Verification of the Seasonal Forecast for the 2005/06 Winter

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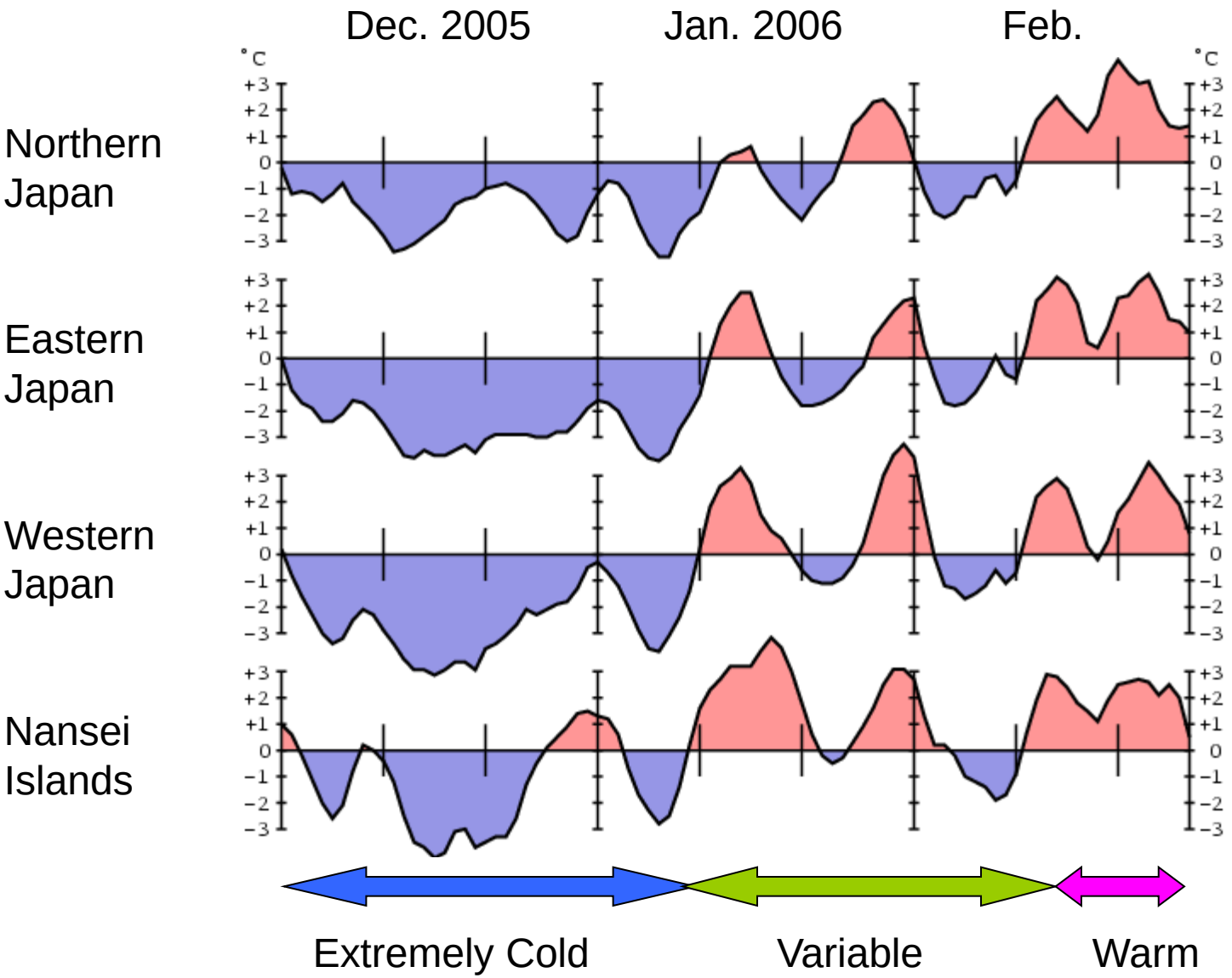
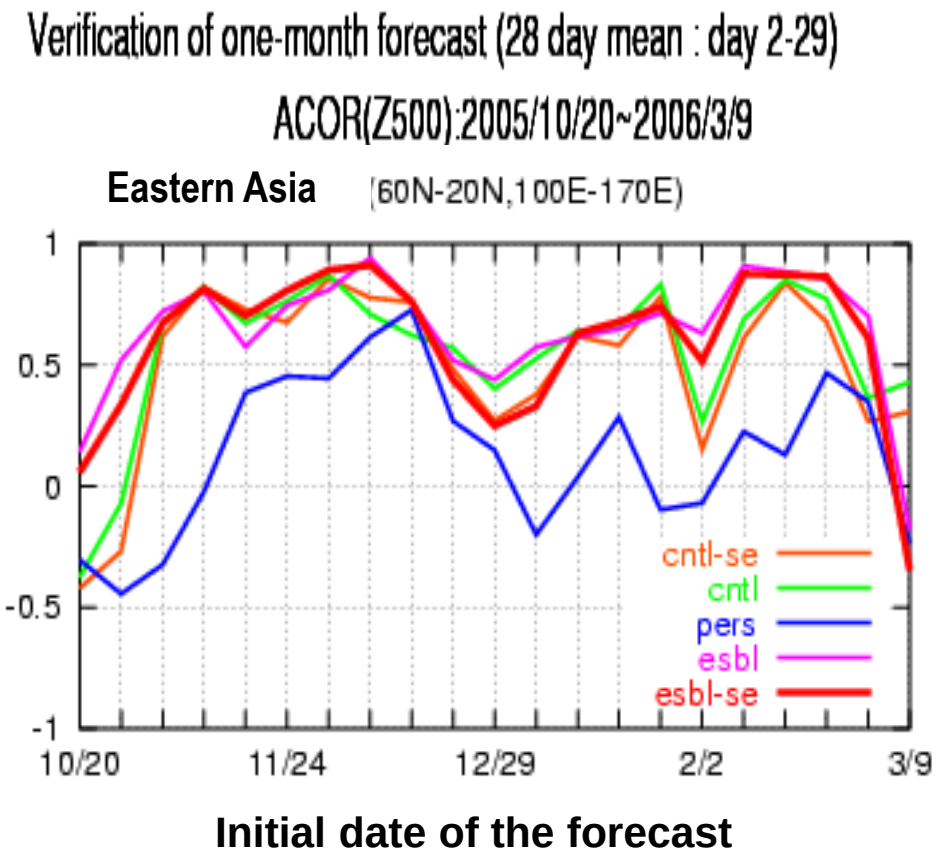
   - Case Study (Heavy rain in Japan during 15-24 July)

Verification of the Seasonal Prediction for the 2005/2006 winter by the JMA's ensemble seasonal prediction system

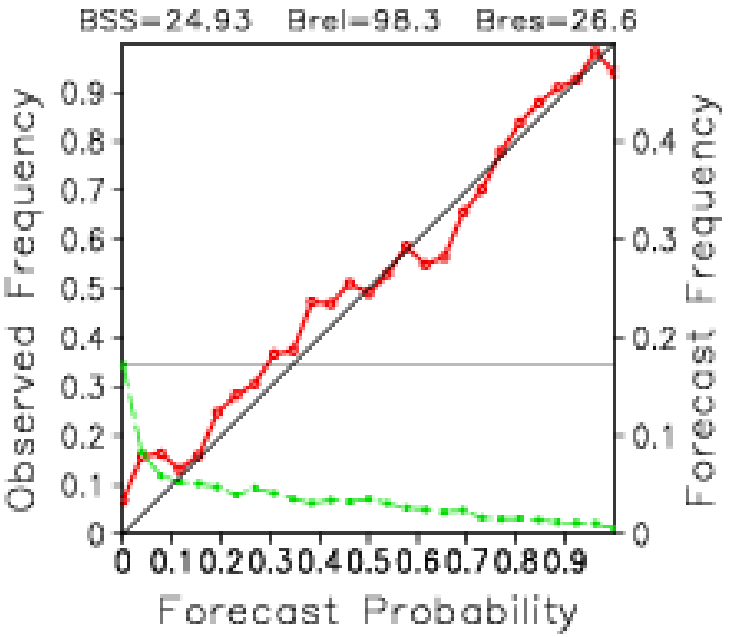
Area-averaged Temperature Anomalies in Japan for 2005/06 winter (5-day running mean)



Verification of one-month prediction



Reliability diagram T850 < -0.5SD

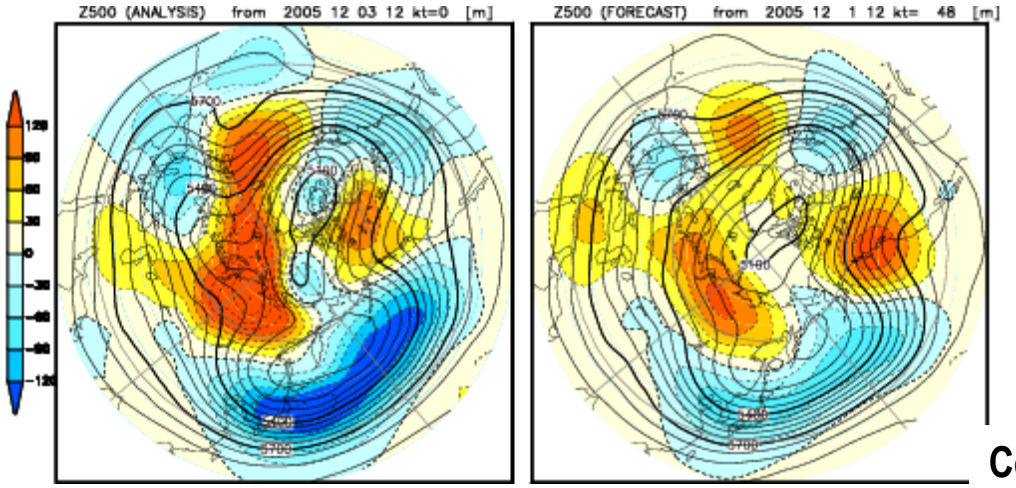


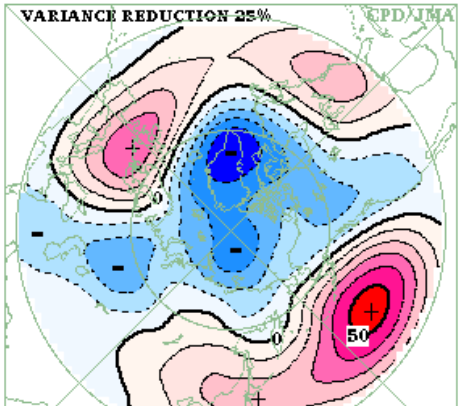
The skill of the ensemble one-month prediction, measured by anomaly correlation score of 28-day mean 500 hPa height in the eastern Asia, was sufficiently good, particularly for the December 2005. Right panel shows the predicted probabilities of cold weather was almost perfectly reliable.

