

TRAVEL REPORT FORM

출장보고서

결 재	선임연구 원	팀장	부서장	원장
	03/26 김해정	03/26 문자연	03/26 유진호	03/26 정홍상
협 조				

I. Travel Overview 출장개요

1. Traveler(s) 출장자

Department 소속	Position 직위(직급)	Name 성명	Note 비고
기후사업본부	선임연구원	김해정	

2. Travel Period 출장기간

2018. 03. 19 ~ 2018. 03. 22

3. Occasion and destination 행사 및 출장지

대만기상청 (Central Weather Bureau, Taiwan ROC)

II. Major Activities 주요업무 수행내용

1. Main Contents and Activities 주요내용 및 활동

1) 출장 목적

- APCC가 수행중인 BSISO 예보 및 연구에 대한 대만기상청의 이해 증진을 통해 그들의 중장기 예보 역량 강화를 도모하고자 대만기상청의 초청을 받아 출장을 수행하였음.
- APCC BSISO 예보로 대만기상청의 새로운 예측 모델 자료를 도입하고자 논의 하였음.

2) 주요내용 및 활동

- APCC BSISO 예보 및 연구에 대한 CWB의 이해 증진을 위한 세미나 2회
- 대만기상청 모델링 및 장기예보 실무진과의 회의 3회
- 대만국립대학 대기과학과 방문을 통해 APCC BSISO 연구 현황 공유

※ 세부내용은 [붙임1] 출장주요내용 참고

2. Relevance to APEC Climate Center's Activities 결론 및 소감

1) 결론

- CWB는 세가지 예측 모델로부터 생산된 BSISO 지수의 예측 성능을 자체적으로 비교하여 APCC BSISO 예보에 기여할 모델/자료 구성을 결정할 예정. 이후 APCC BSISO로의 참여 모델 전환이 가능하고 그 과정에서 APCC BSISO 담당자와 지속적인 대화를 할 것으로 논의.
- MJO/BSISO 모니터링/예보 그리고 활용 가능성 창출에 대하여서는 추후 지속적으로 CWB의 장기예보팀과 서로의 노하우를 공유하기로 협의.
- CWB BSISO 예보 담당자 중 일부에게 올 해 개최될 APCC S2S 교육프로그램의 참가자로 참석할 기회를 제공함으로써 CWB의 BSISO 예보 역량 강화를 도모할 예정.

2) 소감

[성과] 금번 출장의 가장 큰 성과는 APCC가 수행중인 BSISO 예보의 주요 사용자 중 하나인 대만기상청 장기예보 실무진들에게 APCC BSISO 예보 및 활용 가능성에 대해 홍보를 한 것이었다. 실제로 방문 기간 내내 대만기상청에서는 APCC BSISO에 관하여 엄청난 관심을 보였고 이러한 관심은 대만 기상학계로까지 이어져 애초 계획에 없었던 대만국립대학 교수진과의 미팅까지 만들어내었다.

[APCC의 수준] BSISO의 유용성이 조금씩 알려지기 시작한 만큼 아시아몬순 지역 기상예보 실무진들도 APCC BSISO 실무진들이 모니터링/예보하는 방식과 유사한 일들을 하고 있음을 알게 되었다. 누구보다도 우리가 먼저 BSISO 업무를 시작하였기 때문에 APCC가 하고 있는 BSISO 연구는 기상예보관의 시각뿐만 아니라 응용전문가의 시각에서도 상당한 수준에 이르렀다 볼 수 있는 정도이고 타기관들도 우리의 방식을 벤치마킹하려는 의지를 가지고 있었었다. APCC는 좀 더 구체적이고 견고하게 결과들을 다듬는다면 이는 추후 아시아몬순 지역 기상/수문 실무진들을 대상으로 하는 APCC의 전략 상품 중 하나로 만들 가능성이 높은 연구가 될 수 있을 듯 하다.

