Eighth Session of the Forum on Regional Climate Monitoring, Assessment and Prediction for Asia (FOCRAII)
5-7 April 2012, Beijing, China

Recent Development of TCC

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1. Introduction

Tokyo Climate Center as a WMO Regional Climate Center

WMO Regional Climate Centres are centres of excellence that create regional climate products including long-range forecasts in support of regional and national climate activities and thereby strengthen capacity of WMO Members in a given region to deliver better climate services to national users.

The Tokyo Climate Center (TCC), as a WMO Regional Climate Center (RCC), supports the climate services of NMHSs in the Asia-Pacific region through the provision of climate data and products, and capacity-building activities.

Provision of Data and Products through the TCC Website

気象庁 Japan Meteorological Agency

Tokyo Climate Center (WMO Regional Climate Center)

TCC home | About TCC | Site Map | Contact us

Home | World Climate | Climate System Monitoring | El Niño Monitoring | NWP Model Prediction | Global Warming | Climate in Japan | Training Module | Press release

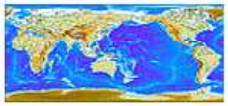
HOME

RCC Functions and Main Products

- Operational Activities for LRF
- Operational Activities for Climate Monitoring
- Operational Data Services to support operational LRF and climate monitoring
- Training in the use of operational RCC products and services

Additional Functions

ClimatView



Introduction to ITACS

GPC Tokyo (a Global Producing Center for Long-range Forecasts (LRF))

Monthly Highlights on Climate System (latest issue)

TCC News

STRATALERT TOKYO last updated : 22 Apr 2011

text | figures

What's New

15 Sep

New

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14 Se

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- Mor

- Sea

14 Se

Upda

- Mor

- Sea

9 September 2011 NEW

Updated Information: El Niño Outl 11 - March 2012)

9 September 2011 NEW

of One-month Forecasting (only for registered NMHS users)

29 August 2011 NEW

Greenhouse Gases (WDCGG)

RSMC Tokyo - Typhoon Center

Meteorological Research Institute, JMA

Monitoring Center (GSNMC)

Beijing Climate Center

APEC Climate Center

Operational Activities for LRF

Operational Activities for Climate Monitoring

Operational Data Service, to support operational LRF and climate monitoring

Training in the use of operational RCC products and services

Links to products and services in line with RCC Mandatory Functions

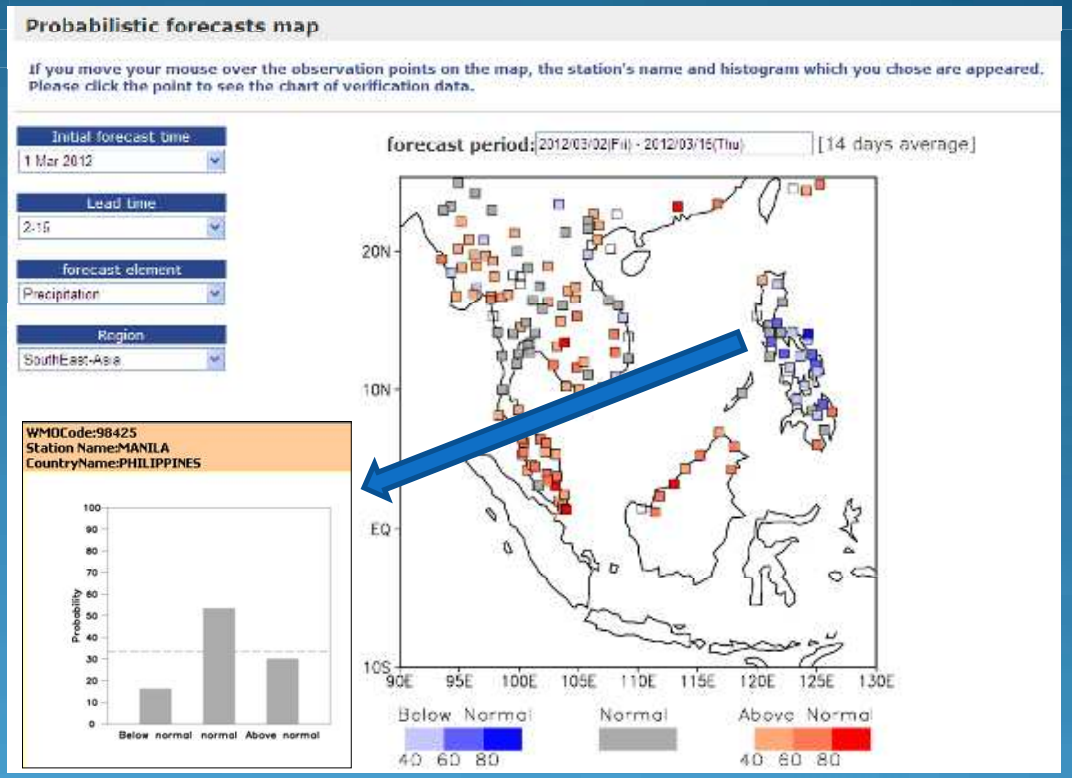
http://ds.data.jma.go.jp/tcc/tcc/index.html

2.Products and tools

- Example of TCC's forecast product -
One-month Probabilistic Forecast for Southeast Asia

TCC provides tercile probabilistic forecasts of 2m temperature and total precipitation at a number of major stations in Southeast Asia, based on the needs of regional and sub-regional scale forecasts from NMHSs.

In February this year, the number of available stations increased in accordance with minor revision of the probabilistic forecast system.

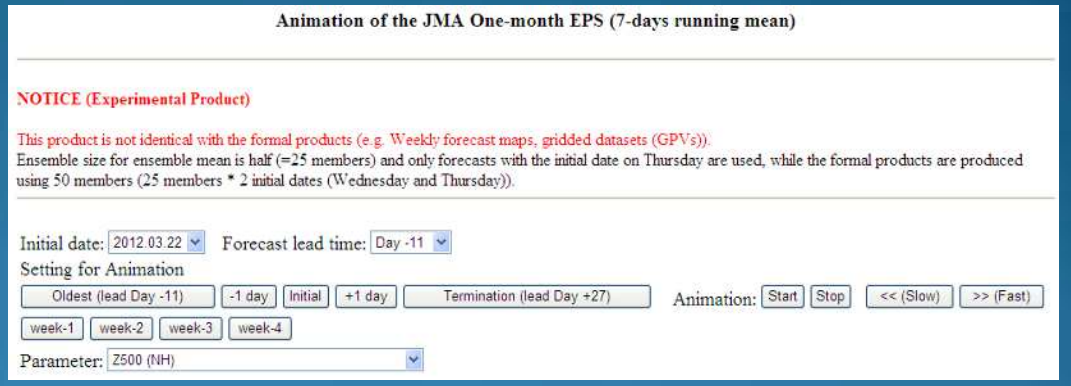


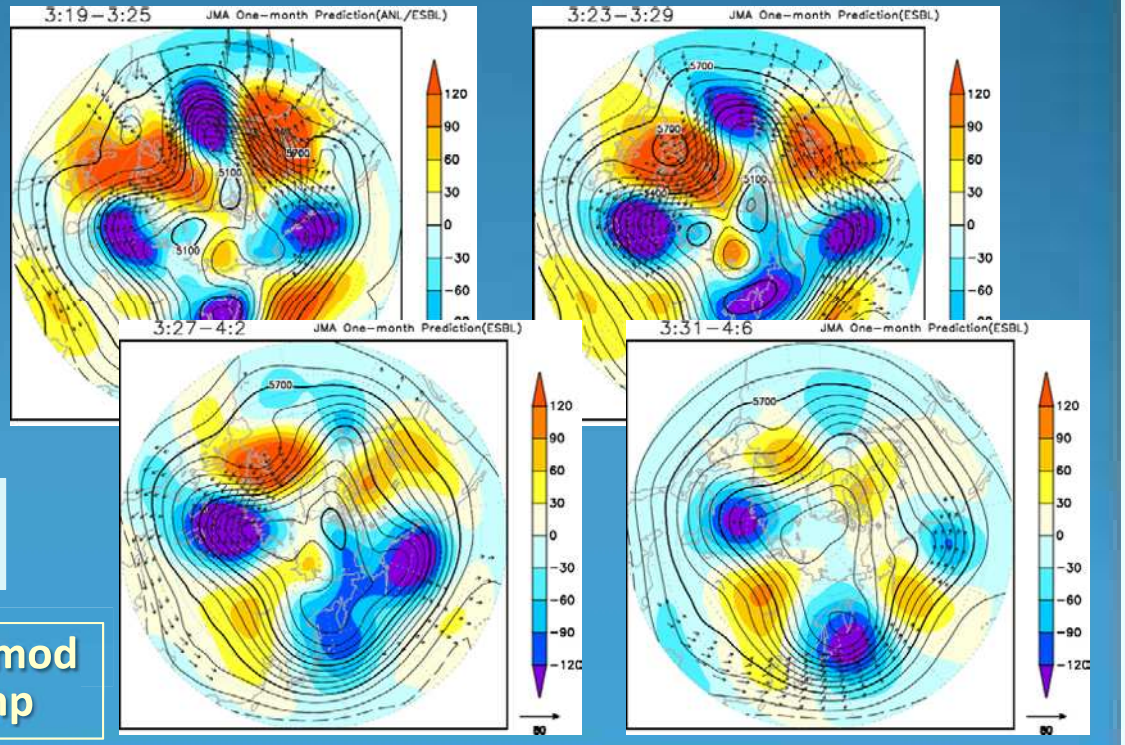
Initial Forecast Time: 1 Mar. 2012
Lead time: 2-15 days
Element: Precipitation

http://ds.data.jma.go.jp/tcc/tcc/products/guidancetst/

- Example of TCC's forecast product -
Animation of JMA One-month EPS

TCC started providing animation of JMA One-month EPS in October 2011 on an experimental basis.





