A Network System For Monitoring And Predicting ENSO Event And Sea Temperature Structure Of Warm Pool In The Western Pacific Ocean

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Beijing 100081, China

→ Supported By:

APN project 99012, project 2000-12 and project 2001-12 during 1999-2001

→ Contributors:

China, Japan, Australia, Korea, USA, Philippines, Indonesia, Malaysia, VietNam, and Hong Kong

η Background γ

Numerous investigators have shown that ENSO cycles (consisting of El Nino and La Nina phases) have significant relations with and impacts on climate, environment, and socio-economic aspects in the Asian and western Pacific countries and regions, such as Indonesia, Philippines, Malaysia, Vietnam, Thailand, Australia, Japan, Korea and China. It may cause droughts, floods, cold injuries, heat waves, landfall of typhoons as well as forest fires in the Asian and Pacific region, thus bringing about huge socio-economic losses and deterioration of environment to these regions.

(To be continued)

η Background γ

For instance, recent statistics data have shown that due to the effect of 1997/1998 El Nino event, global and regional climate changed abnormally, and large-scale severe natural disasters caused 4,829,884 persons to be homeless and direct economic losses up to US$33.9 billions.

(To be continued)

η Background γ

It has been found that there are some definite correlative relationships between the onset, maturity and decay of ENSO, and precipitation patterns, activity of tropical cyclones the intensity of winter and summer monsoon over Asia.

(To be continued)

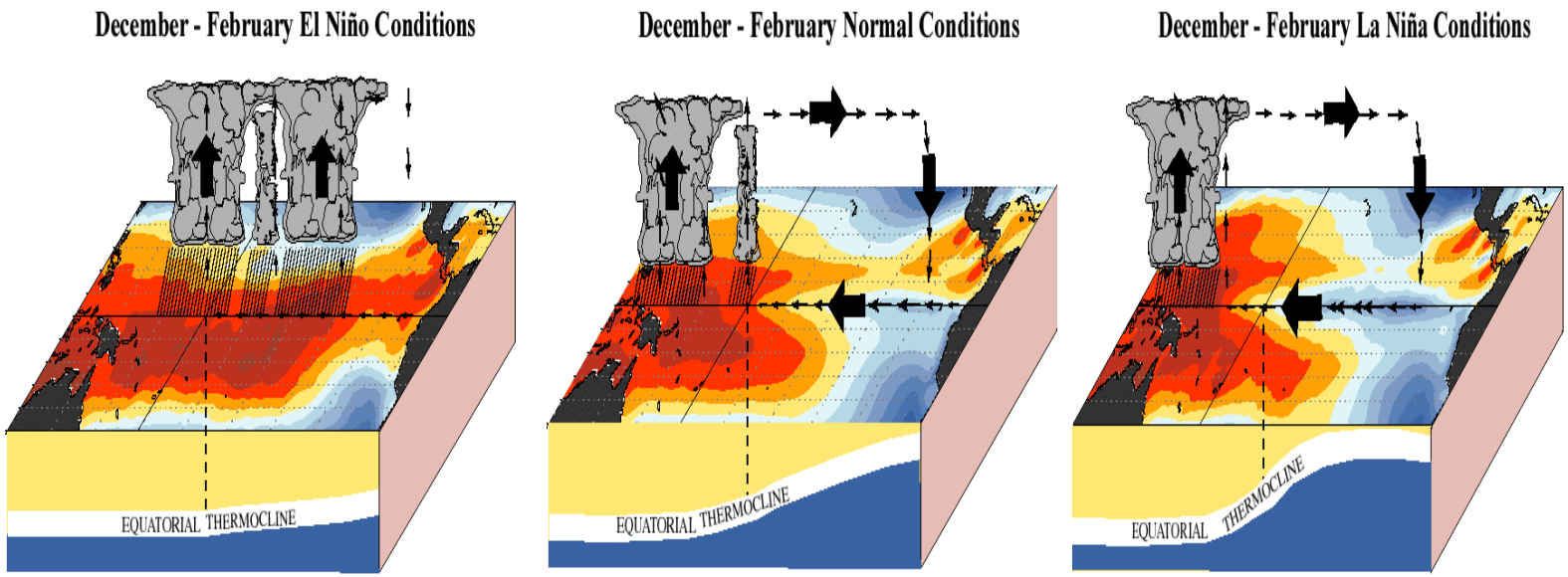
η Background γ

On the other hand, the sea surface temperature anomaly (SSTA) in the western Pacific Ocean may exert a teleconnection effect on the weather and climate in East Asia through PJ (Pacific–Japan) pattern or Walker circulation. The thermal regime of the warm pool and the convection activity in the region around Philippines play important roles in affecting the seasonal and interannual variability of the East Asian summer monsoon.

(To be continued)

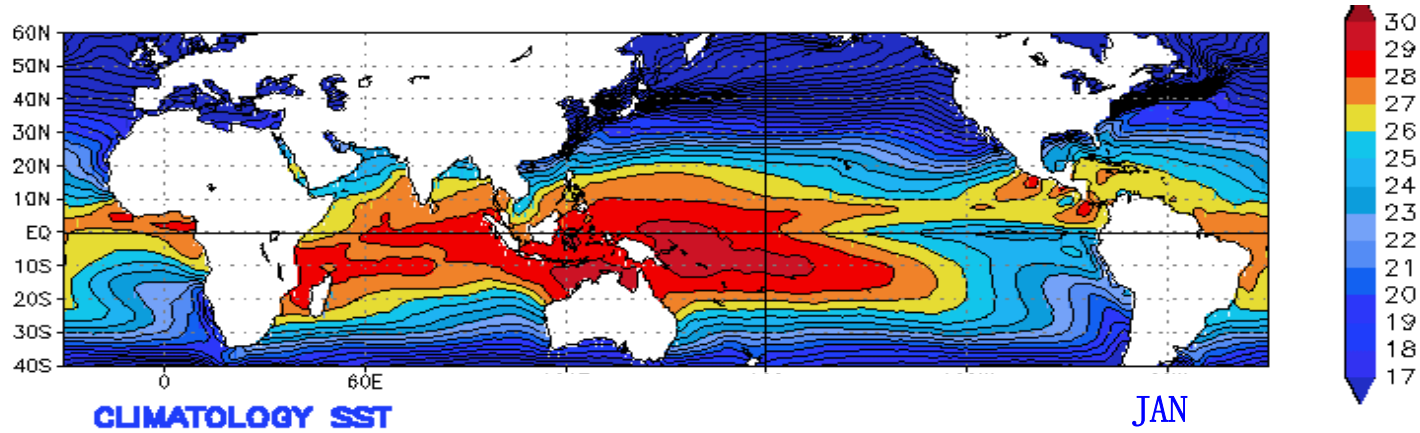
η Background γ

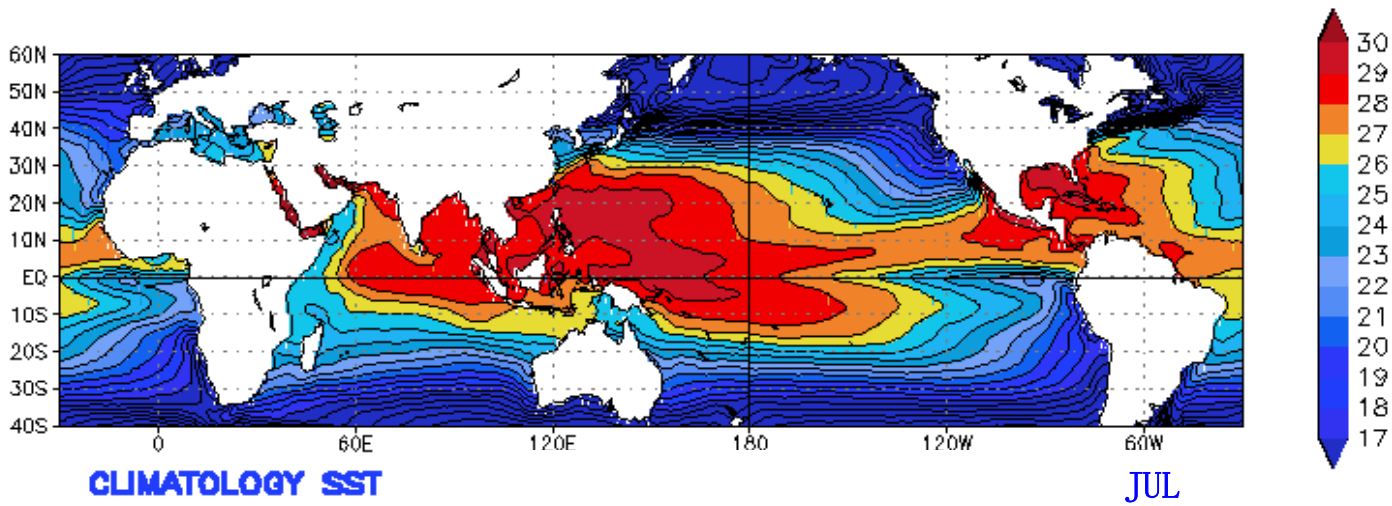
Therefore, from the unique regional view-point, it is an urgent task to set up a network system for monitoring and predicting sea temperature of the warm pool in the western Pacific Ocean and its relationship to the summer monsoon activity. It is very necessary to improve our understanding and knowledge in these fields and very essential to enhance the monitoring and prediction of ENSO events and SSTA on the warm pool over the western Pacific Ocean at the seasonal and interannual time scales with necessary related information, products and data sets distributed to APN countries/regions via an Internet network, thus leading to improvement of seasonal and interannual prediction of monsoon activity and significant climate events in this region.



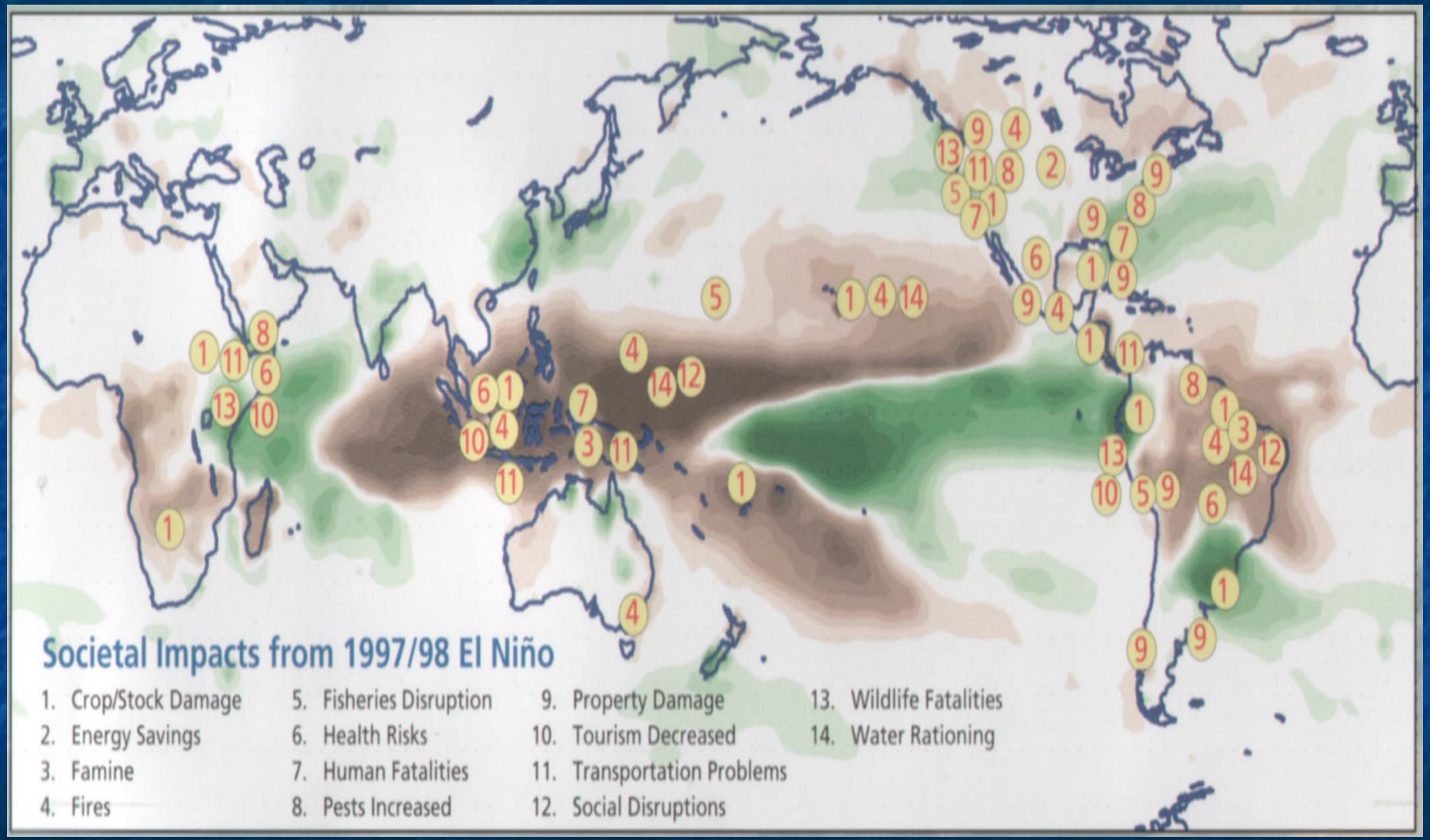
(left) El NIÑO-related winds, equatorial Walker circulation, and subsurface ocean structure;
(middle) Mean tropical Pacific rainfall, winds, and subsurface ocean structure;
(right) LA NIÑA-related winds, equatorial Walker circulation, and subsurface ocean structure

