Products of the JMA Ensemble Prediction System for One-month Forecast

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   Outline of EPS for one-month forecast

2) Examples of prediction

   Prediction of Low Frequency Variability (LFV) such as blocking, stationary Rossby waves, Arctic Oscillation, MJO

3) Examples of products

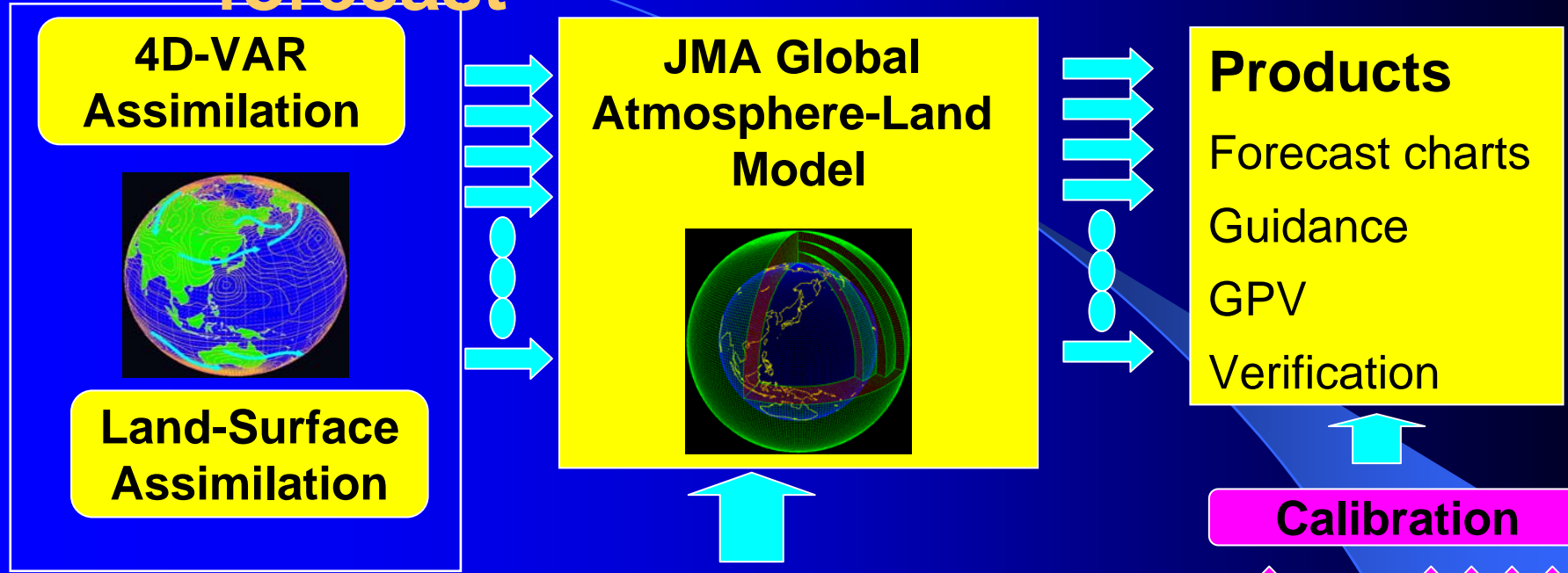   Forecast charts

4) Tokyo Climate Center WEB

   (http://cpd2/kishou.go.jp/tcc/)

1) Introduction

Official one-month forecast issued by JMA

Date of Issue	Every Friday

Contents	**Probabilistic forecasts of three categories**
	    Monthly mean temperature
	    Monthly precipitation
	    Monthly sunshine duration
	    Monthly snowfall
	    Weekly mean temperature
	      (1st, 2nd, 3rd&4th week)
	Features of expected weather

Forecast Method	**Dynamical method** (Ensemble prediction) since 1996

The EPS for one-month forecast

4D-VAR Assimilation

Land-Surface Assimilation

JMA Global Atmosphere-Land Model

Products

Forecast charts

Guidance

GPV

Verification

Calibration

SST-Analysis

Persistent SST anomaly

Hindcast

Horizontal resolution	T106
Time integration range	34 days
Executing frequency	Once a week
Ensemble size	26 members
Perturbation	Breeding of Growing Mode and LAF
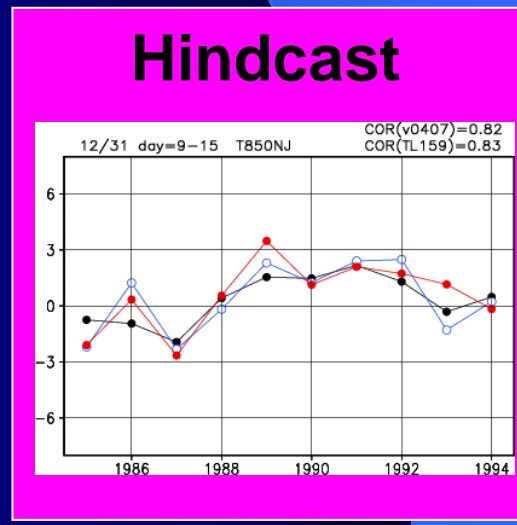
Products for operational long-range forecasters

Forecast charts, guidance, verification results

Atmospheric phenomena closely related to one-month forecast ?

⬇

LFVs such as stationary Rossby wave, blockings,AO, MJO,ISO of Asia monsoon……

⬇

Forecast charts for operational long-range forecasters to understand predicted LFVs and uncertainty of them

2) Example of one-month prediction(1)

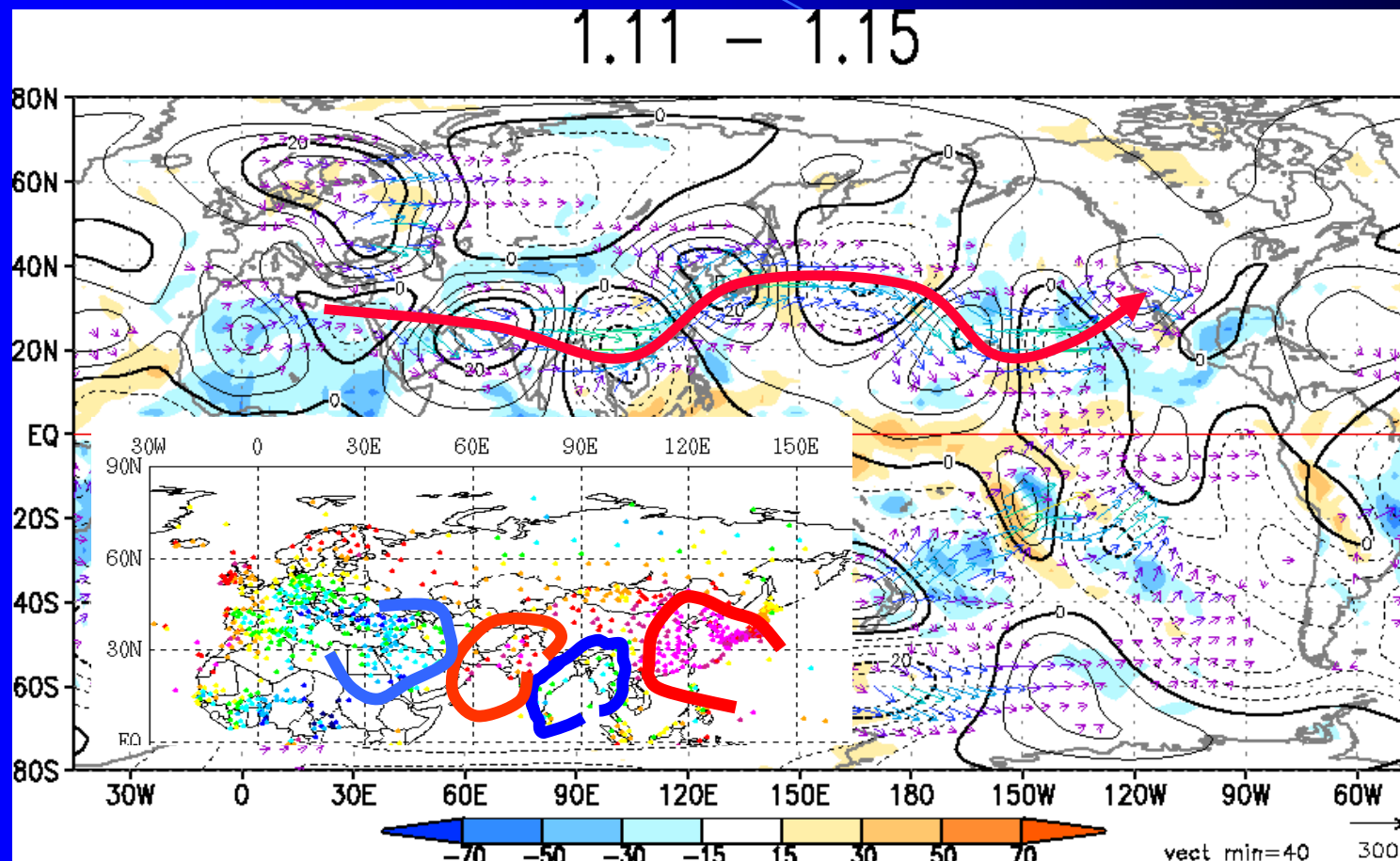## Blocking and stationary Rossby wave
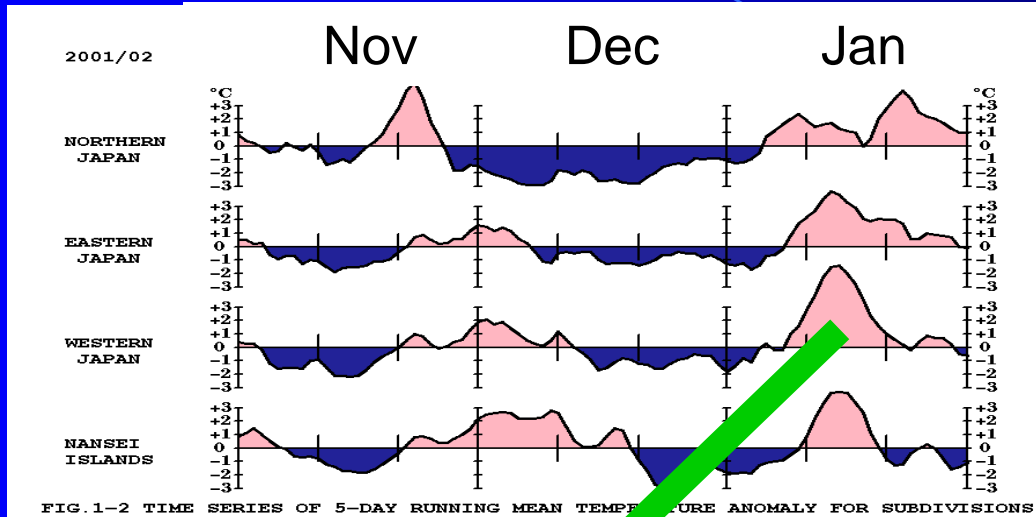
Time sequences of temperature anomalies in Japan (5 day running mean)