Available parameters

- Northern Hemisphere

Z500, T850, SLP

- Tropics

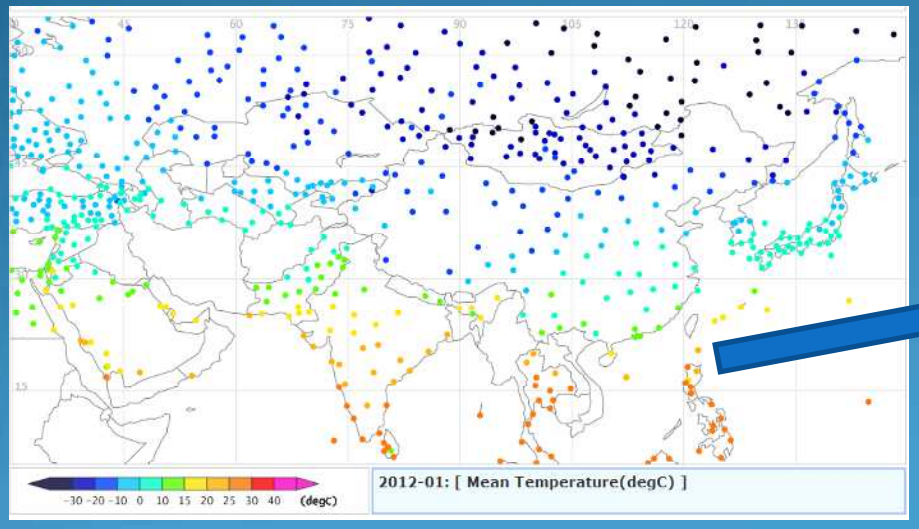
CHI200, PSI200, PSI850, U200, T 2m ……

Only accessible for registered users (NMHSs) of gridded forecast products

http://ds.data.jma.go.jp/tcc/tcc/gpv/model/Anime.1mE.experiment/anime.e.php

- Example of TCC's product -
Climate Database
(ClimatView: Web-based Interactive Tool)

Also provided is a tool overviewing and downloading monthly world climate data. It allows the user to see and obtain monthly mean temperatures, monthly total precipitation amounts and its anomaly or ratio at all available stations.
Since May 2011, new climatological normals for the period from 1981 to 2010 have been used.



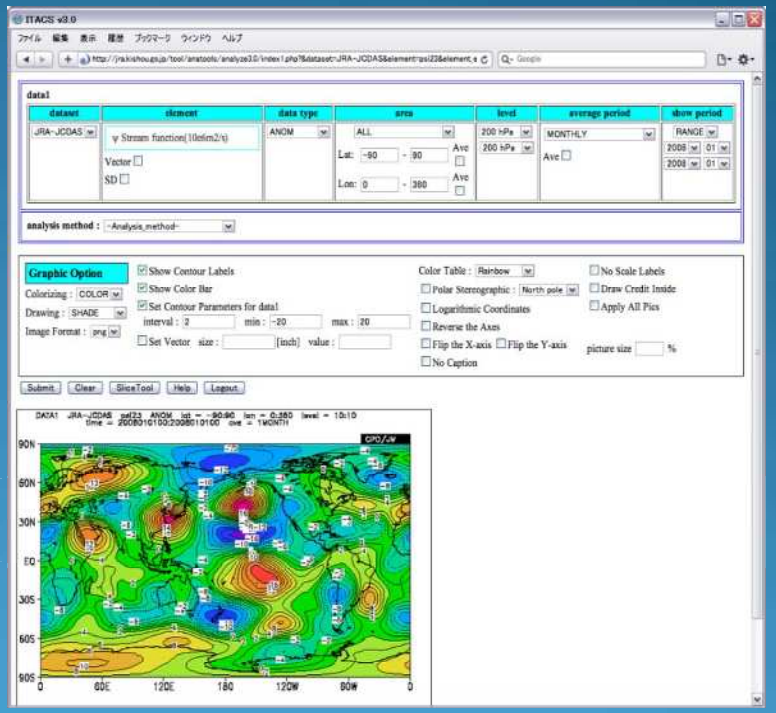
Monthly high, mean and low temperatures and monthly precipitation from Feb. 2011 to Jan. 2012 in Manila

http://ds.data.jma.go.jp/gmd/tcc/climatview/

ITACS : Interactive Tool for Analysis of the Climate System

- A web-based application software for climatological analysis

- A new version (Version 4) has been developed, enabling users to (1) use the JMA's current operational ocean analysis data, (2) set the detailed graphics setting, and (3) download data in binary format, which is compatible to GrADS.

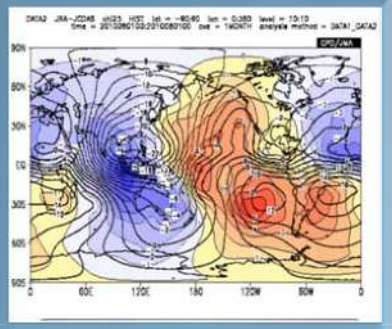


Data

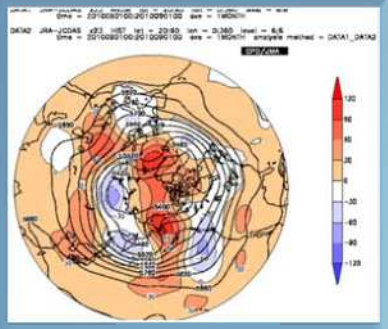
- Japanese 25-year ReAnalysis (JRA25)（1979-2004）
- JMA Climate Data Assimilation System (JCDAS)（2004 - Present)
- Daily Sea Surface Analysis for Climate Monitoring and Predictions (COBE-SST)
- OLR, CLIMAT

http://extreme.kishou.go.jp/tool/itacs-tcc2011/

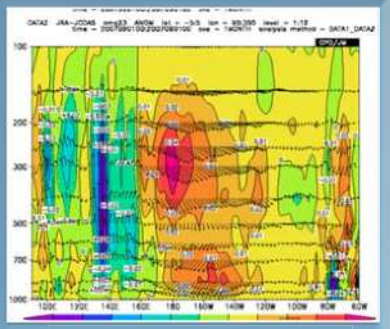
ITACS : Interactive Tool for Analysis of the Climate System (Cont.)



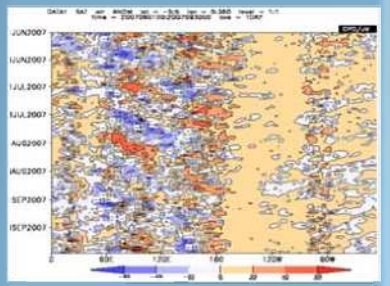
Latitude-Longitude Map



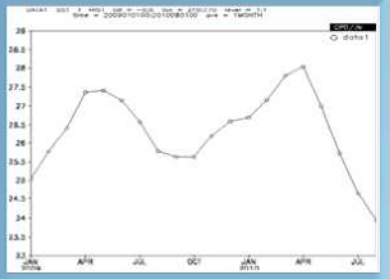
Polar Stereographic Map



Vertical Cross Section



Time-Longitude Cross Section



Time-Series Graph

TCC Reports on Extreme Climate Events (1)

NMHSs are expected to actively contribute to climate risk management, and must issue appropriate information in a timely manner when extreme events occur. Against this background, TCC is committed to assisting NMHSs in fulfilling their roles.

In summer 2011, precipitation over the Indochina Peninsula continued to be above normal from June to September, which caused floods over a wide area in the basins of the Chao Phraya River and the Mekong River. The flood has caused serious damage over the Indochina Peninsula especially in Thailand. On 31 October, 2011, TCC issued a report entitled "Heavy rainfall over the Indochina Peninsula for June – September 2011" on the TCC website.

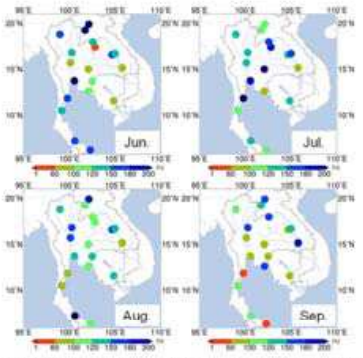


Figure 2 Spatial distributions of monthly precipitation ratio compared to norm
The base period for the normal is 1981 – 2010.