The Warm Pool Of The Western Pacific Ocean

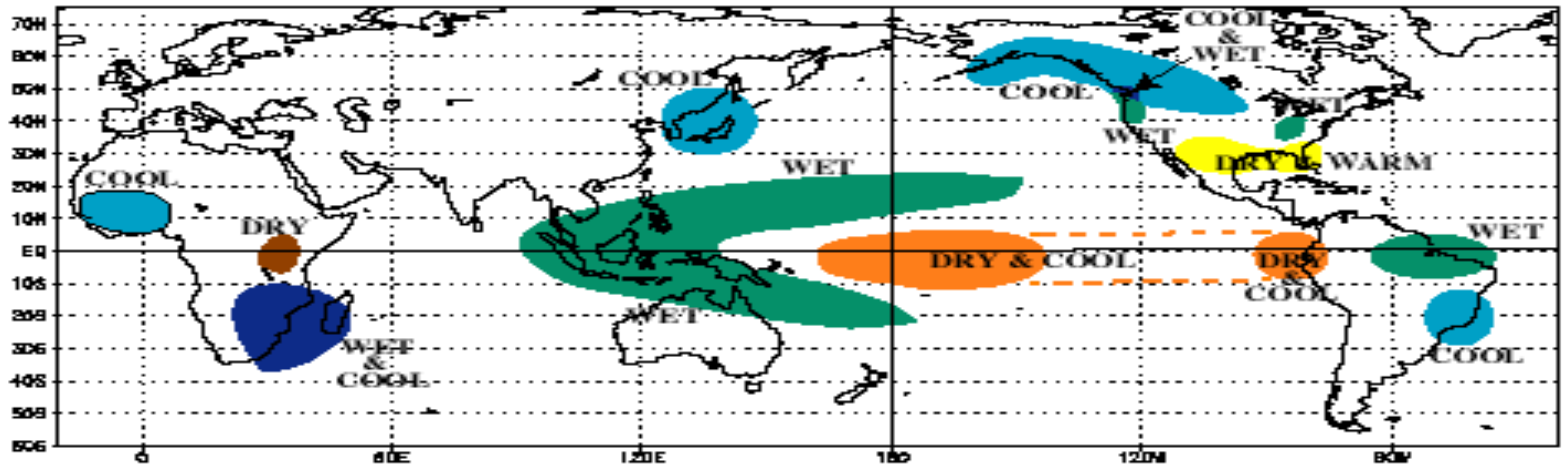




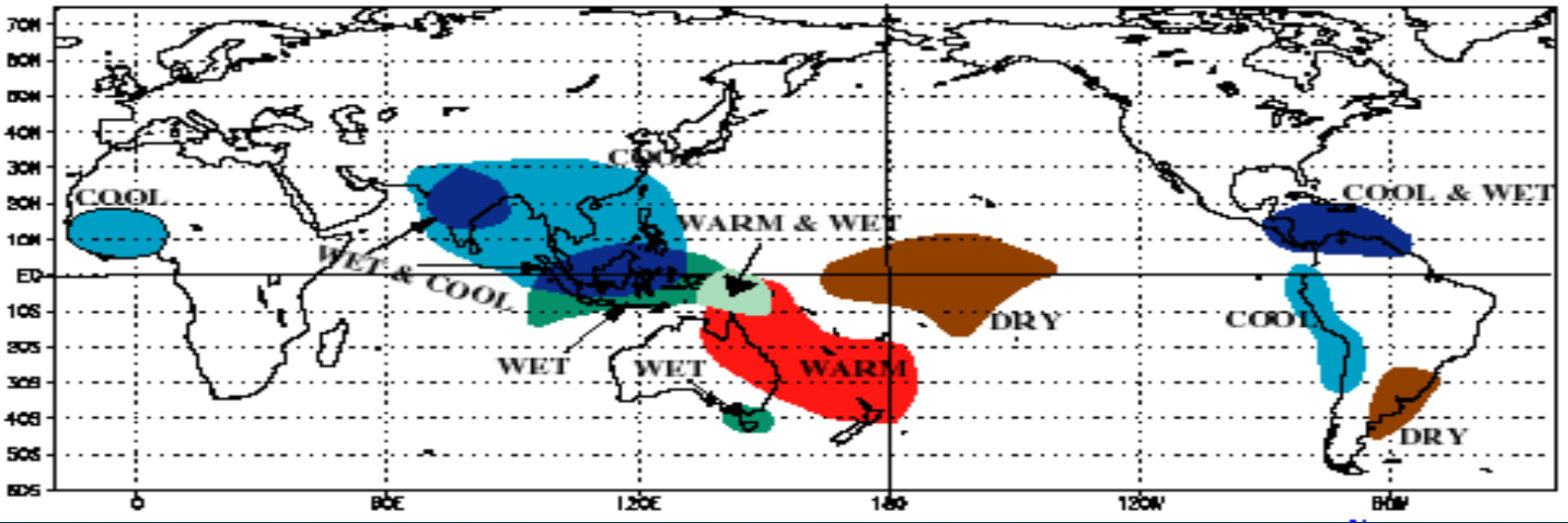
Long-term Mean SST


Societal Impacts from 1997/98 El Niño
1. Crop/Stock Damage
2. Energy Savings
3. Famine
4. Fires
5. Fisheries Disruption
6. Health Risks
7. Human Fatalities
8. Pests Increased
9. Property Damage
10. Tourism Decreased
11. Transportation Problems
12. Social Disruptions
13. Wildlife Fatalities
14. Water Rationing

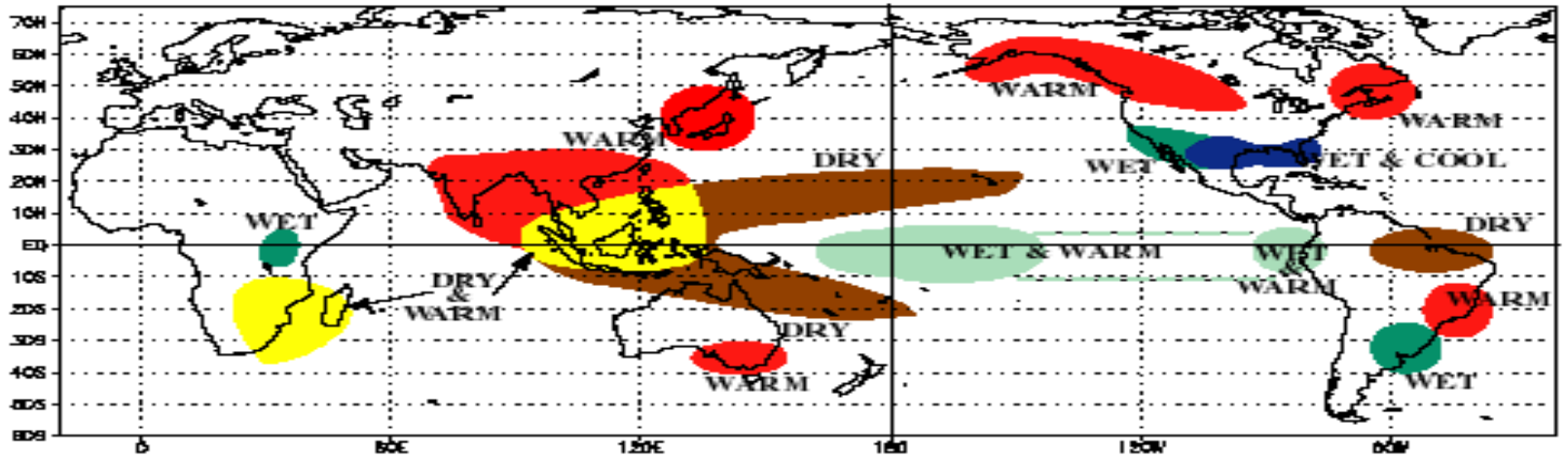
COLD EPISODE RELATIONSHIPS DECEMBER - FEBRUARY



COLD EPISODE RELATIONSHIPS JUNE - AUGUST



WARM EPISODE RELATIONSHIPS DECEMBER - FEBRUARY



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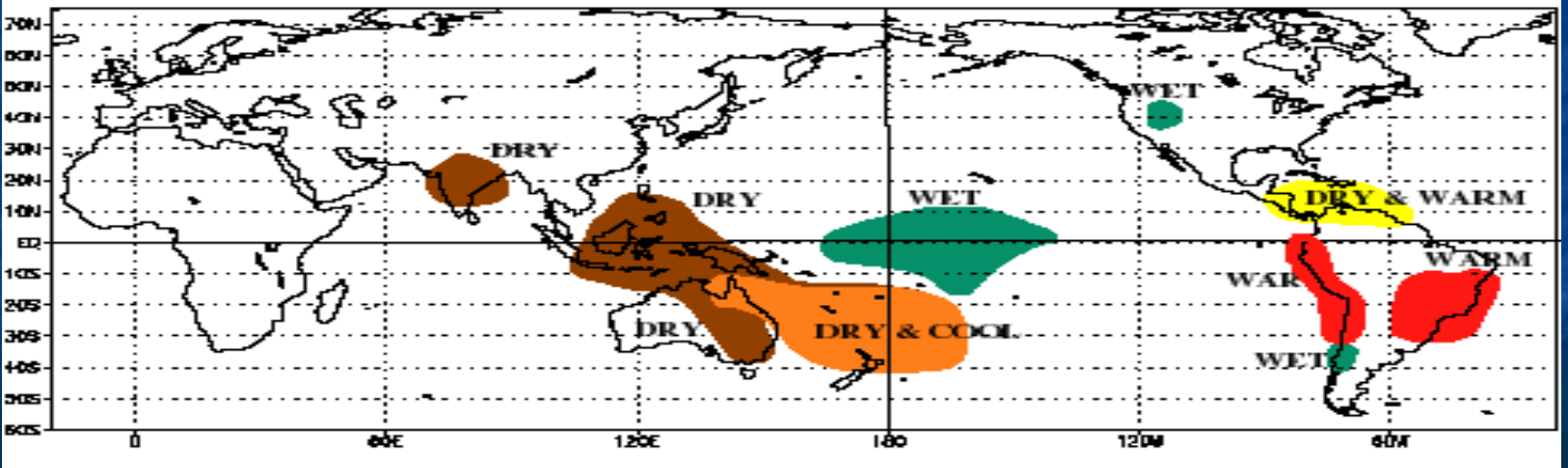
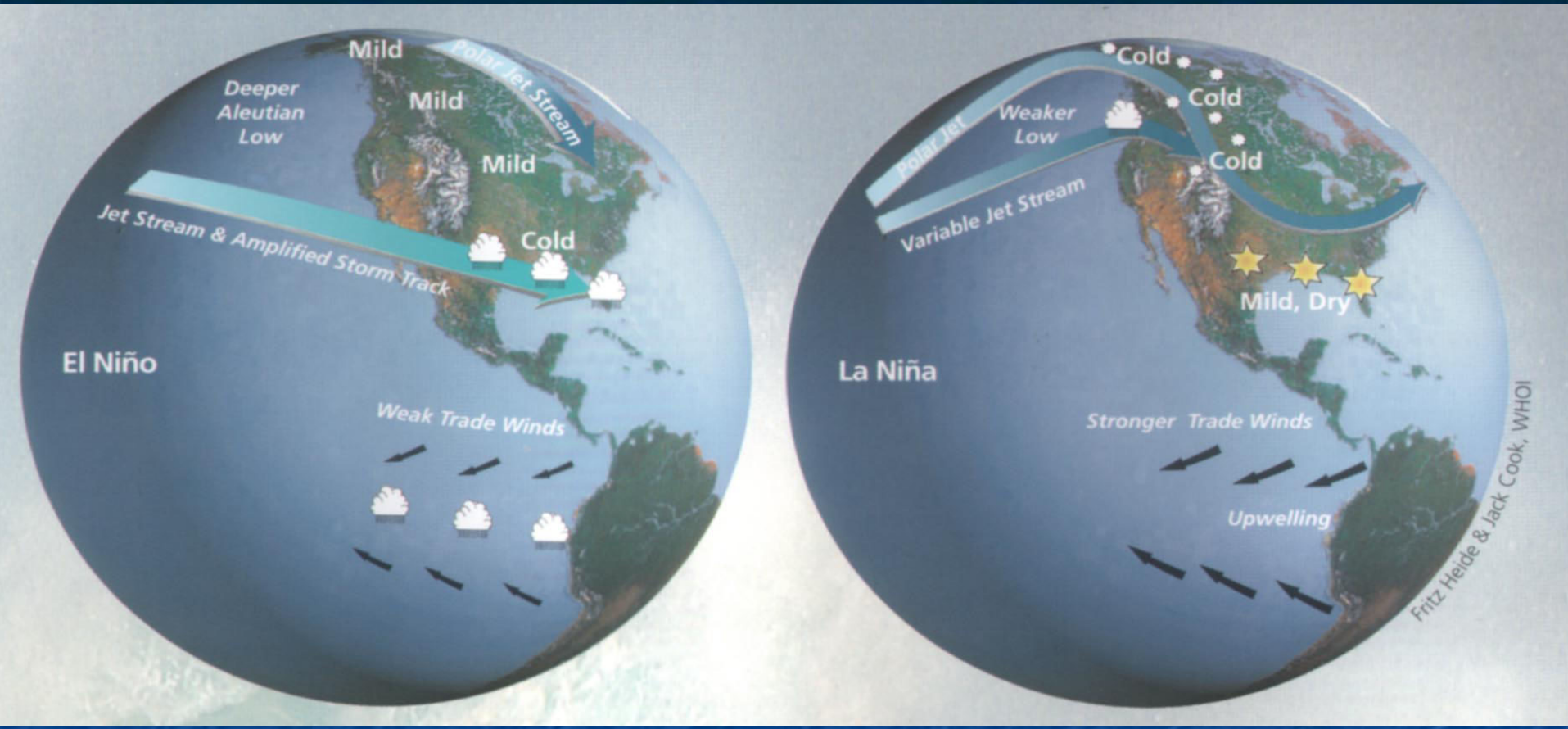
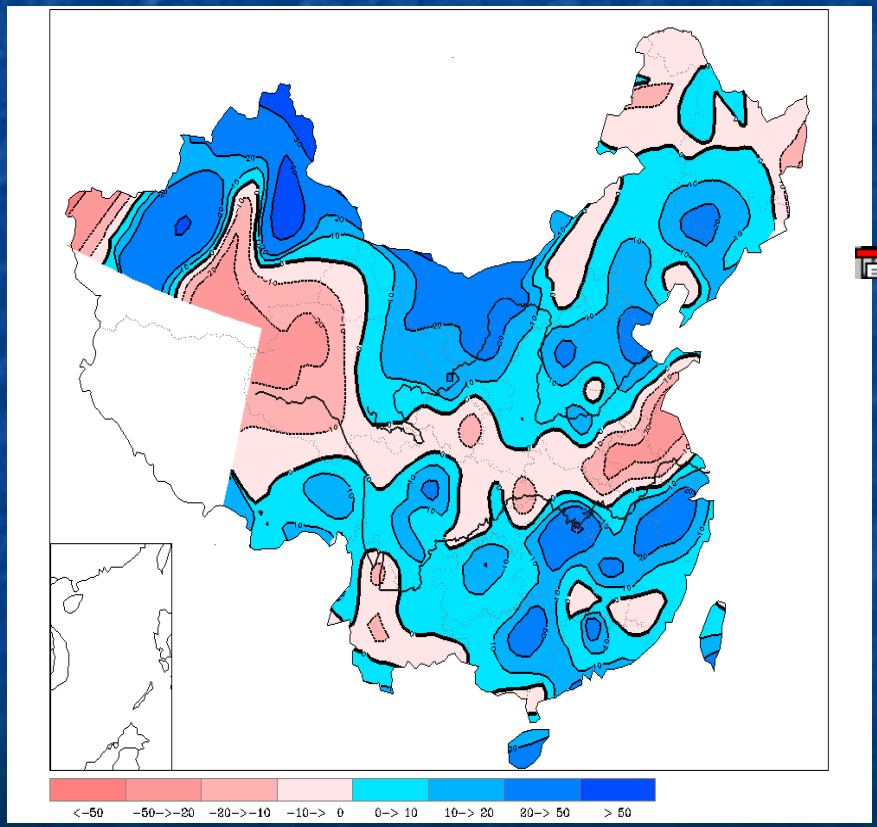