2001.11-2002.2
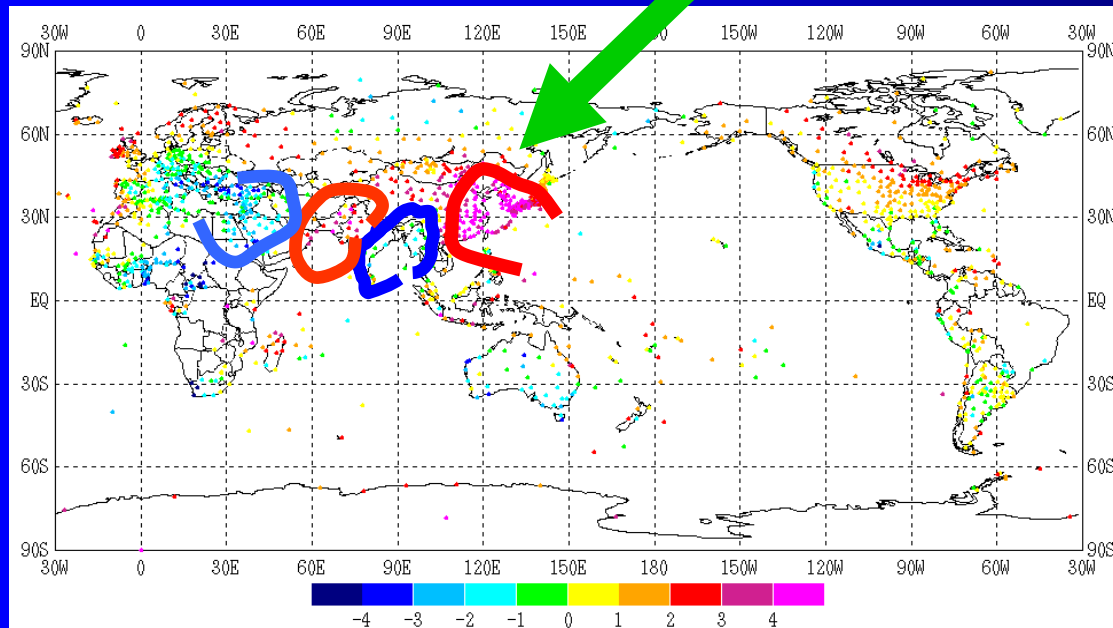
Observed normalized temperature anomalies

2002.1.11-15

Wave train along the Asian jet

Observed 5-day mean stream function anomalies at 200hPa (contours) 2002.1.11-1.15

Structure of the wave train
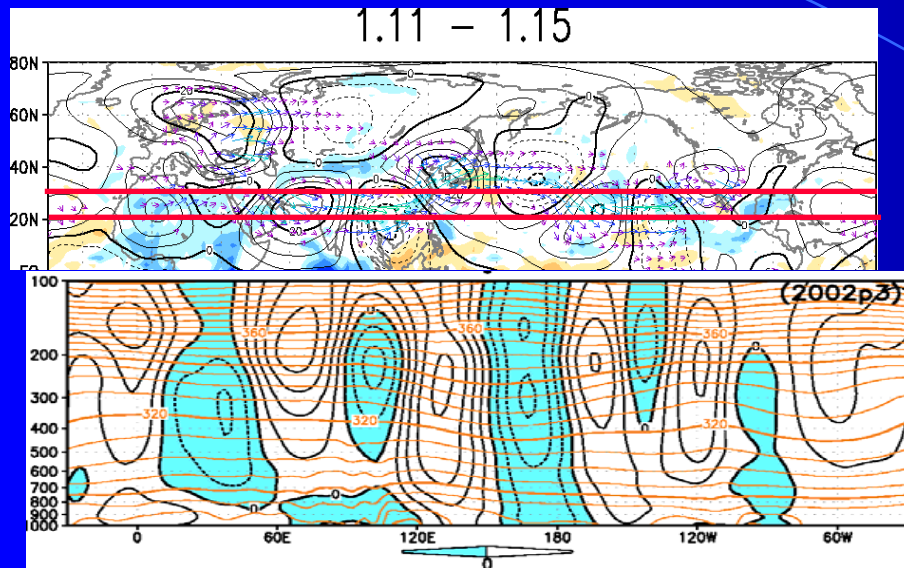
1.11 – 1.15

Observed Longitude-height
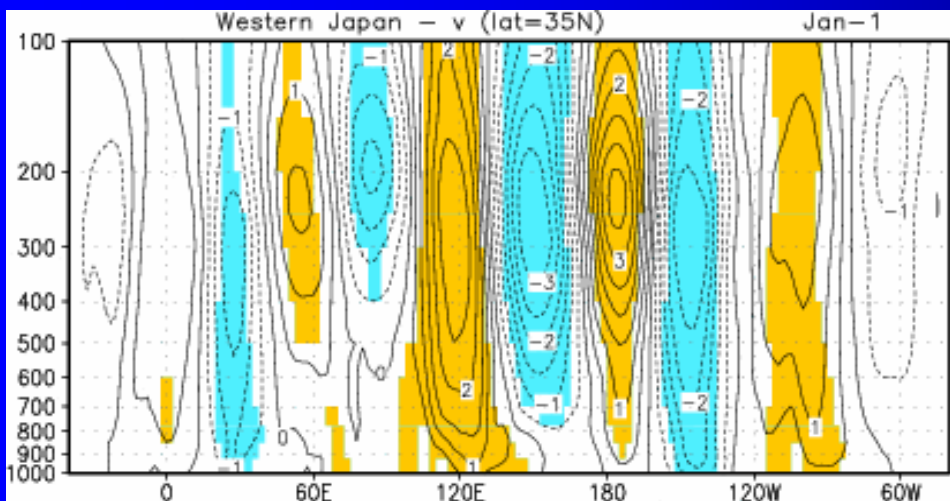cross section of 20N-30N
mean stream function
anomalies

2002.1.11-1.15

PSI200(ANOMALY) lat=20-30

1 JAN

23 JAN

0E   180E
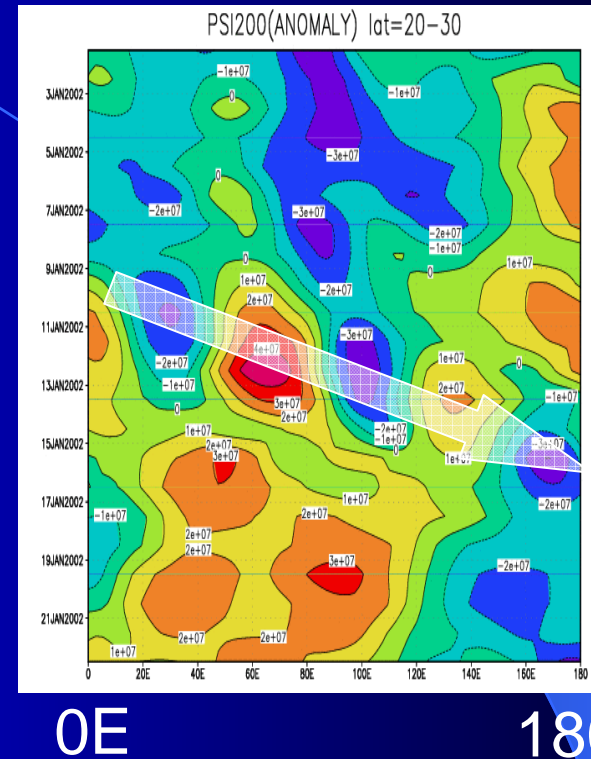
Observed Longitude-time
cross section of 20N-30N
mean stream function
anomalies at 200hPa
2002.1.1-1.23

Statistical relationship between 10-day mean temperature in western Japan and wave trains along the Asian jet
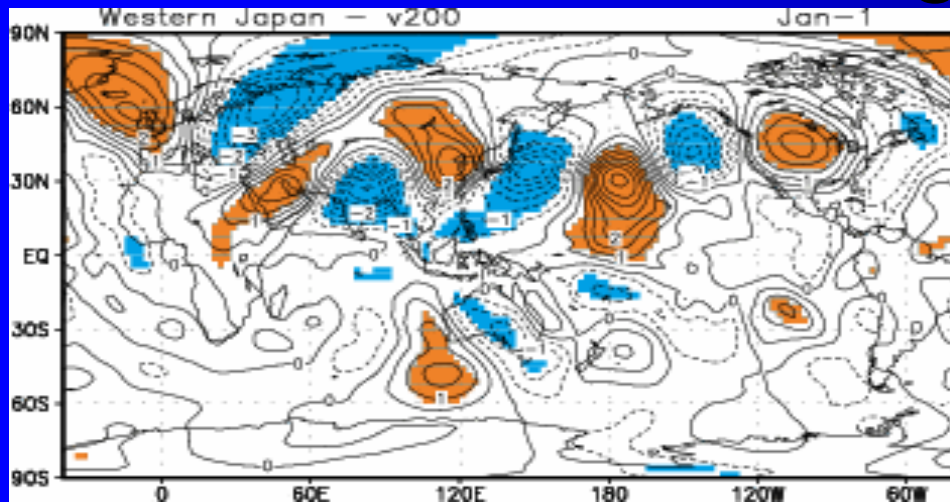
Regression of meridional wind v at 200hPa on 10-day mean temperature in western Japan . 1 Jan.-10 Jan.