[과학적 견해] APCC가 활용중인 BSISO 지수라는 것은 실제 BSISO 현상을 쉽게 진단하기 위하여 간소화한 틀인데 이 BSISO 지수 예보를 다시 실제 BSISO현상/대기 순환장으로 복귀시킨 application field 가 과연 어떤 의미를 가지고 있는지에 대해서는 상당히 많은 고민이 필요하다고 판단된다. 또한 이는 어쩌면 기후학자/예보관의 입장과 응용 전문가의 시각에서 이해시키는 방식이 달라져야 할지도 모른다는 생각으로 연계될 수 밖에 없었고 추후 수요자에 따라 해석하는 방안에 대한 고민 또한 필요하다고 생각된다. 이를 해결하기 쉬운 방법 중 하나로, 실제 BSISO 예보를 3-4주 중장기 예보에 활용하는 아시아몬순지역 예보 실무진들과 지속적으로 소통하는 것이 필요하다고 보여진다.

[CWB와의 협력] CWB와의 협력에 있어서는 APCC는 모델 예측 자료 수신에 있어서는 CWB의 수요자로서, BSISO 예보 활용에 있어서는 CWB의 공급자로서 상호 긴밀한 관계를 유지하고 있으므로 두 당사자 간의 장단점을 적극 활용한다면 추후 BSISO 연구에서도 상당한 시너지 효과 및 협력의 기회를 창출 할 수 있을 것으로 생각 된다.

이를 위하여 실무진들은 수요자의 견해에 기반하여 좀 더 나은 연구 및 협력 방안을 창출하려 노력해야 할 것이고 센터는 이러한 실무진들의 노력이 빛을 발할 수 있게 BSISO 업무에

지금 보다 많은 관심을 가지고 지원하길 바란다.

3. Suggestions and Remarks 건의사항

III. References (Presented and Collected Materials) 주요 수집자료

(with attachment of any information or report in case of attendance of conferences, workshops and meetings) 학술대회, 워크숍, 회의 등 참석 시 관련 정보 및 문서 첨부

대만기상청 방문 주요내용 및 활동

【 2018. 03. 23. (금) / 기후사업본부 김해정 】

○ 주요내용 및 활동

- APCC BSISO 예보 및 연구에 대한 CWB의 이해 증진을 위한 세미나 2회
 - APCC의 계절 및 계절내 현업 예측 소개
 - APCC BSISO 예보의 실용화 방안 및 활용 가능성에 관한 소개
- APCC BSISO 예보로의 새로운 CWB 예측 모델 자료 도입 논의
 - 3가지 대만기상청 현업 예측 모델 개요 및 예측 현황 공유 (from CWB modeling team)
 - APCC BSISO 현업 예측 시스템 공유 (from HJKIM)
 - 대만기상청 GFS모델의 BSISO 예측 방법 및 스킬에 관한 논의 (from CWB LRF team)
 - APCC에서 분석한 CWB BSISO 예측 스킬 공유 (from HJKIM)
 - APCC BSISO 예측으로의 대만기상청 참여모델 전환 논의 (together)
- 대만기상청이 수행중인 새로운 BSISO 지수 개발에 대한 논의 (with Ms.Yun-Lan)
- 대만기상청 WEEK3&4 예보 업무에 대한 토의 (with CWB LRF team)
 - MJO/BSISO 모니터링 및 예측 업무 공유
- 대만국립대학 대기과학과 방문을 통해 APCC BSISO 연구결과 공유 (with Dr. Mong-Ming Lu & Prof. Chung-Hsiung Sui)

※ 세부 일정

날짜	시간	수행내용	비고
3/19 (월)	11:00	대만 도착	
	14:00-16:30	APCC BSISO 예보로의 새로운 CWB 예측 모델 자료 도입 논의	
	16:30-17:00	Director. Mark Cheng과의 면담	
	17:00-20:00	CWB modeling & LRF team 과의 만찬	
3/20 (화)	10:00-12:00	APCC의 계절 및 계절내 현업 예측 소개	
	12:00-13:00	Deputy Direct General, MD Cheng 과의 오찬	
	14:00-14:30	CWB 예보 회의 참관 및 Director. Kuo-Chen Lu와의 면담	
	14:30-16:30	대만기상청이 수행중인 새로운 BSISO 지수 개발에 대한 논의	
	16:30-17:00	CWB 시설 견학	
3/21 (수)	10:00-12:00	APCC BSISO 예보의 실용화 방안 및 활용 가능성에 관한 소개	
	12:00-13:00	CWB LRF team 과의 오찬	
	13:30-15:30	대만기상청 WEEK3&4 예보 업무에 대한 토의	
	16:30-17:30	대만국립대학에서 APCC BSISO 연구결과 공유	
	17:30-18:00	Prof. Po-Hsiung Lin 과의 면담	
	18:00-20:00	Dr.Mong-Ming Lu & Prof.Chun-Chieh Wu 와의 만찬	
3/22	11:00	대만 출발	

