



Advancement of EAMAC/WMO and Assessment Of EAWM Indices in BCC

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Ulaanbaatar, Mongolia • 5 Nov. 2013







Outline

1

Review of Last EAWM

2

Advancement of EAMAC/WMO

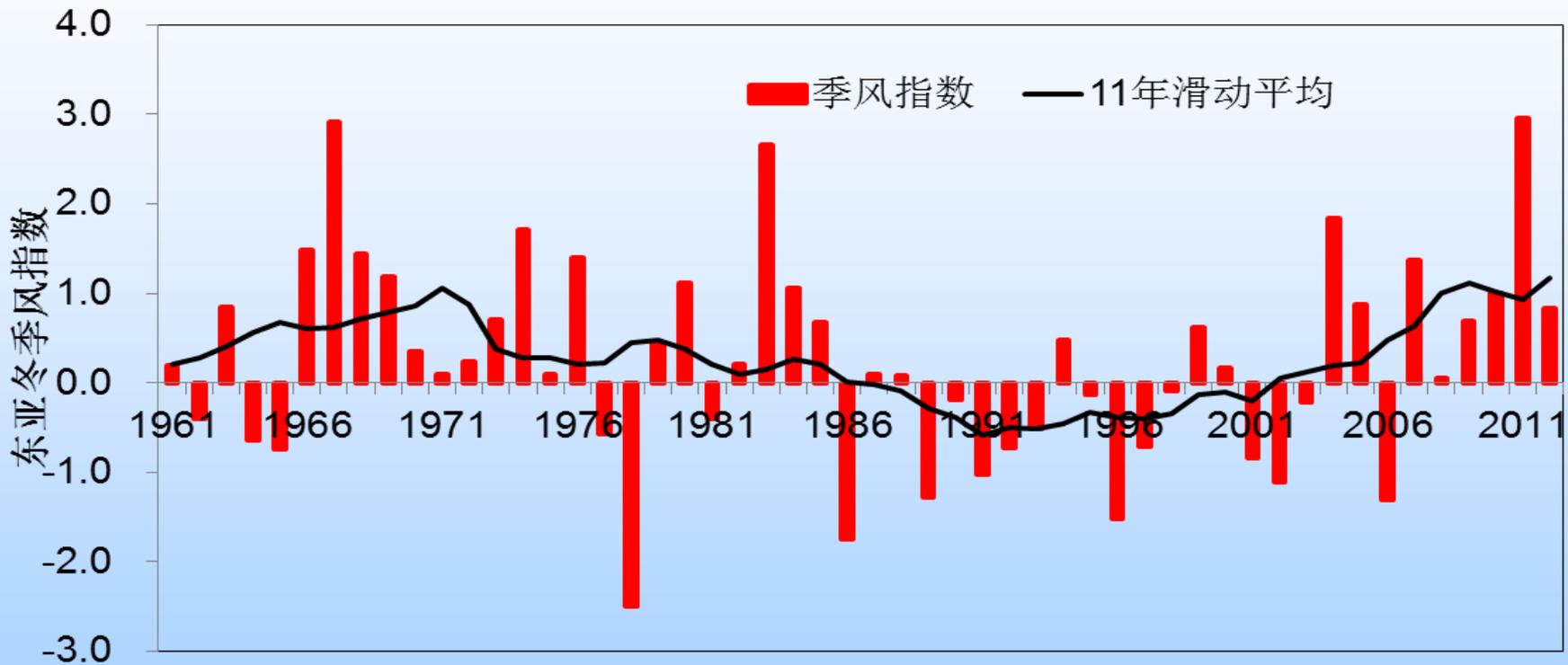
3

Assessment Of EAWM Indices

4

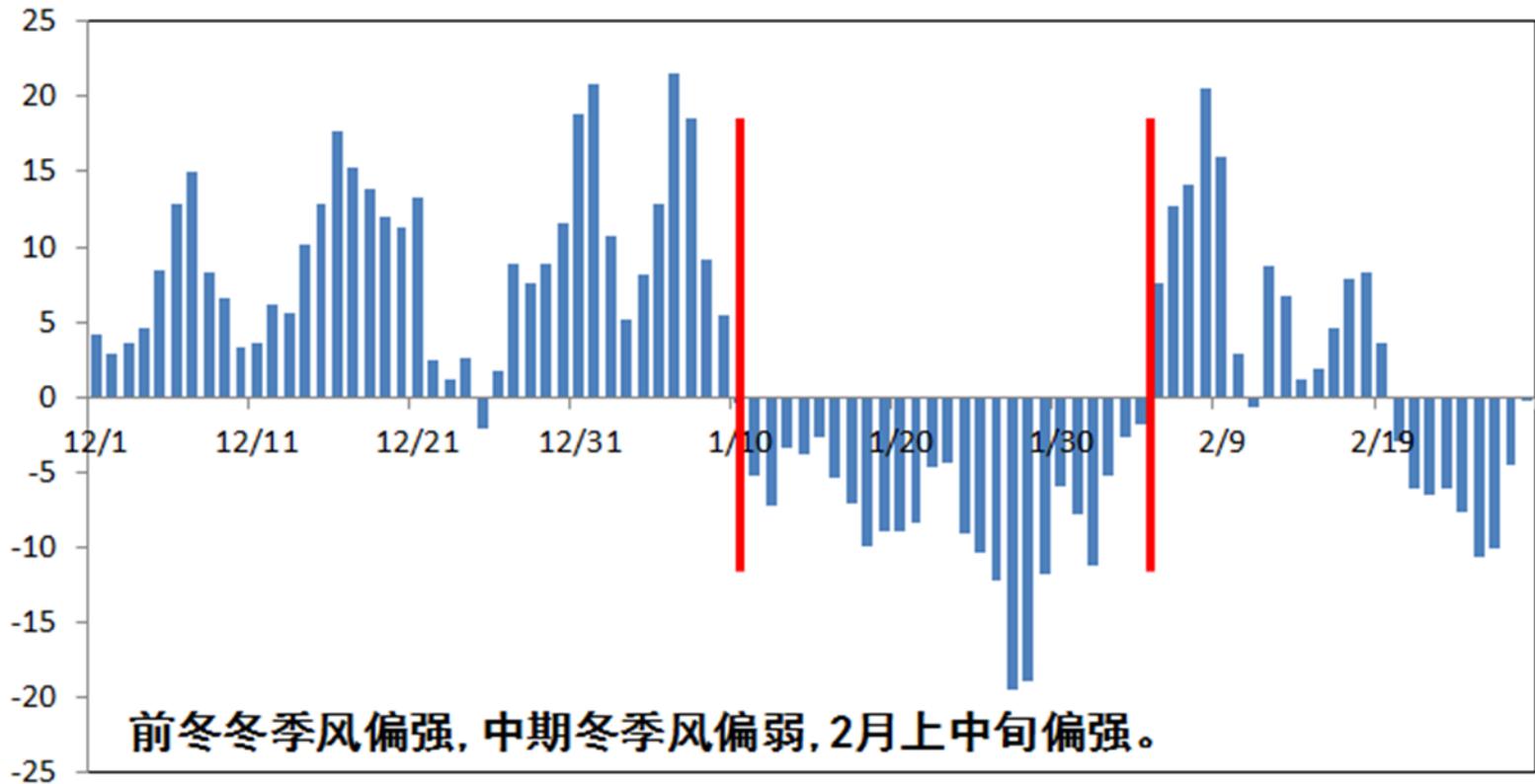
Results and Discussions

2012/2013 Winter Monsoon (REVIEW)