Longitude-height cross section of regression of meridional wind v at 35N

Climatology of stationary Rossby wave packets propagation (1-10 JAN,1971-2000)
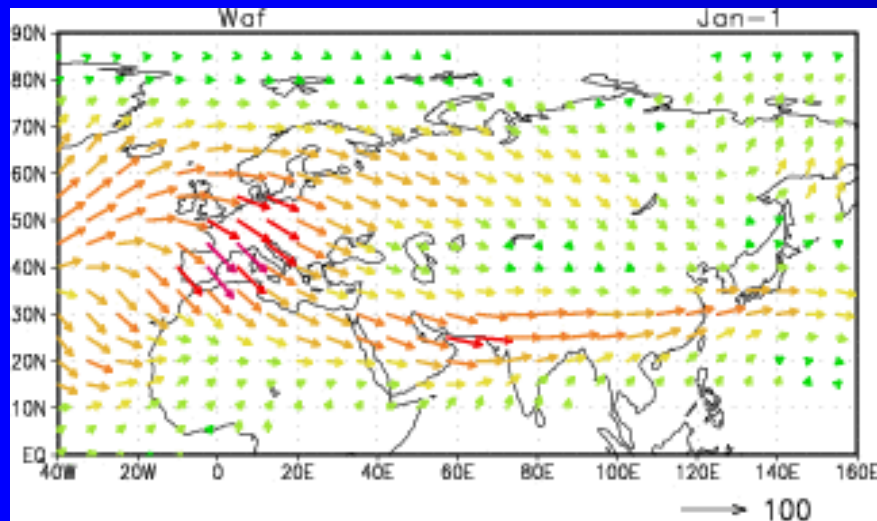
Wave activity flux (Takaya and Nakamura,2001,JAS,608-) at 200hPa
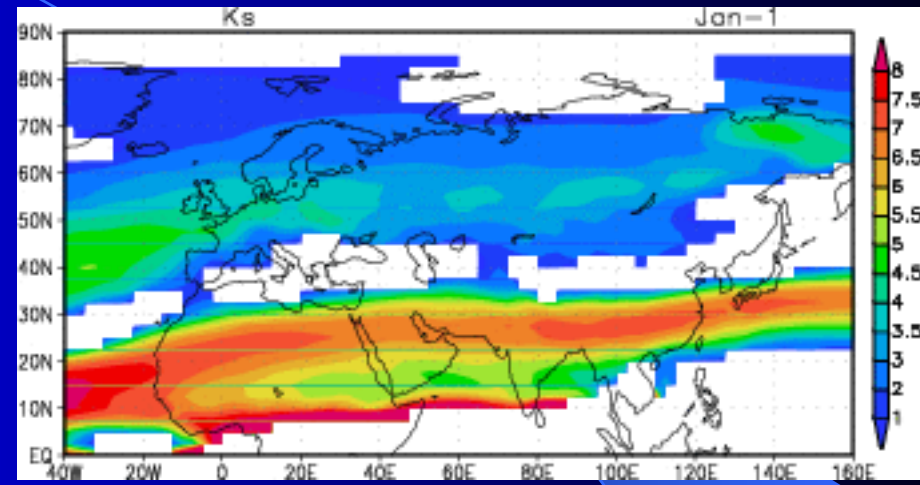
Stationary Rossby wave number Ks (Hoskins and Ambrizzi,1993,JAS,1661-) at 200hPa

Source of Rossby wave train along the Asian jet ?

Blocking over the North Atlantic and Rossby wave trains along the Asian jet

5-day mean stream function anomalies at 200hPa 2005.1.18-
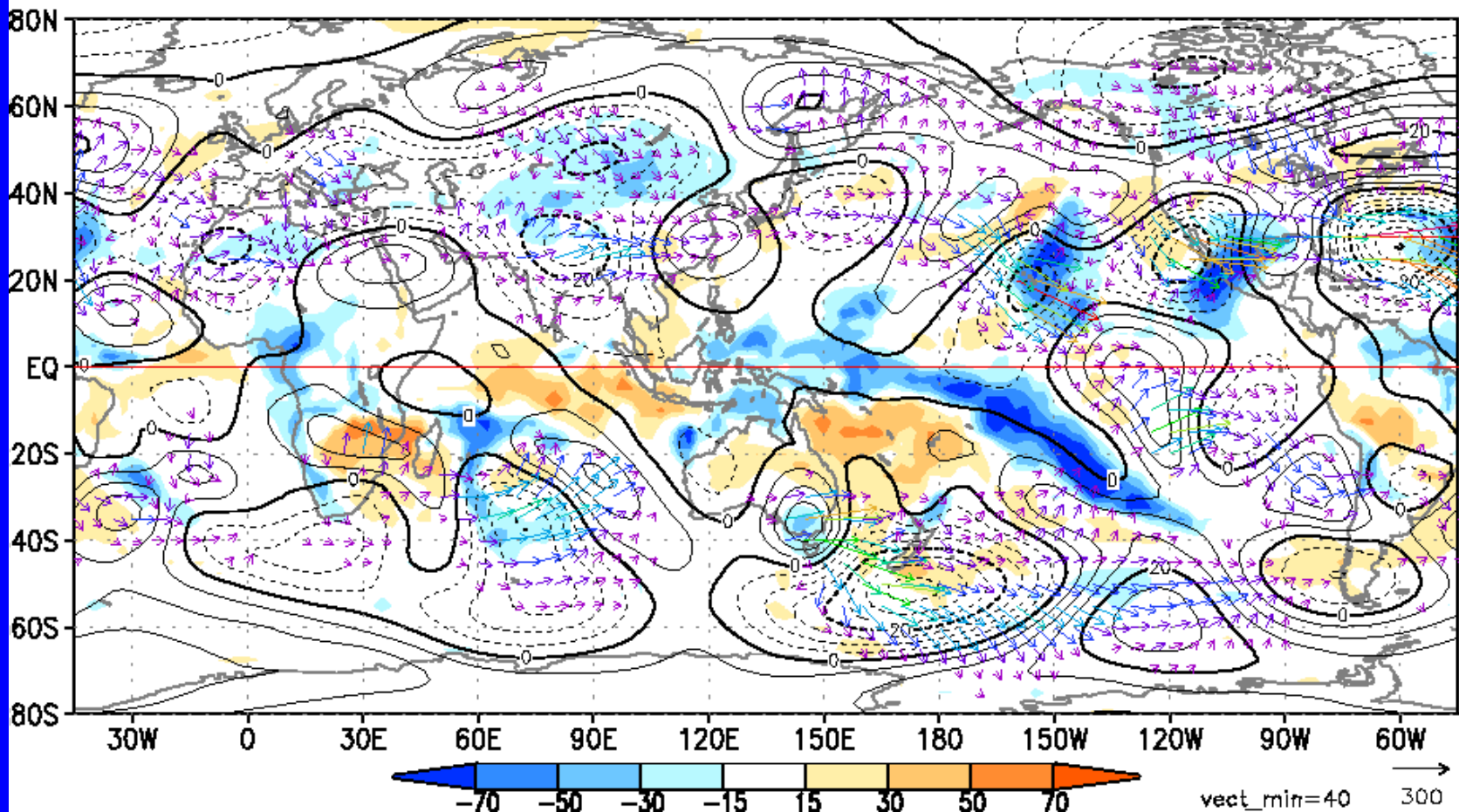
Time cross section of stream function anomalies at 200hPa x-axis : distance along the red line from a base point (60W,60N)