Enhancing the practical usefulness of APCC's BSISO information

(Mar. 21, 2018)

Hae-Jeong Kim* and Yoo-Rim Jung
APEC Climate Center

Better forecast? *practical use*



**Reliable
forecast**



**Reasonable
interpretation**



**Recognition
of the value**



**Actionable
information**

**Illegible BSISO index
→ user friendly information**

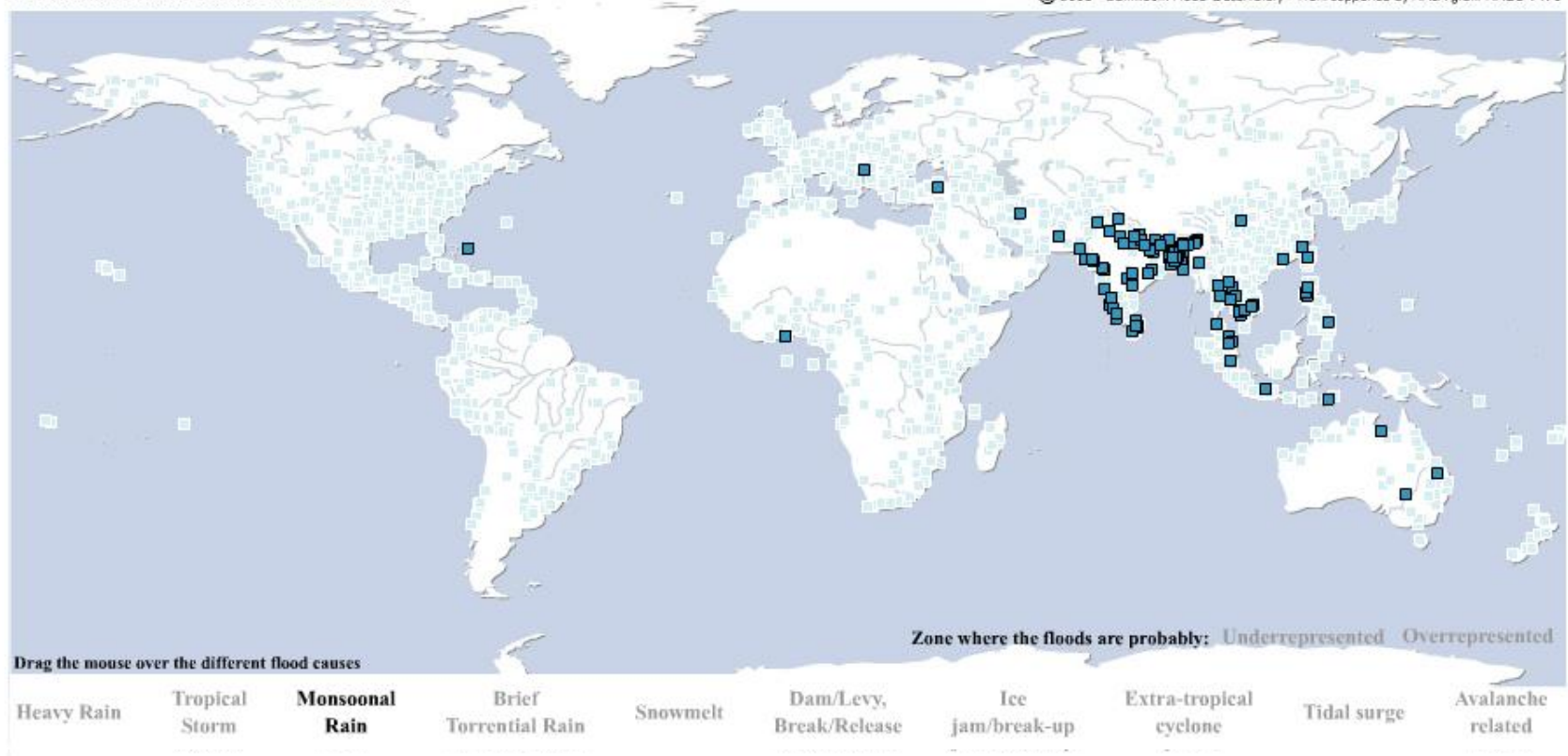
Better forecast? *practical use*



What is the actionable information for?

Flood causes listed since 1985

© 2003 - Dartmouth Flood Observatory - Work supported by NASA grant NAG5-9470



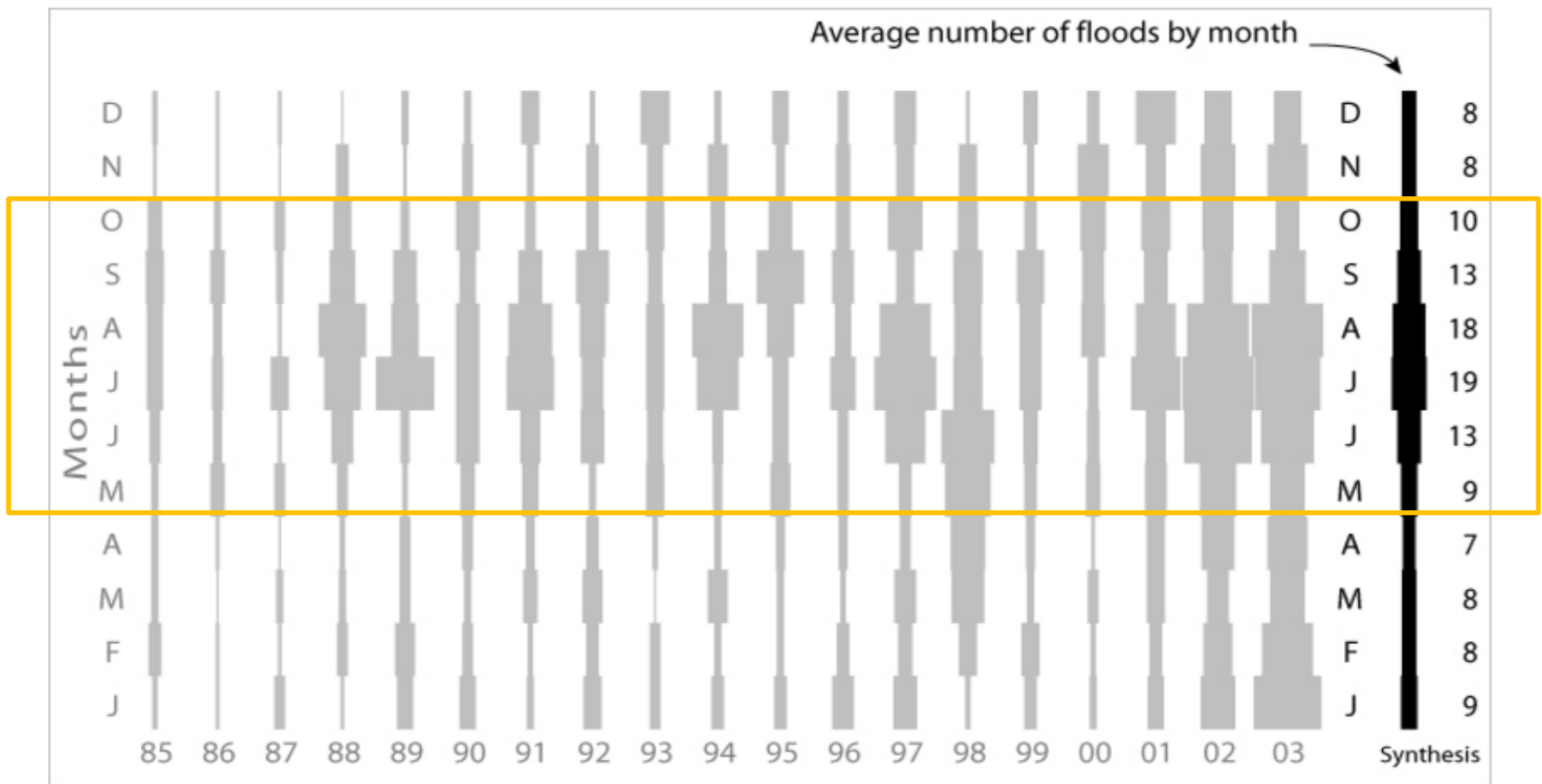
A lot of ***flooding*** is caused by heavy rain, tropical storm and monsoonal rain .

