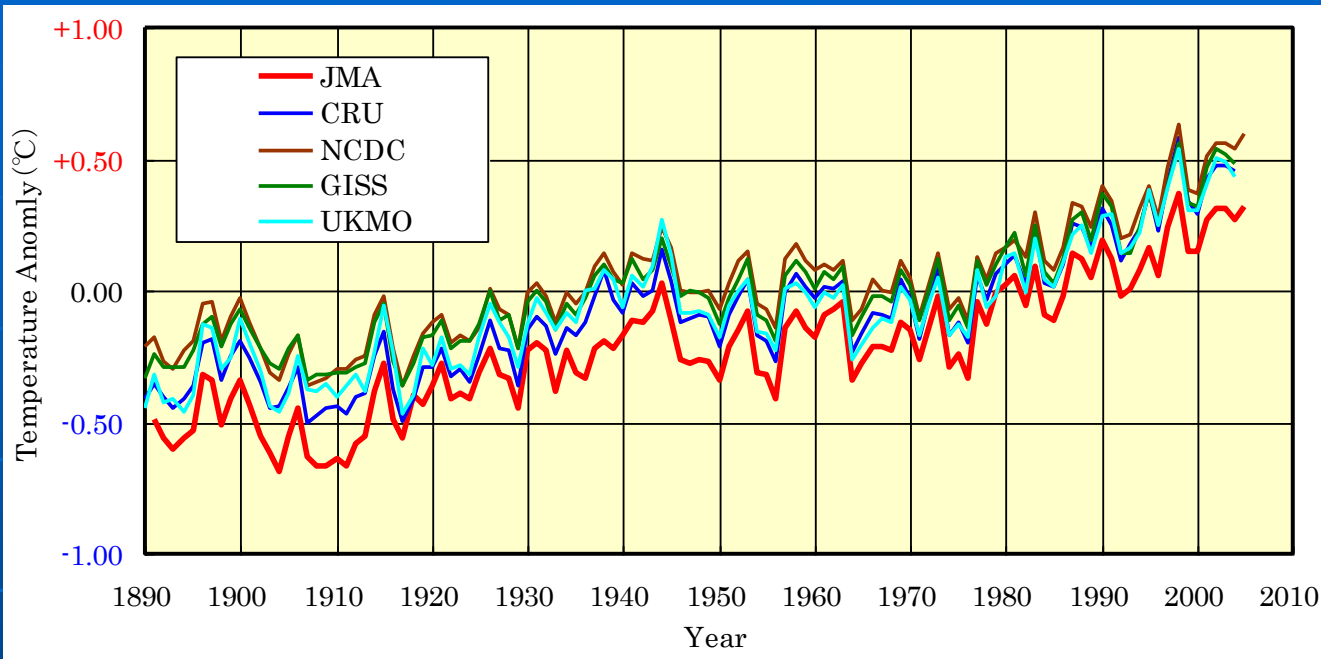②2005(0.32℃)
③2003(0.31℃)
③2002(0.31℃)
⑤2004(0.27℃)
⑤2001(0.27℃)
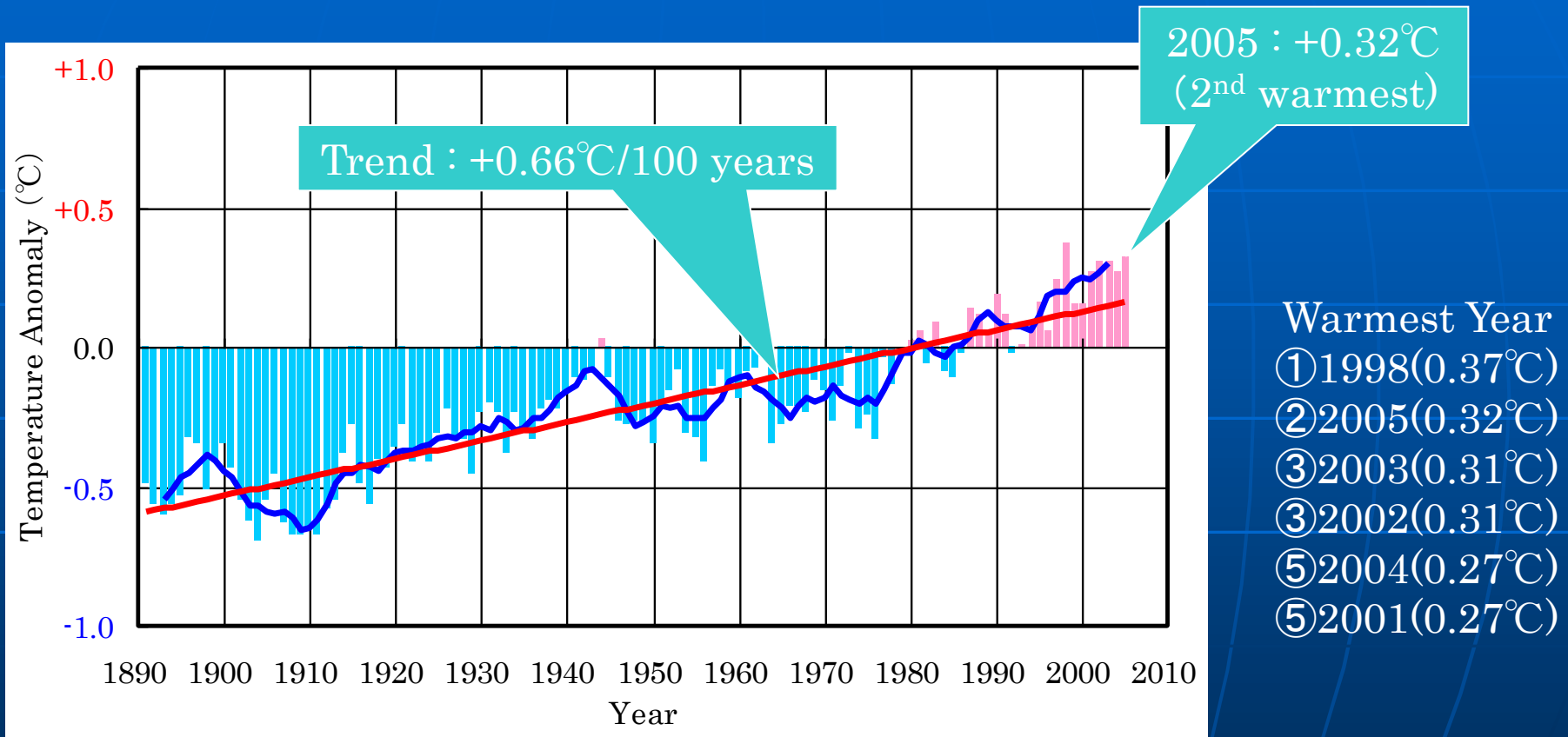
Anomalies are deviations from normal (1971-2000 average).
Bars：anomalies of surface temperature in each year
Blue line：5-year running mean
Red line：the long-term linear trend

Comparison with Other Centers

JMA：Japan Meteorological Agency
CRU：Climatic Research Unit, University of East Anglia
NCDC：National Climatic Data Center, NOAA
GISS： Goddard Institute for Space Studies, NASA
UKMO：Hadley Centre, UK Met Office

Trends	Correlations with JMA
JMA：0.65℃/100 years	CRU：0.98
CRU：0.64℃	NCDC：0.98
NCDC：0.56℃	GISS：0.98
GISS：0.53℃	UKMO：0.97
UKMO：0.58℃	

Summary
– Tokyo Climate Center Activity –

- Climate information & products available through
    TCC website :
        http://okdk.kishou.go.jp/

- Expert meeting planned to review RCC network

■Thank you for your attention!