19Jan2005

11Feb2005
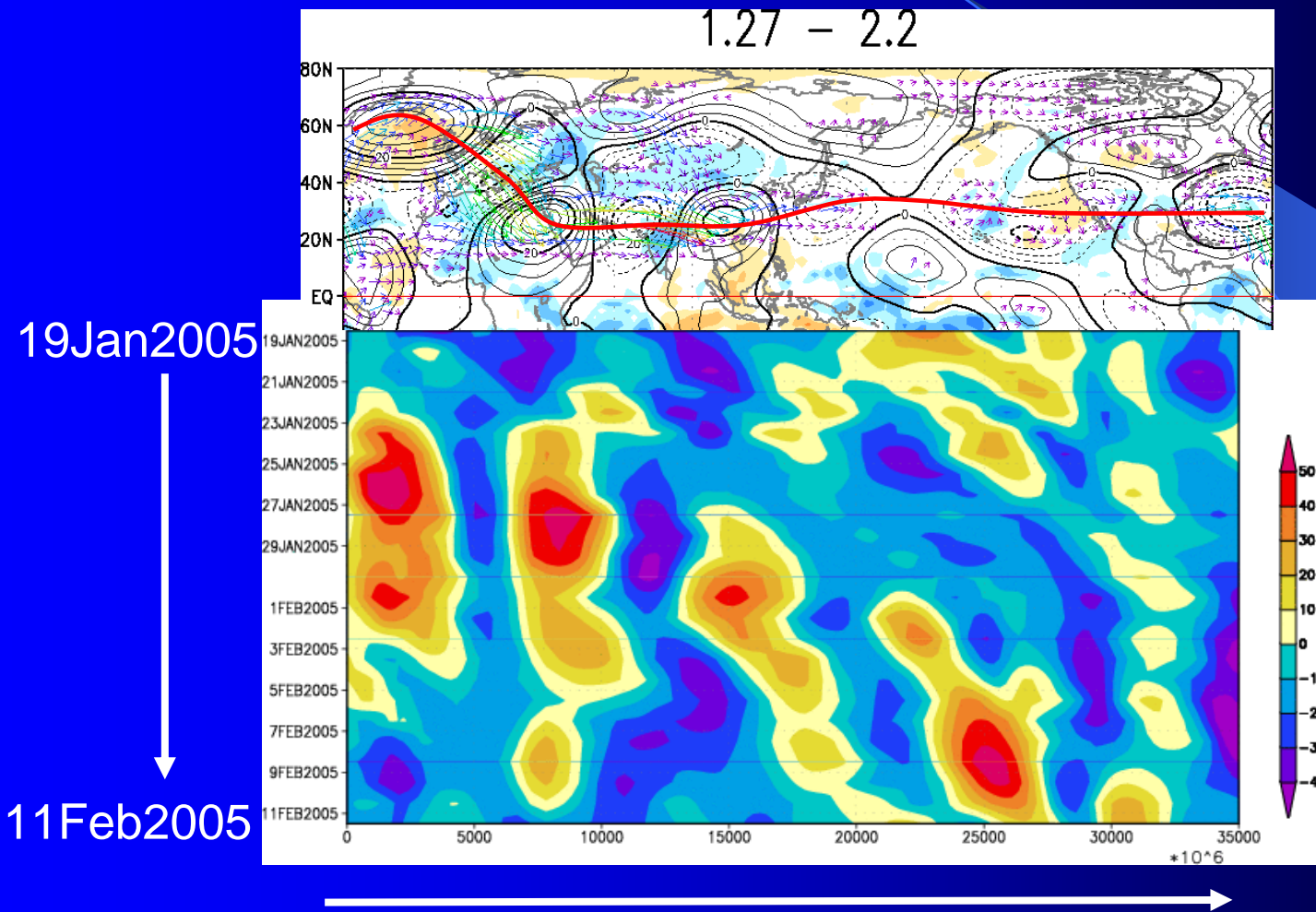
Decay of Blocking due to Rossby wave radiation
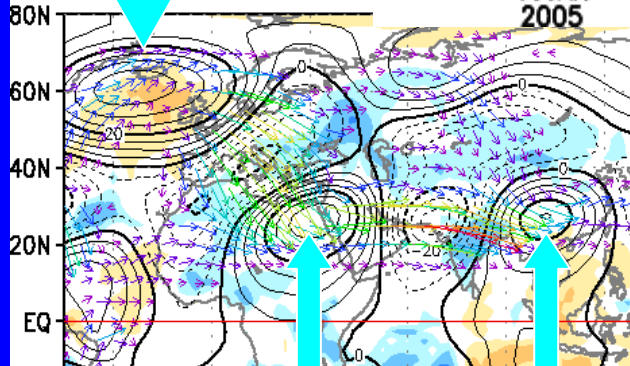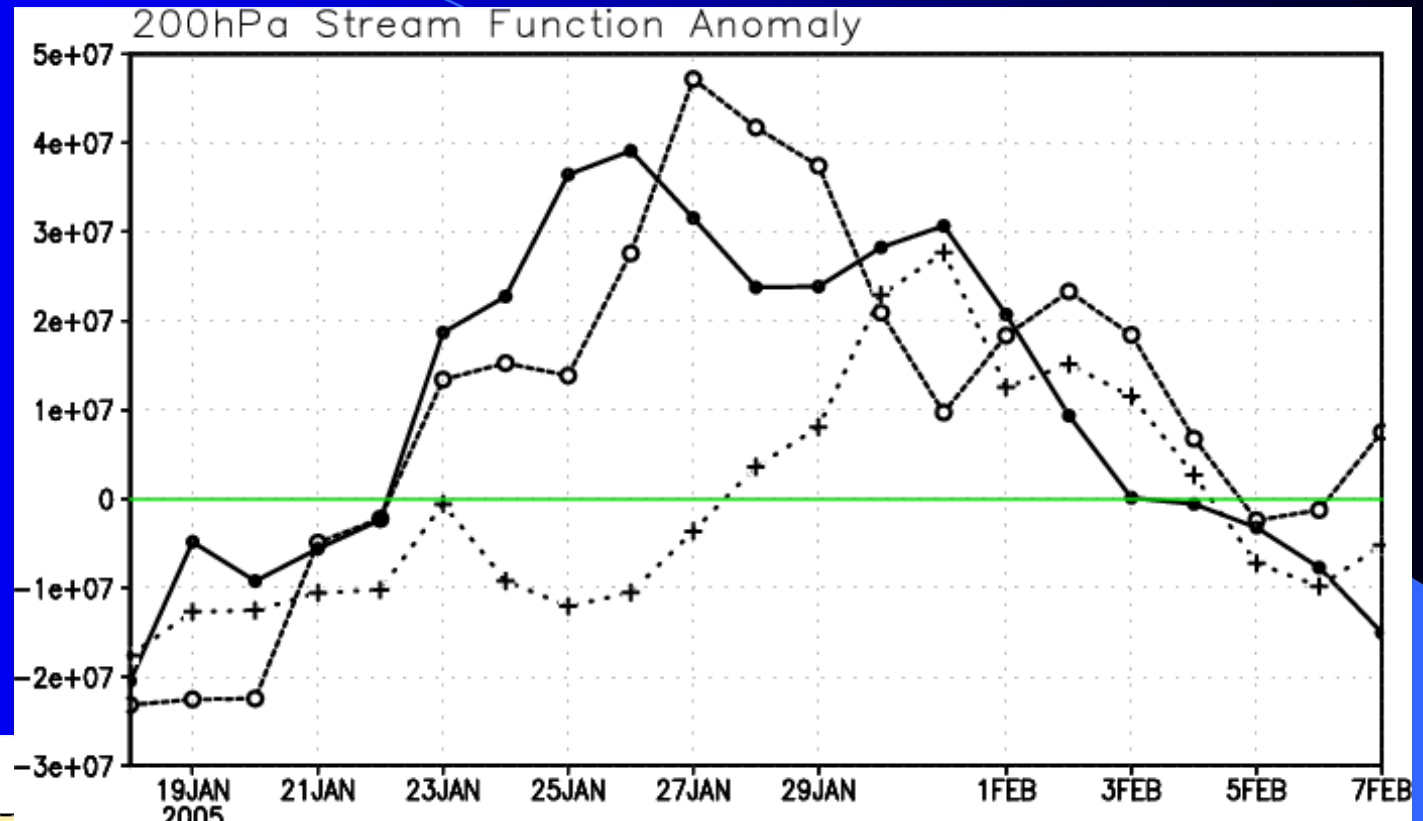
Amplification of Rossby wave in the entrance of the Asian jet

Batoropic kinetic energy conversion
(Simmons et al., 1983, JAS, 1363-)

$$\partial Ke/\partial t = CKx + CKy$$

$$CKx = -(u^2-v^2)\,\partial u_b/\partial x, \quad CKy = -uv\,\partial u_b/\partial y$$
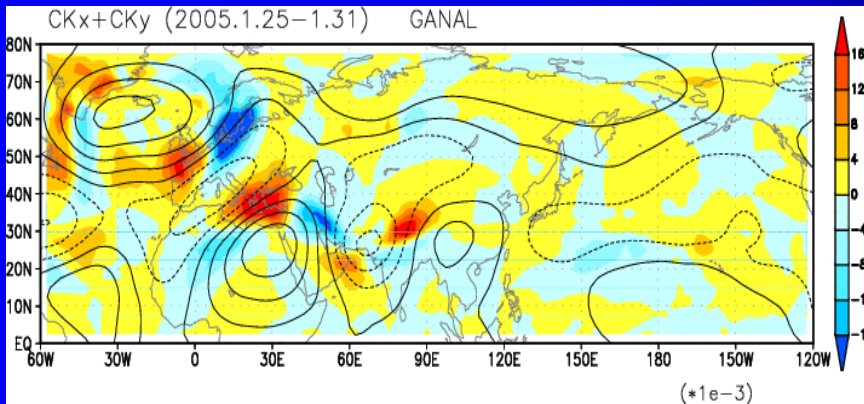
25-31 JAN2005
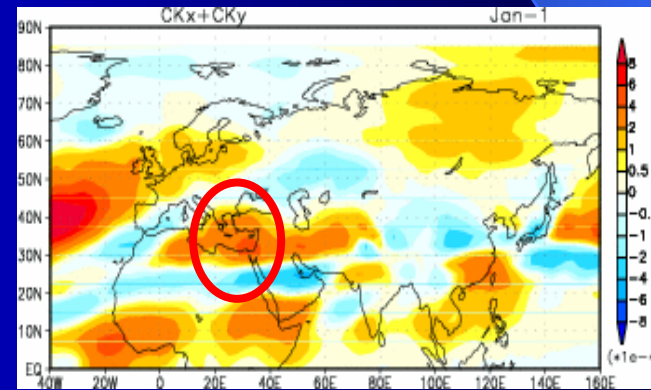
Climatology 1-10 JAN

1971-2000

Prediction of these processes by the JMA EPS for one-month forecast

Initial : 20JAN 2005
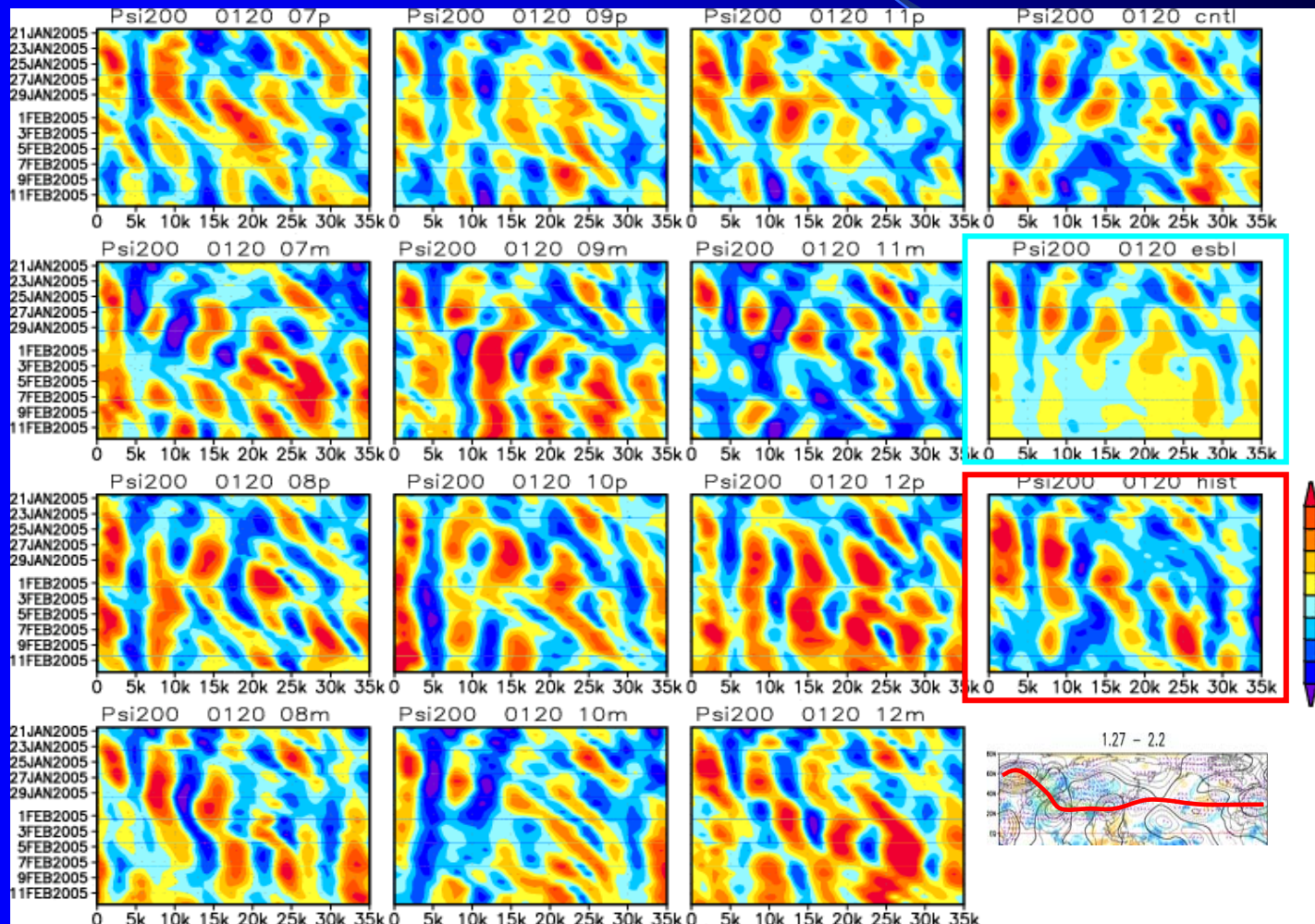
Prediction of development of Blocking