Heavy rainfall over the Indochina Peninsula for June – September 2011

31 October 2011

Tokyo Climate Center, Japan Meteorological Agency

1. Precipitation

In general, the Asian summer monsoon over the Indochina Peninsula lasts from around May to around October, and brings the rainy season. In 2011, precipitation over the Indochina Peninsula continued to be above normal from June to September, which caused floods over a wide area in the basins of the Chao Phraya River and the Mekong River. The flood has caused serious damage over the Indochina Peninsula especially in Thailand.

Four-month total precipitation from June to September 2011 was 120% – 180% of the normal for most meteorological observation stations over the Indochina Peninsula (Figure 1, center). Four-month total precipitation for the period amounts to 921mm (134% of the normal) at Chiang Mai in northern Thailand, 1251mm (140%) at Bangkok (the capital of Thailand), 1641mm (144%) at Vientiane (the capital of Laos) and 835mm (107%) at Phnom-Penh (the capital of Cambodia). It is unusual that heavier-than-normal rainfall continued through the rainy season over the entire area of the basins (Figures 1 and 2).

The heavier-than-normal rainfall over the basin of the Chao Phraya River continued in the first half of October 2011.

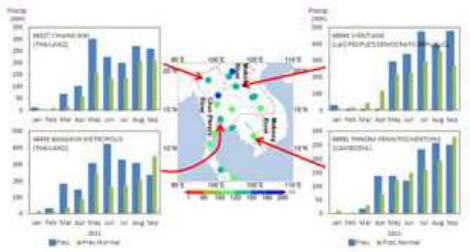


Figure 1 Spatial distribution of four-month precipitation ratio compared to normal (center) and the time series of monthly precipitation at Chiang Mai, Bangkok (Thailand), Vientiane (Laos), and Phnom Penh (Cambodia)
The base period for the normal is 1981 – 2010. "X" in the figure for Vientiane represents that monthly data were not reported.

2. Activity of the Asian summer monsoon

Four-month averaged cumulus convective activity for June – September 2011 was enhanced over 10° – 20°N of South and Southeast Asia (Figure 3), which indicates that the Asian summer monsoon was active. The heavy rainfall over the Indochina Peninsula has likely resulted from the active monsoon.

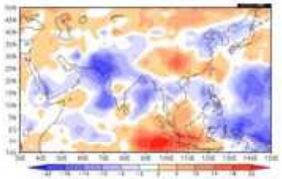


Figure 3 Cumulus convective activity (June – September 2011)
The shading indicates four-month averaged outgoing longwave radiation (OLR) anomaly (W/m^2) for June – September 2011. It can be inferred that negative OLR anomalies (blue-color) show enhanced cumulus convection compared to the normal. The base period for the normal is 1981 – 2010. Original data provided by NOAA.

TCC Reports on Extreme Climate Events (2)

In winter 2012, the Eurasian continent, especially in the mid-latitudes, experienced significantly lower-than-normal temperatures due to strong cold-air inflow.
Temperatures were extremely low from the northern part of East Asia to Central Asia (in and around Mongolia and Kazakhstan) from mid- to late January. The influence of cold air extended to all over Central Asia, such as Uzbekistan and Tajikistan from the beginning of February.

Cold Wave over the Eurasian Continent

6 February 2012
Tokyo Climate Center, Japan Meteorological Agency

1. Overview

Since mid-January 2012, the Eurasian continent, especially in the mid-latitudes, has experienced significantly lower-than-normal temperatures due to strong cold-air inflow (Figure 1). As a result, temperatures have been extremely low from the northern part of East Asia to Central Asia (in and around Mongolia and Kazakhstan) since mid-January, and in Eastern Europe (in and around Ukraine) since the end of January. The influence of cold air has extended to Central to Western Europe as well as to all over Central Asia, such as Uzbekistan and Tajikistan, since the beginning of February.

2. Climatic conditions

Table 1 summarizes weekly extreme climate events from mid-January. Figure 1 shows weekly temperature anomalies from mid-January in the Northern Hemisphere. Figure 2 shows daily temperatures at some meteorological stations in affected countries.

Table 1 Weekly extreme climate events and impacts

Period	Areas	Extreme Climatic Events and impacts
15 – 21 January	In and around Eastern Kazakhstan	Extremely low temperatures - It was reported that more than 40 people were killed in an avalanche/cold wave. (Source: UN Office for the Coordination of Humanitarian Affairs, as of 23 January)
22 – 28 January	From Mongolia to Eastern Kazakhstan	Extremely low temperatures
29 Jan. – 4 Feb.	From Mongolia to Eastern Kazakhstan	Extremely low temperatures
	Eastern Europe	Extremely low temperatures - It was reported that more than 130, 50 and 30 people were killed in Ukraine, Poland and Romania, respectively due to cold wave. (Source: National Governments, as of 5 February)

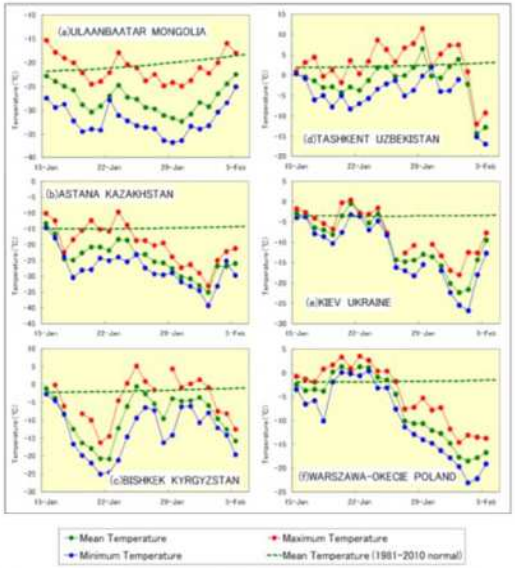


Figure 2 Daily maximum, mean and minimum temperatures (°C) at six stations from 15 January to 5 February 2012 (Based on SYNOP reports)

3. Characteristics of atmospheric circulations

In the middle of January, a high pressure system was enhanced over western Siberia, in association with the large meander of the upper-level westerly jet stream, and significantly cold air mass over central and eastern Siberia flowed into Mongolia and Kazakhstan along the periphery of the high pressure. After that, the high pressure system further developed and expanded over northwestern Russia and northern Europe. In accordance with the westward expansion of the high pressure system, cold air mass around Kazakhstan flowed westward over the southern side of the high pressure and reached eastern and central Europe in early February.

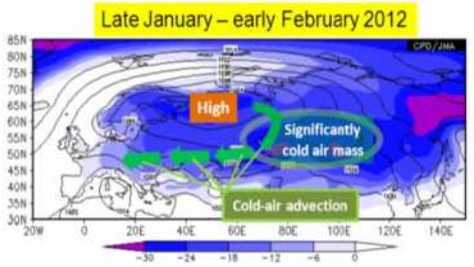
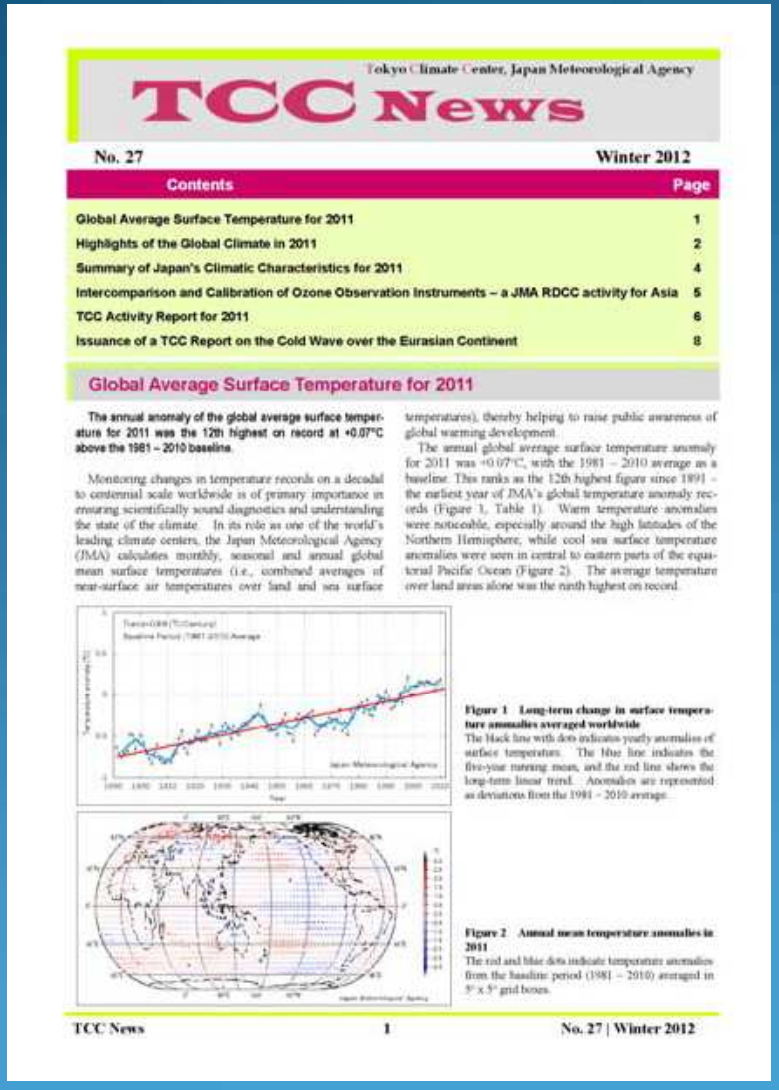