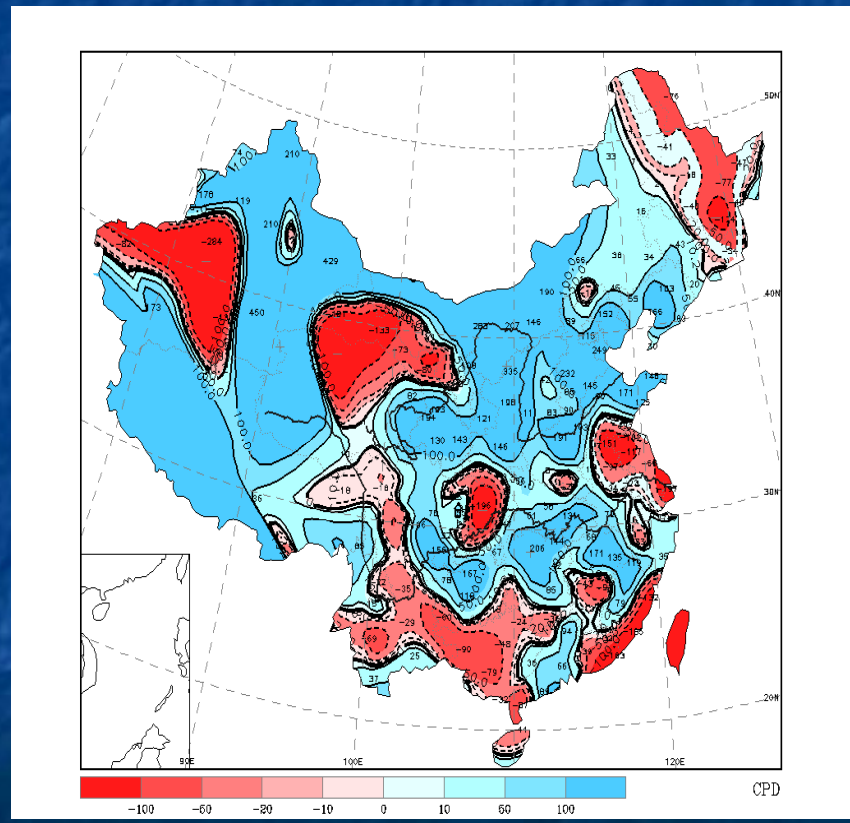
El Nino (Left): Mild weather in western North America and cold weather in Southeastern US.

La Nina (Right): Cold weather in western North America area and mild and dry weather in Southern US.

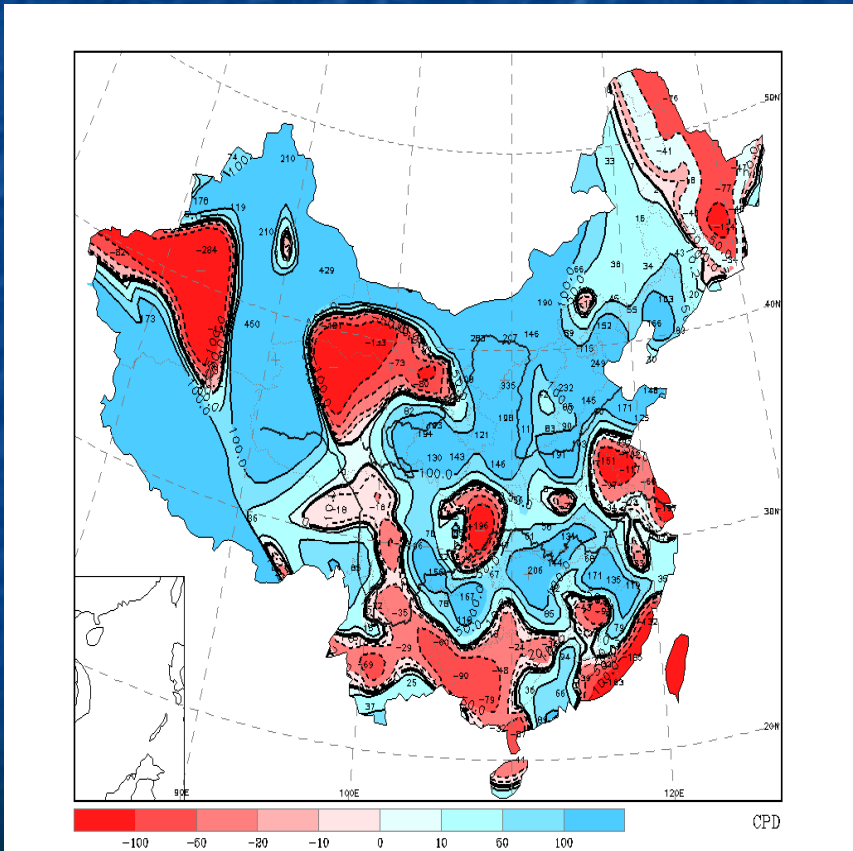
Percentage of Rainfall Anomaly over China in the Summer of the Year Next El Nino



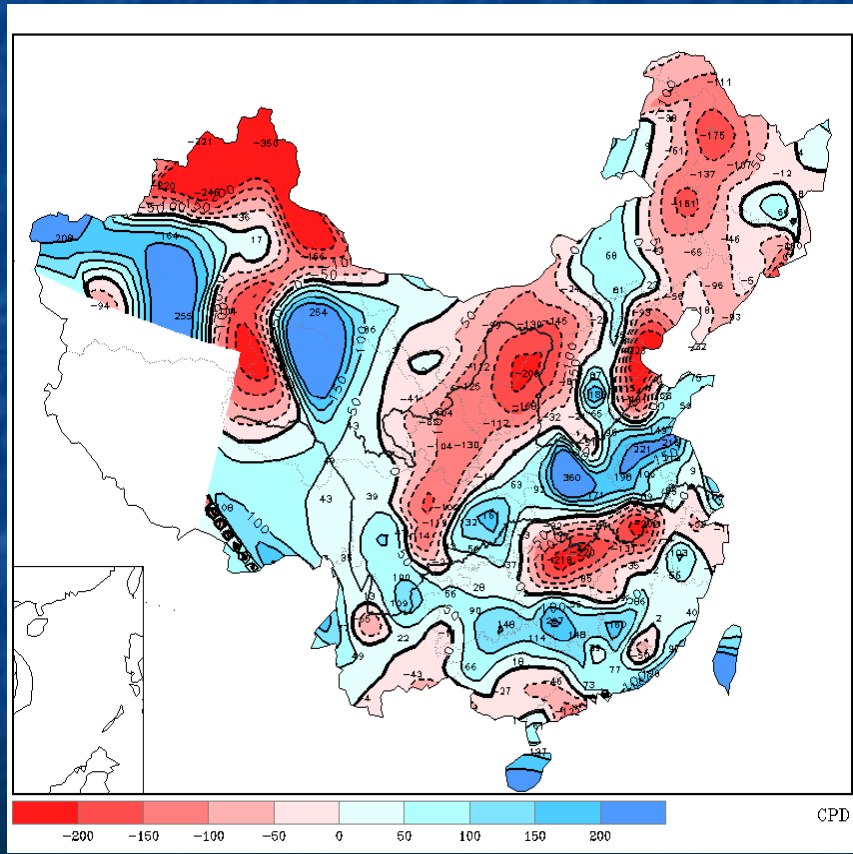
Percentage of Rainfall Anomaly over China in the Summer of La Nina Onset Year