$$EAWM = U500(80-120E; 25-35N) - U500(80-120E, 50-60N)$$

Daily Monitoring of EAWM index



Low-High Lever Circulation

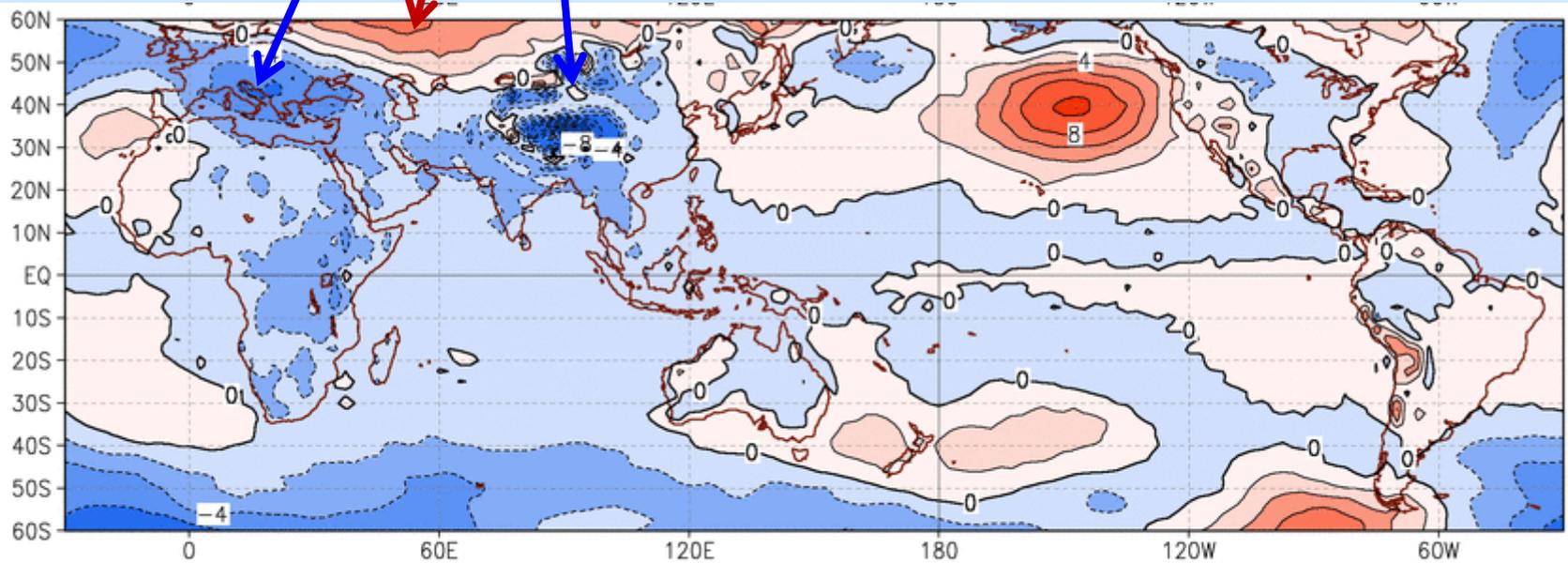
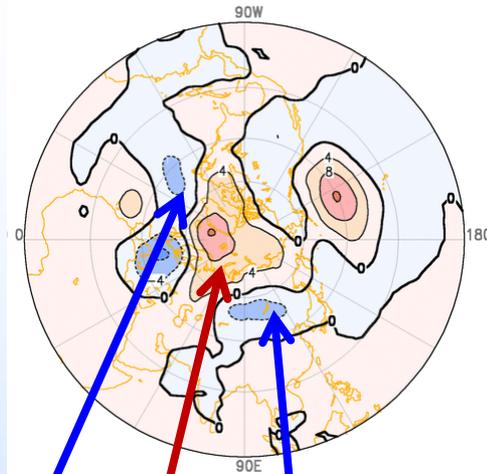
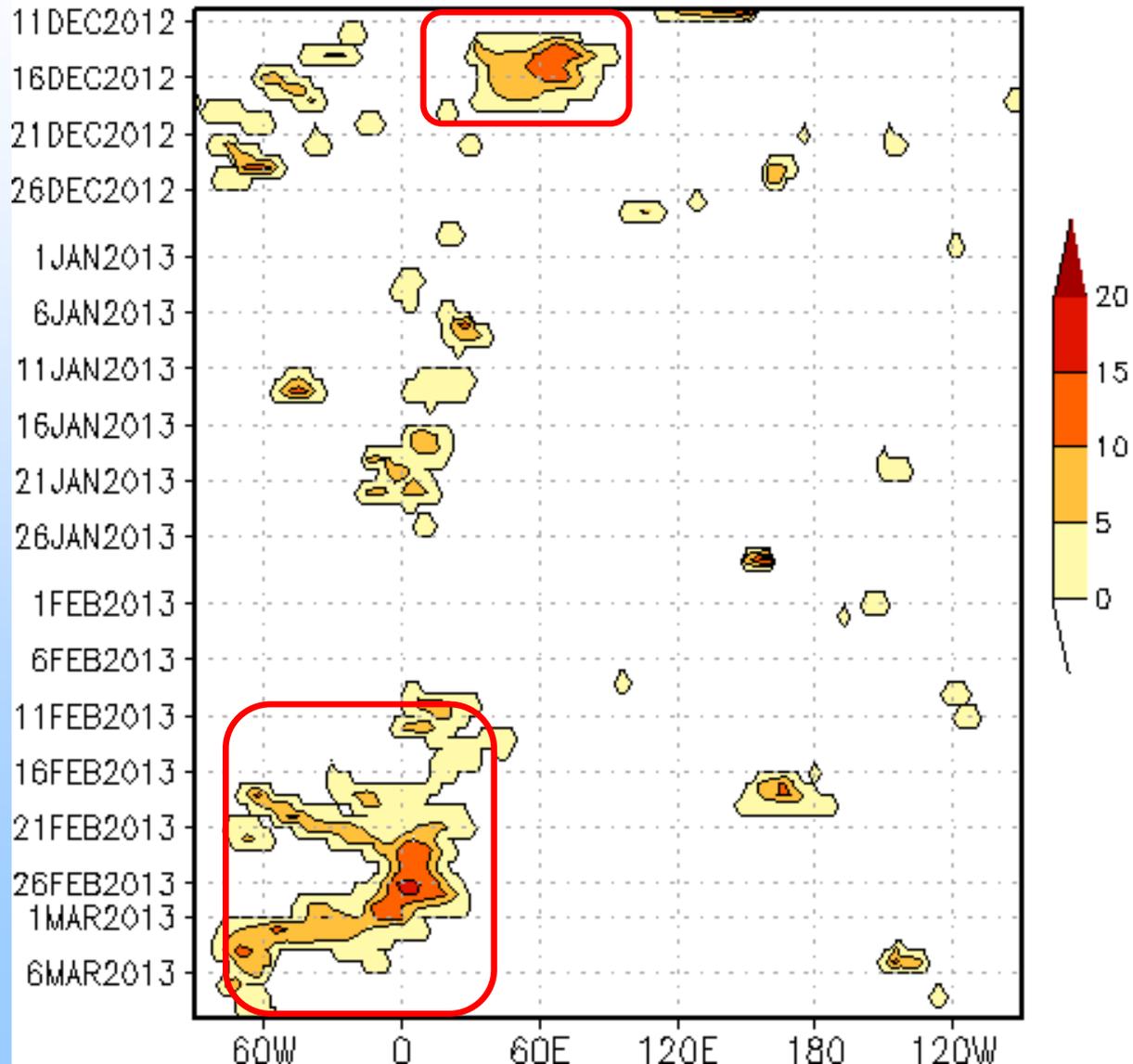