Better forecast? *practical use*



What is the actionable information for?

When do the floods start?



Those could be *considerably associated with the BSISO activity.*

Better forecast? *practical use*

Under operational perspective



#1. To find the BSISO impact on heavy rainfall

#2. To make a user guideline for somewhere or somebody

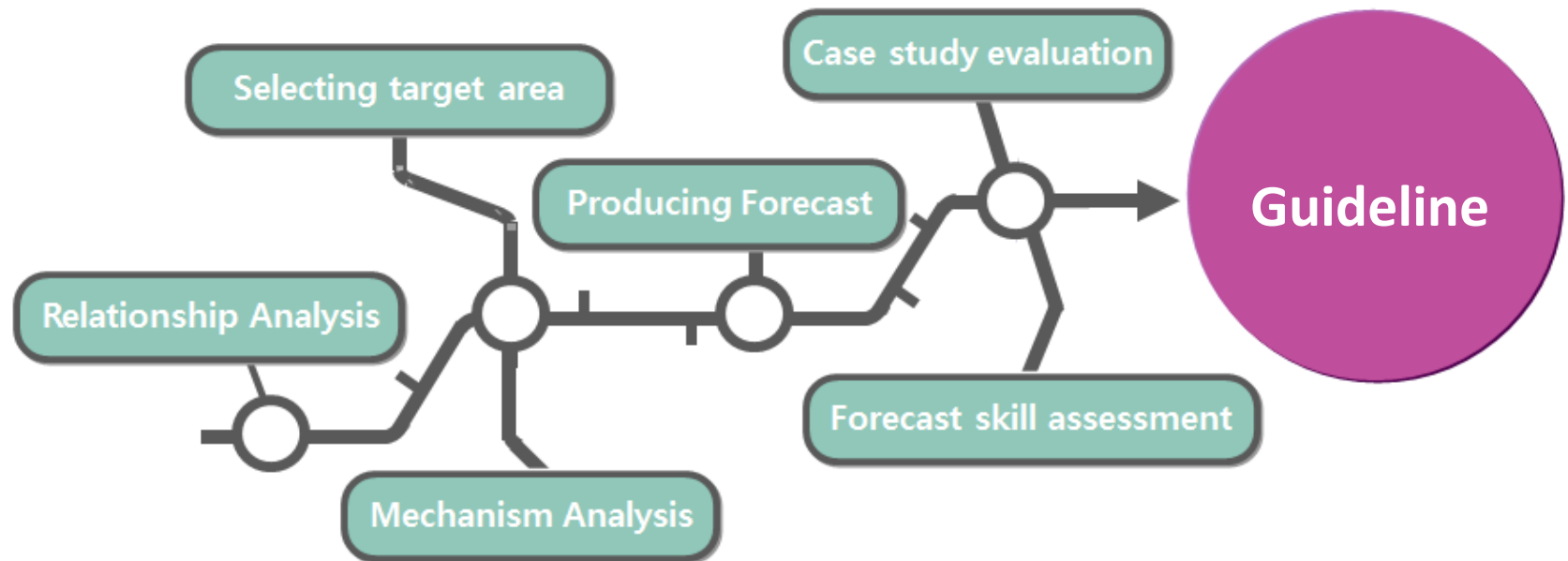
: Focused on the *flood prone areas with large rivers over Southeast Asia*