One-month prediction of the AO

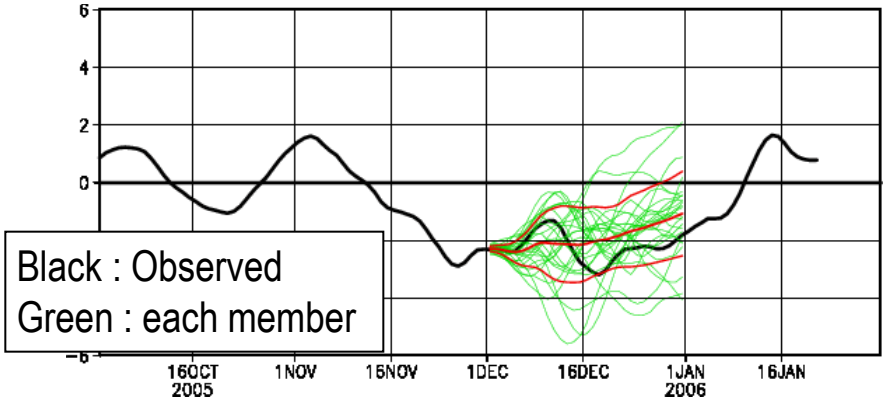
Initial: 1st Dec 2005

Z500 OBS FCST(ENS) day:2-29 Winter EOF.1

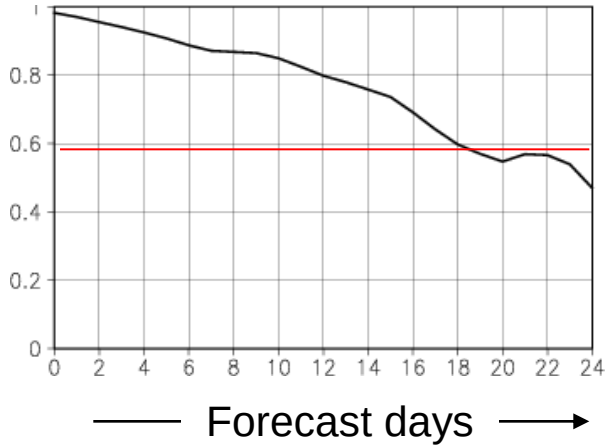




AO index (EOF1 score) 7-day running mean

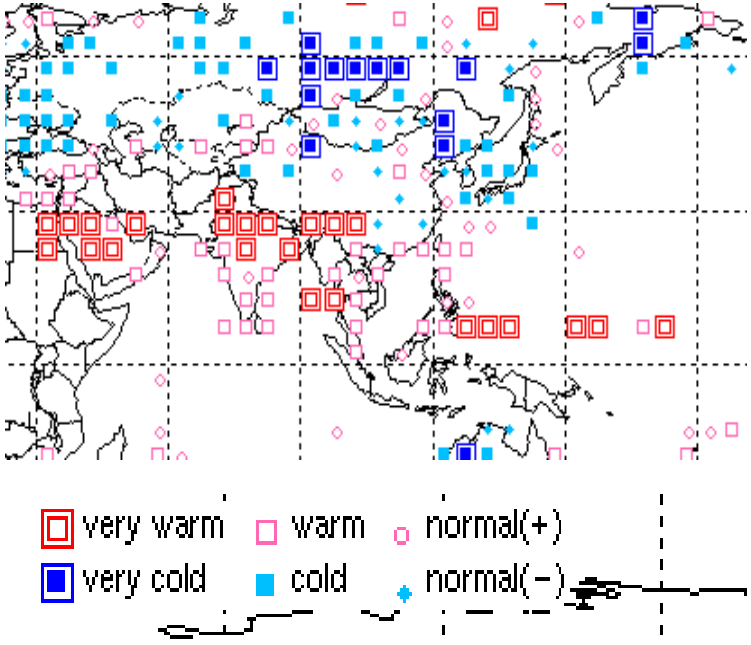


Correlation between predicted and observed AO index. 7-day running mean.
Ten cases from 2005.11.03-2006.1.5

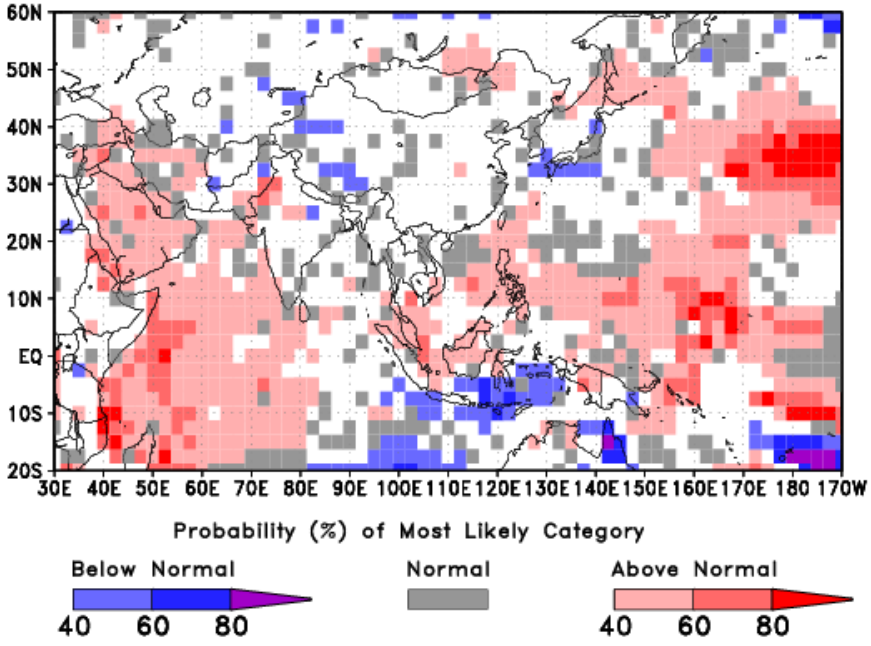


Three-month prediction for DJF
initial:2005.11.13

Observed Surface Temperature Anomaly (Normalized)



Experimental Tercile Probabilistic Prediction (T2m) for DJF 2005/06 issued in November

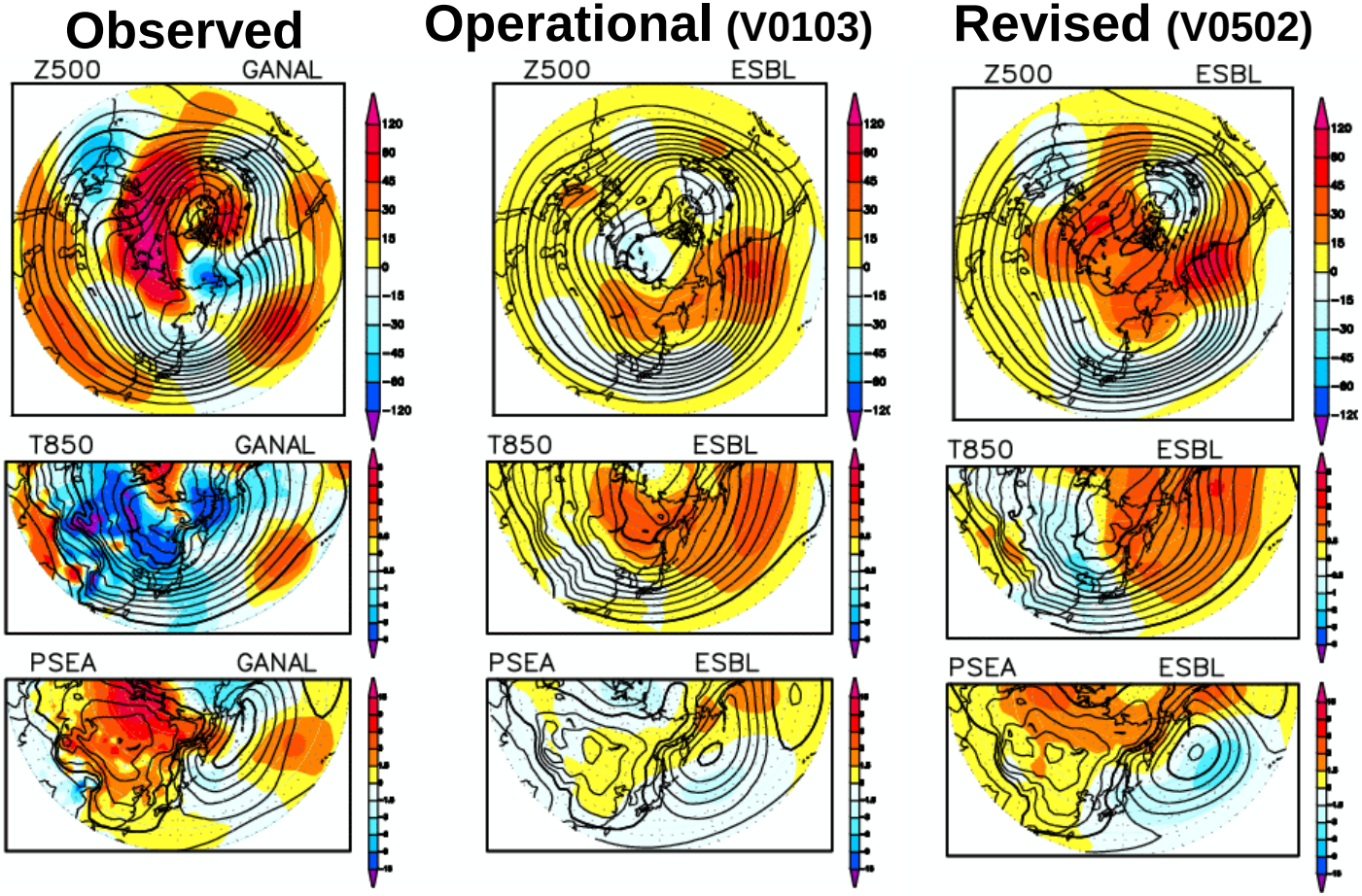


Blank grids mean they showed no skill in the hindcast verification or have no dominant category with larger than 40% probability

For the winter mean temperature, the EPS prediction had good correspondence with the observation overall, particularly in the western Japan and around the Philippines, however, it had no significant information over the Continent.