Figure 3 Sea level pressure and surface air temperature (29 January – 4 February)
The contours indicate sea level pressure (hPa), and the cold shading denotes 2 m temperature (°C)

TCC issued a report "Cold Wave over the Eurasian Continent" on 6 February 2012 on its website.
The Center also provided NMHSs in the affected areas with supplementary commentary on the situation as well as information on how to prepare the figures using web-based tools such as ITACS available on the TCC web.

http://ds.data.jma.go.jp/tcc/tcc/news/index.html

TCC News



Tokyo Climate Center, Japan Meteorological Agency

TCC News

No. 27 Winter 2012

Contents Page

Global Average Surface Temperature for 2011

The annual anomaly of the global average surface temperature for 2011 was the 12th highest on record at +0.07°C above the 1981 – 2010 baseline.

Monitoring changes in temperature records on a decadal to centennial scale worldwide is of primary importance in ensuring scientifically sound diagnostics and understanding the state of the climate. In its role as one of the world's leading climate centers, the Japan Meteorological Agency (JMA) calculates monthly, seasonal and annual global mean surface temperatures (i.e., combined averages of near-surface air temperatures over land and sea surface temperatures), thereby helping to raise public awareness of global warming development.

The annual global average surface temperature anomaly for 2011 was +0.07°C, with the 1981 – 2010 average as a baseline. This ranks as the 12th highest figure since 1891 – the earliest year of JMA's global temperature anomaly records (Figure 1, Table 1). Warm temperature anomalies were noticeable, especially around the high latitudes of the Northern Hemisphere, while cool sea surface temperature anomalies were seen in central to eastern parts of the equatorial Pacific Ocean (Figure 2). The average temperature over land areas alone was the ninth highest on record.

Figure 1 Long-term change in surface temperature anomalies averaged worldwide
The black line with dots indicates yearly anomalies of surface temperature. The blue line indicates the five-year running mean, and the red line shows the long-term linear trend. Anomalies are represented as deviations from the 1981 – 2010 average.

Figure 2 Annual mean temperature anomalies in 2011
The red and blue dots indicate temperature anomalies from the baseline period (1981 – 2010) averaged in 5° x 5° grid boxes.

TCC News 1 No. 27 | Winter 2012

- TCC news is a quarterly newsletter issued in February, May, August and November containing articles on the latest climate information (significant climate events, seasonal outlook…..), introduction of TCC's new products and relevant activity.
- The latest issue (No. 27) is now available.

http://ds.data.jma.go.jp/tcc/tcc/news/index.html

3. Capacity building activities

TCC's Annual Training Seminar

TCC puts emphasis on capacity-building activities through annual training seminars focusing on operational climate services. The topic of the seminar changes from year to year, depending on requirements from NMHSs and TCC's progress in climate and analysis capabilities, such as the introduction of upgraded climate models.

	Theme	Participants
Nov. 2008	Climate Information and Forecasting	13: China, Hong Kong, India, Indonesia, Iran, Korea (2), Lao, Malaysia, Mongolia, Philippines, Thailand, Viet Nam
Dec. 2009	Climate Analysis using Reanalysis Data	11: Bangladesh, Indonesia, Laos, Malaysia, Mongolia, Pakistan, Papua New Guinea, Philippines, Sri Lanka, Thailand, Viet Nam
Jan. 2011	Application of Seasonal Forecast Gridded Data to Seasonal Forecast Products	19: Bangladesh, Hong Kong, Indonesia, Kazakhstan, Laos, Malaysia, Maldives, Myanmar, Nepal, Pakistan, Philippines (2), Qatar, Singapore, Sri Lanka, Thailand, Uzbekistan, Viet Nam
Nov. 2011	One-month Forecast Products	13: Bangladesh, Cambodia, Hong Kong, Indonesia, Laos, Malaysia, Mongolia, Myanmar, Pakistan, Philippines, Sri Lanka, Thailand, Viet Nam

TCC's Annual Training Seminar

Materials and presentations of past training seminars are available on the TCC website.

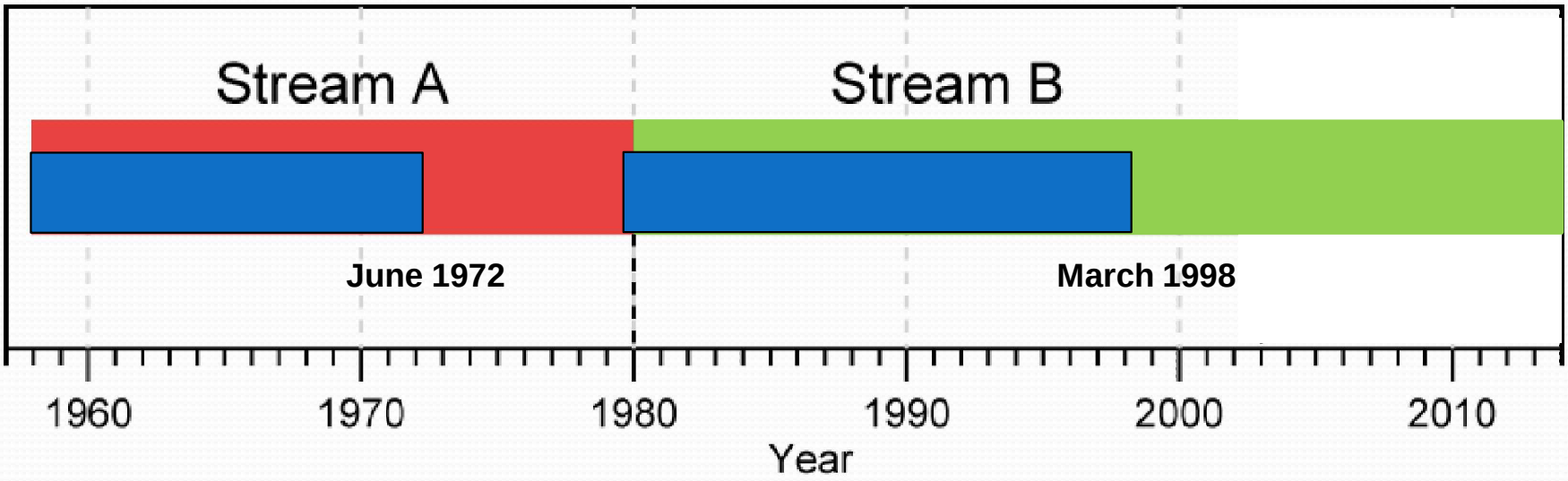
This year's training seminar will be held in autumn in the JMA Headquarters. Detailed information will be provided in due course.

4. JRA-55

JRA-55 Reanalysis system

	JRA-25	**JRA-55**
Reanalysis years	1979-2004 (26 years)	**1958-2012 (55 years)**
Equivalent operational NWP system	As of Mar. 2004	**As of Dec. 2009**
Resolution	T106L40 (~120km) *(top layer at 0.4 hPa)*	**TL319L60 (~60km)** ***(top layer at 0.1 hPa)***
Time integration	Eularian	**Semi-Lagrangian**
Assimilation scheme	3D-Var	**4D-Var** ***(with T106 inner model)***
Bias correction (satellite radiance)	Adaptive method (Sakamoto et al. 2009)	**Variational Bias Correction (Dee et al. 2009)**
Tropical Cyclone	Wind profile retrievals (TCRs) provided by Dr.Fiorino were assimilated.	**Same as JRA-25**