Initial : 20JAN 2005
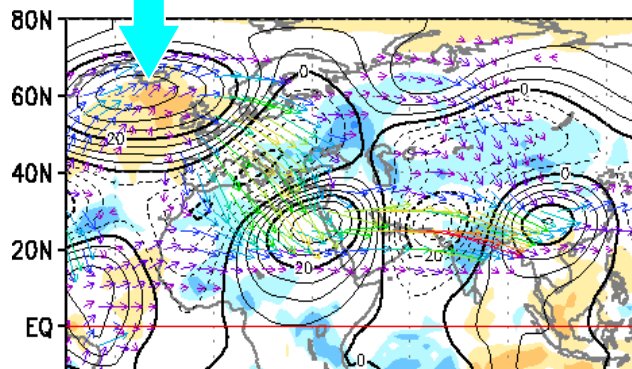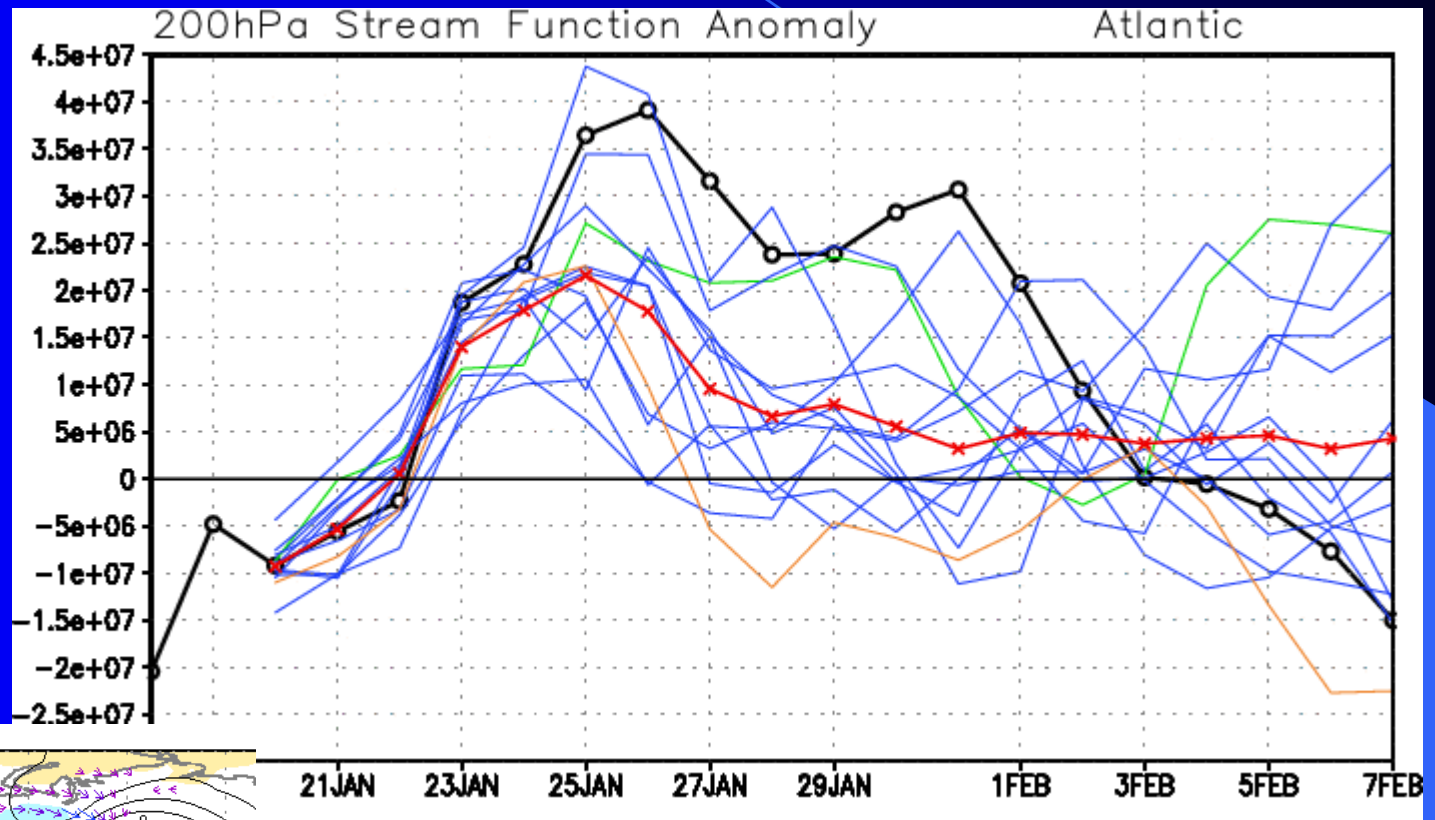
Prediction of decay of Blocking due to Rossby wave radiation
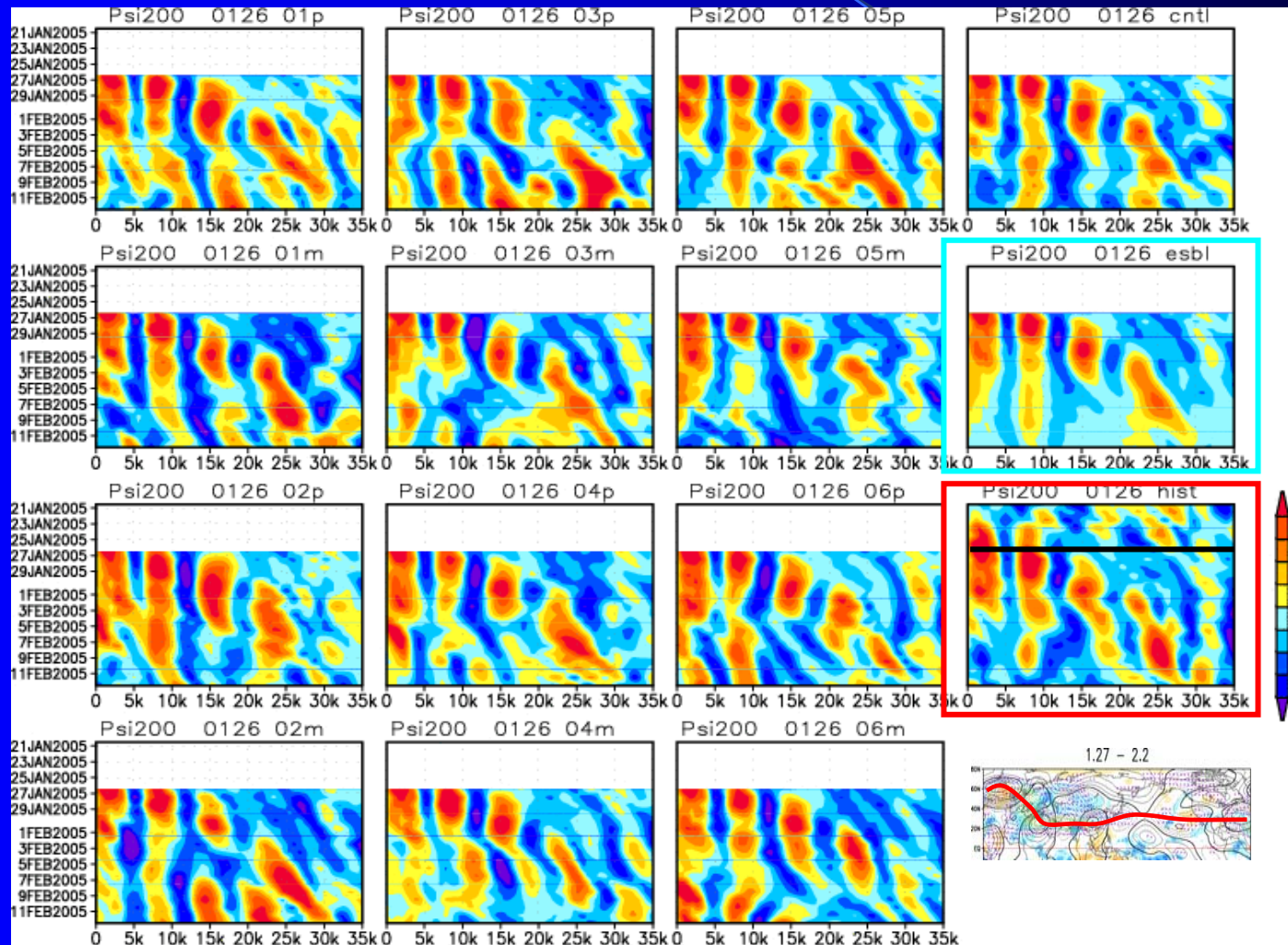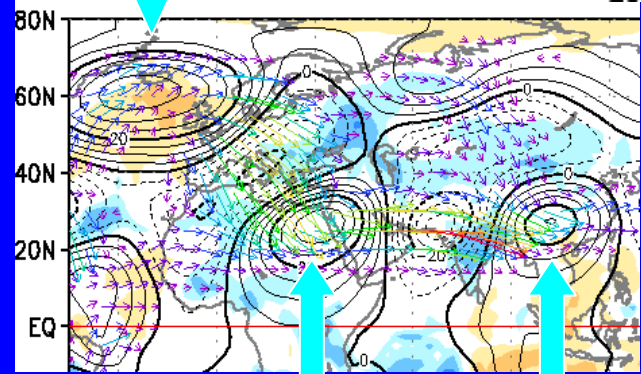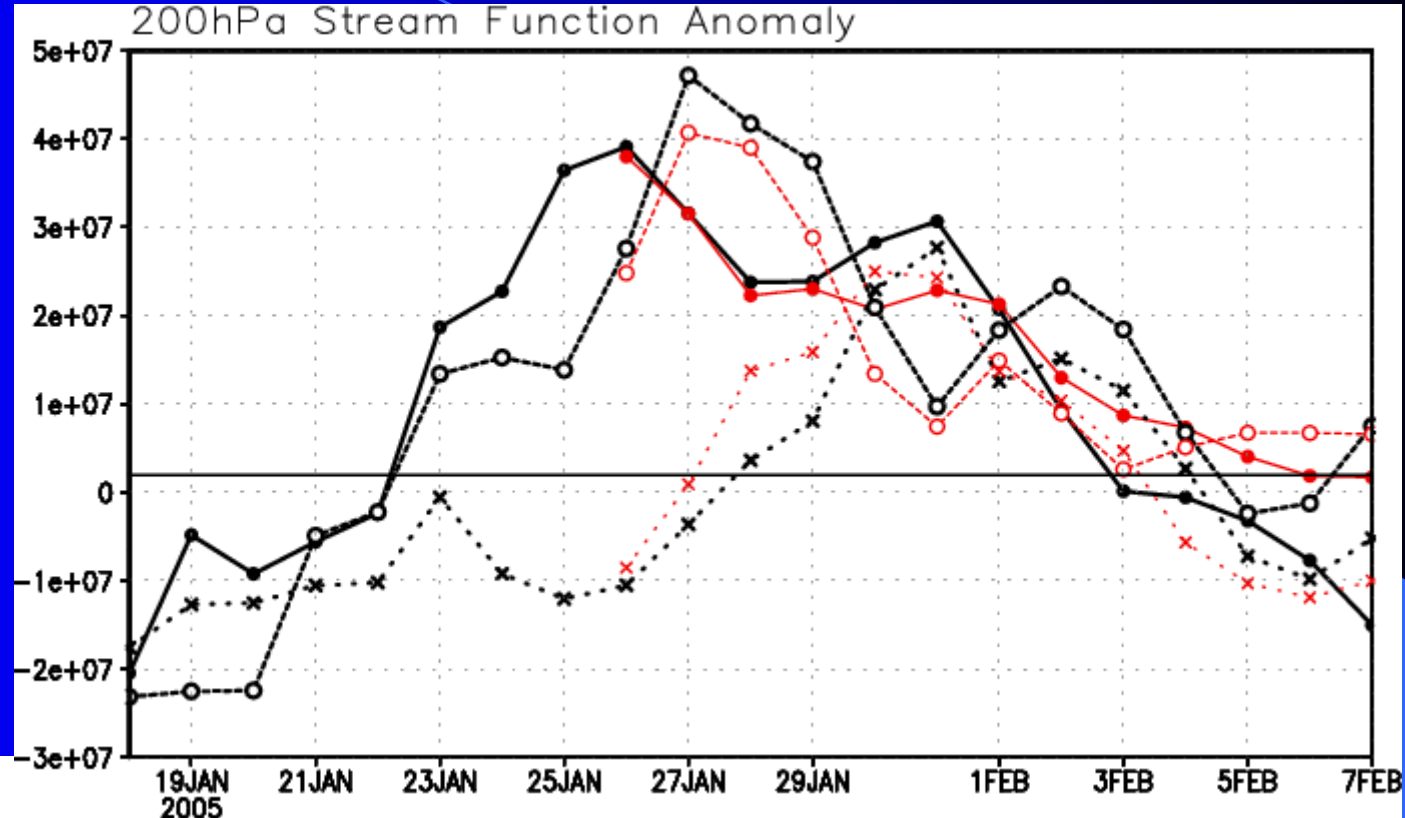
Initial : 26JAN 2005