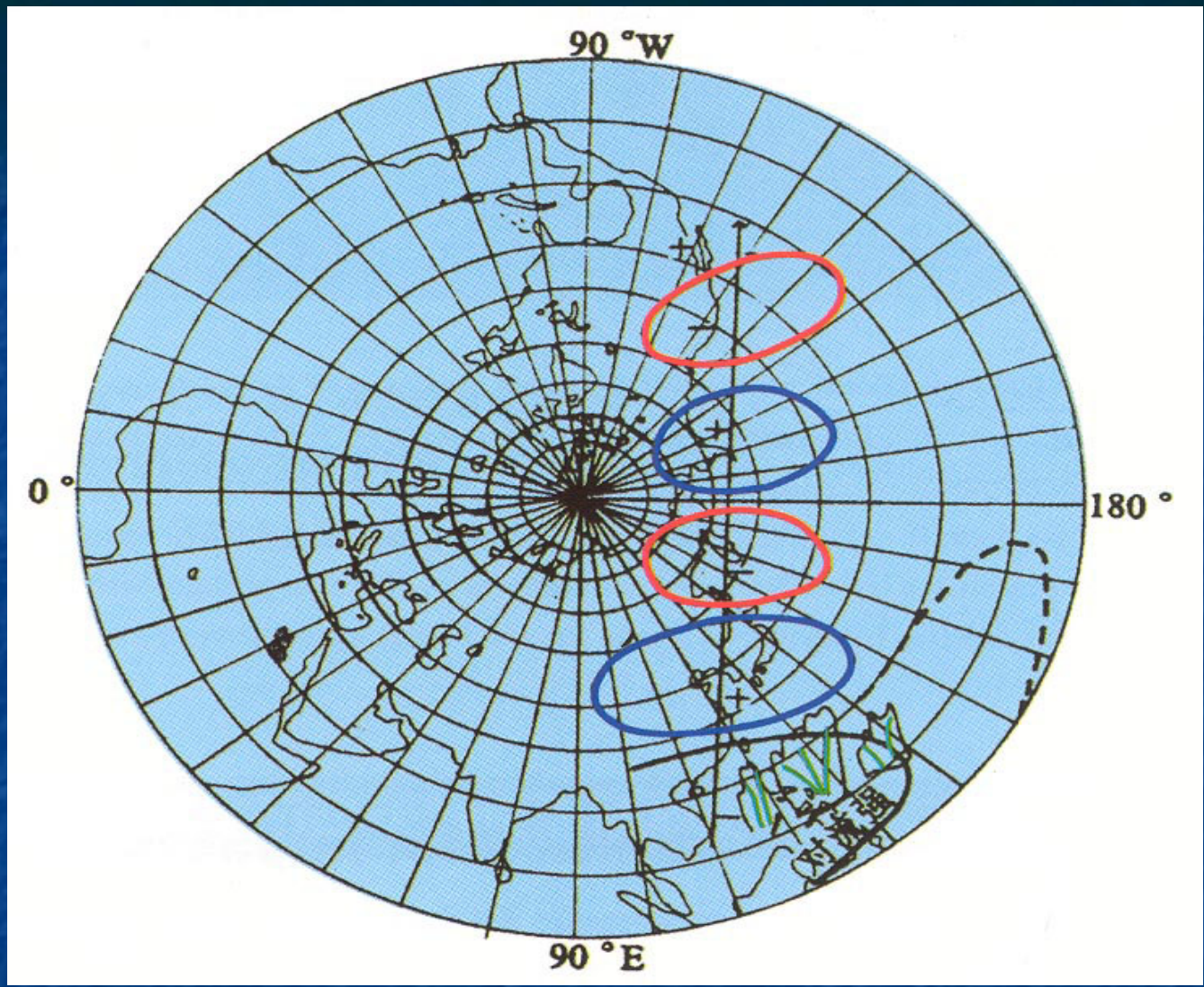


Percentage of Rainfall Anomaly over China in the Summer of La Nina Onset Year

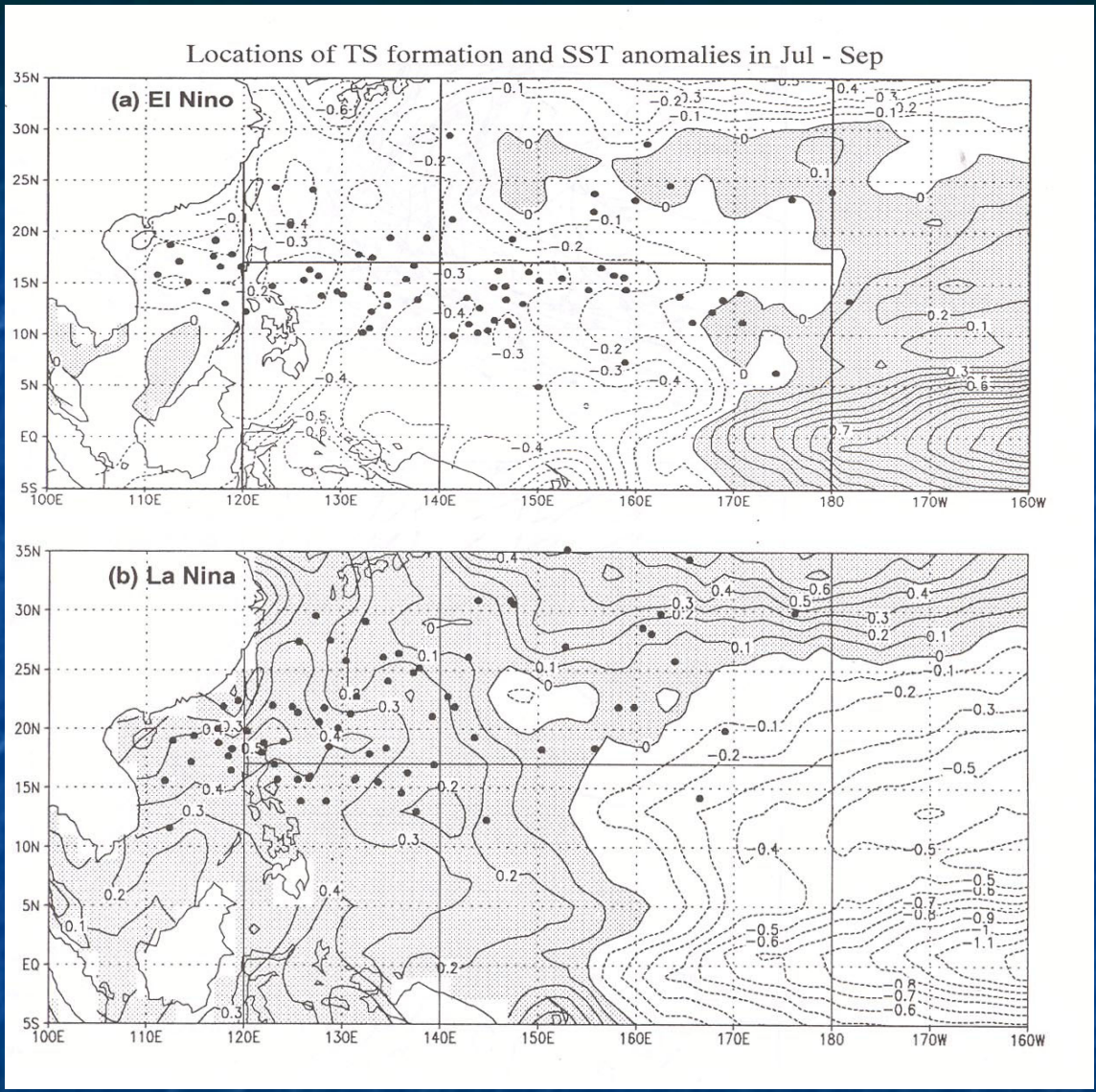


Percentage of Rainfall Anomaly over China in the Summer of the Year Next La Nina





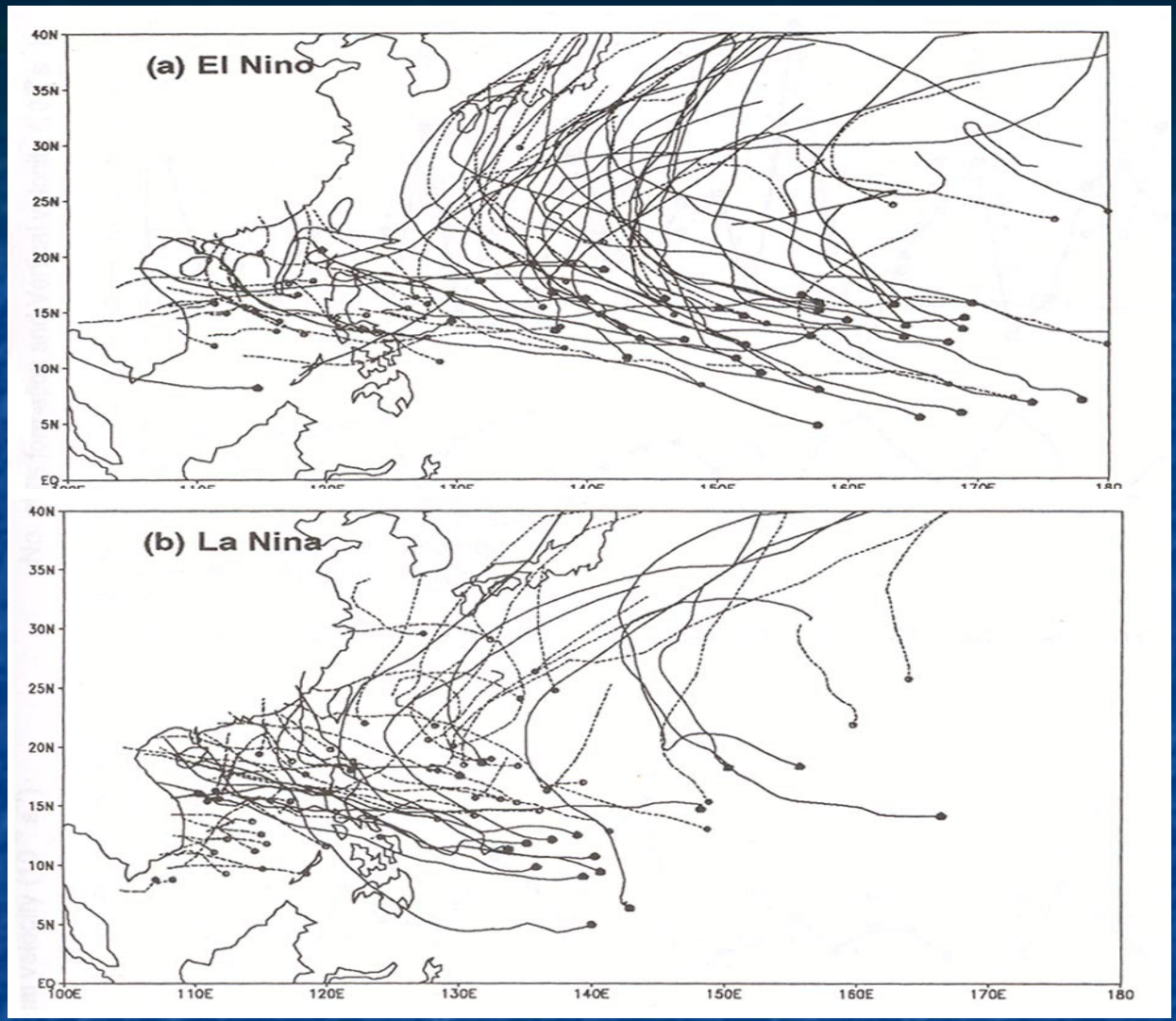
The distribution of atmosphere circulation anomaly in the Northern Hemisphere as the convective around Philippine enhances in summer



Locations of initial tropical storm formation and SST anomalies (contours with units of ℃) in peak season (July-September) during (a) the six strongest El Nino years (65,72,82,87,97) and (b) the six strongest La Nina years (70,73,75,88,98,99).

The straight solid lines indicate boundaries of sub-regions of the western North pacific. (From Bin Wang, 2002)

During strong El Nino (La Nina) years, the TS formation in the SE and NW quadrant exhibits a dipole anomaly pattern with enhanced (suppressed) formation in the SE (NW) quadrant. In the SE quadrant, the 5 warmest years have 31 TS formations while the 6 coldest years have only 2. In the NW quadrant, the situation reverses with 28 TS forming during the cold years while only 7 during warm years. In addition, about 75% of the TS formed north of 17N during the cold years, while 74% formed south of the 17N during the warm years. The seasonal mean latitude of TS formation during the peak season is highly correlated with NINO3.4 SST anomaly (correlation coefficient r=-0.80). The mean longitude of TS formation during the late season is also significantly correlated with the SSTA in NINO3.4 regions (r=0.68) . Consistent with the dipole pattern, the July-September is 18 longitude eastward during strong El Nino compared with strong La Nina.



(a) September-November TS tracks during the six strongest warm years.

(b) The same as in (a), but for six strongest cold years.

(From Bin Wang, 2002)

The TS tracks differ substantially between the strong warm and cold year. During El Nino fall, the number of TSs that formed south of 15N and recurved northward across 35N is 2.5 times that during cold years.

INTENSITY INDICATOR OF ENSO EVENTS CLASSIFIED BY SYNTHESIZED AIR-OCEAN INDEX

Class	Very Strong	Strong	Moderate	Weak	Very Weak
Warm Event	≥2.0	1.9~1.0	0.9~-0.9	-1.0~-1.9	≤-2.0
Cold Event	≤-2.0	-1.9~-1.0	-0.9~0.9	1.0~1.9	≥2.0

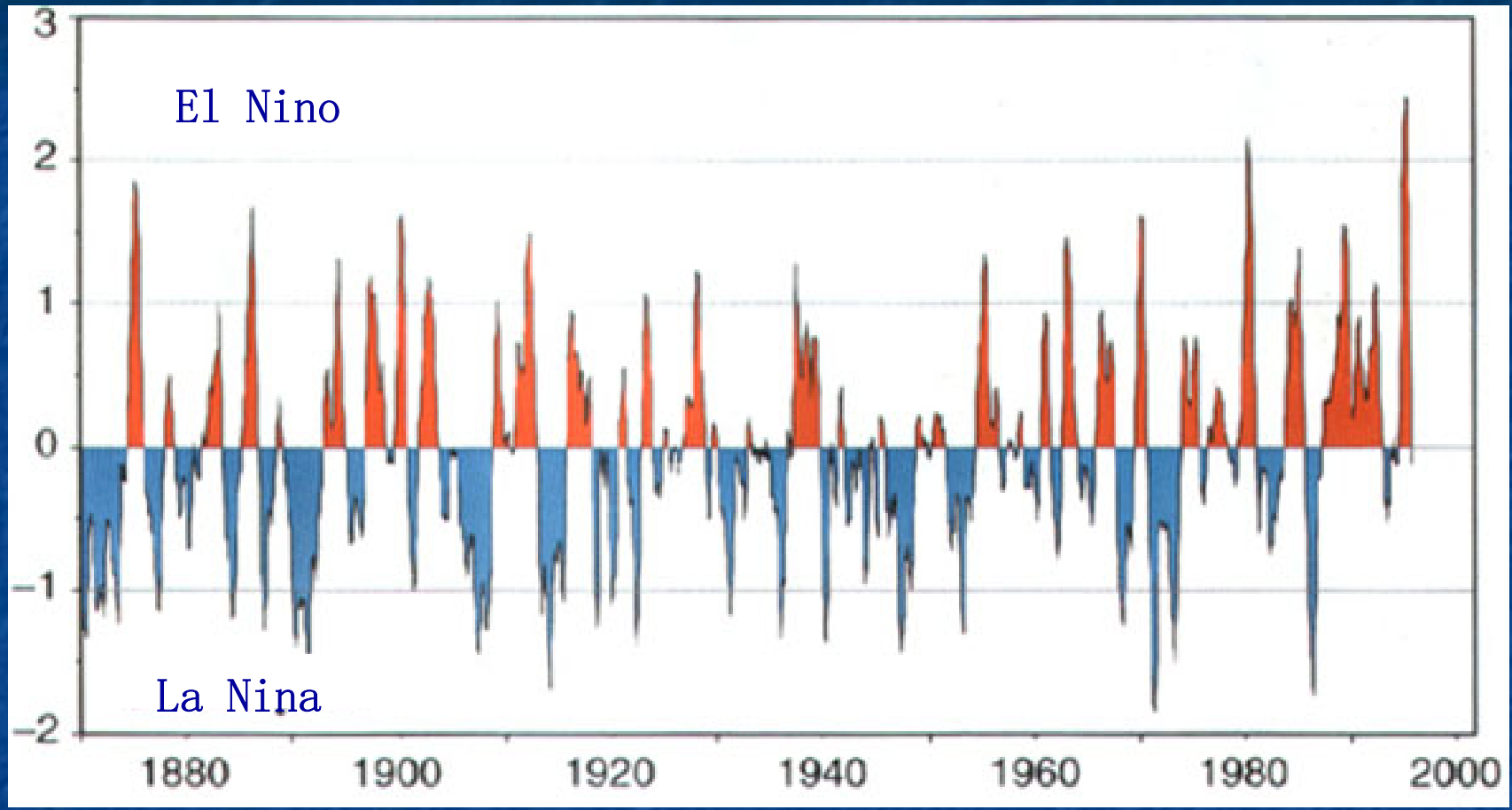
CLASSIFICATION OF ENSO EVENTS

	ONSET &END	DUR.	PEAK(℃)	PEAK MON.	SSTA INT.	SYN. INT.	ONSET TYPE
WARM	1951.06–1952.01	8	1.0	11	W	W	E
	1953.04–1953.11	8	0.9	9	VW	W	E
	1957.04–1958.07	16	1.4	1	S	M	E
	1963.07–1964.1	7	0.8	10	W	W	E
	1965.05–1966.03	11	1.3	12	M	M	E
	1968.10–1970.01	16	1.1	5	M	M	C
	1972.04–1973.02	11	1.9	10	W	W	E
	1976.07–1977.01	7	0.9	10	W	W	E
	1979.09–1980.02	6	0.9	9	VW	VW	E
	1982.05–1983.09	17	2.5	12	VS	VS	C
	1986.09–1988.01	17	1.6	9	VS	VS	C
	1991.05–1992.07	15	1.4	4	S	S	C
	1993.03–1993.11	9	1.1	5	W	M	C
	1994.09–1995.02	6	1.2	12	W	W	C
	1997.04–1998.05	14	2.8	12	VS	VS	E

CLASSIFICATION OF ENSO EVENTS

	ONSET& END	DUR.	PEAK(℃)	PEAK MON.	SSTA INT.	SYN. INT.	ONSET TYPE
COLD	1954.04–1956.04	25	–1.7	11	VS	VS	E
	1956.07–1956.12	6	–0.7	9	VW	W	C
	1964.03–1965.01	11	–1.1	12	M	W	E
	1967.08–1968.05	10	–0.7	2	W	VW	E
	1970.06–1971.12	19	–1.4	12	M	S	E
	1973.06–1974.05	12	–1.4	12	M	S	E
	1974.09–1976.03	19	–1.5	12	S	VS	C
	1984.10–1985.10	13	–0.9	12	M	W	E
	1988.04–1989.05	14	–1.6	12	S	S	E
	1995.09–1996.04	8	–0.5	11	VW	VW	E
	1998.10–2000.03	18	–1.3	1	S	S	C

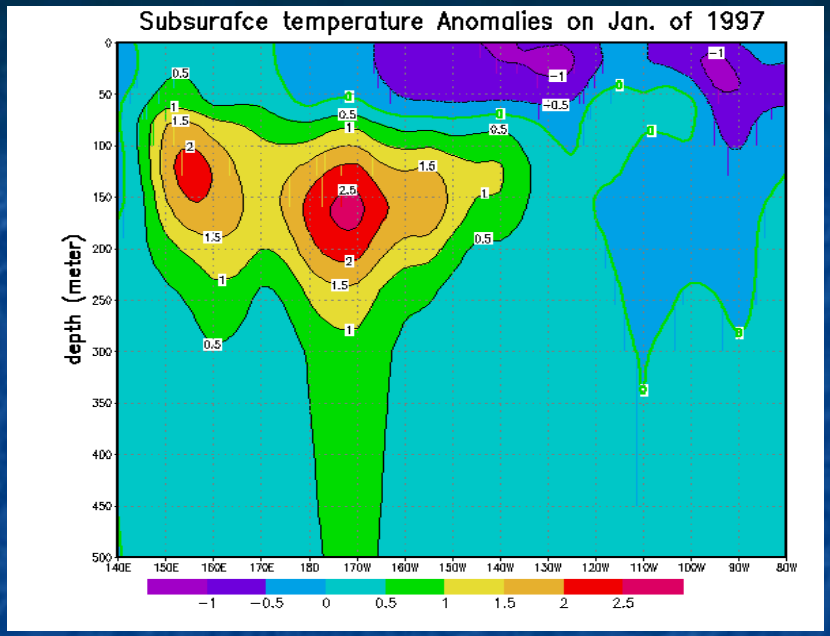
The 1997-1998 El Nino event is strongest in history