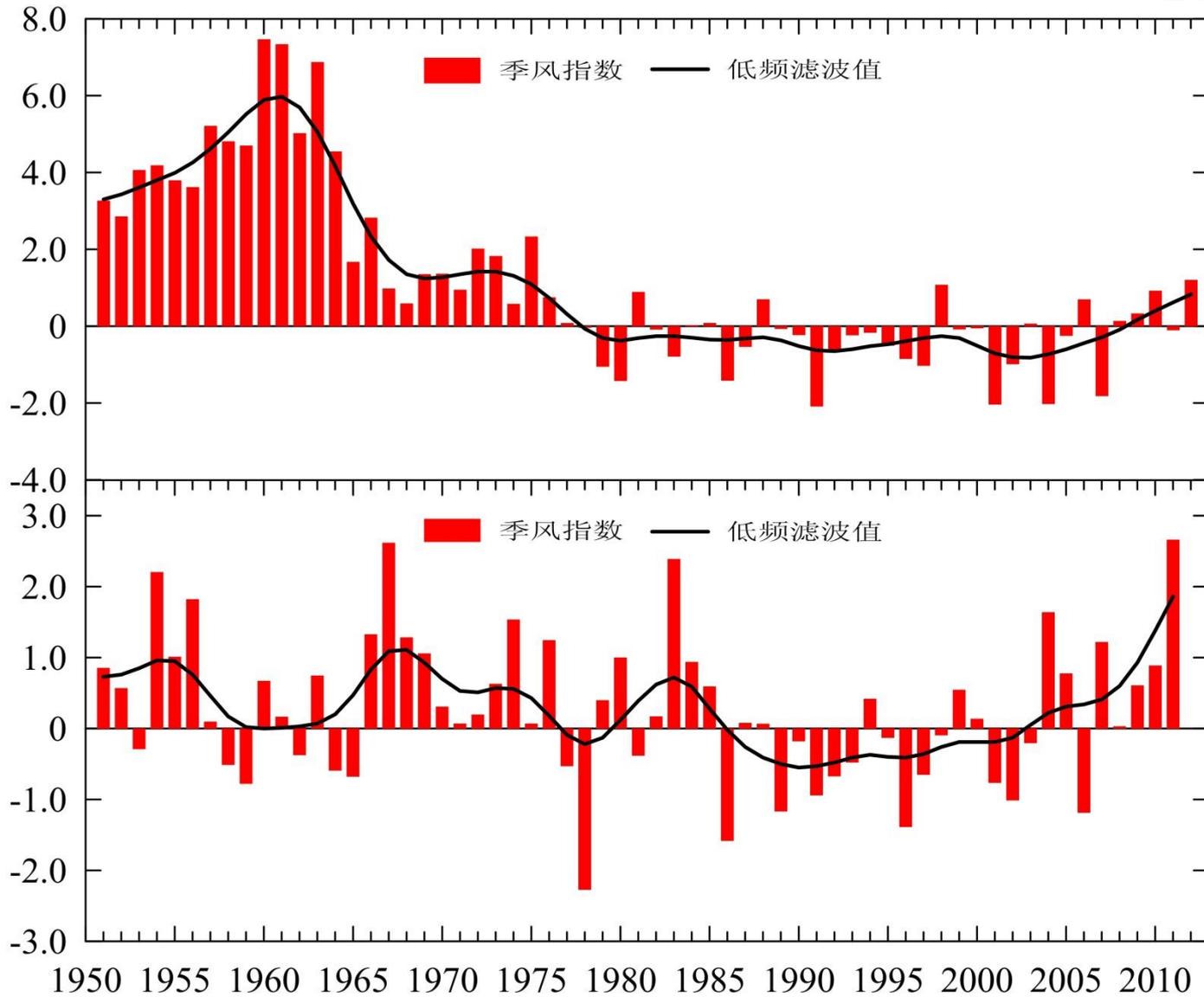
图 S9 季平均海平面气压(上)及距平(下)(hPa) 2012.12-2013.02

Blocking High

BLOCKING STRENGTH GHGS [$m(\text{deglat})^{-1}$]-OBSERVATIONS
UPDATED THROUGH 10Mar2013



东亚夏季季风指数



Intensity of EASM and EAWM

Organization and Mission of the EAMAC/WMO



1. Organization

GENERAL SUMMARY OF CAS-XIV 7.3.9

The Commission endorsed the proposal of China to establish an East Asian Monsoon Activity Centre in Beijing for Project M1. The main functions of the Centre will be:

- improving operational capabilities on East Asian monsoon monitoring, prediction and service;
- providing training related to Asian monsoon;
- organizing and coordinating activities on East Asian monsoon research.highest quality data for assessment, analysis and research of extreme events therefore contributing to the goal of improved forecast and disaster prevention as well as mitigation

• 2. Mission

- To promote and facilitate the exchange, cooperation, and collaboration among researchers and forecasters on the research and operation;
- To improve operational capabilities on Asian monsoon monitoring, prediction and service;
- To provide training related to Asian monsoon and to promote the economic and social development.

History of EAMAC

The Commission endorsed the proposal of China to establish an East Asian Monsoon Activity Centre in Beijing for Project M...
The main functions of the Centre will be...
— GENERAL SUMMARY OF CAS-XIV 7.3.9

Monitoring group

Providing monitoring information of East Asian Monsoon and gathering and processing data employed in research activities on Asian Monsoon