Impact of the model revision in March 2006 on the forecast for 2005/06 winter

initial:2005.11.13



Additional experiment was done using the revised model, which put into operation in March 2006. The result shows better correspondence with the observation over the Eurasian continent, though a little worse over the North America.

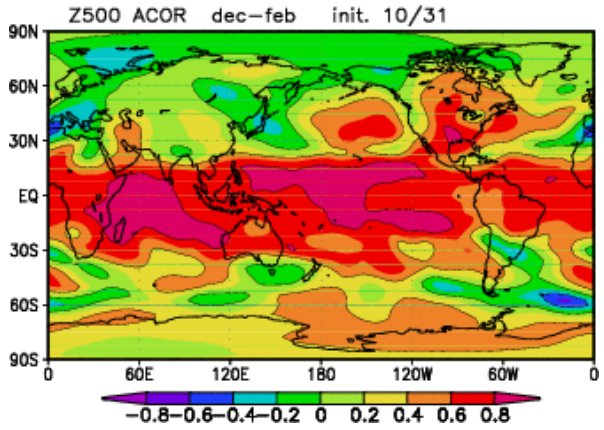
Verification of DJF mean circulation fields prediction with 21 years Hindcast experiment

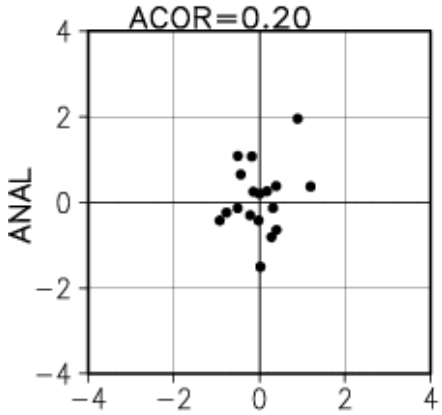
1983-2003, 5members, initial:10th Nov.

Z500 Anomaly correlation

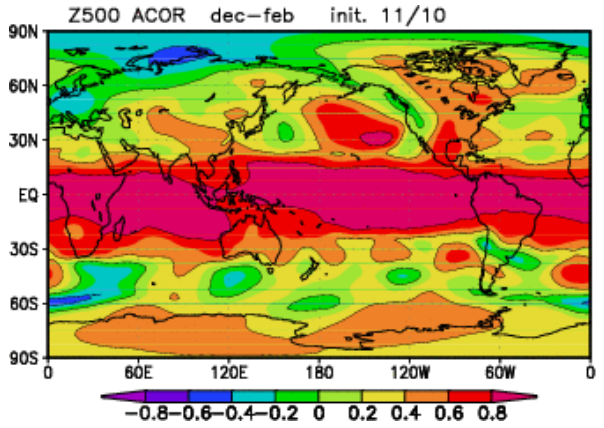
AO index (EOF1 of NH500, 90 day mean)

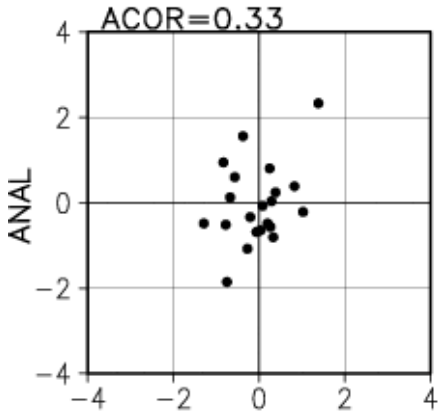
Old version (V0103)





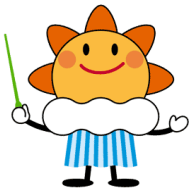
New version (V0502)





A long-term hindcast experiment was executed on an almost same condition. The result shows that the new version has generally better skill in the middle and low latitudes as well as the AO index.

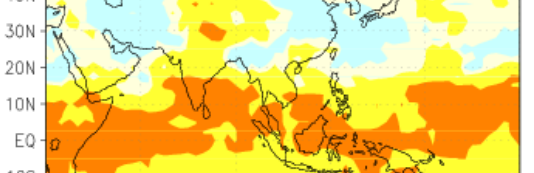
Verification of DJF mean T2m by the 21-year Hindcast experiment

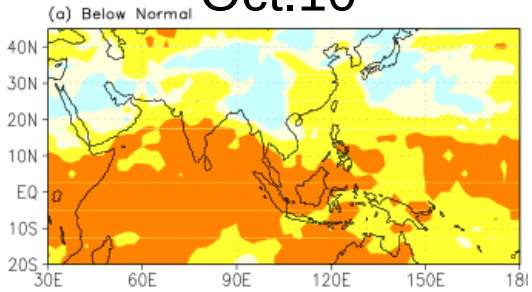


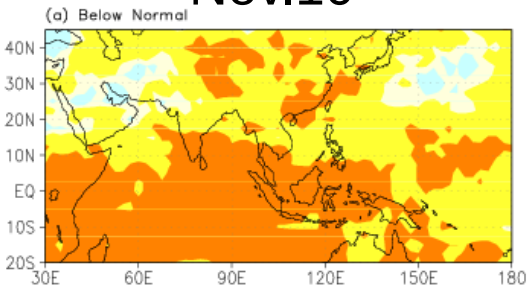
Revised model (V0502), 1983-2003, 5members, ROC area

Initial date: Sep.10 Oct.10 Nov.10

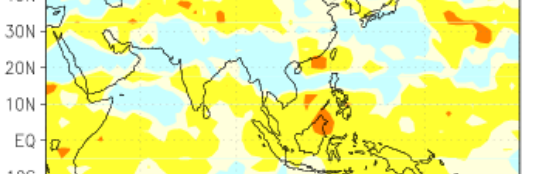
Above Normal

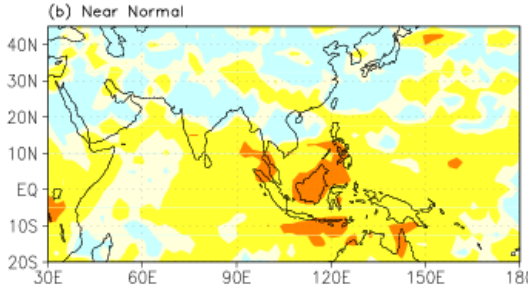


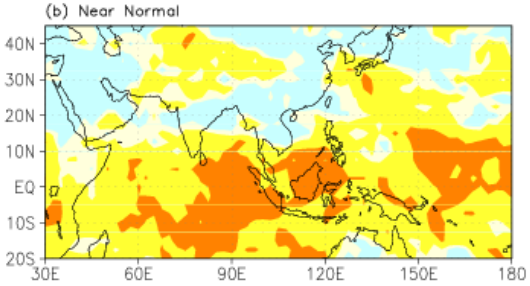




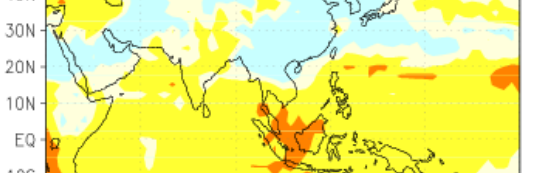
Near Normal

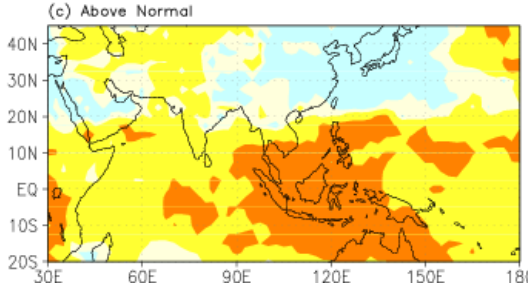


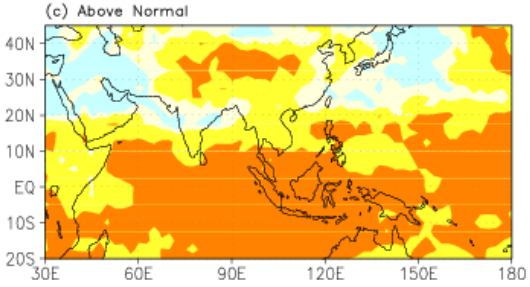




Below Normal



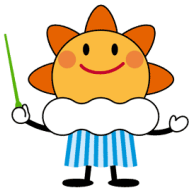




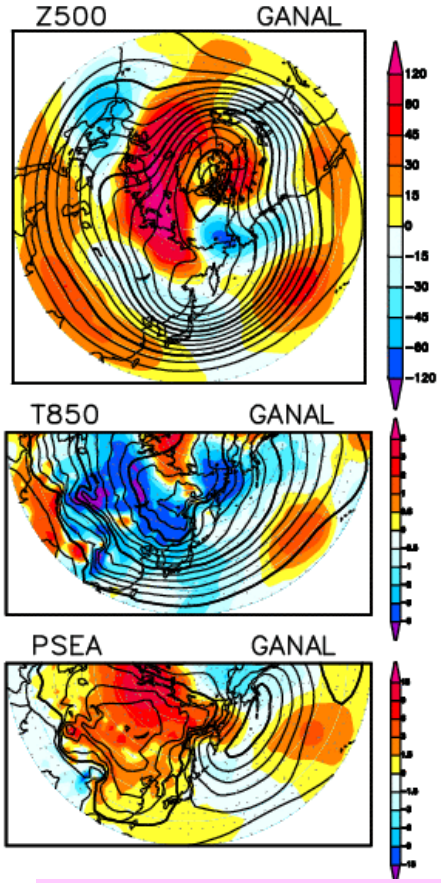
The longer is the forecast lead time, the poorer is the prediction skill, especially over the Eurasian continent. Predictions from November are fairly reliable.