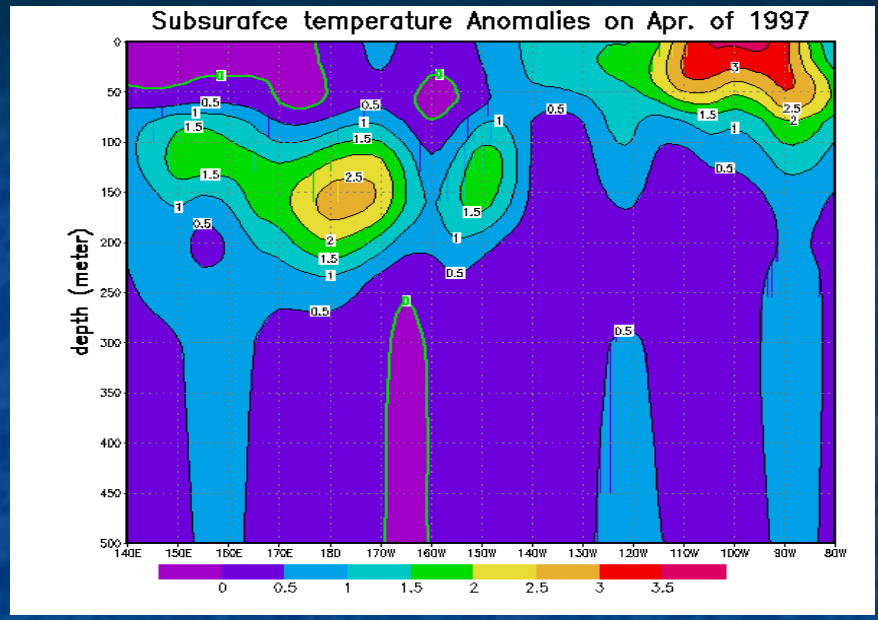


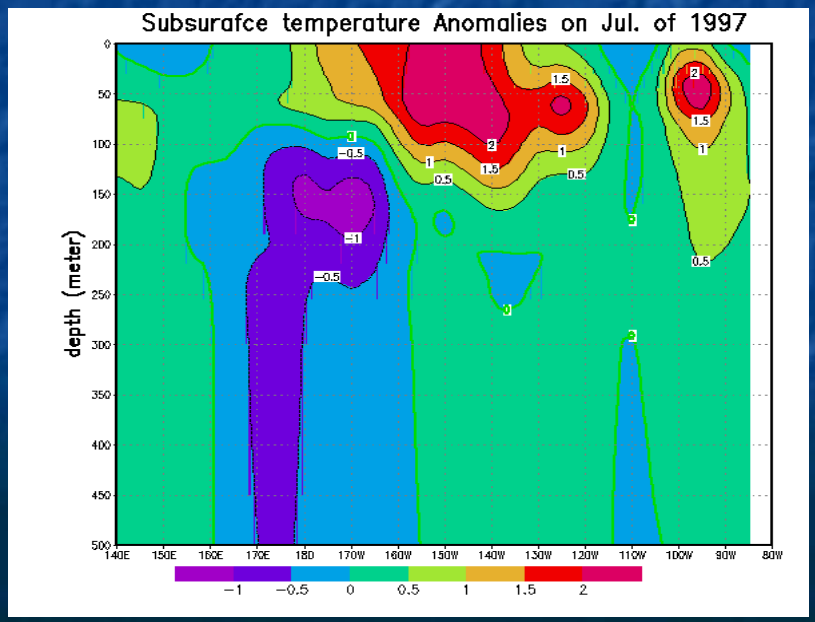
The time series of El Nino/ La Nina events during 1870—2000

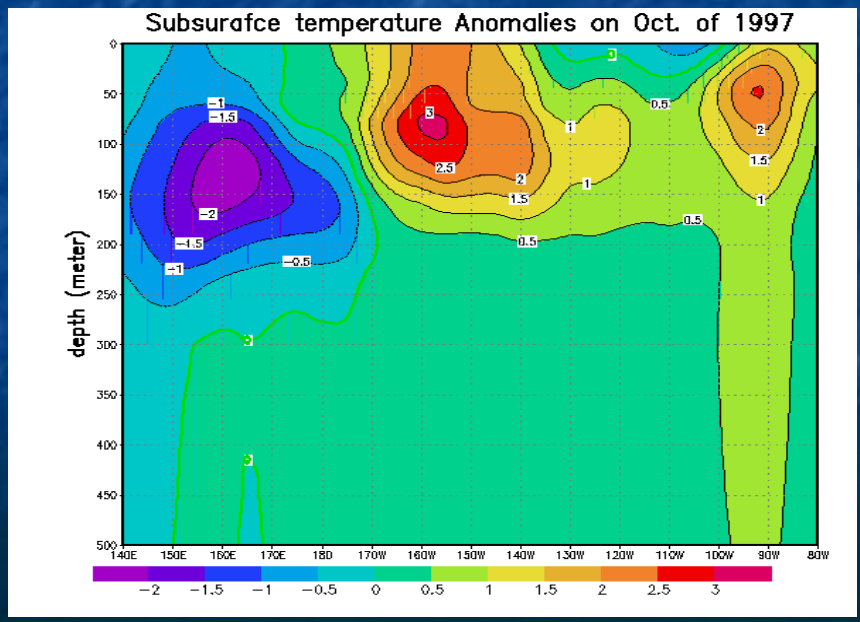
(Relative to the mean values for 1961-1990)

Subsurface Sea Surface Temperature Anomaly for 1997-1998

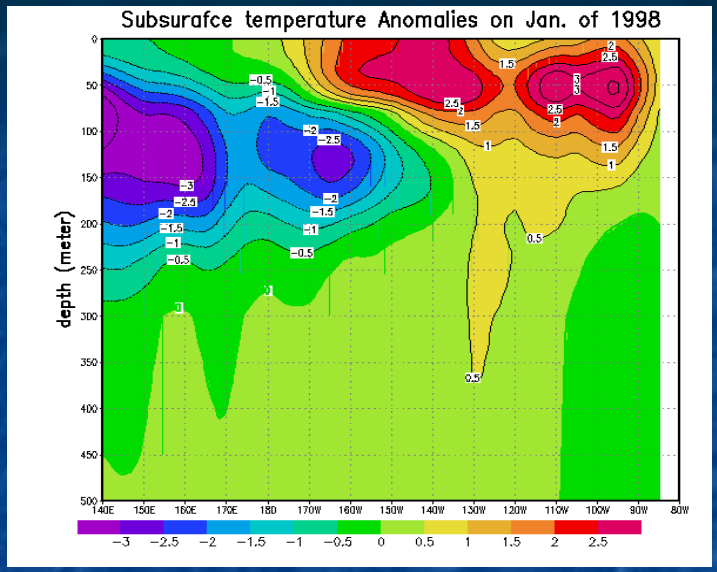


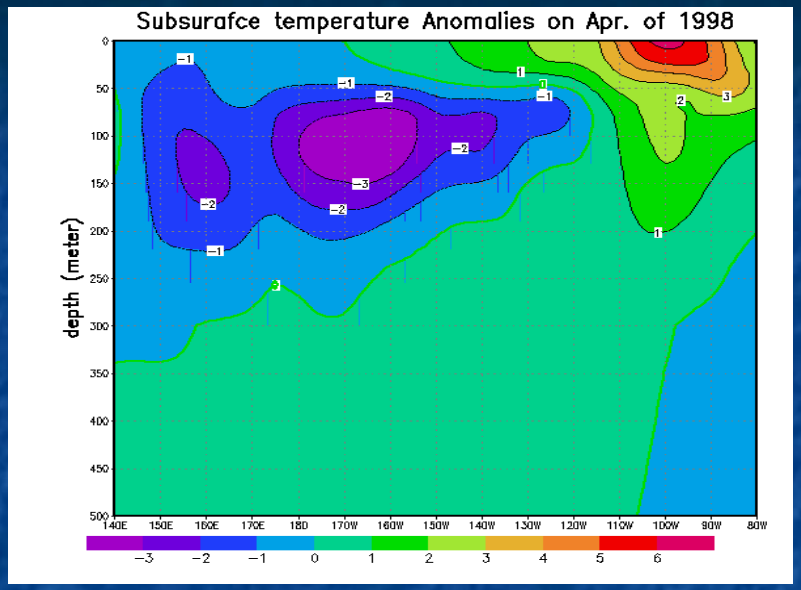


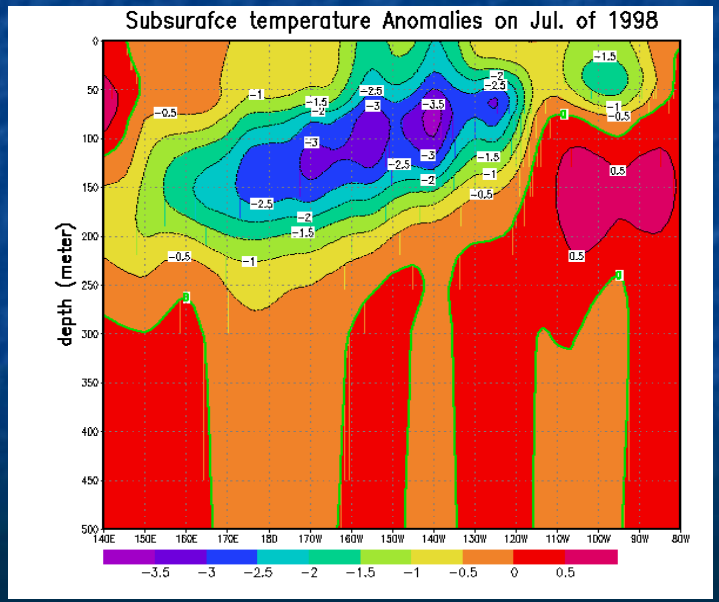


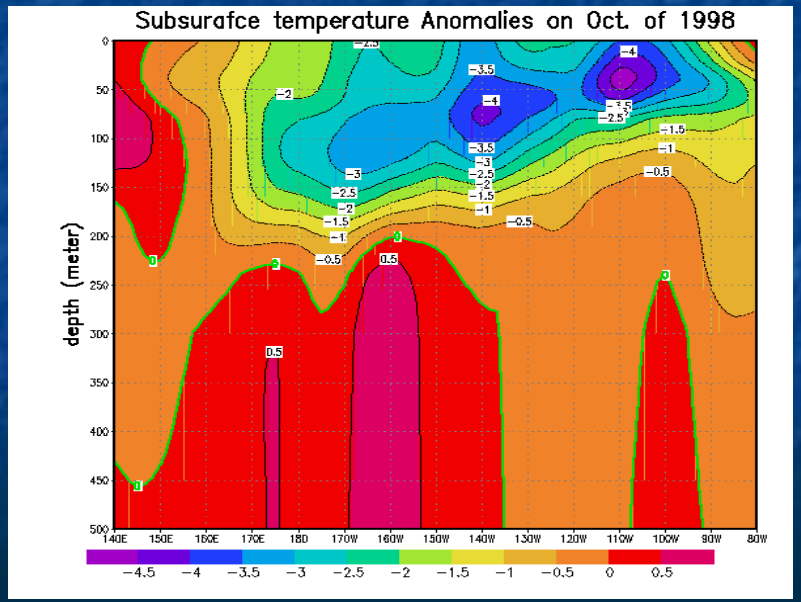


Subsurface Sea Surface Temperature Anomaly for 1997-1998









OBJECTIVES

The major objectives of project APN99012 are: 1) monitoring and predicting ENSO event and SSTA over the warm pool in the western Pacific Ocean, 2) setting up the monitoring Internet system of ENSO event and warm pool in the APN region, 3) releasing SSTA predictions to the APN region, 4) organizing International Workshop in the APN region.

The major objectives of project APN2000-12

are: 1) Collection of data and information relative to ENSO and the warm pool, 2) Setting up and improving the network and issuing products, 3) Scientific research work, 4) Improving El Nino/La Nina prediction system.

The major objectives of project APN2001-12

are : 1) To monitor and predict the ENSO event and the sea temperature structure over warm pool; 2) to assess impact on monsoon activity, tropical cyclone (T.C.) and extreme events; 3) to implement network of above information.

NETWORK

Through three year's efforts, all the original purposes and contents outlined in proposals of the APN projects have been achieved. A network and its web-page (http://www.ncc.gov.cn) of the APN projects (#99012, #2000-12 and #2001-12) have been successively set up, with their catalogues and information residing on a workstation. National Climate Center (NCC), China Meteorological Administration is responsible for maintenance and improvement of this network in the Internet, and collection necessary information, updating the network on the monthly basis. Other participating countries/regions furnish information and data sets.

In the network, a special emphasis is placed on oceanic and meteorological conditions over Warm Pool and the South China Sea, the impact of ENSO events and SSTA of Warm Pool on the weather and climate of APN countries (including tropical cyclones and monsoon). This is a distributed network for climate monitoring and prediction contributed by APN countries established successfully in the APN region for the first time.

The network system in friendly manner provide useful interface and information to meteorologists, publics, and policymakers and greatly build up APN capability to disseminate and exchange monitoring and prediction information of ENSO events and the warm pool for APN countries, which is especially useful for developing countries in APN region to timely receive the information and warning for their preparedness of potential disasters. Up to now, the web-page has been visited for about 7236 times.

DIGITAL DATA

The project has cloceted data and information relative to ENSO and the warm pool, such as TOGA—TAO and SCSMEX—A, B, C buoy data, oceanic data of the warm pool and the South China Sea, the oceanic observations of Japan along 137°E, and satellite data such as OLR and TBB, etc. The data sets needed for the project were provided by participating countries.

Researches and Predictions

We have made a significant progress in scientific researches. The predictions of the tropical Pacific Ocean SSTA during 2001-2002 has been made and issued on the APN network.
The related research papers, prediction and data sets are put on the web .