Prediction group

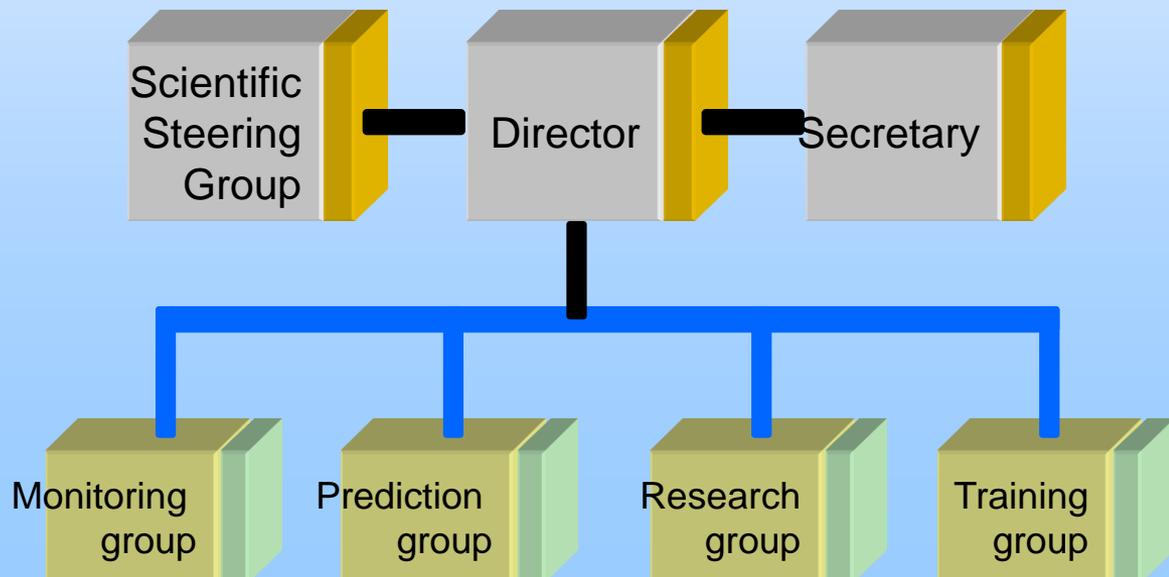
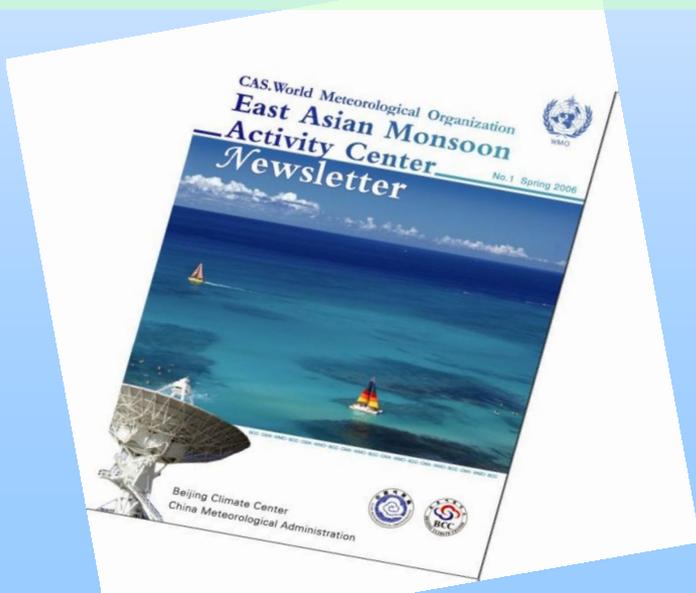
Doing operational prediction of East Asian Monsoon and releasing related productions

Research group

Doing research activities that are focused on forecasting of East Asian Monsoon and related mechanism

Training group

Providing training related to Asian monsoon and organizing and coordinating activities on East Asian monsoon research





Tropical Meteorology Research



MONSOON PANEL

Executive Committee

Chair: Prof Chih-Pei CHANG (USA)

Prof Alice GRIMM (Brazil)

Dr H R HATWAR (India) [Delhi Monsoon Act ivity CTR](#)

Dr Jean-Philippe LAFORE (France)

Prof Jun MATSUMOTO (Japan)

Prof Mezak RATAG (Indonesia)

Dr Matthew WHEELER (Australia)

Dr WU Guoxiong (China)

Dr YAP Kok Seng (Malaysia) [KL Monsoon Activity CTR](#)

Prof ZHANG Renhe (China)

Prof. XIAO Ziniu (China) [EA Monsoon Activity CTR](#)

NMHS &
Major
Programs

Expert Team on Severe Monsoon Weather

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Co-Chair: Prof Richard JOHNSON (USA)

Members:

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Prof Ben Jong-Dao JOU (USA)

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Prof JIAO Meiyuan (China)

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Co-Chair: Prof Bin WANG (USA)

Members:

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Dr Harry HENDON (Australia)

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Dr William LAU (USA)

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Prof WANG Huijun (China)

Prof Tetsuzo YASUNARI (Japan)

Prof Huang-Hsiung HSU (USA)

Prof Dave GUTZLER (USA)

Scientists

Corresponding Members

Ms Rokiah Haji ANGGAS (Brunei Darussalam)

Dr Boon-Ying LEE (Hong Kong, China)

Dr FONG Soi kun (Macao, China)

Dr Prisco D. Nilo (Philippines)

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NMHS

<http://bcc.cma.gov.cn/EAMAC/>

emac@cma.gov.cn



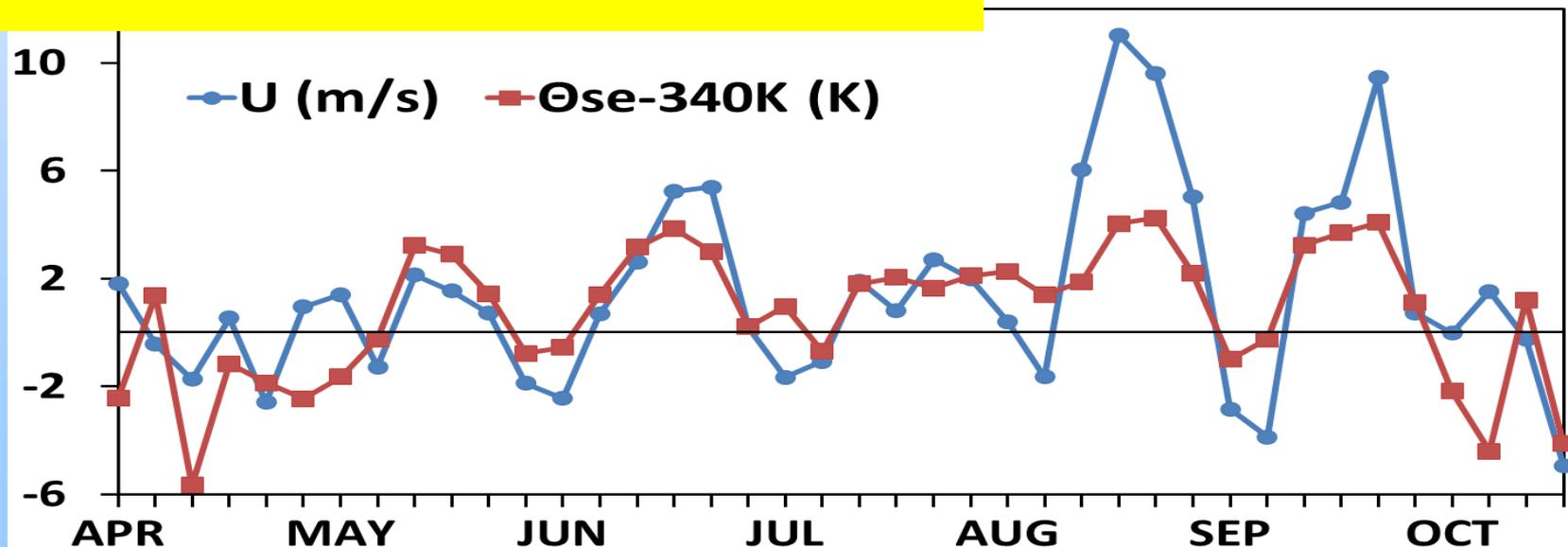
Dr. Gilbert BRUNET, Chair of the Joint Scientific Committee of the World Weather Research Programme (WWRP/WMO), visited Beijing Climate Center and EAMAC/WMO on 10 July 2012. On behalf of BCC, Dr. Brunet is head of the Meteorological Research Division (MRD), Environment Canada, his work covers analytical and empirical studies of wave processes from regional to planetary scale, and numerical weather prediction from minutes to seasons.