JRA-55 progress status

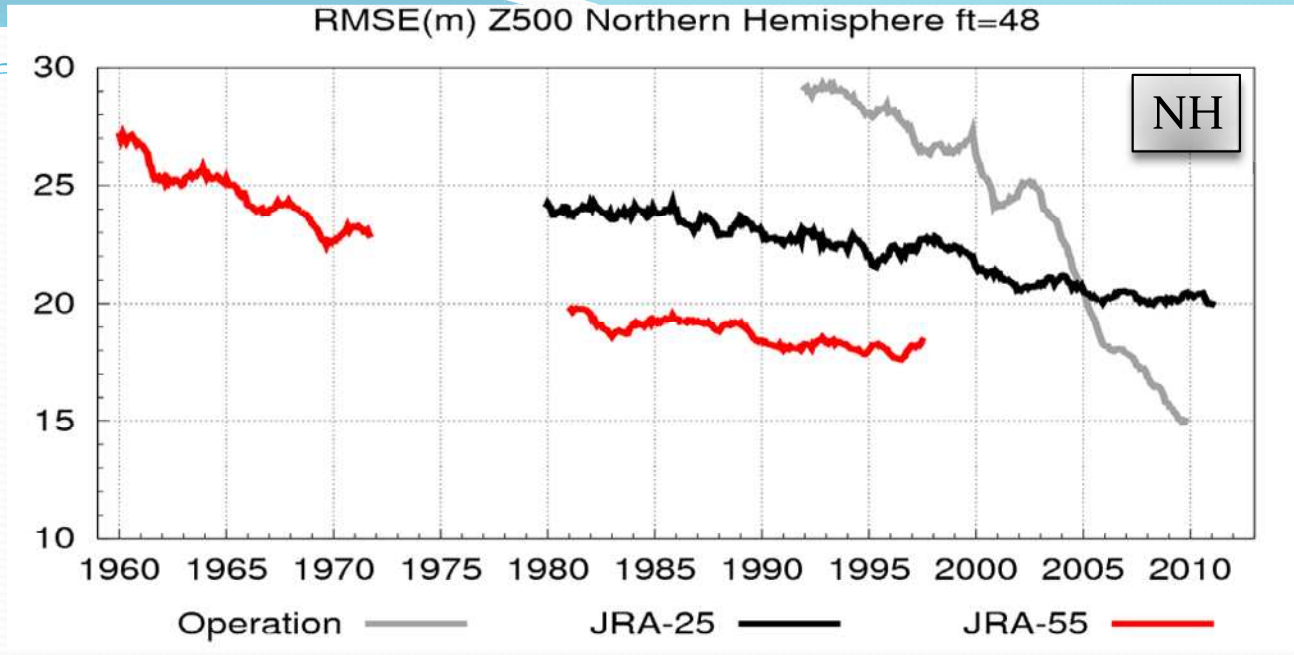


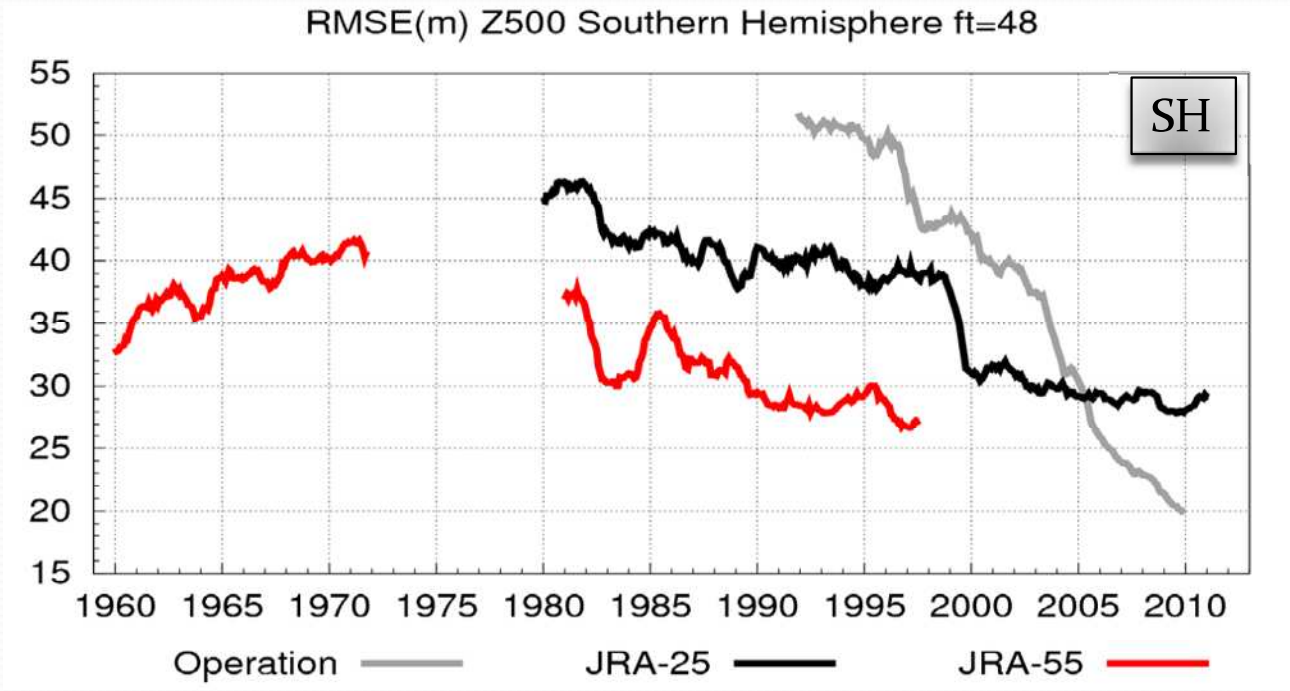
Completed as of 2 April, 2012

JRA-55 will be completed in the first half of 2013.

Comparison of Forecast Scores

RMSE of Z500 for NH and SH





Thank you for your attention.

Supplementary slides

Long Range Forecast Products on the TCC website (1)

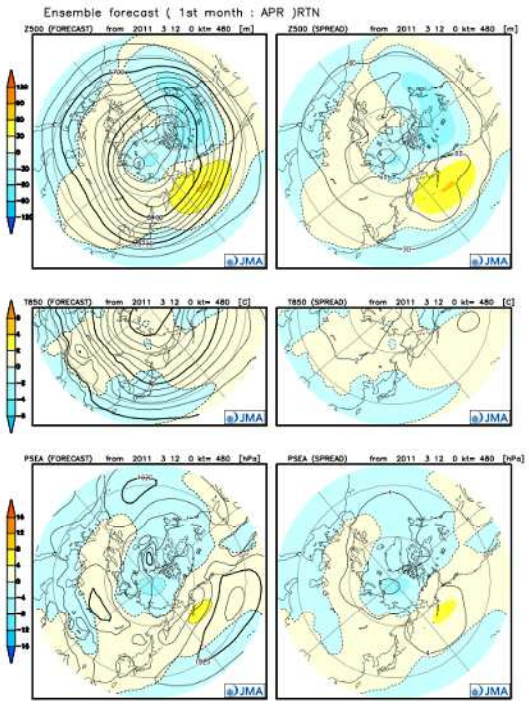
forecast map

forecast period
the first month
initial date
2011.03.12.00Z

coresponding verification

[FORECAST](left figures)
top : Contours show 500hPa height in an interval of 60m.
middle : Contours show 850hPa temperature in an interval of 3C.
bottom : Contours show sea level pressure in an interval of 4hPa.
(Shaded pattern show anomalies.)

[SPREAD](right figures)
top : Contours show spread of 500hPa height in an interval of 30m.
middle : Contours show spread of 850hPa temperature in an interval of 2C.
bottom : Contours show spread of sea level pressure in an interval of 4hPa.
(Shaded pattern show anomalies.)



Forecast map

Forecast and verification maps for one-month, three-month and warm/cold season forecasts are available.

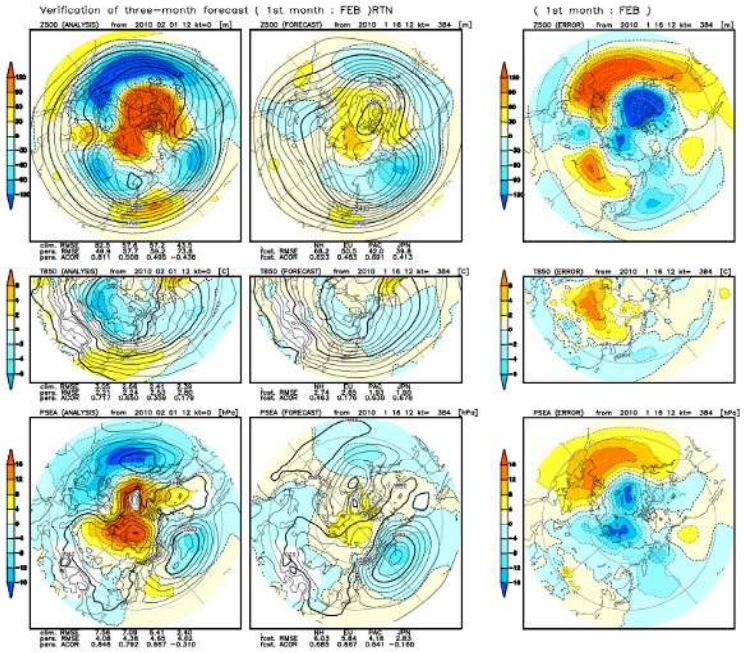
th forecast for each forecast

show anomalies.)
errors.)

f 60m.
interval of 3C.
bottom : Contours show sea level pressure in an interval of 4hPa.