Verification of the 6-month ensemble prediction for the winter 2005/06

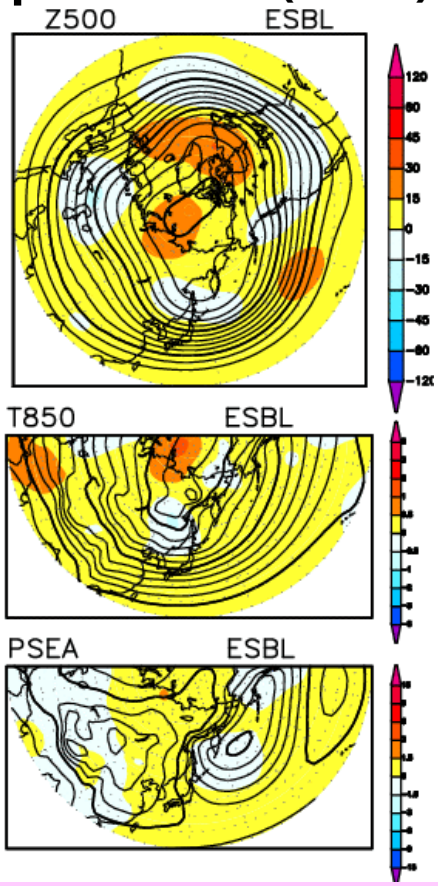
Initial date:2005.9.11



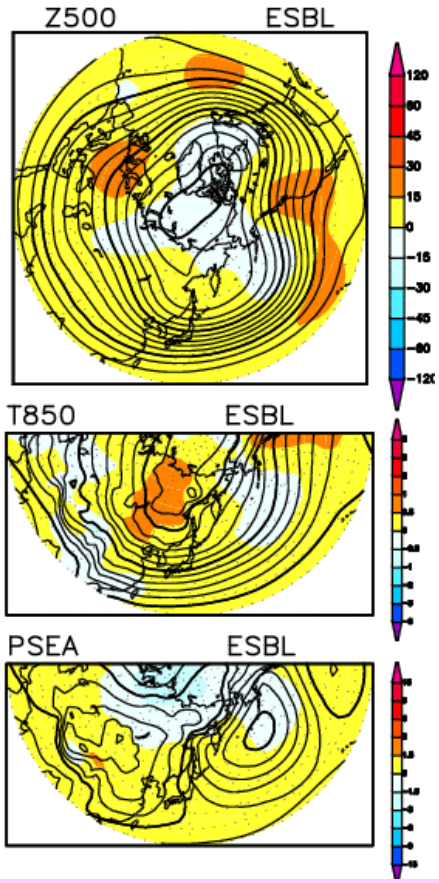
Observed



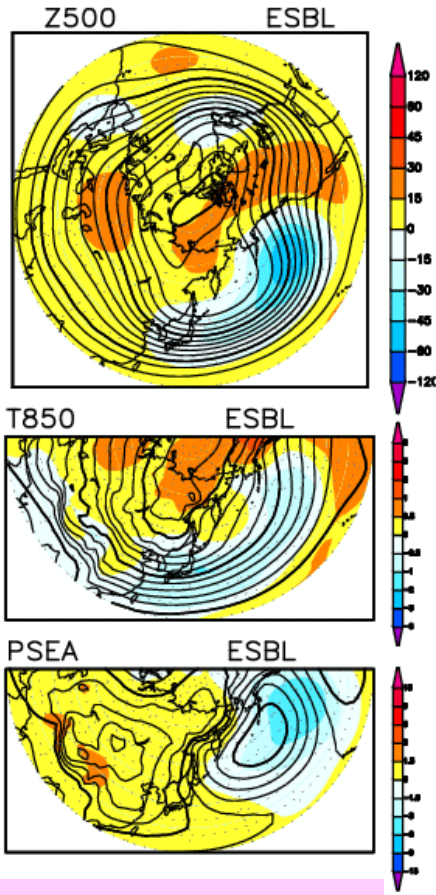
Operational (V0103)



Revised (V0502)



Revised with Real SST



Long-range prediction from September 2005 had poor skill. Additional experiment was done using the revised model with/without observed SSTs. With real SST case successfully predicted the stronger-than-normal Asian winter monsoon.

Summary : verification of the ensemble prediction for 2005/06 winter (DJF)

1) One-month prediction (initial:2005.12.1)

- Anomalous circulation fields, such as strong negative phase of the AO in Dec. 2005, were well predicted

2) Three-month prediction (initial:2005.11.13)

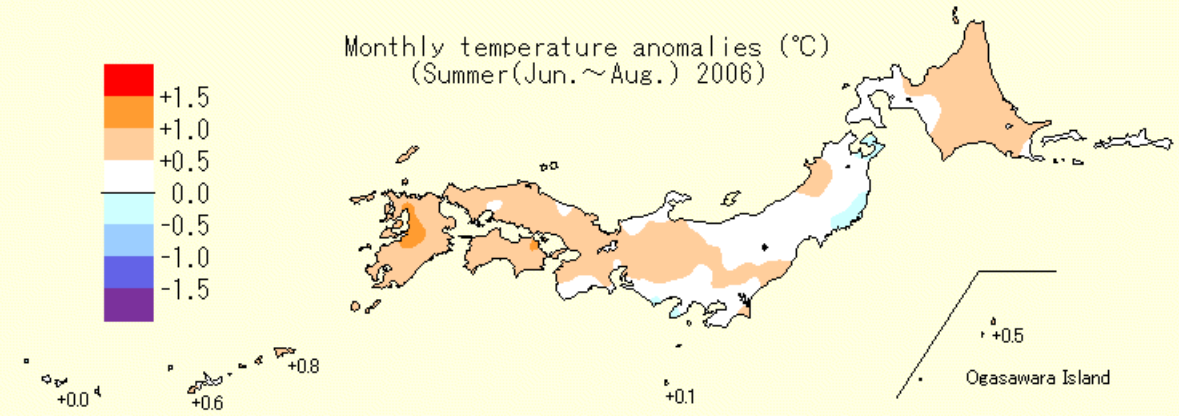
- Marginally predicted. The prediction by the new model (V0502) was better than that by the old one (V0103) as expected from 21-years hindcast experiments.

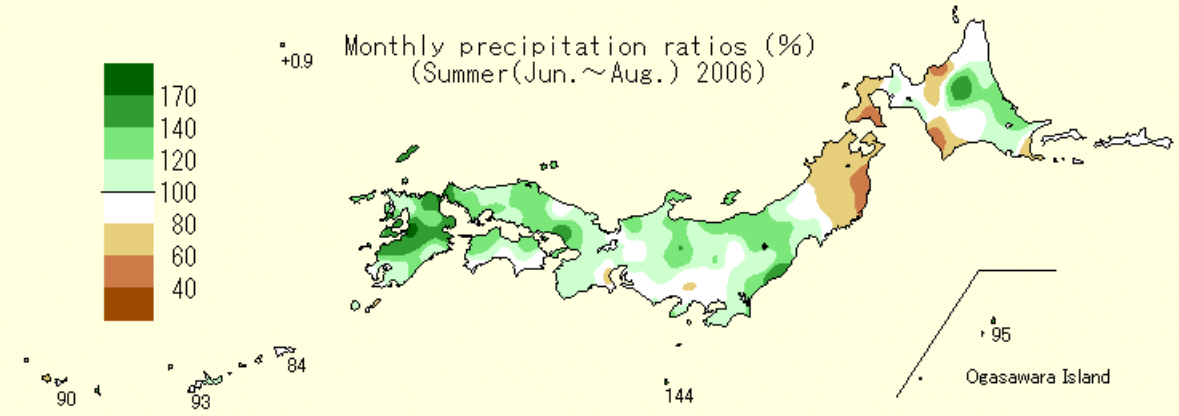
3) Cold-season prediction (initial:2005.9.11)

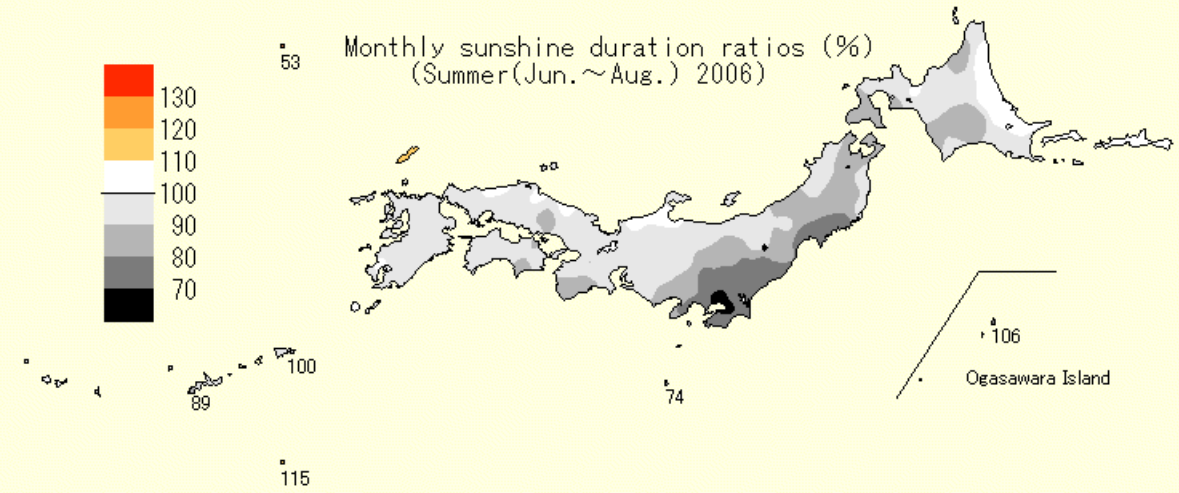
- If real SST anomalies were fed in the model, the anomalous circulation fields were marginally predicted.