Current Operational Products of the EAMAC/WMO

Monsoon Monitoring

- Today's Monsoon (Monsoon Watch);
- Asian Monsoon Activities (Onset, Break, End etc.);
- East Asian Monsoon Systems;
- Monsoon Indices Choices (Summer/Winter Monsoon);
- Monsoon Climate Impact (Seasonal Precipitation, such as **Mei-Yu.**);
- Data Share and Services;
- Research and Publications (EAM Monitoring Bulletin, Reports,)

SCS Monsoon Operational Monitoring in 2013



Monitoring and Assessment of Monsoon and

极端高温

2013年06月29日-2013年08月29日



图例

- 达极端阈值
- 超历史极值

Comprehensive intensity

3.22

2.70

2.44

2.39

2.20

2.11

1.97

1.94

1.61

1.24

Start Time

2013-6-2

2003-6-3

1967-7-1

1966-7-1

1978-6-2

2005-6-1

2001-6-2

2007-7-3

1961-7-1

1979-7-7

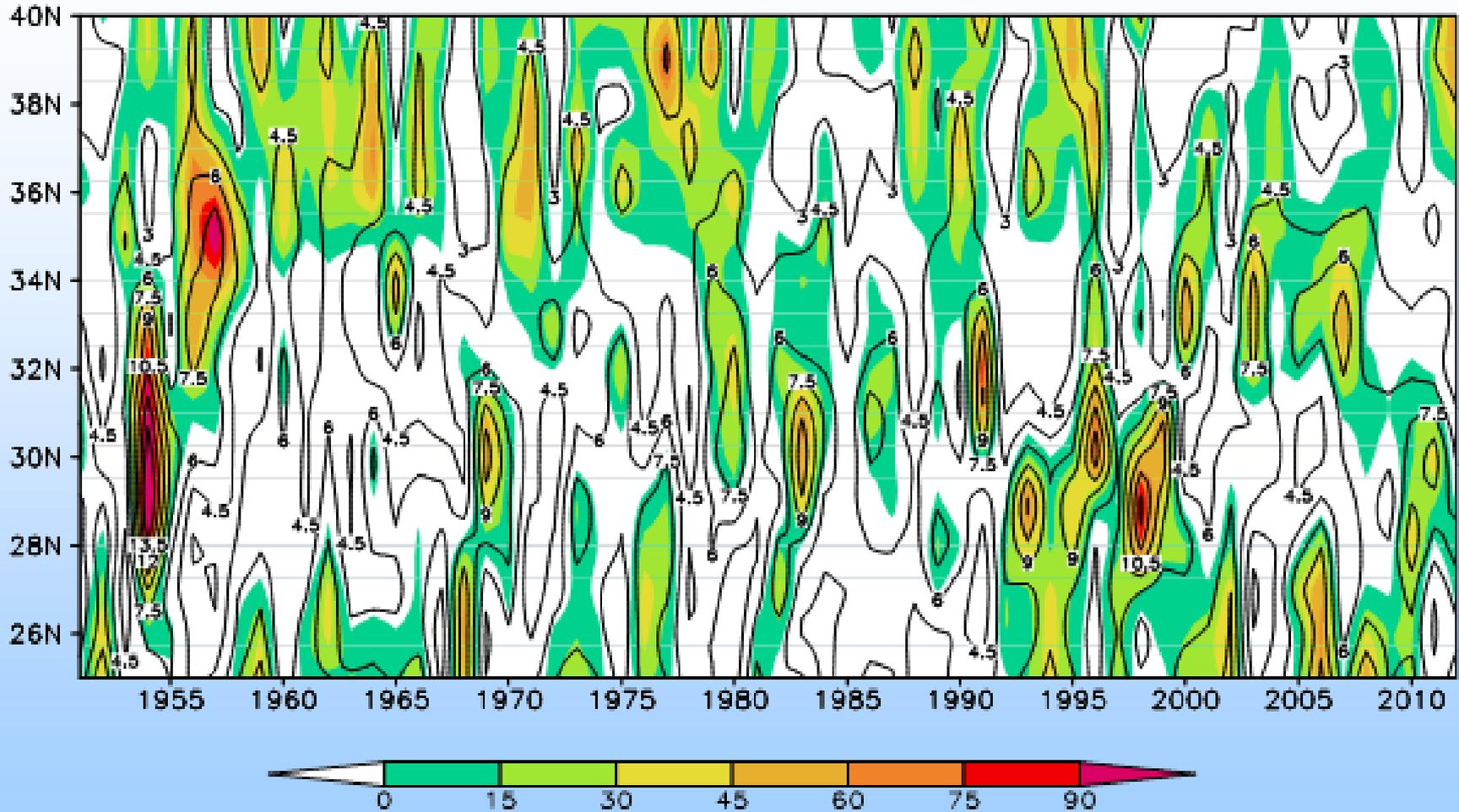
1979-8-17

42

1187

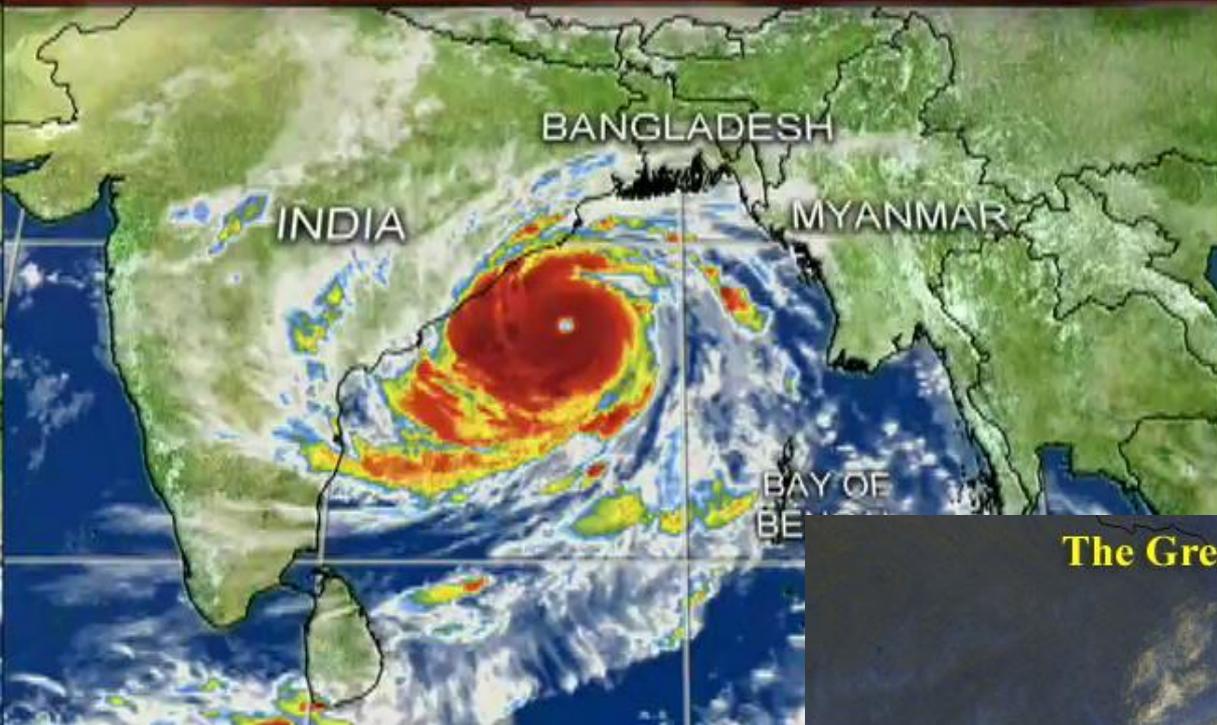
1.09

Top 10 regional extreme heat wave events ranked by comprehensive intensity

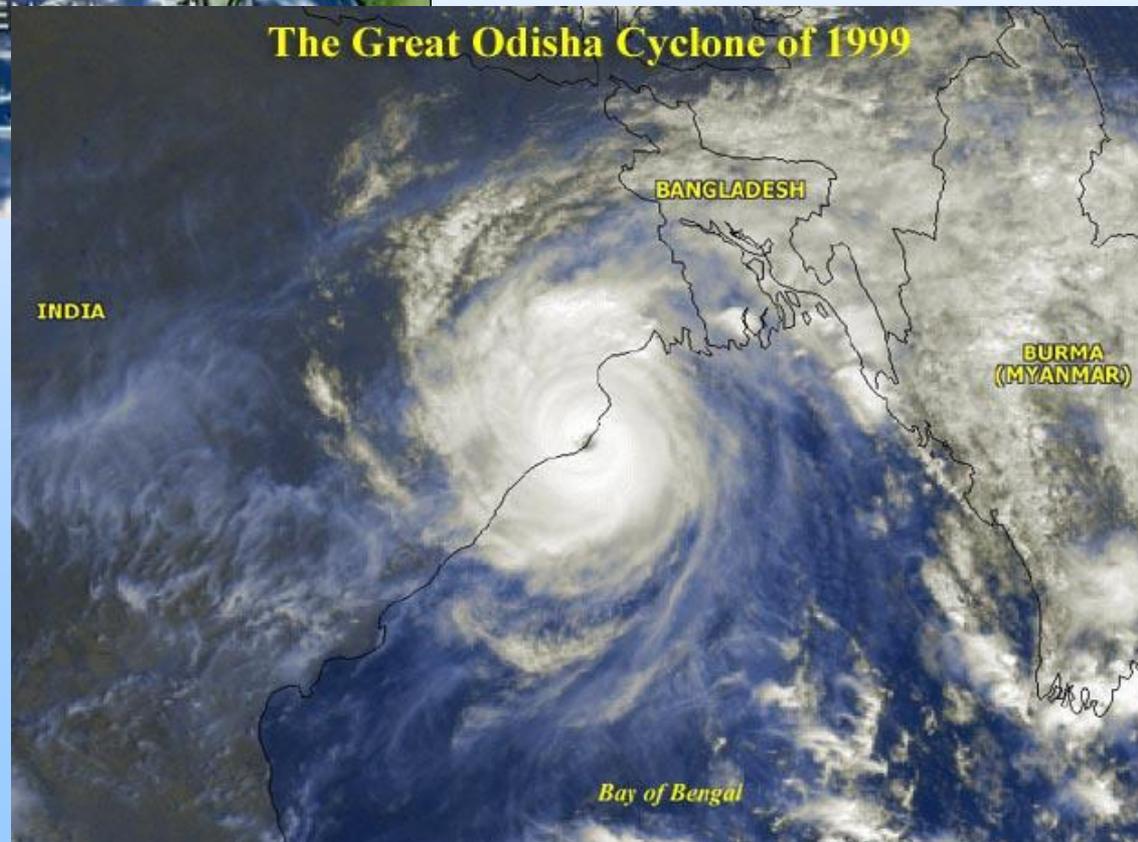


Meiyu seasonal PRP (%) along 110° -122° E

SUPER CYCLONIC STORM PHAILIN



The Great Odisha Cyclone of 1999



International visiting scholar Program



Providing training related to Asian monsoon and organizing and coordinating activities on East Asian monsoon research





Future Outlooks of the EAMAC/WMO



- 1. Constructing Integrated Operational System for the Asian Monsoon Monitoring and Diagnosis**
- 2. Enhancing operational capacity building in forecasting East Asian Summer/Winter Monsoons**