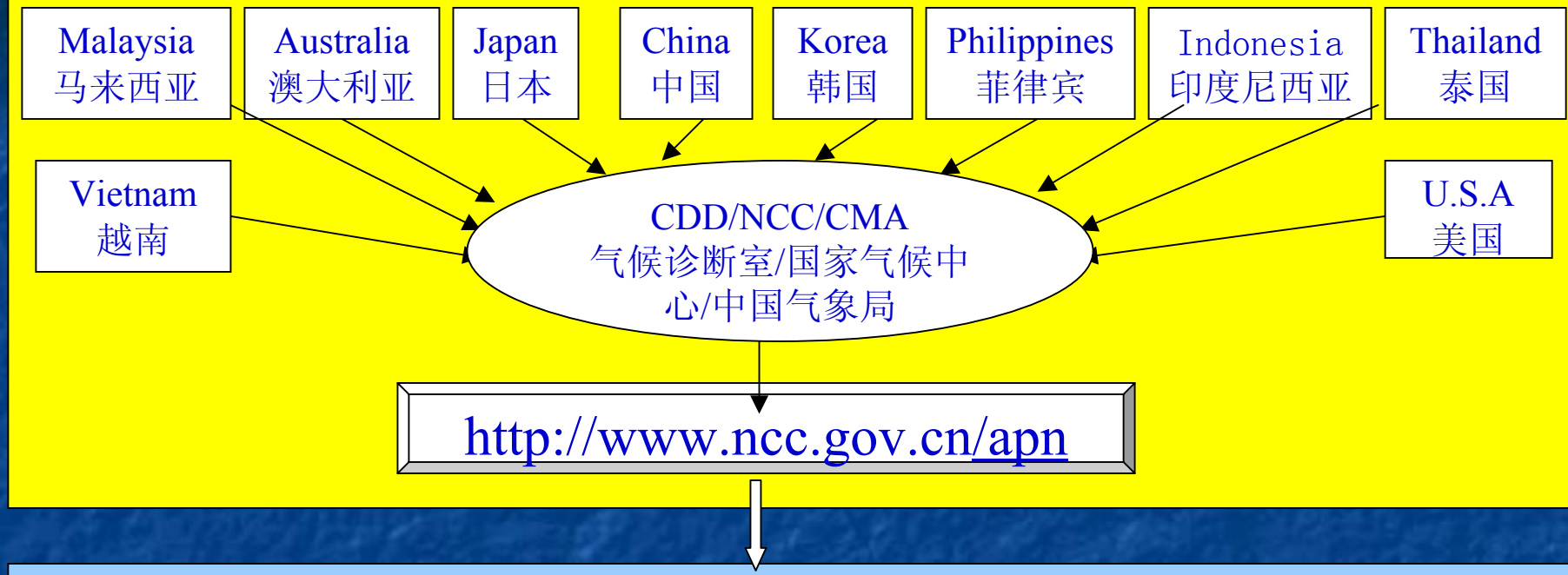
BOOKLET

A booklet of this APN Project has been published too.

WORKSHOP

Several international workshops have been organized or are being organized by our project. On 16-17 September 1999, the project successfully held an inception meeting in Beijing. On February 27-29, 2000, the international workshop on ENSO and SSTA over the warm pool was held successfully in Shanghai, China. On September 27-28,2000, an interim examination meeting for the APN Project 2000-12 (the network system for monitoring and predicting ENSO event and sea temperature structure of the warm pool in the western Pacific Ocean) was held in Beijing. An international workshop on monitoring and seasonal to interannual prediction of ENSO event and the warm pool and their impact on the East Asian monsoon was held in Macau on 5-7 February 2002.

APN Project #99012, #2000-12 , #2001-12



Main Contents

MONITORING	HISTORICAL VIEW	PREDICTON & OUTLOOK
ENSO SIGNAL	ENSO CLASSIFICATION	DYNAMICAL MODELS
WARM POOL	EL NINO EVENTS	STATISTICAL MODELS
TROPICAL CONVECTION	LA NINA EVENTS	CLIMATE OUTLOOK
MONSOON		TYPHOON OUTLOOK
WEATHER SYSTEMS		
ANIMATION	DIGITAL DATA	MEETING
ANNOUNCEMENT		

Welcome to APN ENSO Network! - MIROSOFT INTERNET EXPLORER-ROMAN99

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APN

Asia-Pacific Network for Global Change Research

Jul 17,2002, Wednesday

MONITORING AND PREDICTION OF ENSO EVENT AND SEA TEMPERATUER STRUCTURE OF THE WARM POOL IN THE WESTERN PACIFIC OCEAN

PROJECT LEADER: Prof. Ding Yihui

CONTRIBUTORS: China, Japan, Australia, Korea, USA, Philippines, Indonesia, Malaysia, VietNam

NEW STUDIES

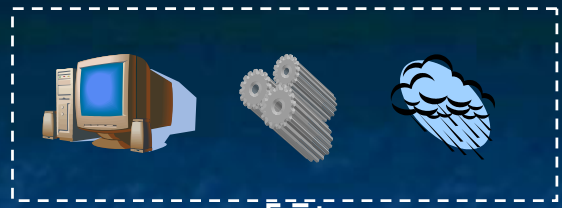
1. Air-Sea Interactions at During and Befor The Onset Nino
2. Diagnosis of 1998 2000 C
3. A Preliminary Study on t Relationships among East As Monsoon, El Nino and Cold S Songliao Plain, China
4. New Publications

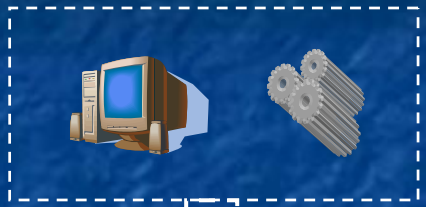
PROJECT MEETINGS

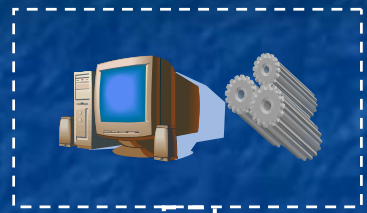
1. APN Project 99012 incep BeiJing, China, 16-17 Septemb
2. APN Project 99012 meeti China, 27-29 February, 2000.
3. APN Project 2000-12 mee China, September 27-28, 2000.
4. APN Workgroup meeting, M 5-7, February, 2002 *NEW!*

Internet

STRUCTURE:







Monitoring

Prediction & outlook

APN ENSO NETWORK

Historical view

New studies

Digital data

Project meetings

Products of the ENSO monitoring and prediction running system

:address link of other countries

rain data from China and typhoon data from Australian

MONITORING

Enso signal	Warm pool	Tropical convection	Monsoon	Weather system	SST Animation
COI SOI SI SST/SSTA SLP/SLPA High cloud Zonal wind	SST/SSTA W.P & Indian Ocean Warm pool Indices cross section of T, ocean heat content, depth of isotherm	divergent wind at 850hpa divergent wind at 200hpa long wave radiation High cloud amount Velocity potential At 850hpa Velocity potential At 200hpa	monsoon onset South China sea summer monsoon pentad wind at 850&200hpa Pentad olr height and wind at 200&850hpa rainfalls	zonal wind at 200&850hpa divergent wind at 200&850hpa 500hpa height 100hpa height typhoon	SST Animation

Prediction and outlook

ENSO Dynamical models

- NCC model
- JMA el nino model
- BMRC enso model
- KMA el nino model

ENSO Statistical models

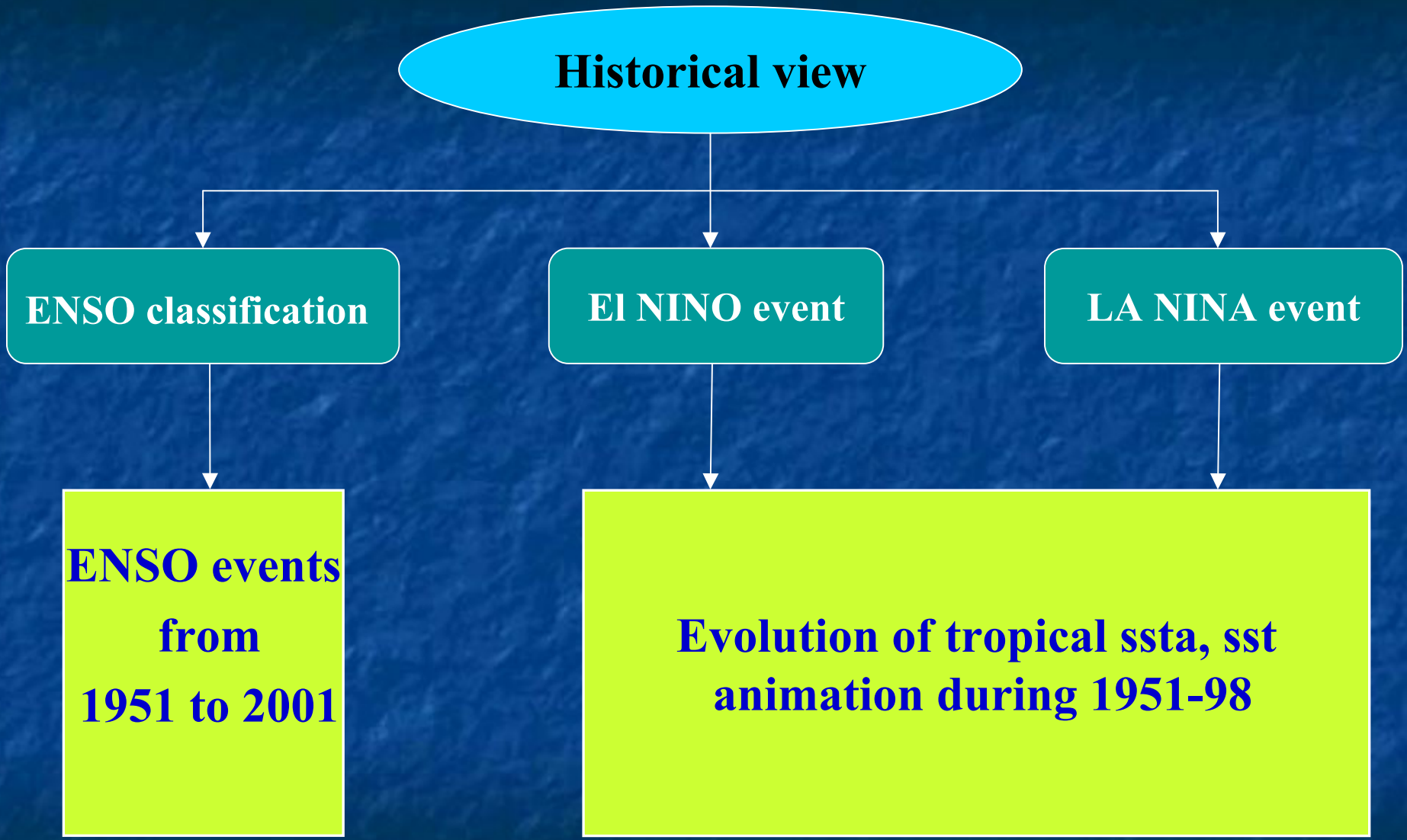
- Singular spectral analysis
- Canonical correlation Analysis
- Analogue prediction
- Optimum filter assemble
- Ensemble of multi-statistical model forecast

Climate outlook

- Australia
- Korea
- Philippines
- Malaysia

Typhoon outlook

- HK
- Philippines


Historical view
ENSO classification
El NINO event
LA NINA event
ENSO events from 1951 to 2001
Evolution of tropical ssta, sst animation during 1951-98

DATA SOURCE:


JAPAN Meteorological Agency
CHINA Meteorological Administration/NCC HK
KOREA Meteorological Administration
APN ENSO NETWORK
AUSTRALIA Bureau of Meteorological
USA, Malaysia, Vietnam Philippines, Indonesia

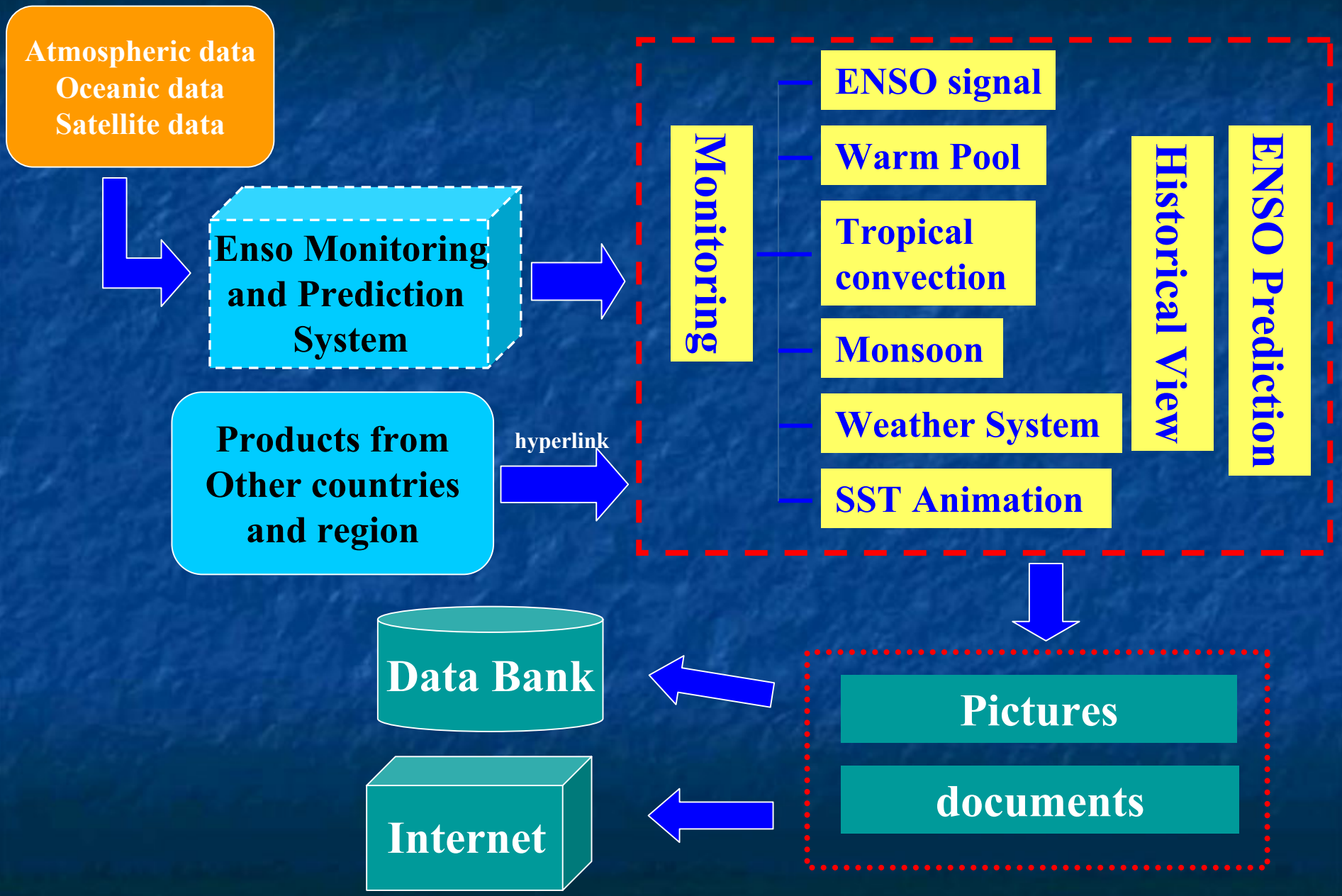
Monitoring

	Enso signal	Warm pool	Tropical convection	Monsoon	Weather system	Anima ti-on
China	ssta indices in nino regions monthly ssta ssta cross section coi/soi slp/slpa zonal wind	monthly mean sst standardized ssta western Pacific warm pool indices Indian Ocean warm pool indices	divergent wind at 850pha divergent wind at 200hpa	monsoon onset summer monsoon 850 pentad wind 200 pentad wind Pentad olr Chiian rain	200hpa zonal wind 850hpa zonal wind 500hpa height 100hpa height 200hpa & 800hpa divergent wind	sst animati on
Japan	Indices for nino3,sl ,soi, high cloud, zw monthly ssta ssta cross section	depth-longitude cross section of temperature time-longitude cross section of ocean heat content and depth of isotherm	long wave radiation High cloud amount Velocity potential at 850 and 200hpa	200 and 850hpa height and wind and anomaly	track of tropical storm	
Australi a	soi Monthly ssta Monthly slp/slpa			monsoon onset 850hpa wind 200hpa wind Rainfalls	typhoon	
Other countrie s		Sst indices from Malaysia		monsoon onset from Malaysia, Indonesia Rainfall from Malaysia, Vietnam,Indone sia	Typhoon from Philippines, Vietnam, Indonesia	