Better forecast? *practical use*



Strategy

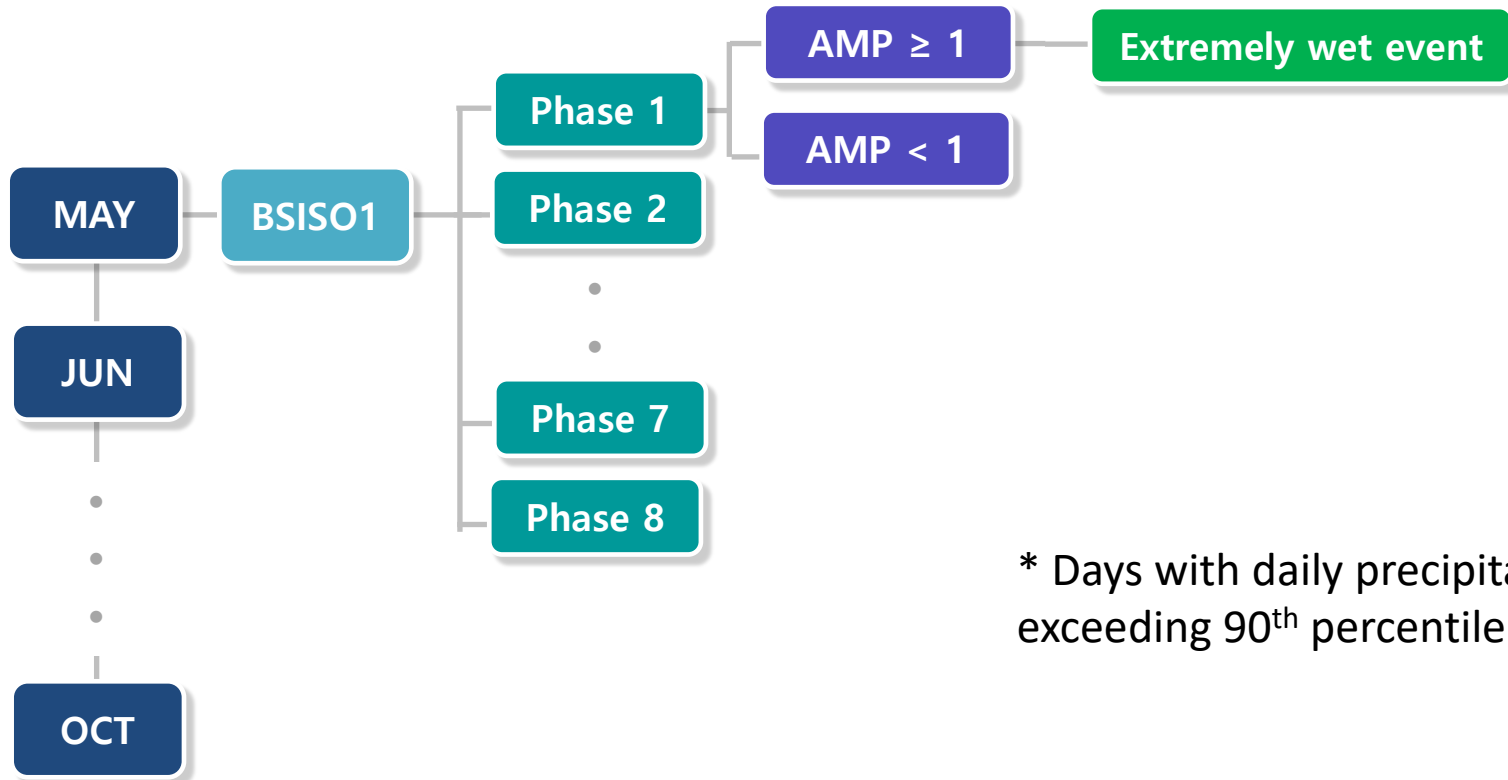
'15 '16



Better forecast? *practical use*



Relationship analysis (*Composite analysis : BSISO-Heavy rainfall probability*)



* Days with daily precipitation exceeding 90th percentile

Probability of heavy rainfall occurrence estimated by BSISO phases & amplitude

$$= \frac{\text{number of days [BSISO1}_{AMP} \geq 1, \text{ BSISO1 phase1, daily PRCP} > 90\text{th percentile}]}{\text{number of days [BSISO1}_{AMP} \geq 1, \text{ BSISO1 phase1}]} \times 100$$