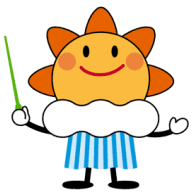
Summary of the Asian Summer Monsoon in 2006

- Climate in Japan
- Monsoon Activities
- Tropical Cyclone Activities
- Case Study (Heavy rain in Japan during 15-24 July)









Climate in Japan

2006 Summer (JJA)

upper : 3-month mean temperature anomaly

Generally warmer than normal

middle : 3-month total precipitation ratio

Greater than normal in Western Japan (active Baiu)

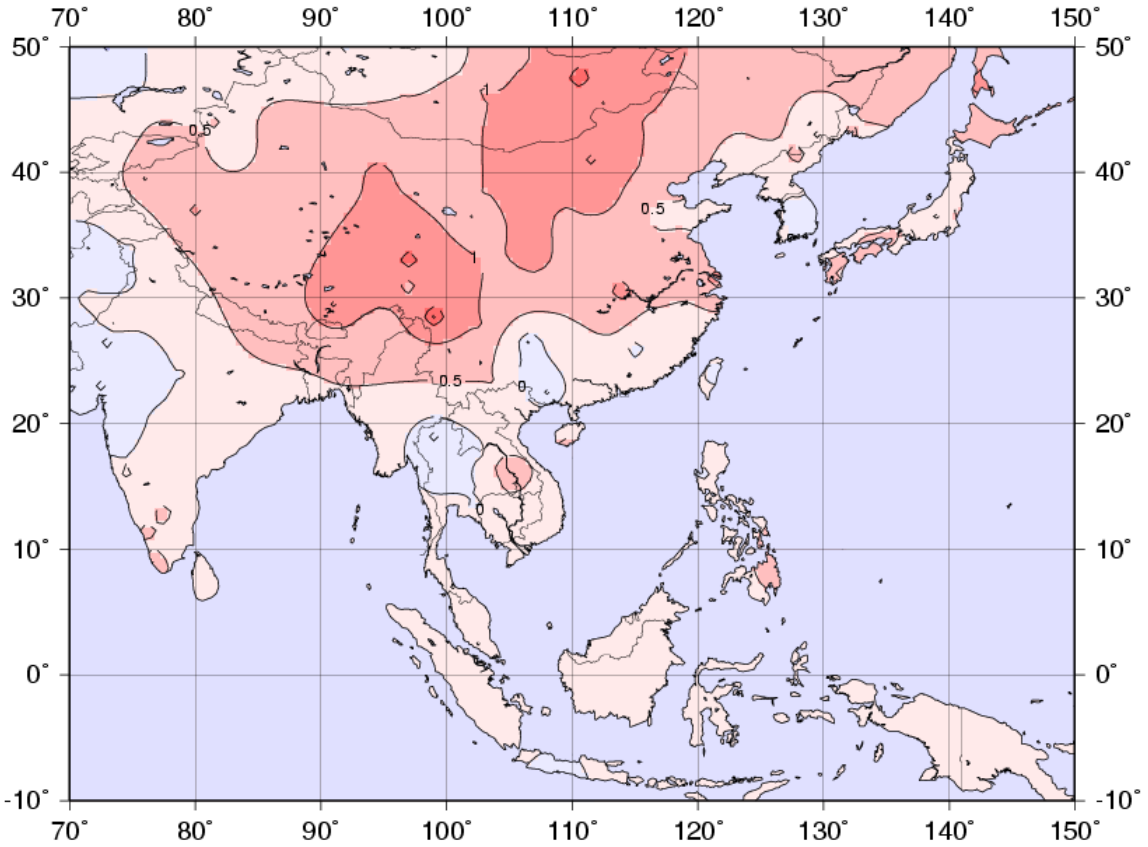
Bottom : 3-month total sunshine duration ratio

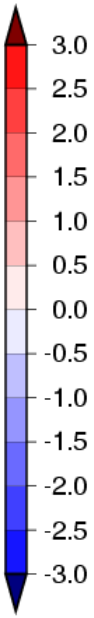
Generally less than normal

Total precipitation in the Baiu season was greater than normal

- Beginnings of the Baiu season were near or later than normal
- Ends were later than normal

Summary of the Asian Summer Monsoon Season (Jun. – Sep. 2006)





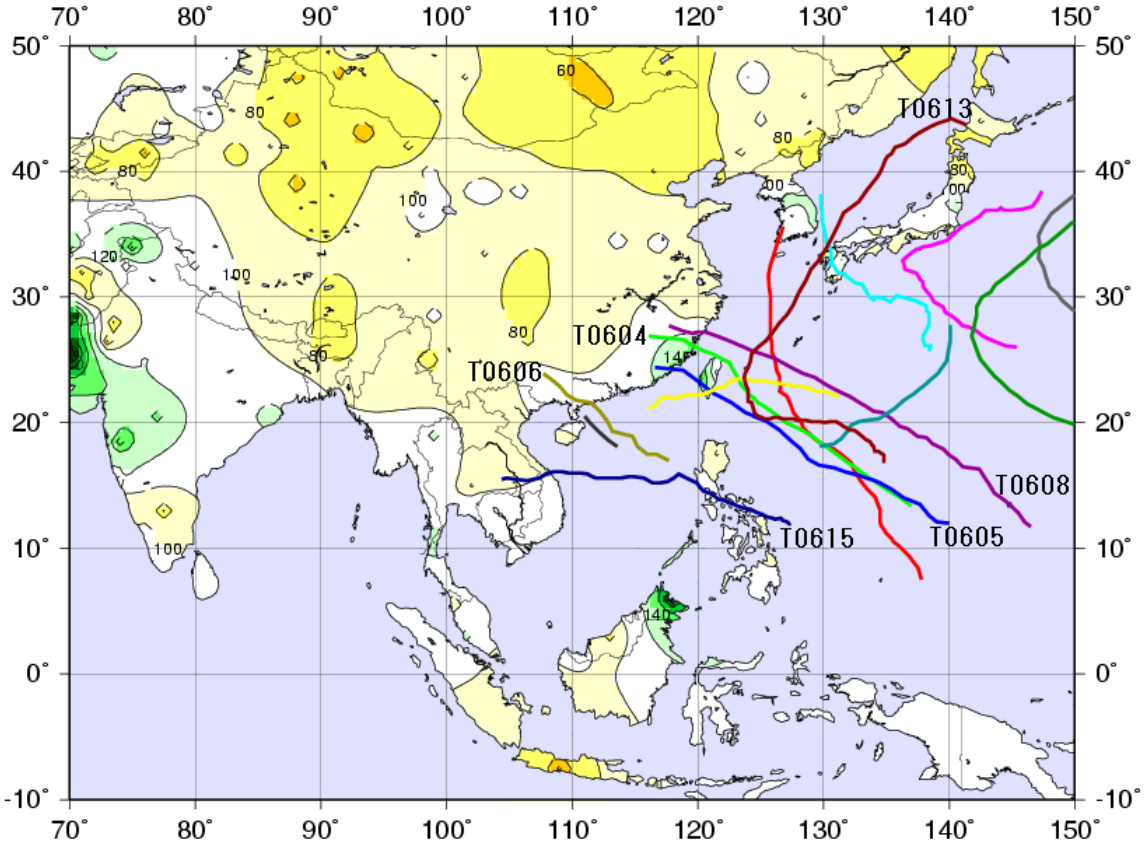
4-month mean temperature anomaly (Jun.- Sep. 2006)

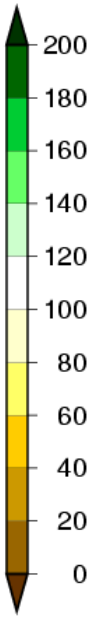
Base period: 1971-2000

Temperatures are higher than normal most of Asia

- Noticeably high from Tibet to eastern Mongolia
- Slightly lower than normal in Korea, southern China, northern Thailand and western India

Summary of Asian Summer Monsoon Season (Jun. – Sep. 2006)





4-month total precipitation ratio (Jun.- Sep. 2006)

Base period: 1971-2000

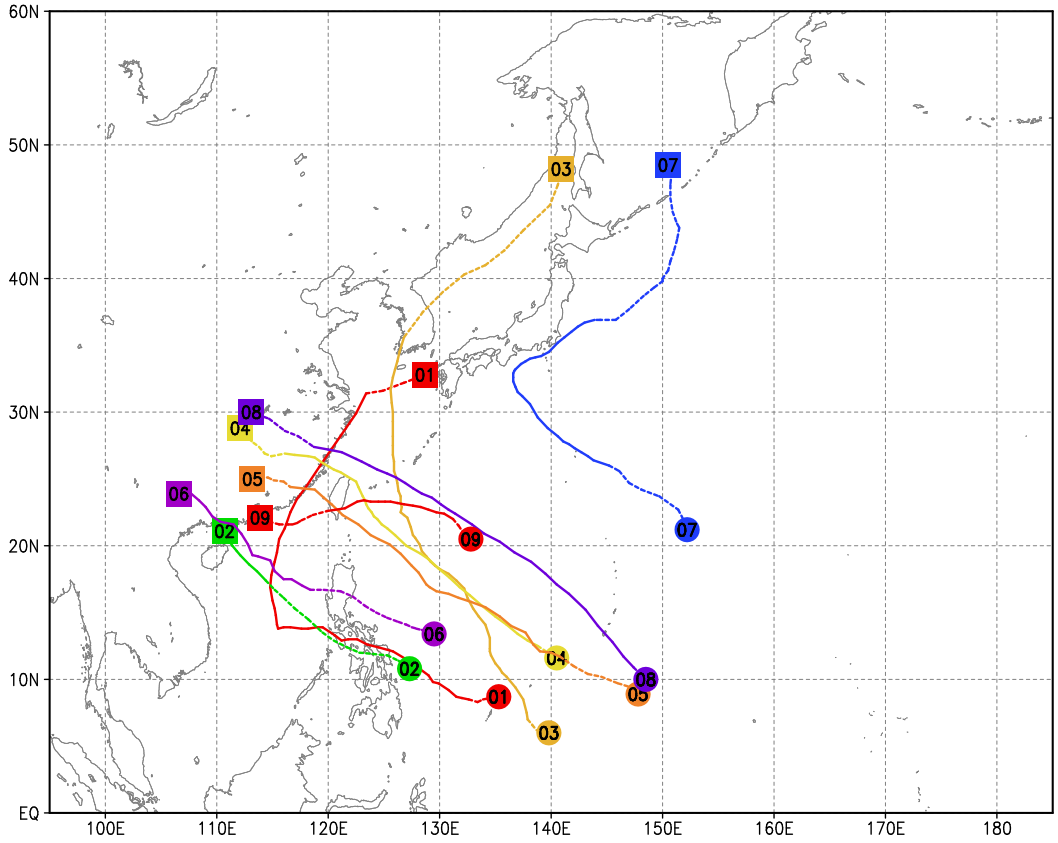
Fourteen named tropical cyclones formed in the Western North Pacific during this period. This number is slightly less than normal.

Eight cyclones out of them reached the typhoon intensity.