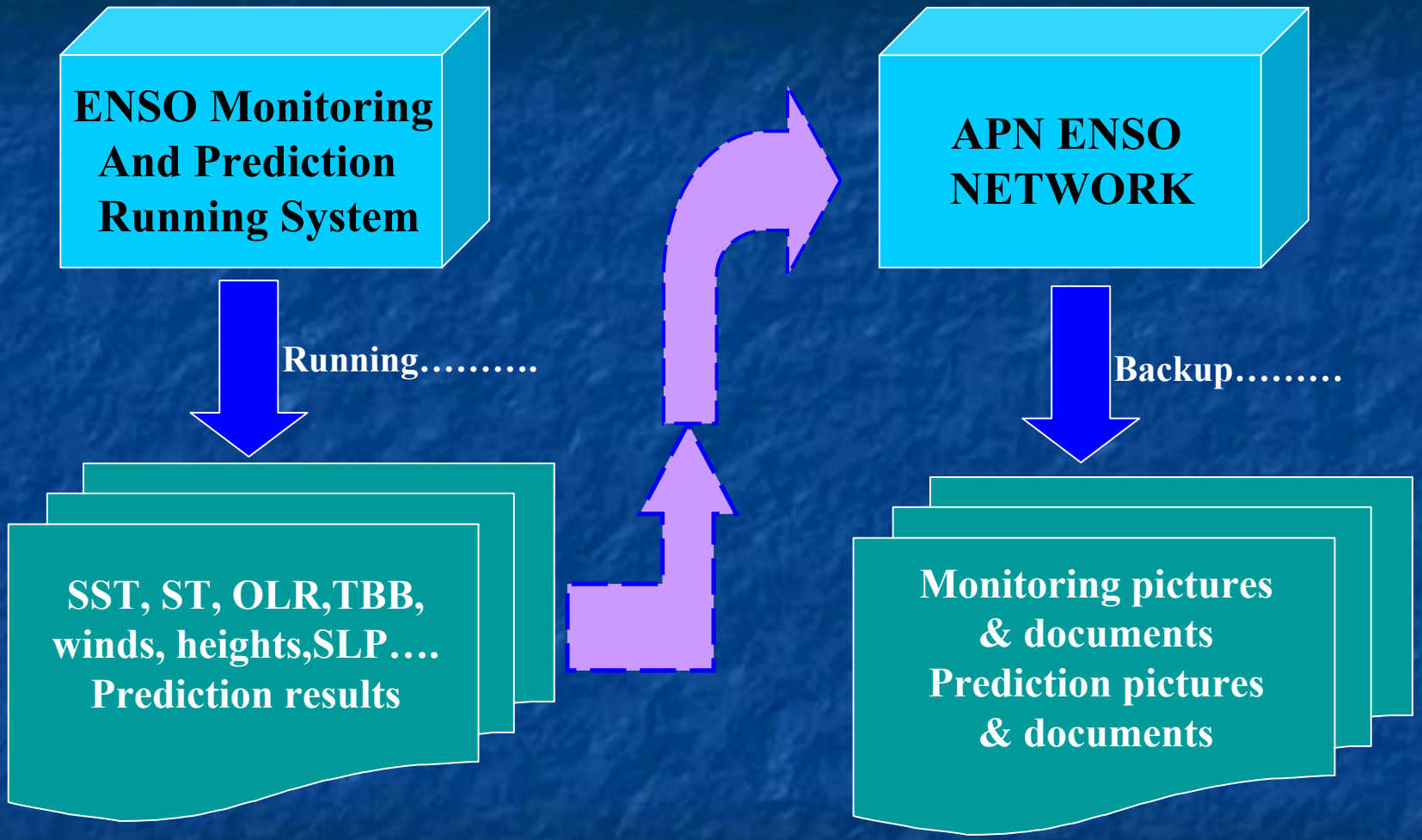
	Prediction & Outlook			
	Dynamical Models	Statistical Models	Climate Outlook	Typhoon Outlook
China	NCC model	Singular spectral analysis Canonical correlation analysis Analogue prediction Optimum filter assemble Ensemble of multi-statistical model forecast		Total number of NW Pacific typhoon from HK
Japan	JMA EL NINO model			
Australia	BMRC ENSO model		Australia	
Korea	KMA EL NINO model		Korea	
Other Countries			Philippines Malaysia	Philippines

	Historical view		
	Enso Classification	**EL NINO Event**	**LA NINA Event**
China	**Classification of enso events from 1951 to 2000**	**Evolution of ssta during 1982-83** **Evolution of ssta during 1986-87** **Evolution of ssta during 1997-98**	**Evolution of ssta during 1954-55** **Evolution of ssta during 1970-71** **Evolution of ssta during 1988-89**
Korea		**ssta animation for el nino events during 1951-98**	**ssta animation for la nina events during 1951-98**

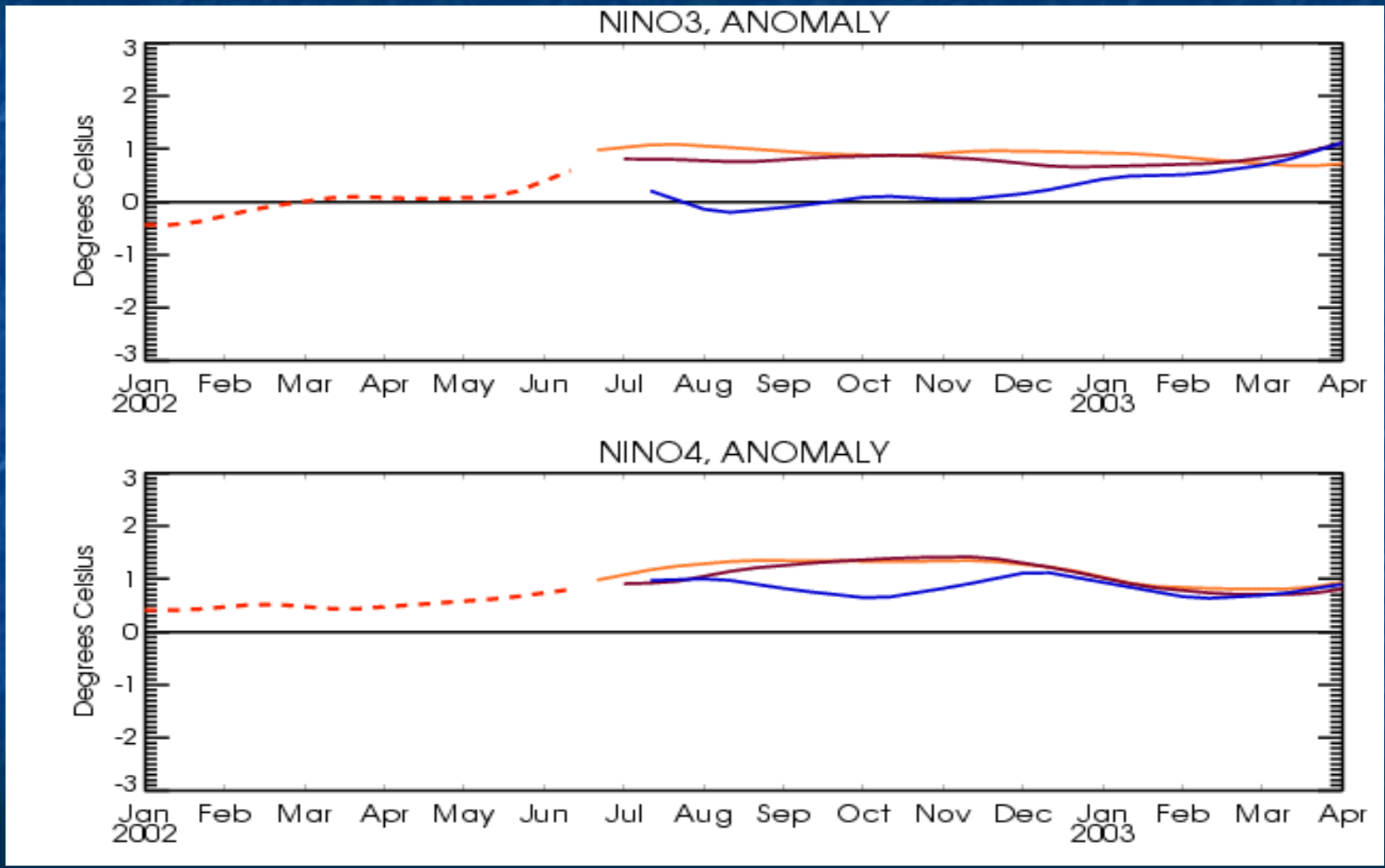
FLOWCHART OF THE WORK FOR APN ENSO NETWORK:



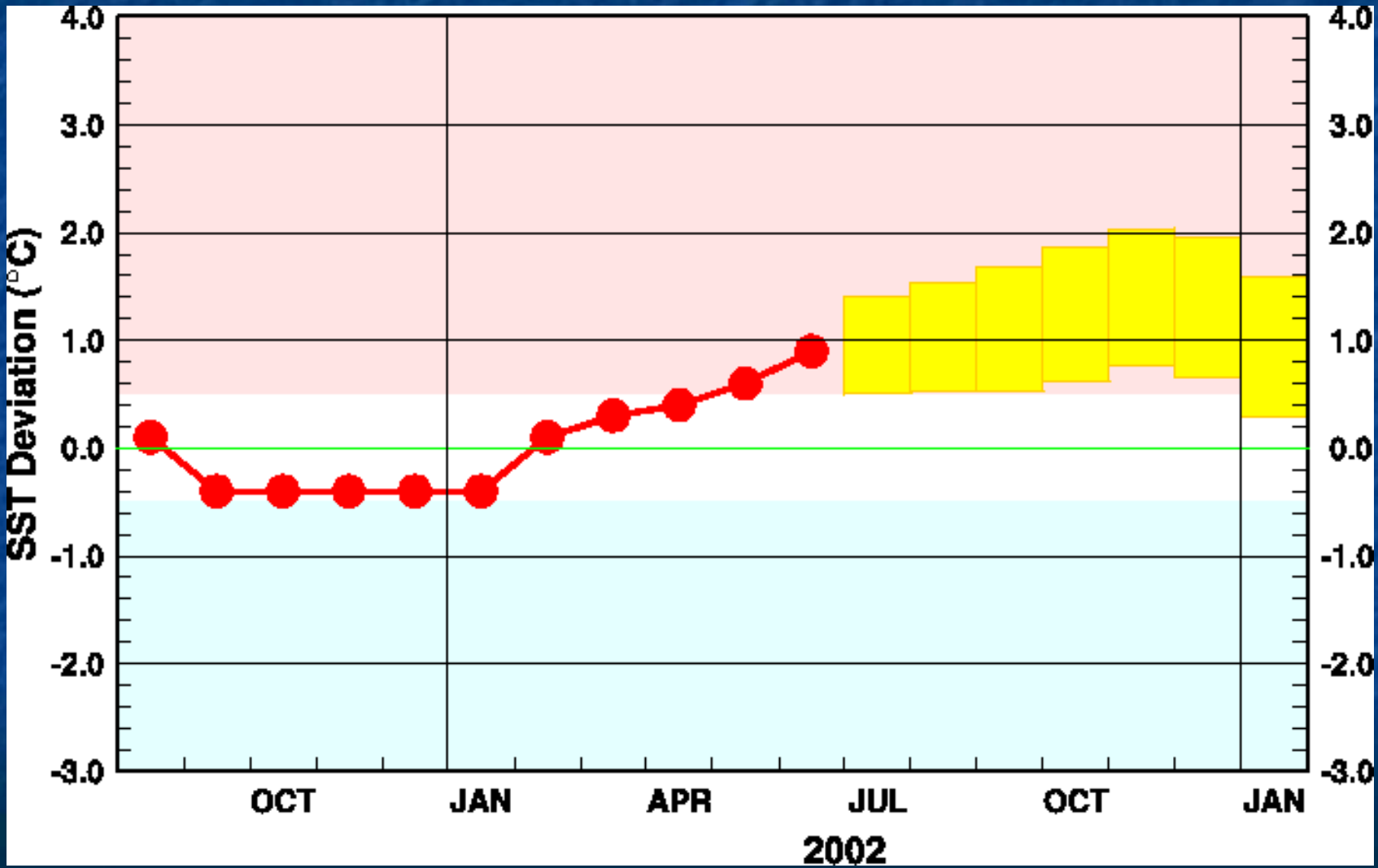
FLOW CHART OF BACKUP WORK EACH MONTH:



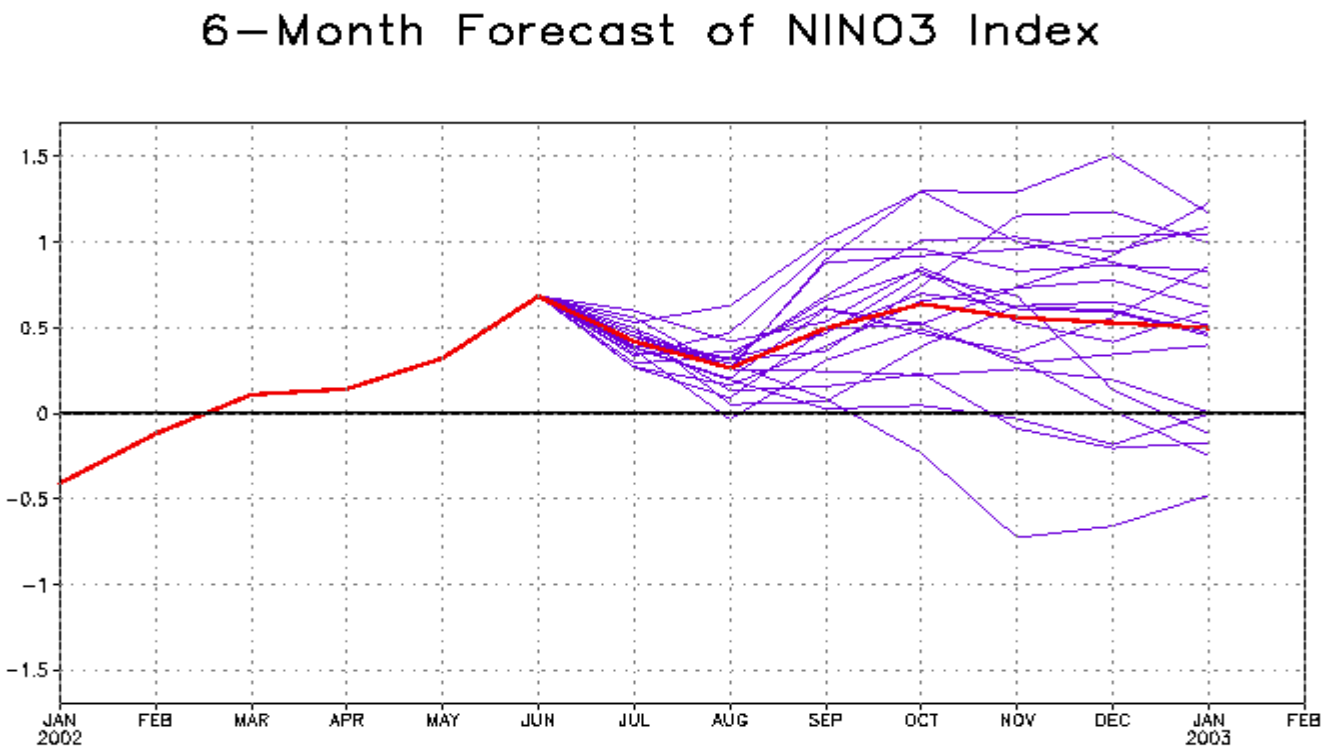
Experimental Predictions Using a Global Coupled Ocean-Atmosphere Model *(AUS)*



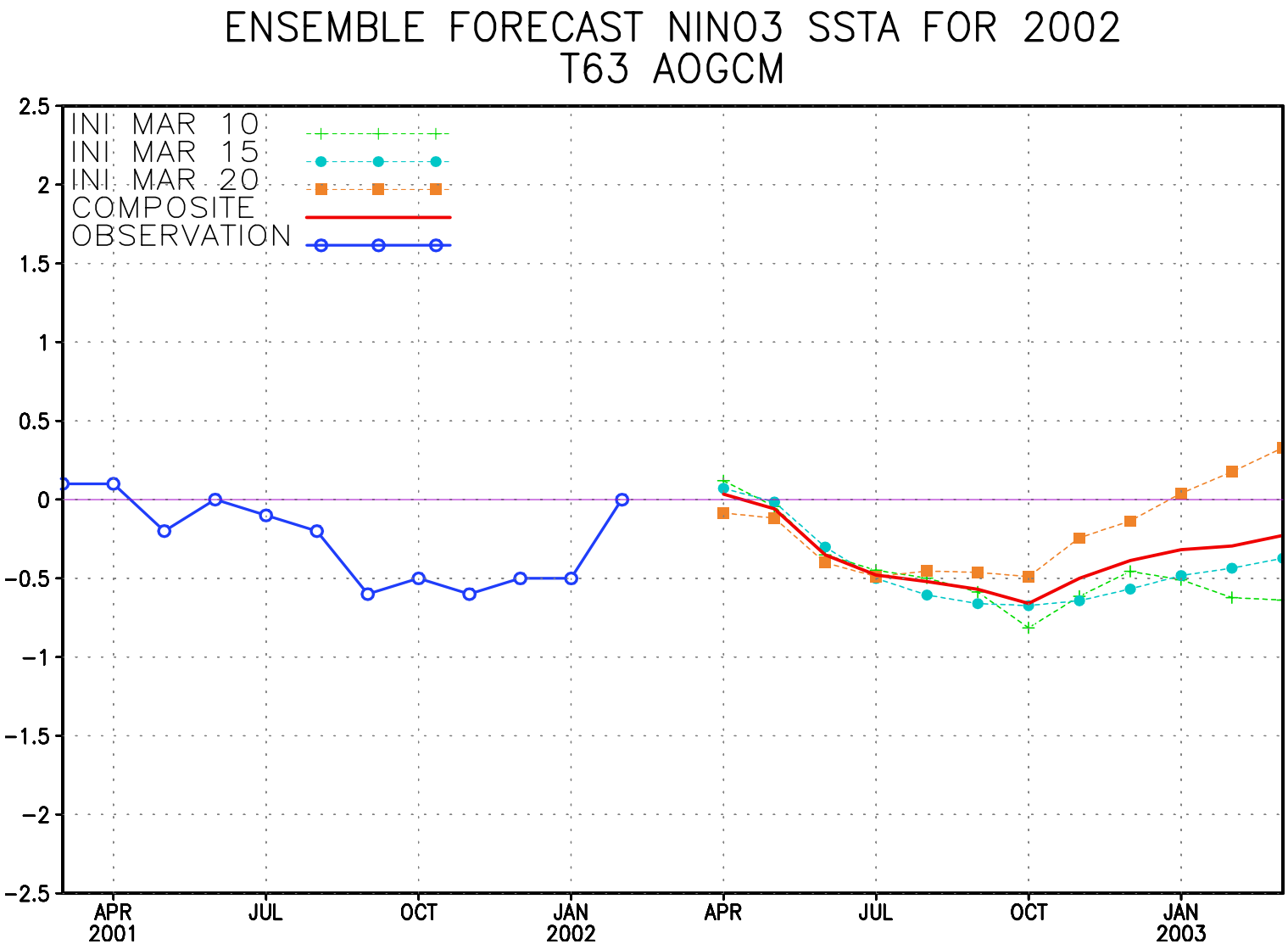
Outlook Of The SST Deviation For Region B (Niño.3) By The El Niño Forecast Model With MOS. (JMA)



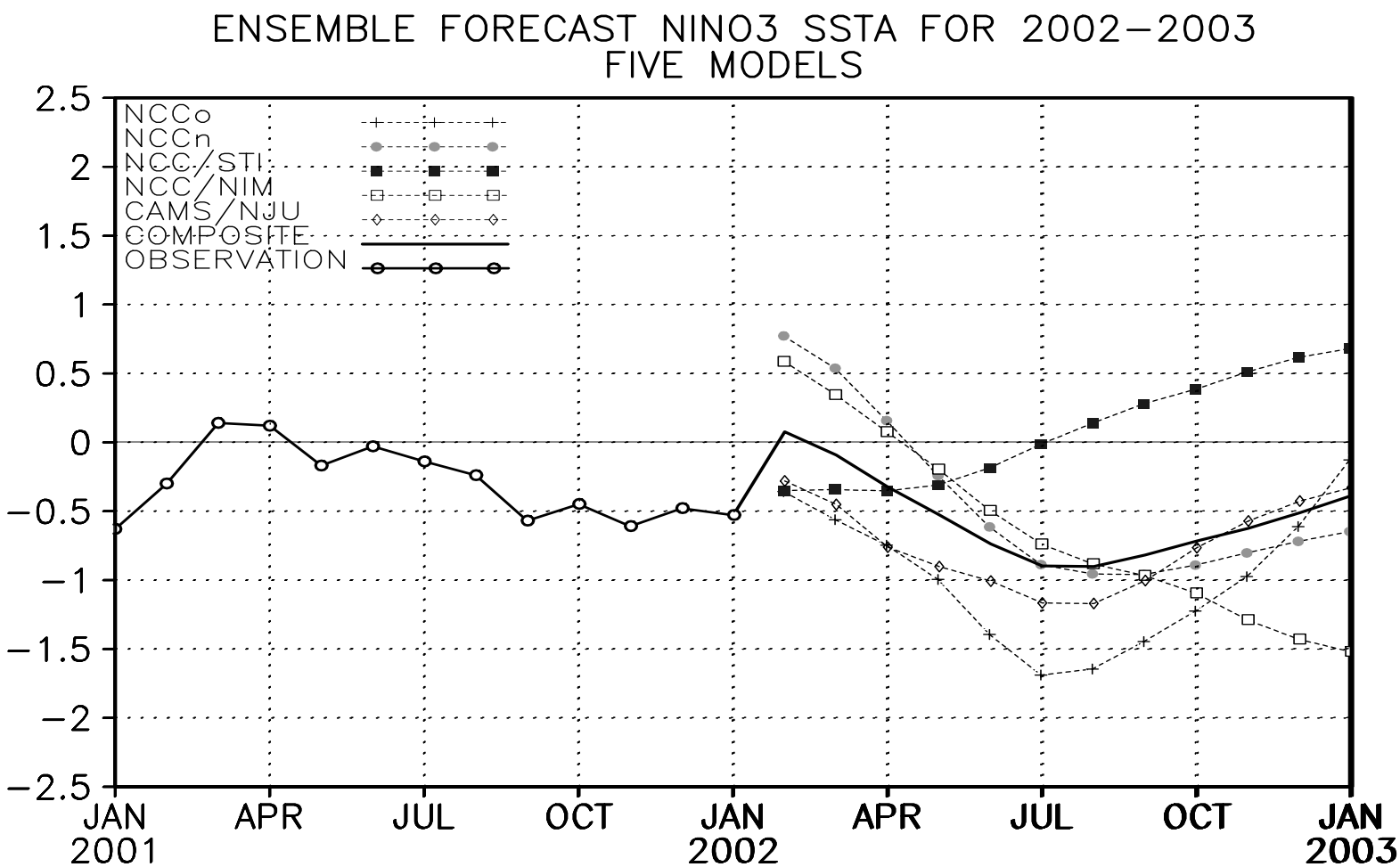
Intermediate Ocean-Statistical Atmosphere Coupled Model (KMA)

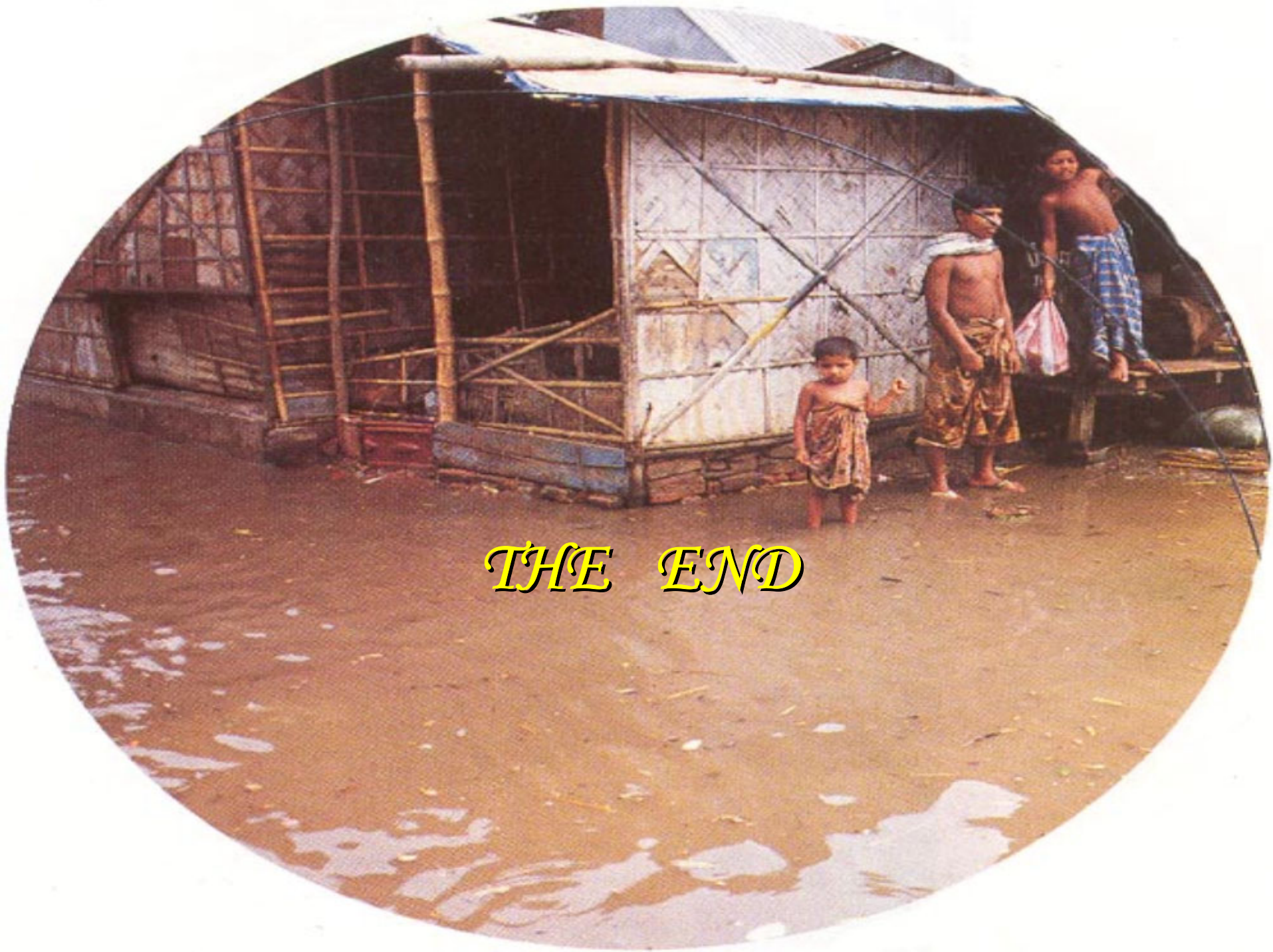


NCC/CMA T63 AOGCM



NCC/CMA SAOMS

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