Better forecast? *practical use*

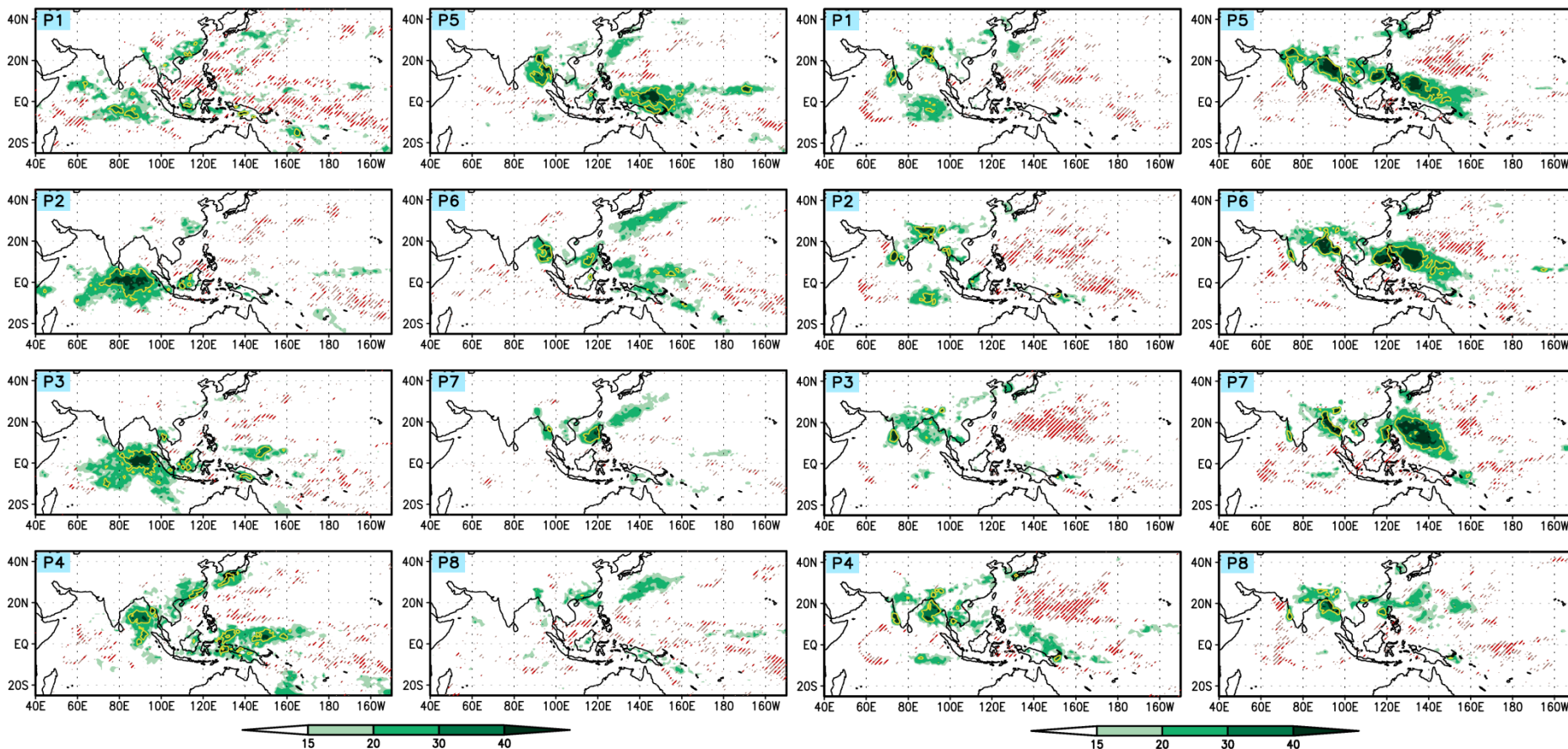


Relationship analysis (Composite analysis : BSISO-Heavy rainfall probability)