Choices of Monsoon Indices

001. Webster-Yang monsoon index

(U850-U200 averaged over $0-20^{\circ}$ N, 40° E- 110° E)

Webster, P. J., and S. Yang, 1992: Monsoon and ENSO:

Selectively interactive systems. *Quart. J. Roy. Meteor. Soc.*, **118**, 877-926.

002. Australian monsoon index

(U850 averaged over 2.5° S- 15° S, 110° E- 150° E)

Hung, C. W., and M. Yanai, 2004: Factors contributing to the onset of the Australian summer monsoon. *Quart. J. Roy. Meteor. Soc.*, **130**, 739-758.





003. South Asian monsoon index

(V850-V200 averaged over 10° N- 30° N, 70° E- 110° E)

Goswami, B. N., B. Krishnamurthy, and H. Annamalai, 1999: A broad-scale circulation index for interannual variability of the Indian summer monsoon. *Quart. J. Roy. Meteor. Soc.*, **125**, 611-633.

004. Dynamic Indian monsoon index

U850 (5° N- 15° N, 40° E- 80° E) - U850 (20° N- 30° N, 70° E- 90° E)

Wang, B., and Z. Fan, 1999: Choice of south Asian summer monsoon indices. *Bull. Amer. Meteor. Soc.*, **80**, 629-638.





005. East Asian - Western North Pacific monsoon index

U850 (5° N- 15° N, 90° E- 130° E) - U850 (20° N- 30° N, 110° E- 140° E)

Wang, B., R. Wu, K. M. Lau, 2001: Interannual variability of Asian summer monsoon: Contrast between the Indian and western North Pacific-East Asian monsoons. *J. Climate*, **14**, 4073-4090.

Wang, B., Z. Wu, J. Li, J. Liu, C. P. Chang, Y. Ding, and G. Wu, 2008: How to measure the strength of the East Asian summer monsoon. *J. Climate*, **21**, 4449-4463.