ACOR : anomally correration
RMSE : root mean square error
fcst : ensemble mean forecast
clim : climate forecast
pers : persistency forecast

NH : 0-360,20N-90N
EU : 0-180,20N-90N
PAC : 90E-90W,20N-90N
JAP : 100E-170E,20N-60N

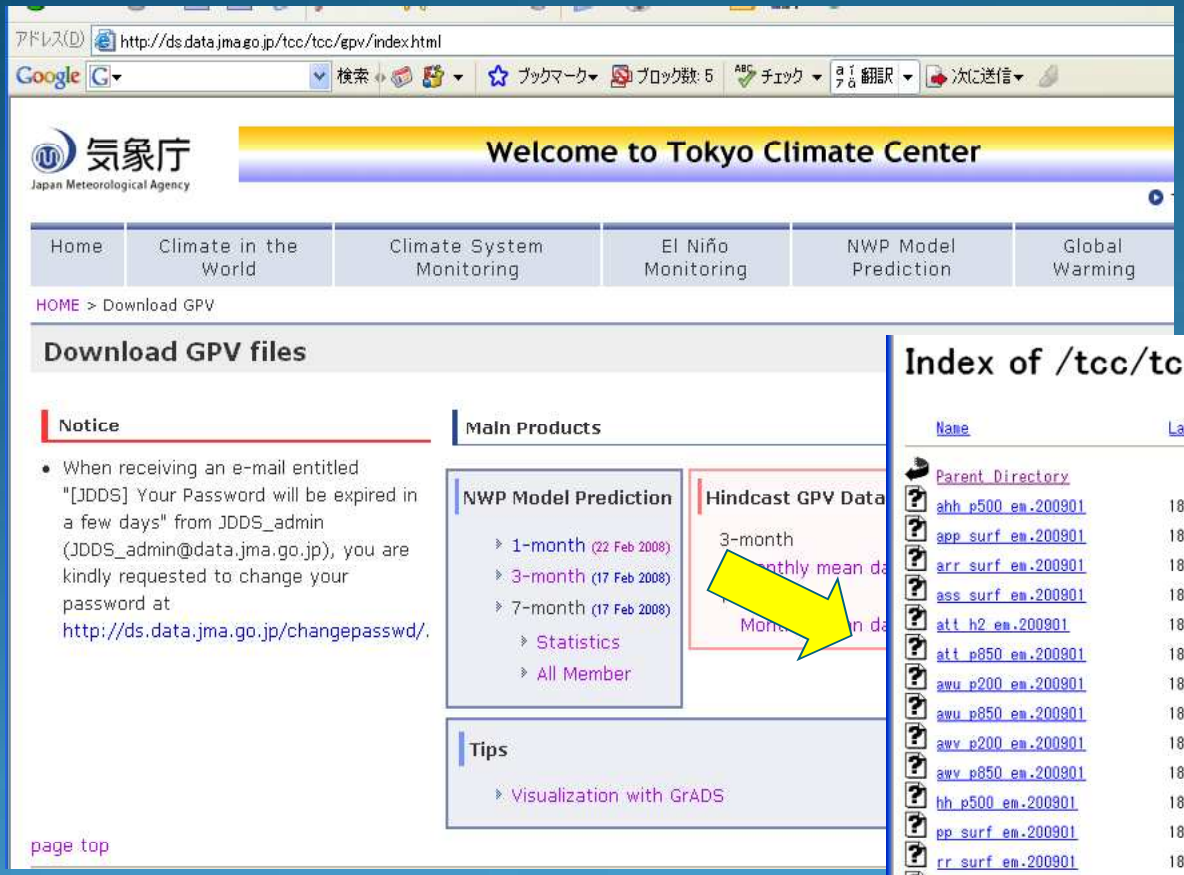


Verification map

Update interval
One-month Forecast: Every Friday
Three-month Forecast: Every month
Warm season Forecast: Feb., Mar. and Apr.
Cold season Forecast: Sep. and Oct.

http://ds.data.jma.go.jp/tcc/tcc/products/model/index.html

Long Range Forecast Products on the TCC website (2)

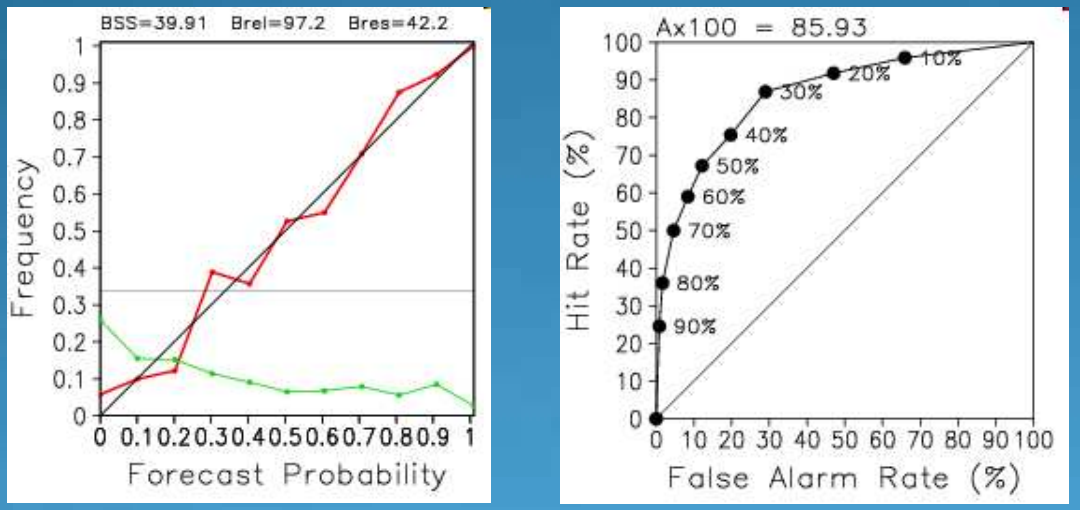


Registered users (NMHSs) can download and LRF products. Format: GRIB2.

http://ds.data.jma.go.jp/tcc/tcc/gpv/index.html

Verification of RCC quantitative LRF products, including the exchange of basic forecasts and hindcast data

TCC provides verification results (e.g., SVS LRF scores, Brier Skill Scores, ROC, Hit Rate Skill Score) and hindcast data for several elements including 2-m temperature and total precipitation. Whenever an LRF system is updated, a set of hindcasts is implemented and verification datasets are distributed.



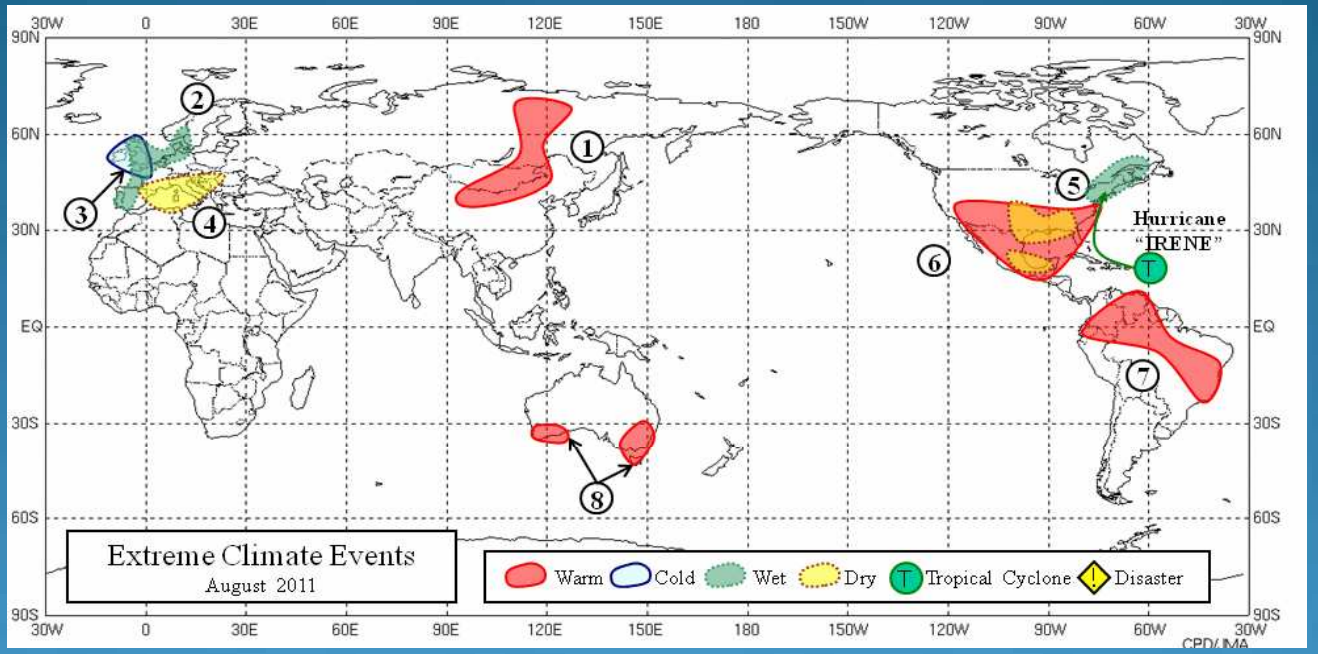
Verification results (Brier Skill Score (left) and ROC (right)) for 2m mean temperature

http://ds.data.jma.go.jp/tcc/tcc/products/model/verif/1mE/index.html

Climate Monitoring

Weekly, Monthly, Seasonal and Annual Temperature/Precipitation
Hazardous Climatic Events (Flood/Drought/Tropical Cyclone)