Prediction of decay of Blocking

Initial : 26JAN 2005
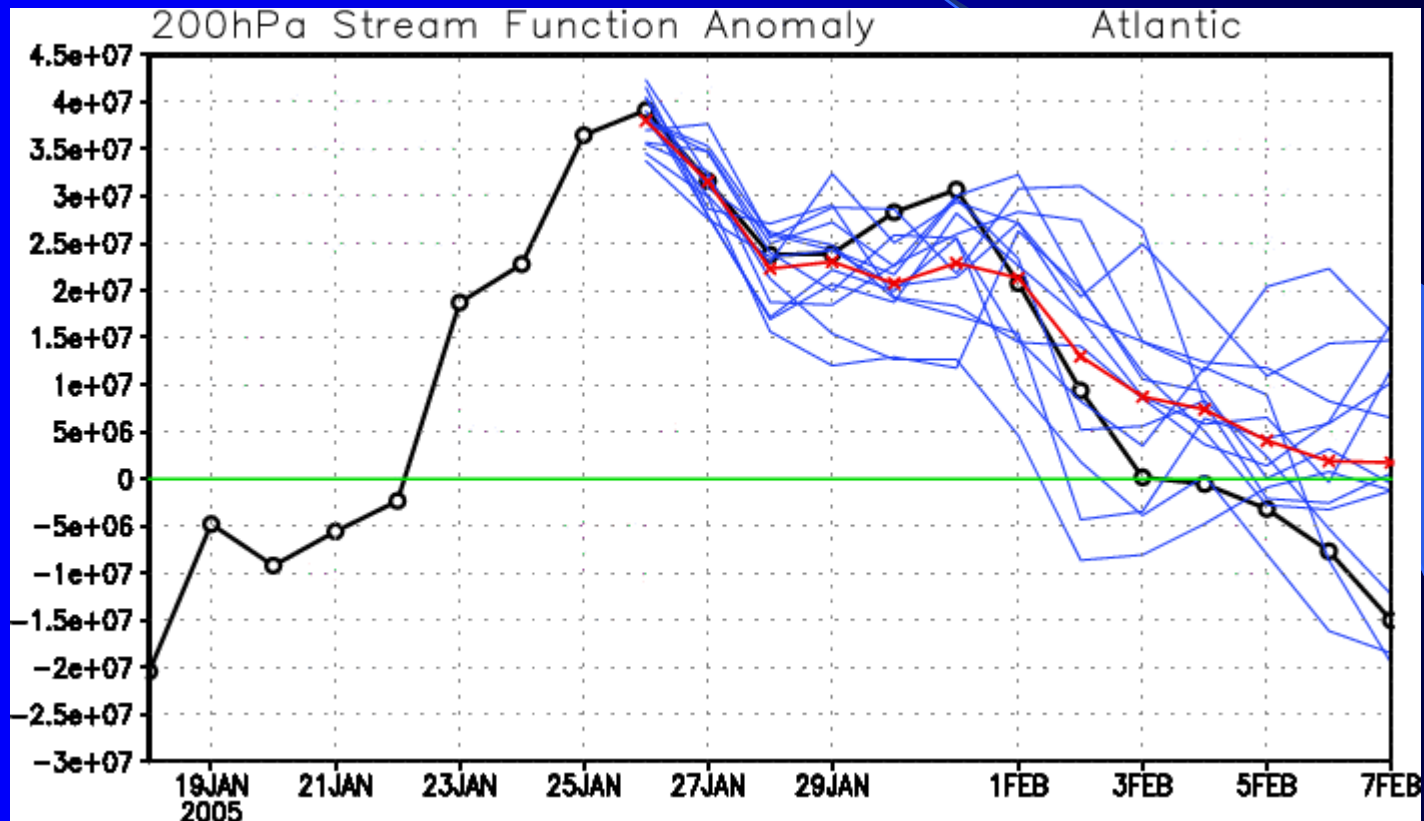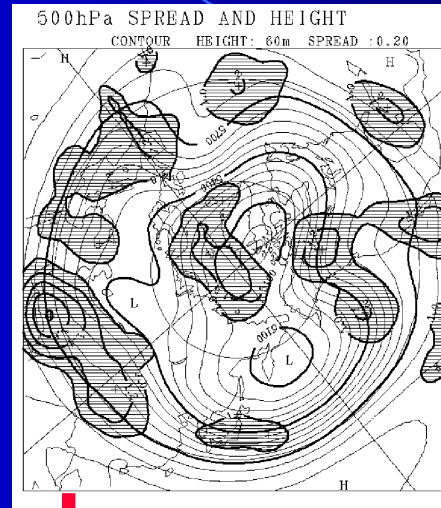
Prediction of decay of Blocking due to Rossby wave radiation
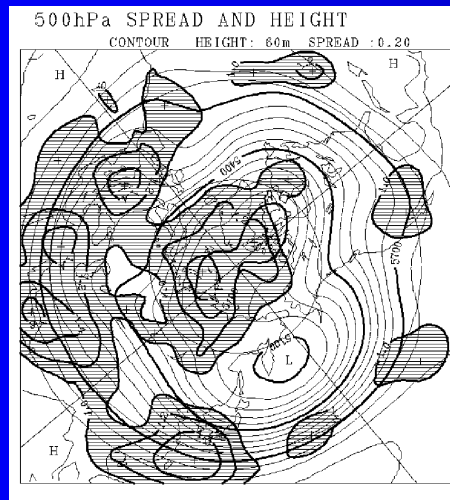
Initial : 26JAN 2005
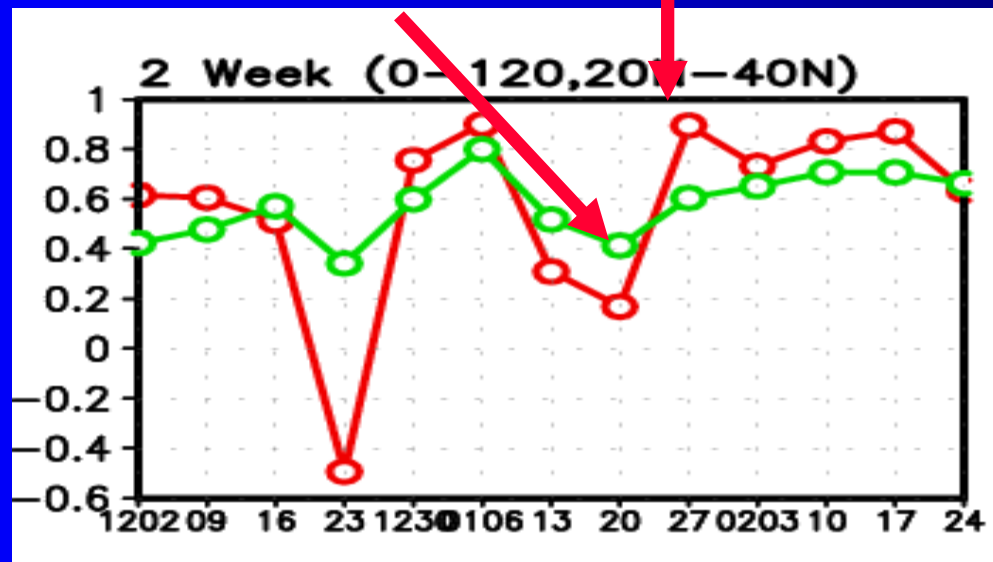