006. East Asia monsoon index



$$\delta = \frac{\|\bar{V}_1 - V_i\|}{\|\bar{V}\|} - 2$$

$$\|A\| = \left(\iint s |A|^2 dS \right)^{1/2}$$

$$\|A_{i,j}\| \approx \sqrt{a} \left(\left(|A_{i-1,j}^2| + |A_{i,j}^2| + |A_{i+1,j}^2| \right) \cos \varphi_{j-1} + |A_{i,j-1}^2| \cos \varphi_{j-1} + |A_{i,j+1}^2| \cos \varphi_{j+1} \right)^{1/2}$$

Li, J., and Q. Zeng, 2002: A unified monsoon index. *Geophys. Res. Lett.*, 29, NO. 8, 1274, 10.1029/2001GL013874.



from IPRC



Australian Monsoon (AUSM)

U850 (5° S- 15° S, 110° E- 130° E)

Kajikawa, Y., B. Wang and J. Yang, 2010: A multi-time scale

Australian monsoon index, *Int. J. Climatol*, doi: 10.1002/joc.1955.





$$I = \sum_{i=1}^5 (H_{1i} - H_{2i}) \quad \text{if } (H_{1i} - H_{2i}) \leq -5.0$$

where $H_1=H_{500}$ at 110° E, $H_2=H_{500}$ at 160° E, $i=1$ means at 10° N, $i=2$ means at 20° N and so on.

$$I = \sum_{i=1}^5 (SLP_{1i} - SLP_{2i})$$

where $SLP_1=SLP$ at 110° E, $SLP_2=SLP$ at 160° E, $i=1$ means at 20° N, $i=2$ means at 25° N and so on. $Nor(X)$ means the normalization of X.

$$I_{EAM} = \sum_{i=1}^{17} (H_{1i} - H_{2i})$$

where $H_1=H_{500}$ at 110° E, $H_2=H_{500}$ at 150° E, $i=1$ means at 10° N, $i=2$ means at 12.5° N and so on.

Guo, Q. Y., 1983; Shi, N., and Q. G. Zhu, 1996; Peng, J. Y., Z. B. Sun, and D. H.

Ni, 2000





~~U850-U200~~, (5° N- 15° N, 90° E- 130° E)

U850-U200, (0° - 10° N, 100° E- 130° E)

CI1 negative OLR anomalies averaged over the area (10° - 25° N, 70° - 100° E)

CI2 negative OLR anomalies averaged over the area (10° - 20° N, 115° - 140° E)

WSI1 westerly shears ($U850-U200$) averaged over the area (5° - 20° N, 40° - 80° E)

WSI2 westerly shears ($U850-U200$) averaged over the area (0° - 10° N, 90° - 130° E),

SSI1 southerly shears ($V850-V200$) averaged over the combined areas (15° - 30° N, 85° - 100° E)

SSI2 southerly shears ($V850-V200$) averaged over the combined areas (0° - 15° S, 40° - 55° E)

DU2 the $U850$ in (5° - 15° N, 90° - 130° E) - $U850$ in (22.5° - 32.5° N, 110° - 140° E).





U850(10° N-20° N, 100° E-150° E)-U850(25° N-35° N, 100° E-150° E)

RM1 = V850-V200 (10° -30° N, 70° -110° E)

RM2=U200(40° -50° N, 110° -150° E)-U200(25° -35° N, 110° -150° E)

u v velocity at 850hPa, (20° -40° N, 110° -125° E)

u v velocity at 850hPa, (20° -40° N, 110° -140° E)

V850 anom (20° -30° N, 110° -130° E)

V850 anom (20° -40° N, 110° -140° E)

Wang, Q., Y. H. Ding, and Y. Jiang, 1998; He, M., W. L. Song, and L. Xu, 2001; Wang, B., and Z. Fan, 1999; Lau, K.-M., and S. Yang, 2000; Wang, H. J., 2002; Qiao, Y. T., L. T. Chen, and Q. Y. Zhang, 2002; Wu, A. M., and Y. Q. Ni, 1997; Wang, Y. F., B. Wang, and J.-H. Oh, 2001;





June-August

Nor(V_{sw})-Nor(OLR) (22.5° N- 32.5° N , 112.5° E- 135° E)

V_{sw} means southwesterly component at 850hPa in unit of m/s, Nor(X) means the normalization of X.

$(V_{sw}-1.0)/a+(235-V_{olr})/b$ (5° - 20° N, 105° - 120° E)

Where V_{sw} means the southwesterly component at 850hPa in unit of m/s, V_{olr} means the value of OLR in W/m^2 and a and b are the constants, in which $a=1$ m/s and $b=10$ W/m^2 .

Nor(V_{sw})-Nor(OLR) (10° N- 20° N , 100° E- 120° E)

V_{sw} means southwesterly component at 850hPa in unit of m/s, . Nor(X) means the normalization of X.

Ju, J. H., C. Qian, and J. Cao, 2005; Liang, J. Y., S. S. Wu, and J. P. You, 1999; Wu, S. S., and J. Y. Liang, 2001:





Nor(U850-U200, (0° -10° N, 100° E-130° E))+Nor(SLP(160° E)-
SLP(160° E),(10-50° N))

Nor(- 0.25Zs'(20° N,125° E) + 0.50Zs'(40° N,125° E) -
0.25Zs'(60° N,125° E))

where $Z' = Z - z$ (Z is the seasonal-mean 500 hPa geopotential height in a summer, Z is the climatological-mean geopotential height) , $Zs' = Z' \sin 45^\circ / \sin \varphi$, φ is the latitude. Nor(X) means the normalization of X.

$$\Delta D / \sqrt{\sum (\Delta D_j)^2 / n}$$

$$\Delta D (D_{850} \text{ means } D_{200})_j$$

averaged over 7.5-17.5° N, 105° E-125° E,

$$\Delta D_j$$

means wind flux divergence at grid point j.

Zhu, C. W., J. H. He, and G. X. Wu, 2000; Huang, G., and Z. W. Yan, 1999; Li, C. Y., and L. P. Zhang, 1999