Total precipitation of the summer monsoon season was near normal

- Below normal (less than 80%) area : northern part of China to Mongolia, Java Island
- Above normal (larger than 120%) area : western coast of India, north-eastern Kalimantan, Korea, south-eastern coast of China = affected by tropical cyclones

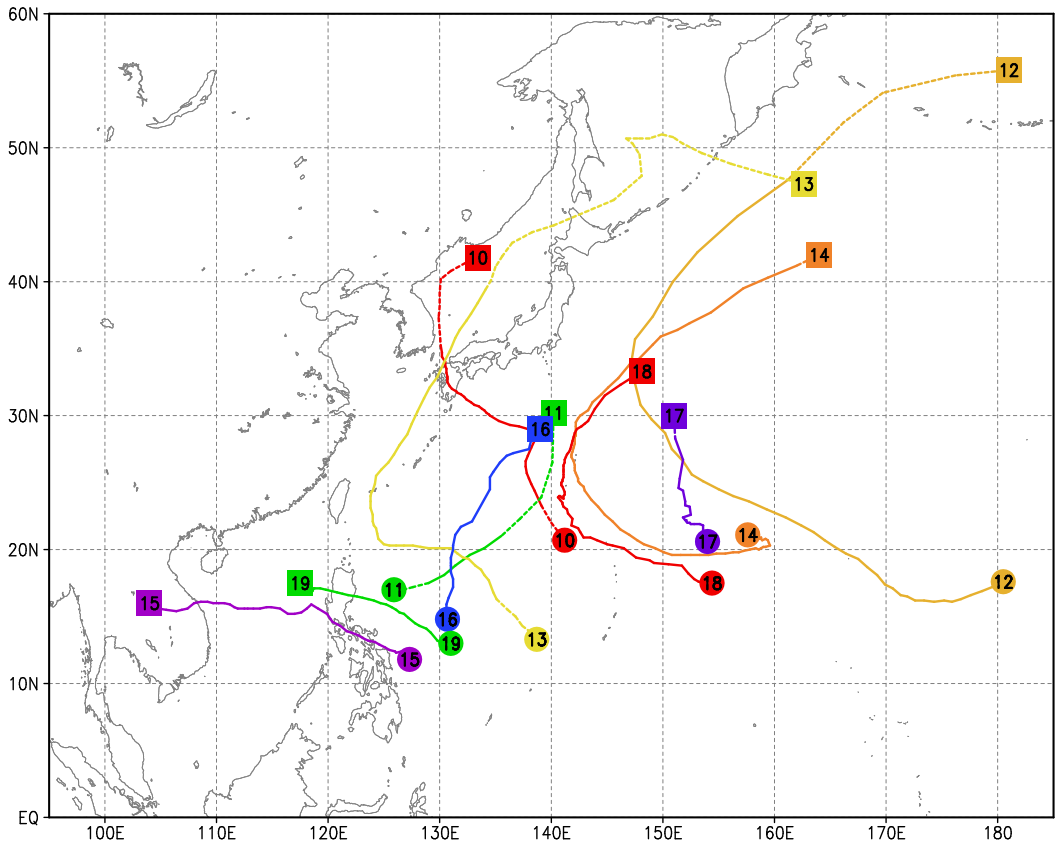
Tropical Cyclone Activity in 2006



Tracks of nine named cyclones formed before 10th August 2006

From May to early August, many named cyclones took westward track and made landfall on the continent. CHANCHU (0601), BILIS (0604), KAEMI (0605), PRAPIROON (0606) and SAOMAI (0608) brought damage to China (1414 deaths in total), the Philippines (88 deaths in total), and Vietnam (241 deaths in total) due to flood, landslide, strong wind and so on. On the other hand, EWINIAR (0603) moved northwards and hit the Republic of Korea to bring damage to the country including 6 deaths/missing.

Tropical Cyclone Activity in 2006 (cont.)

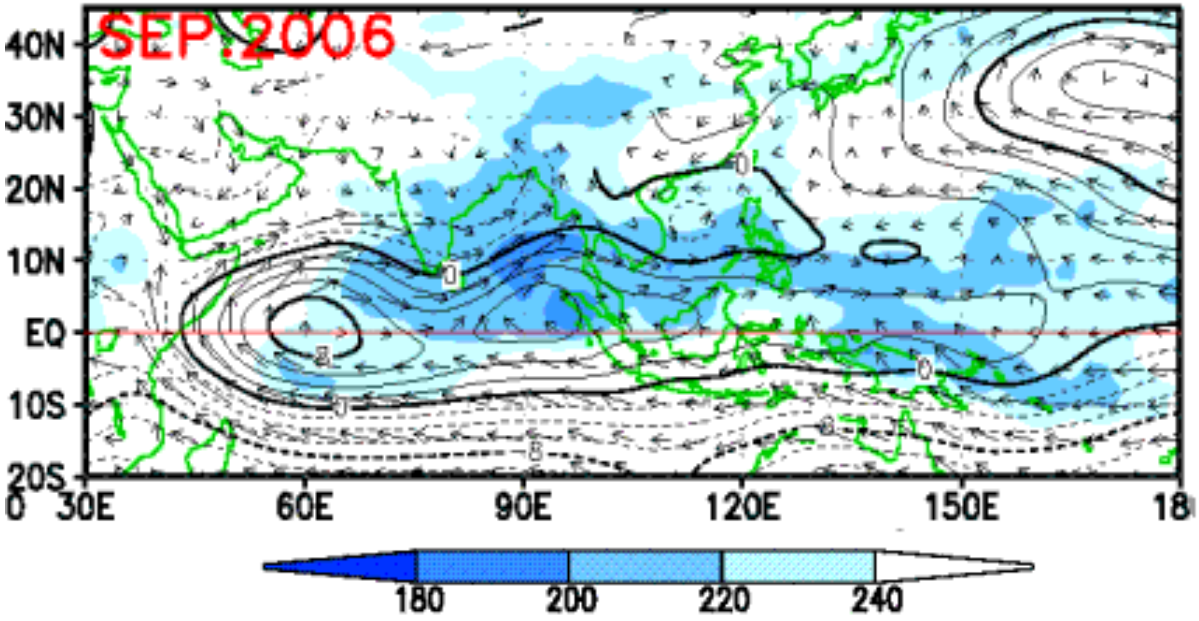


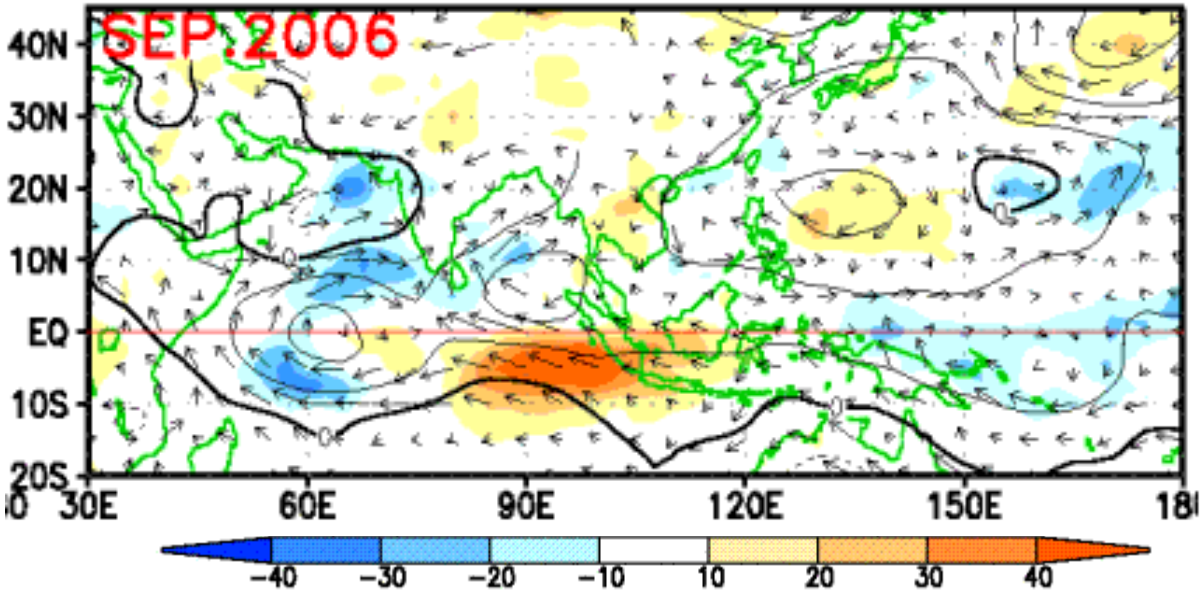
Tracks of ten named cyclones formed after 10th August 2006 (till 00UTC 31th Oct 2006)

After late August, many named cyclones formed over the sea east of the Philippines and moved northwards.

In particular, SHANSHAN (0613) hit Japan resulting in 10 deaths/missing due to flood and strong wind. On the other hand, XANGSANE (0615) and CIMARON (0619) moved westwards in the South China Sea to bring damage to the Philippines (238 deaths in total), Thailand, and Vietnam (71 deaths in total).

Overall Activity of Asian Summer Monsoon





4-month mean OLR
(Jun.- Sep. 2006)

Upper: raw data
Lower: anomaly

Asian summer monsoon activities were near normal

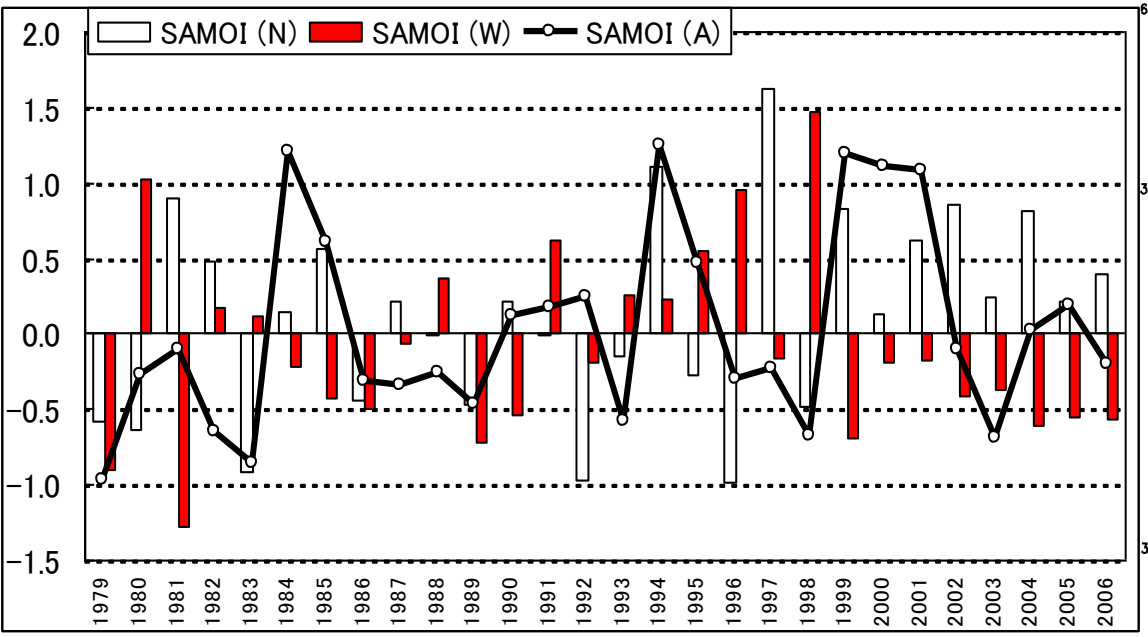
- The monsoon was active in July and the active area was significantly shifted eastward and northward.