200hPa Stream Function Anomaly

Spread-skill relationship of 2nd weak prediction around the Asian jet in 2004/05 winter
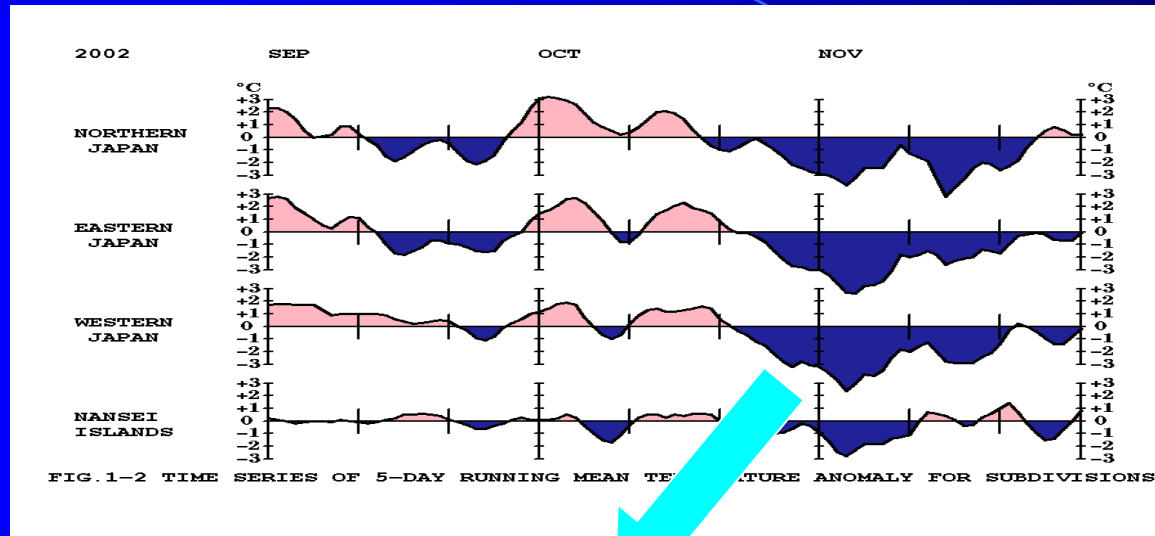
Initial : 20JAN 2005   27JAN2005

Spread among ensemble members Z500 ; 7-day mean (9-15 day)

Spread (evaluated by anomaly correlation in 0-120E,20-40N) among ensemble members (green)   and skill (red) of ensemble mean stream function at 200hPa;7-day mean (9-15 day)
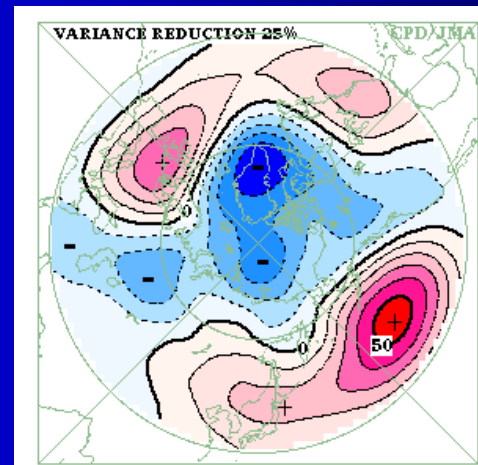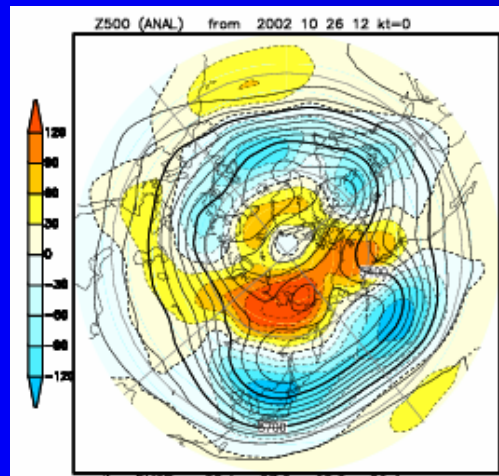
Example of one-month prediction(2)
The Arctic Oscillation (AO)

Time sequences of temperature anomalies in Japan (5 day running mean)
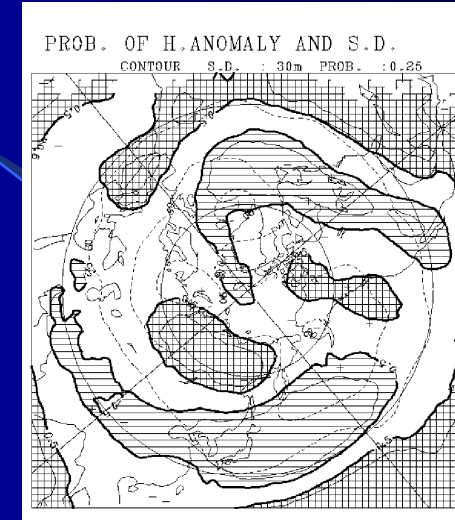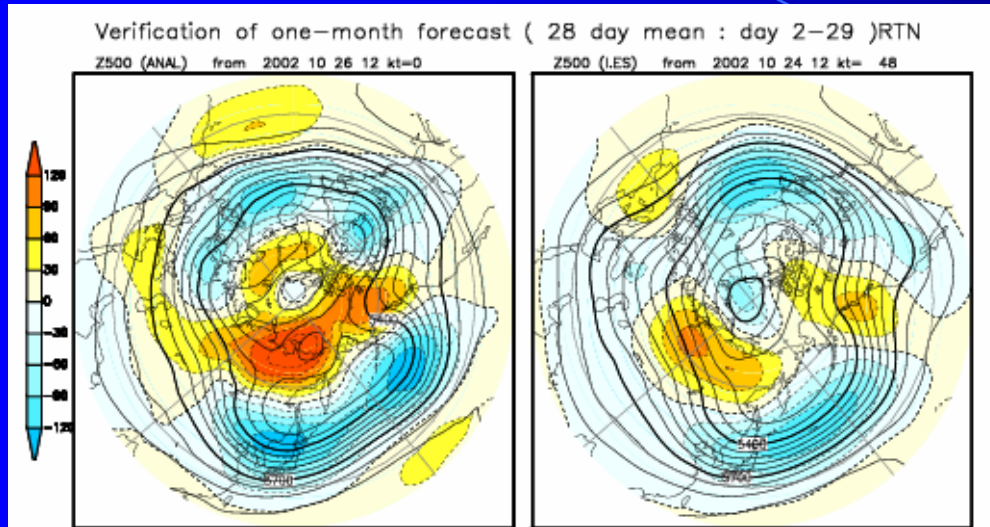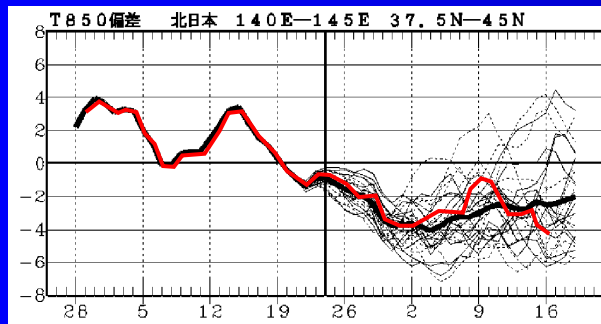
2002.9-2002.11

AO like pattern

Z500 Observation 2002.10.26-11.22   Z500 EOF1 in winter

Prediction of the Arctic Oscillation

Z500 Observation   Ensemble mean   Probabilities exceeding ±0.5SD
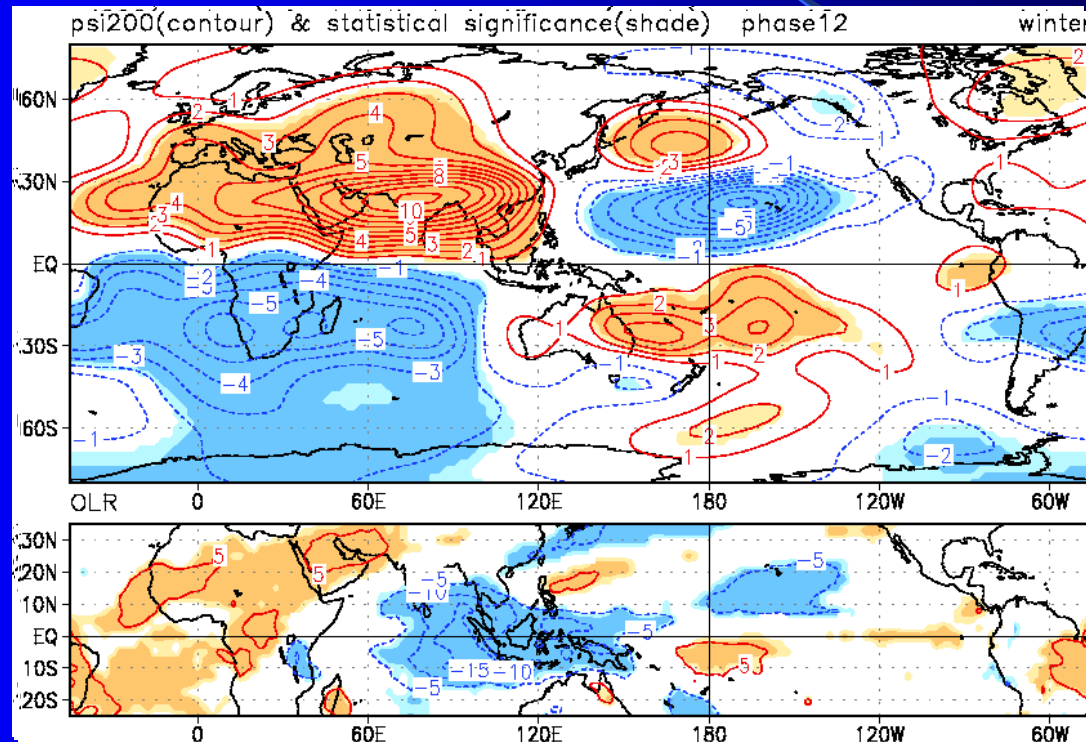Init:2002.10.24,28 day mean (day:2-29**)**

7 day running mean T850 temperature anomalies over Northern Japan (init:2002.10.24)

Red: observation

Black: prediction

Example of one-month prediction(3)