- 13、周兵 (Bing ZHOU)、何金海、吴国雄等
2003年

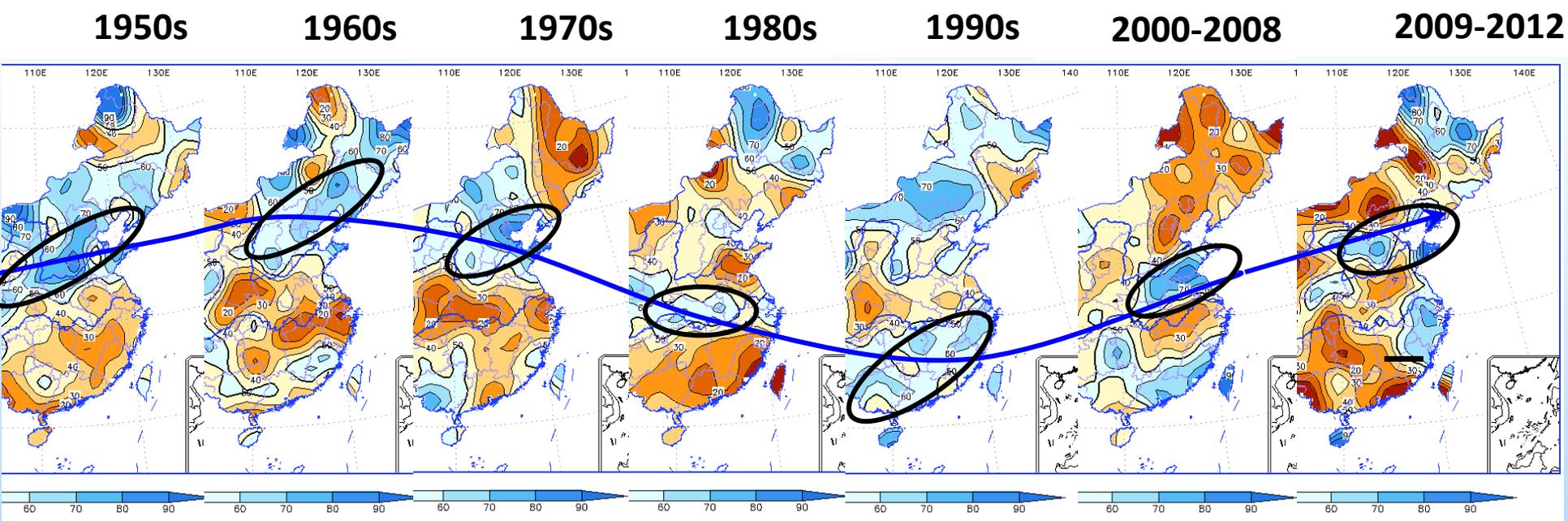
东亚副热带季风指数 I_{es} :

$$I_{es} = V_{850} - V_{200}, (10-25^{\circ} \text{ N}, 100-125^{\circ} \text{ E})$$

南海季风指数 I_{ss} :

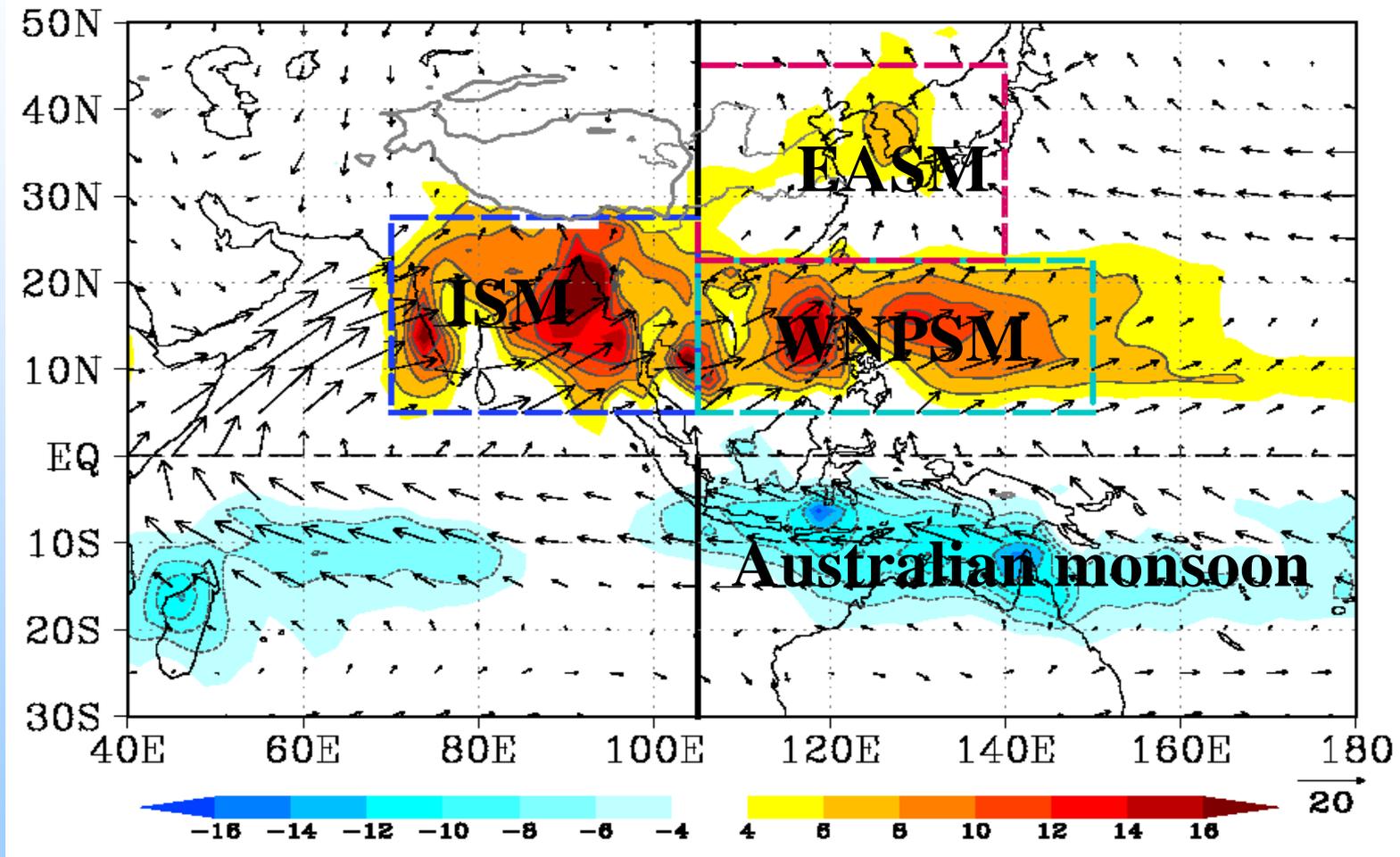
$$I_{ss} = V_{850} - V_{200}, (10^{\circ} \text{ S} - 10^{\circ} \text{ N}, 100-140^{\circ} \text{ E})$$

Activities of JJA Main Precipitation Belt



1951-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2011	2012
1	1	1	3	4	2	1
Northern			Southern		Middle	Northern

A-A Summer Monsoon Regions





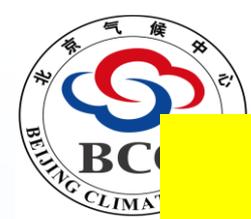
Results and Discussions

- EAMAC NEWSLETTER
- TMR/WWRP (Monsoon Panel & Exp Team)
- Monitoring & Prediction of East Asian Monsoon
- FOCRA II -2014 SUMMER MONSOON
- East Asian Meiyu-Baiu-Changma Systems
- INTERACTION with other Monsoon Activity Centres
- Later AMY 2008-2012
-



Results and Discussions(2)

- 1、 The climate in the Northeast, Southwest, Meiyu areas occurred persistently abnormal since late 1990s. PDO and EAM effect may be the main reasons.
- 2、 Need more attention inter-decadal turning signal, and abnormal climate with its own variation period.
- 3、 Meiyu season framework has been further expanded under the traditional framement, the Jiangnan Pattern, the Yangtze River Pattren and the Jianghuai Pattern, which associated with the monsoon advance.



**BCC & TCC & APCC & ...
FOCRA-II & SASCOF & EASCOF**

3C Concepts

- Combining (winter & summer monsoon)**
- Cooperating (Wide East Asian Center)**
 - Covering (Asia RCOF)**



Thank You !