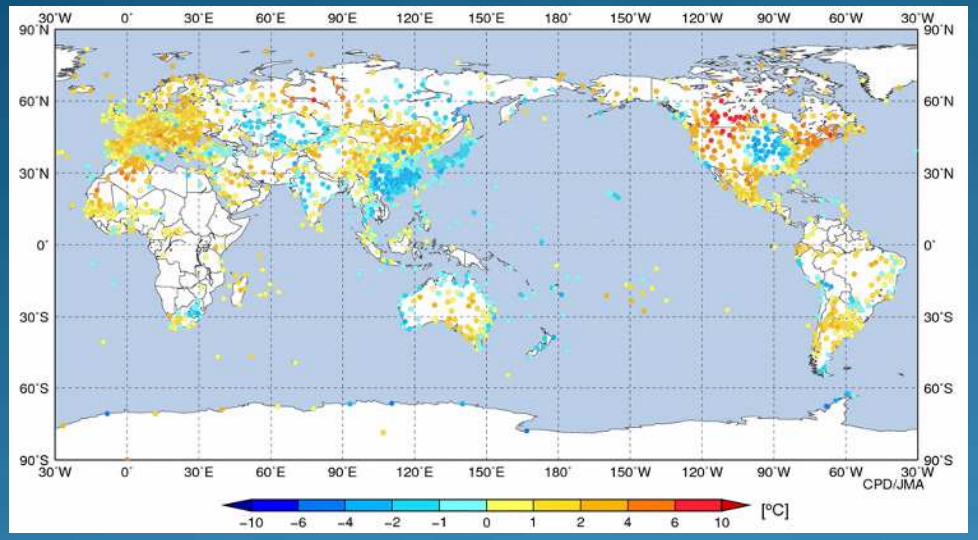
Distribution of Monthly Extreme Climate (August 2011)

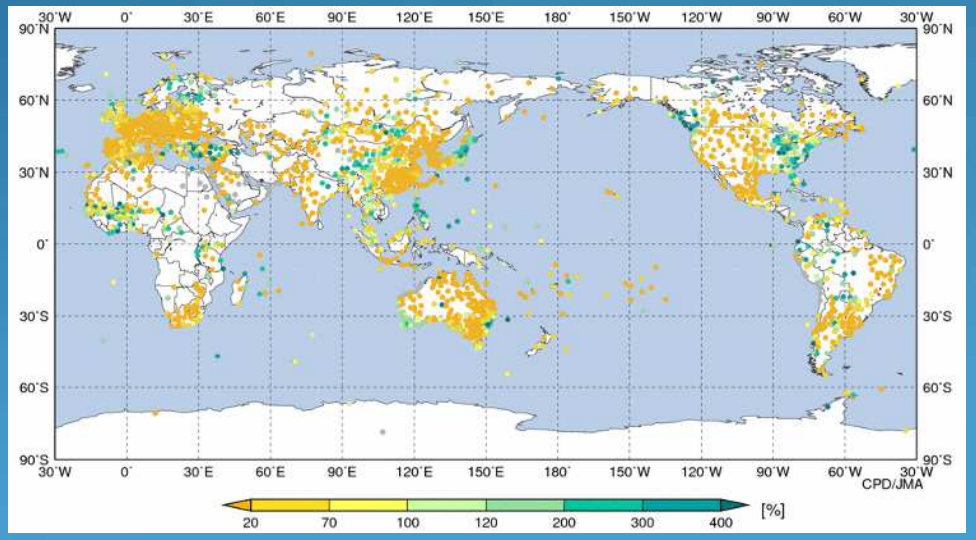


1. High temp. from central Siberia to northern China
2. Heavy prec. in western Europe
3. Low temp. around the UK
4. Light prec. in southern Europe
5. Heavy prec. in the northeastern USA
6. High temp. and light prec. from the southern USA to Mexico
7. High temp. in northern South America
8. High temp. in southeastern and southwestern Australia

http://ds.data.jma.go.jp/tcc/tcc/products/climate/index.html

Climate Monitoring

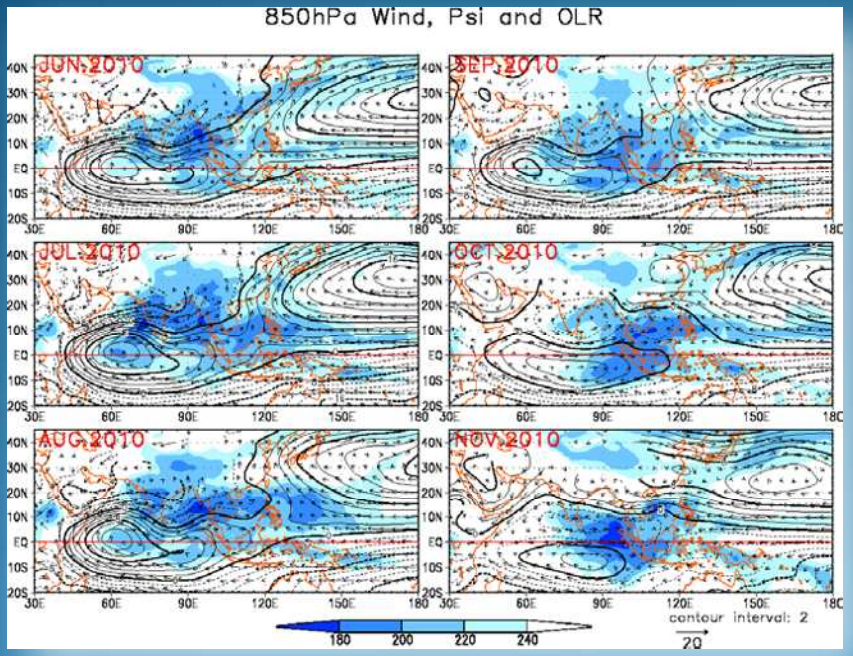


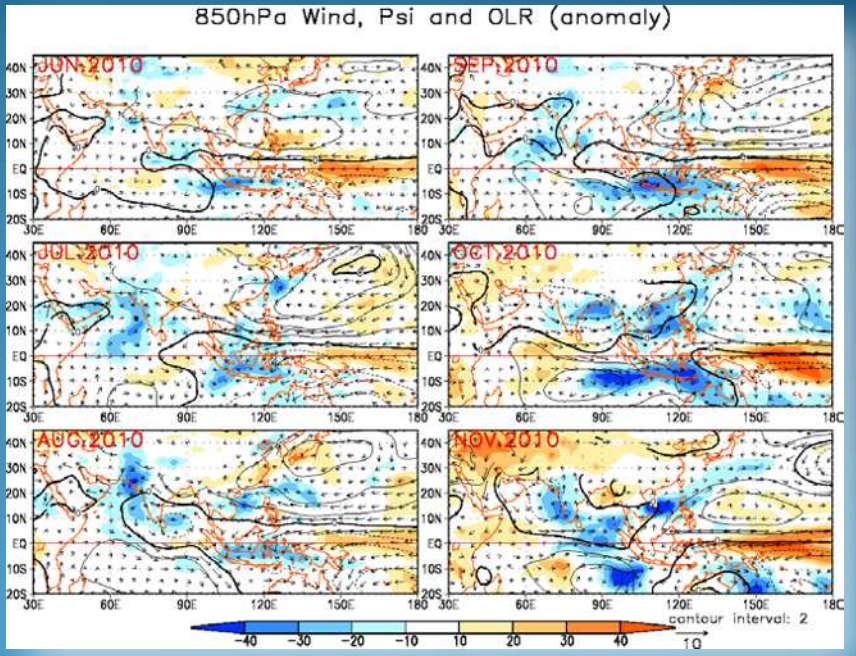


Weekly Temperature Anomaly (top) and Precipitation Ratio (bottom) (21 – 27 September 2011)

http://ds.data.jma.go.jp/tcc/tcc/products/climate/index.html

Asian Monsoon Monitoring





For monitoring Asian Monsoon, TCC provides monthly mean and anomaly of Stream Function, Wind and OLR in the 850hPa height field.

http://ds.data.jma.go.jp/tcc/tcc/products/clisys/ASIA_TCC/map1_mon.html

Climate System Monitoring

Atm
Trop
Sea
Snov

⇒

15 September, 2011 — Japan Meteorological Agency

Monthly Highlights on Climate System (August 2011)

Highlights in August 2011
- The monthly mean temperature in northern Japan were above normal.
- Monthly mean temperatures were extremely high and monthly precipitation amounts were extremely light from the southern USA to Mexico.
- Wave trains were observed from the Atlantic to northern Eurasia.
- Convective activity was enhanced over the western Pacific, the Arabian Sea and the Caribbean Sea.
- Remarkable SST anomalies were scarcely seen in the equatorial Pacific.