- The southwest monsoon rainfall over India was 99% (according to the IMD)

SAMOI (Summer Asian Monsoon OLR Index)

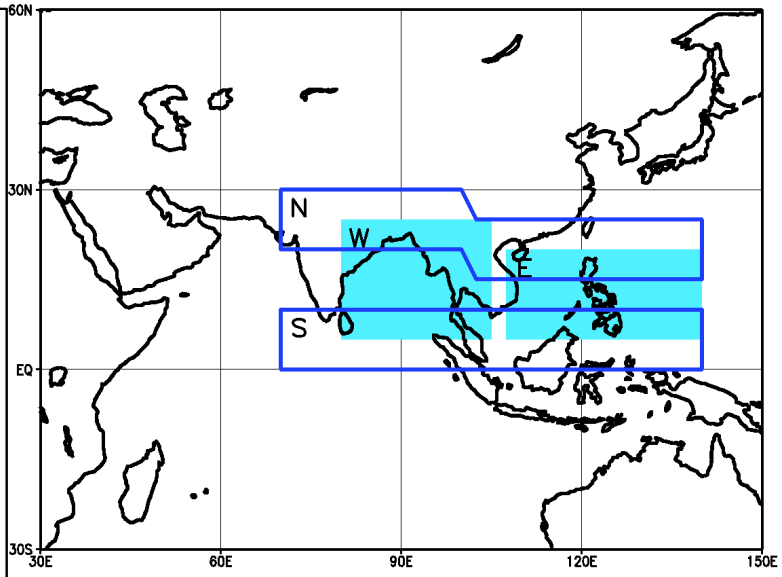
	SAMOI (A)	SAMOI (N)	SAMOI (W)
Jun.2006	-0.4	-0.2	0.1
Jul.2006	0.6	1.0	-1.5
Aug.2006	-0.8	0.4	-0.3
Sep.2006	-0.3	-0.7	0.1

Inter-annual variation of SAMOI (Summer Asian Monsoon OLR Index)



Time Series of Summer Asian Monsoon OLR Indices (SAMOI)

SAMOI(A), (N) and (W) indicate the activity of summer Asian monsoon, northward and westward shift of the active convection, respectively.



THE AREA OF SAMOI

SAMOI(A) = W + E, SAMOI(N) = N - S, SAMOI(W) = W – E

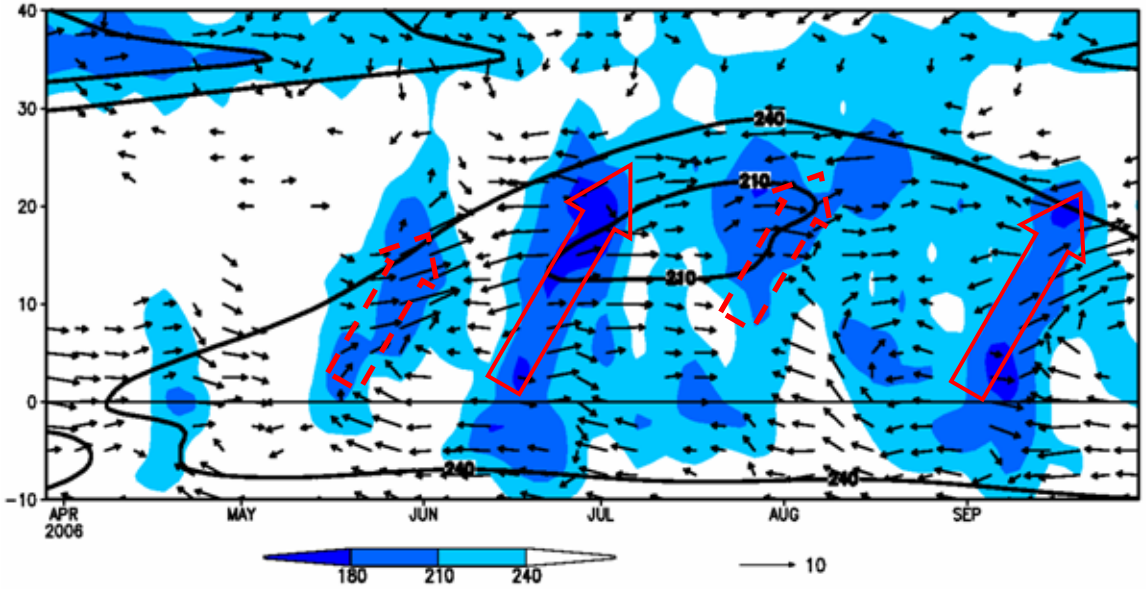
W, E, N and S indicate area-averaged OLR anomalies normalized by standard deviation.

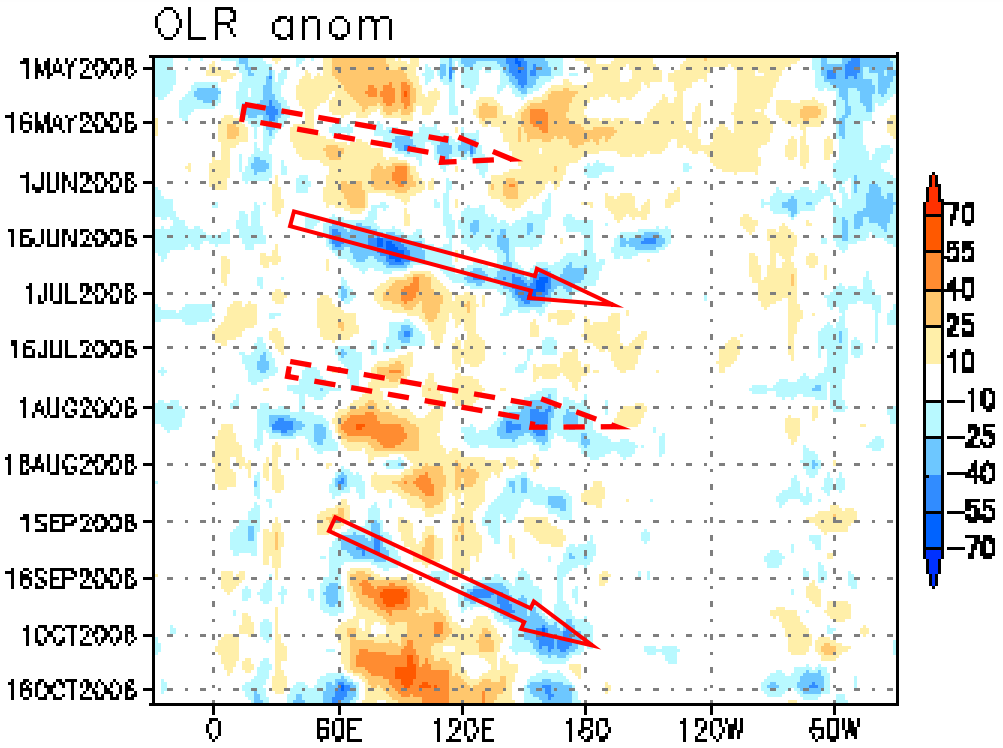
SAMOI(N) = -0.2 : Convective activity in the whole region was near normal

SAMOI(W) = -0.6 : Eastward shift of Convection center (8 consecutive years)

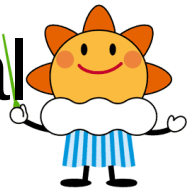
SAMOI(N) = +0.4 : Slightly northward shift of convection center (8 consecutive years)

Indian sub-continent sector





Intra-seasonal Variation of Asian Summer Monsoon



Top: Latitude-Time Cross Section of 5-day mean OLR and 850-hPa Wind Vector Anomaly Averaged in 65E-85E

Solid line : Normal OLR (W/m^2) in an interval of 30 W/m^2 below 240 W/m^2.

Bottom: Longitude-Time Cross Section of 5-day mean OLR anomaly in 5N–5S

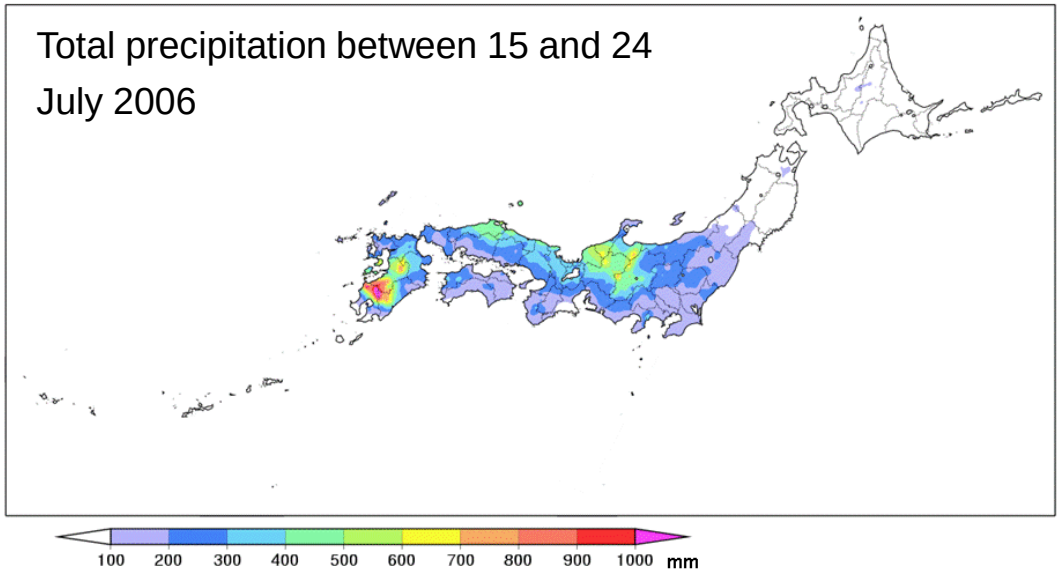
Intra-seasonal variation was intensified four times during the summer monsoon season.