MJO
Composition maps of stream function at 200hPa and OLR at each phase (1-12) of MJO in winter
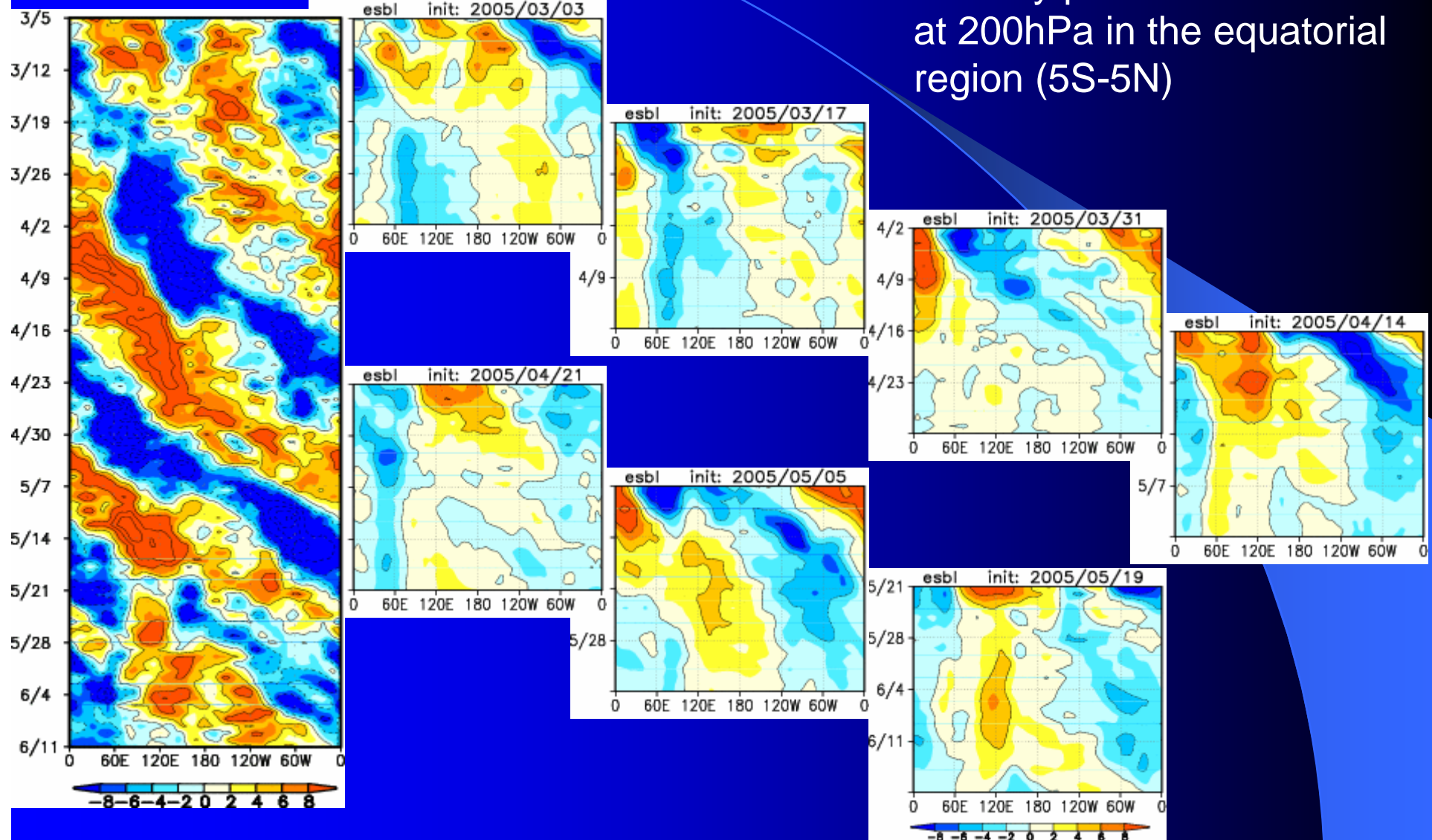

Stream function at 200hPa

OLR

Endoh and Harada (2005)

Prediction of MJO in 2005 spring
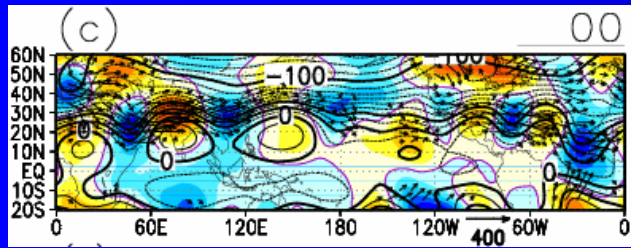
Observation

Prediction (Ensemble mean)

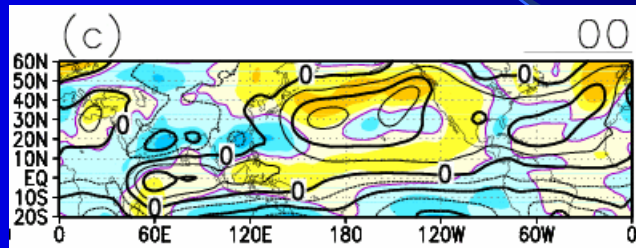Velocity potential anomalies at 200hPa in the equatorial region (5S-5N)

3) Examples of products of the EPS
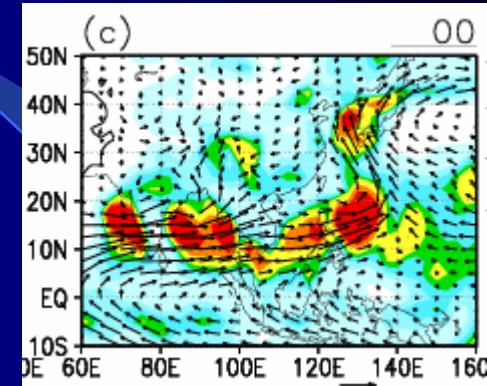
1. Ensemble mean and stamp maps

(1st week, 2nd week, 3-4th week, 1-4th week)

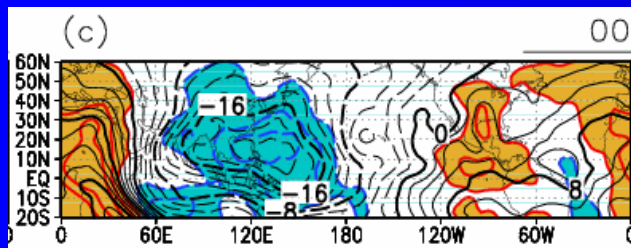

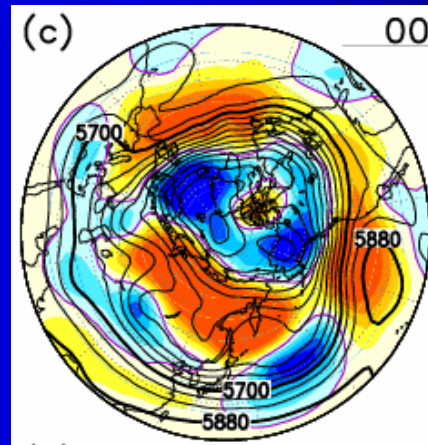Stream function, anomalies, wave activity flux at 200hPa

Stream function and anomalies at 850hPa
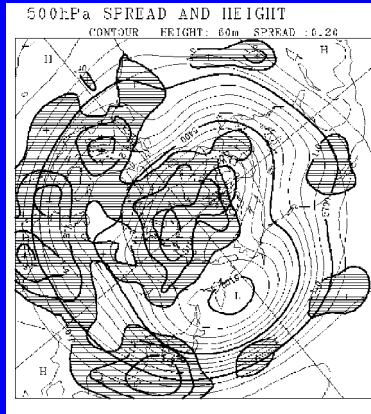

Water vapor flux at 850hPa and precipitation

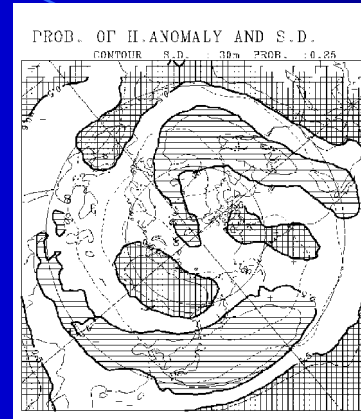Velocity potential and anomalies at 200hPa

Height and anomalies at 500hPa

2. Spread and probability maps
(1st week, 2nd week, 3-4th week, 1-4th week)
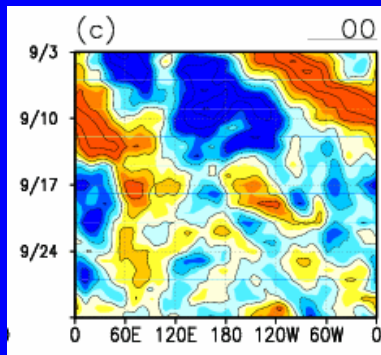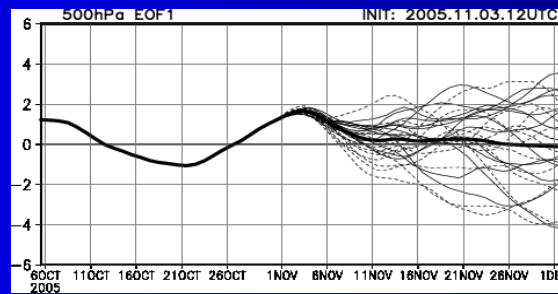

Spread of Z500 among ensemble members

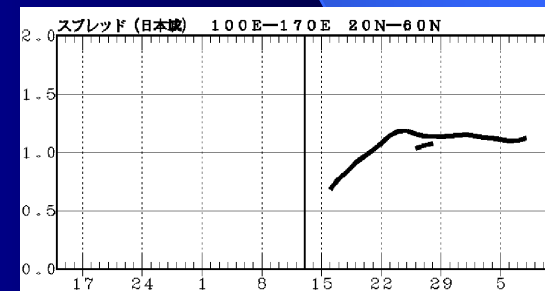Probabilities of Z500 anomalies exceeding ±0.5SD

3. Time series and cross section

Velocity potential anomalies at 200hPa in the equatorial region (5S-5N)

7 day running mean EOF1 scores of Z500 in winter

Z500 spread of 7-day and 28-day mean in East Asia

4) Tokyo Climate Center Web

http://cpd2.kishou.go.jp/tcc/

Ensemble Prediction System : Extended- and Long- Range Forecast

- Model Outline and Operation (extended- and long- range forecast)
- Forecast
  - One-month Prediction (Extended-range weather forecasting)
    - Verification
    - Products : Map | Gridded value (registered users only)
      Grid point value divided into each element (**for narrow band user**) is here (registered users only)
  - Three-month Prediction (Long-range weather forecasting)
    - Probability Forecasts *NEW*
    - Verification
    - Products : Map | Gridded value (registered users only)
  - Warm Cold-Season Prediction (Long-range weather forecasting)
    - Verification (of hindcast)
    - Product : Map | Gridded value (Ensemble statistics / All ensemble members) (registered users only)

One-month prediction

Three-month prediction

Warm/cold season prediction