Climate in Japan

The monthly mean temperature in northern Japan was above normal (Fig. 1). The subtropical high near Japan significantly varied in its strength, causing large fluctuation of temperatures in northern and eastern Japan. The monthly precipitation amount on the Sea of Japan side of western Japan was above normal mainly due to fronts and moist air flow.

World Climate

The monthly anomaly of the global average surface temperature in August 2011 (i.e., the average of the near-surface air temperature over land and the SST) was +0.13 °C (8th warmest since 1891) (Fig. 2). On a longer time scale, global average surface temperatures have risen at a rate of about 0.62°C per century. Extreme climate events are as follows (Fig. 3).

- Monthly mean temperatures were extremely high from central Siberia to northern China.
- Monthly mean temperatures were extremely high, and monthly precipitation amounts were extremely light from the southern USA to Mexico. Monthly mean temperatures in the southwestern and southern USA were the warmest for August on record, according to the NOAA.
- Monthly mean temperatures were extremely high in northern South America.

country.

Tropics

Convective activity was enhanced over the western Pacific, from the western Indian Ocean to the Arabian Sea, over the Bay of Bengal and around the Caribbean Sea, while it was suppressed over the central Pacific (Fig. 6). In the second half of the month, the active phase of an equatorial intraseasonal oscillation propagated eastward across the Indian Ocean (Fig. 7). Across the central equatorial Pacific, easterly and westerly winds were stronger than normal in the lower and upper troposphere, respectively (Fig. 7). In the upper troposphere, anti-cyclones from the eastern Pacific to the Atlantic were pronounced (Fig. 8). The Southern Oscillation Index value was +0.5 (Fig. 10).

Oceanographic Conditions

Remarkable SST anomalies were scarcely seen in the equatorial Pacific in August (Fig. 9). The monthly mean SST anomaly and the deviation from the latest sliding 30-year mean SST in the NINO.3 region were -0.4°C (Fig. 10). In the North Pacific, remarkably positive SST anomalies were observed around 45°N, 160°W and near the Kamchatka. Remarkably negative SST anomalies were seen in the eastern Bering Sea, around the western coast of the USA and Mexico, to the west of Mexico, and to the south of

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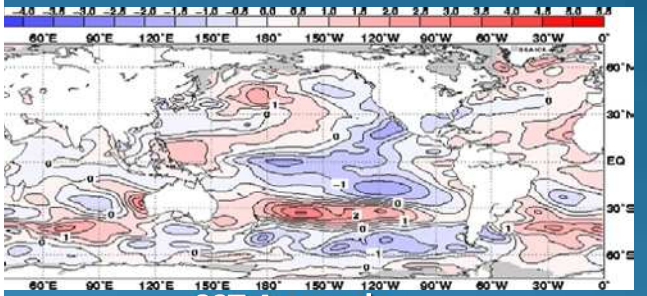
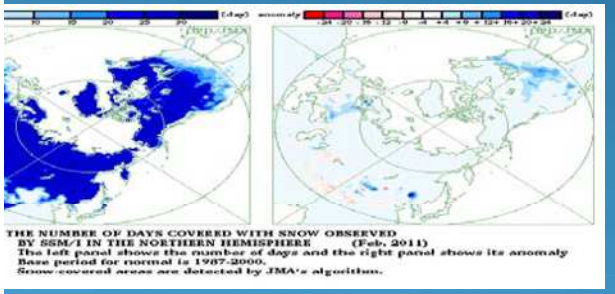
M/I)



SST Anomaly

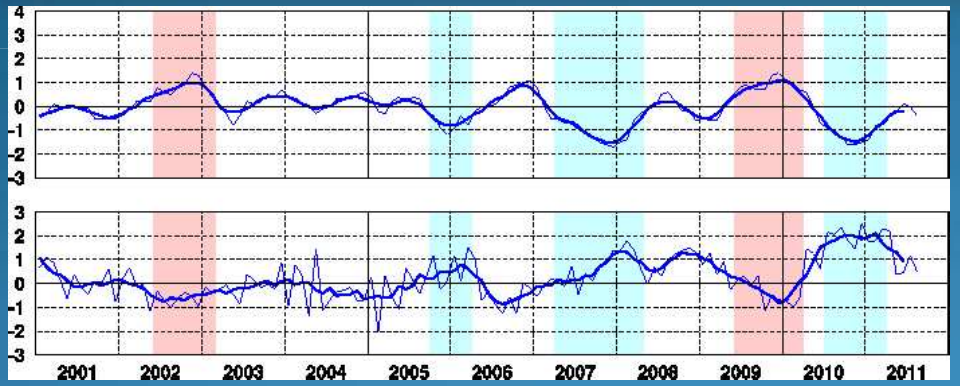


ber of days covered with snow observed by SSM/I (left) and its anomaly (right)

http://ds.data.jma.go.jp/tcc/tcc/products/clisys/highlights/index.html

El Niño Monitoring and Outlook

JMA's El Niño Monitoring Areas

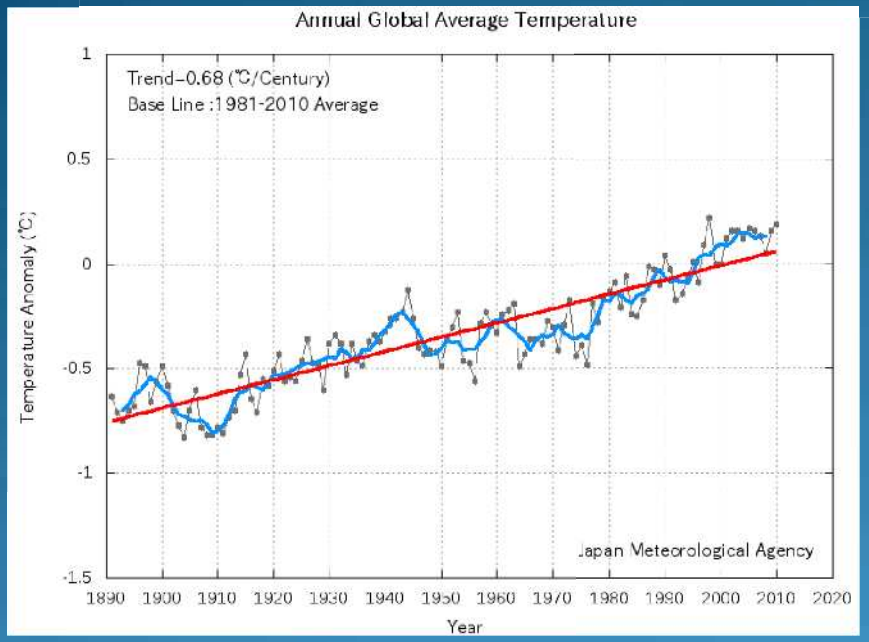


Time series of sea surface temperature deviations from the climatological mean based on a sliding 30-year period for NINO.3 and SOI

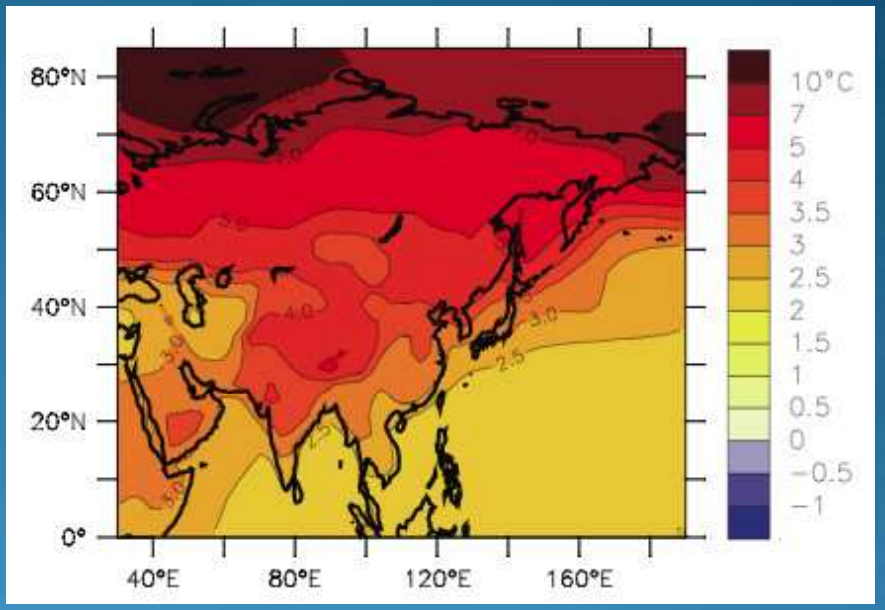
Outlook of sea surface temperature anomalies for NINO.3 until March 2012

http://ds.data.jma.go.jp/tcc/tcc/products/elnino/index.html

Global Warming Monitoring and Projection



Annual anomalies of surface temperature averaged over the globe
(Base period for the normal: 1981- 2010)



Projection of warming in winter (December-February) for scenario A1B for the period 2080 - 2099 relative to the period 1980 - 1999 conducted using 21 climate models (used the report of working group I to the IPCC Fourth Assessment Report)

http://ds.data.jma.go.jp/tcc/tcc/products/gwp/gwp.html