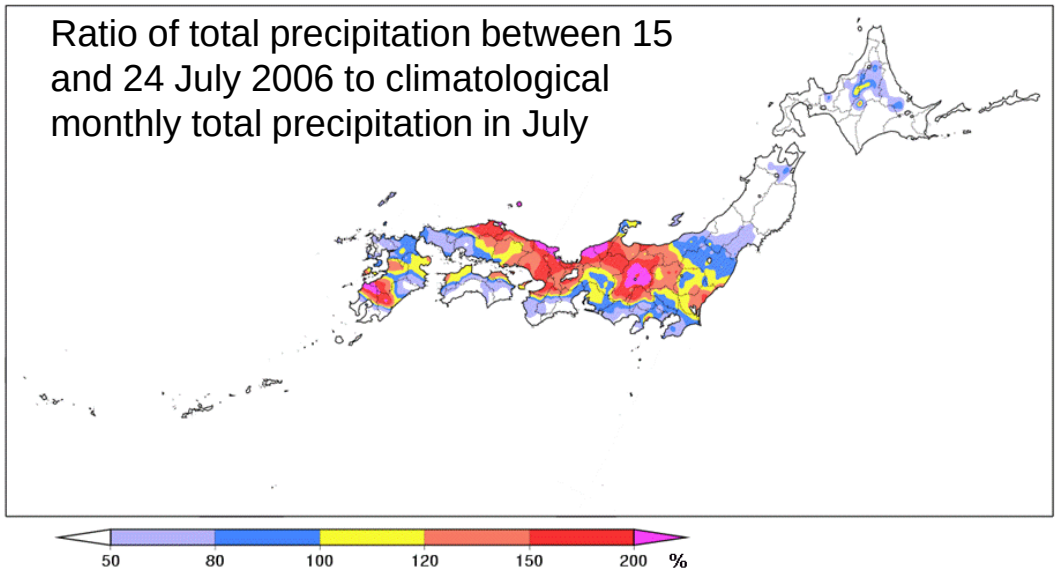
- Clear northward and eastward migrations of active convection were observed in the latter half of June and in September

- Convection was activated in late July and early August in the Western North Pacific

Case Study

Extreme heavy rain in Japan during 15-24 July 2006





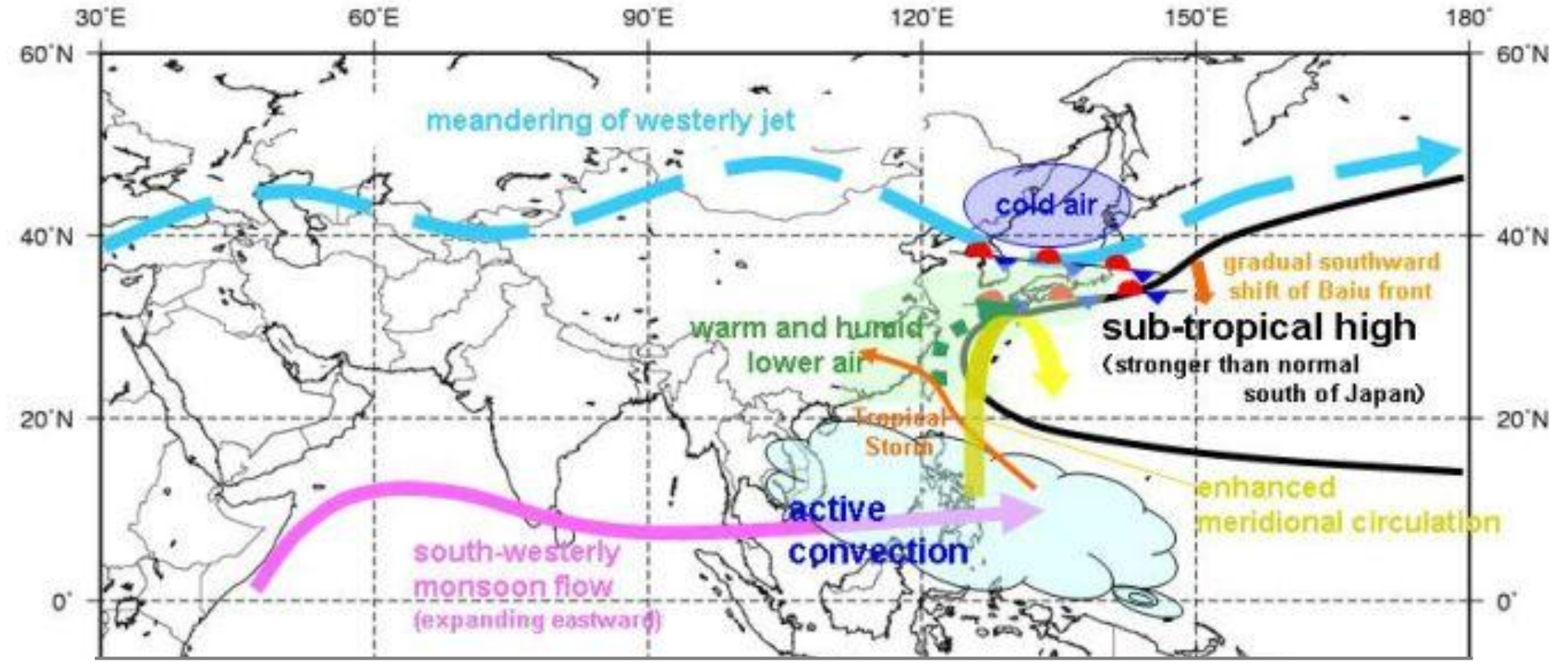
-During 15-24 July 2006, active Baiu front continued to be located over Japan, and brought heavy rainfall.

-10-day accumulated rainfall during 15-24 July exceeded 1,200 mm in the southern part of Kyushu.

- It was above twice as much as monthly rainfall normal for July.

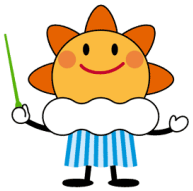
- Due to this prolonged and sustained Baiu frontal activity, rainy season in Japan was delayed for about 10 days from its normal dates.

Background of the extremely heavy rain

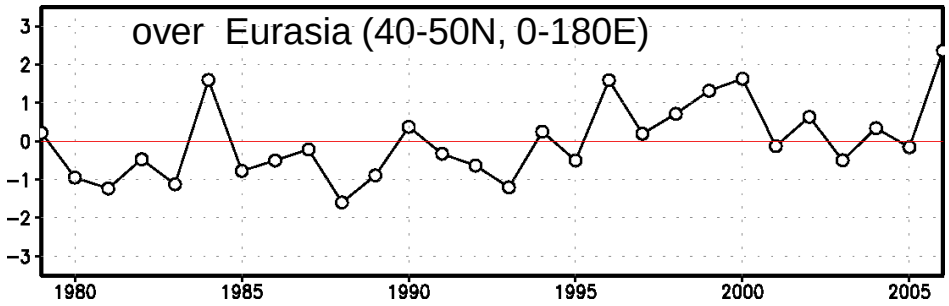


- Around 15 July, the sub-tropical jet started to meander around Japan. The meandering was most remarkable around 19th, drawing cold and dry north-westerlies in the upper troposphere over Japan.
- Meanwhile, the sub-tropical high south of Japan kept stronger than normal during the period, dominating the warm and humid south-westerlies in the lower troposphere toward Japan along the western periphery of the sub-tropical high.
- It is thought that the sub-tropical high was strengthened by the active convection east of the Philippines, possibly associated with higher-than-normal sea surface temperatures in the western Pacific and south-westerly monsoon flow expanding eastward.

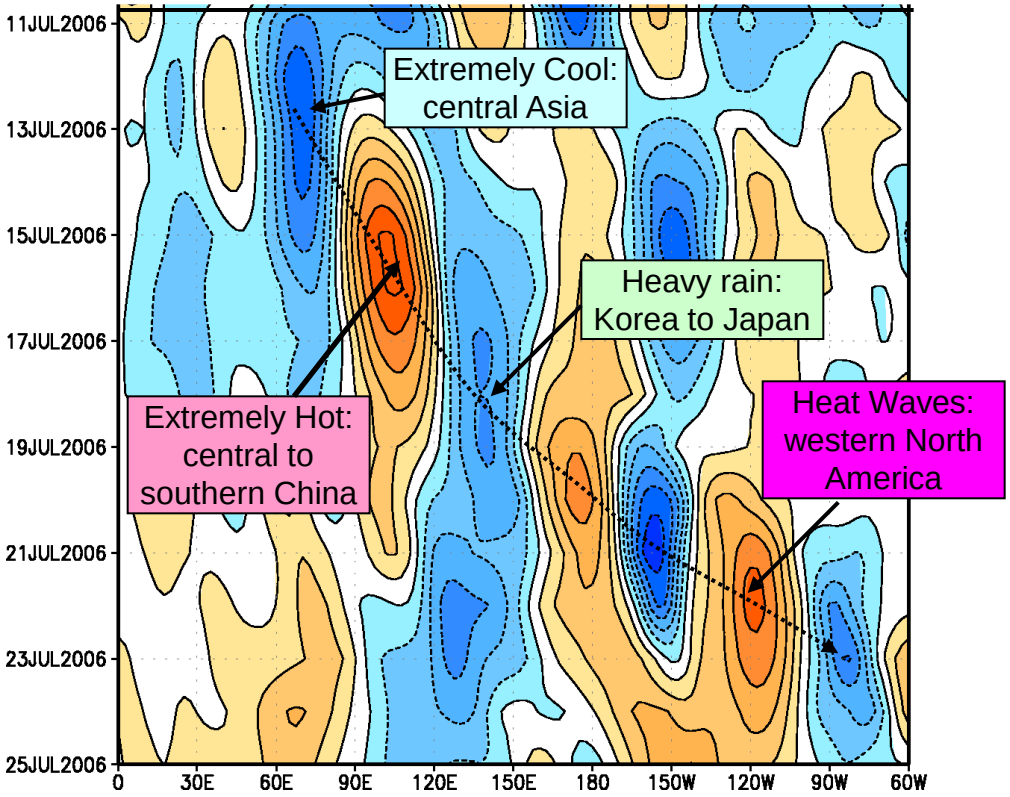
Background of the extremely heavy rain (2)



Wave Activity Flux averaged in 10-19 July over Eurasia (40-50N, 0-180E)



Time-longitude cross section of 250hPa stream function anomaly averaged in 40-50N



- Along the subtropical jet over the Eurasia, significantly active Rossby wave propagation was observed in the middle of July.

- Wave activity Flux over the Eurasia was record high.

- This Rossby wave propagation strengthened the meandering of subtropical jet, and maintained deep trough over Japan.

- This propagation brought large circulation anomalies resulting in extreme weather not only in Japan but also in Asia and North America.

Thank you
for your attention.