Probability of extreme rainfall occurrence based on BSISO phases

[e.g.MAY, BSISO1 $\geq$ 1.0]

[e.g.JUL, BSISO2 $\geq$ 1.0]

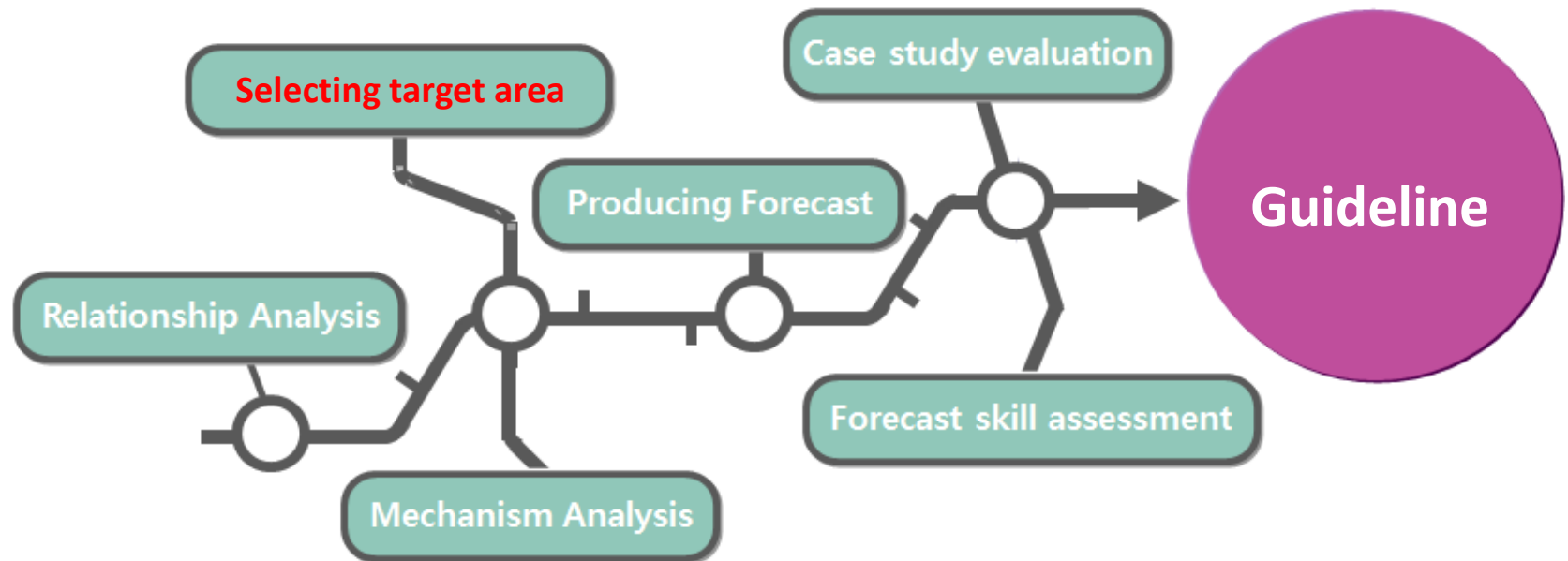


Better forecast? *practical use*



Strategy

'15 '16



Better forecast? *practical use*



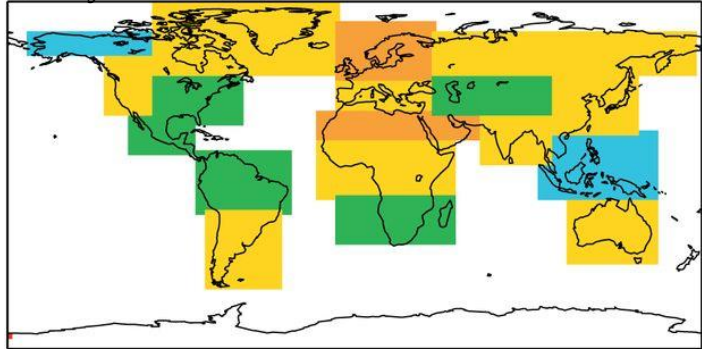
Selecting target area

#R1. Developing countries in the APEC region

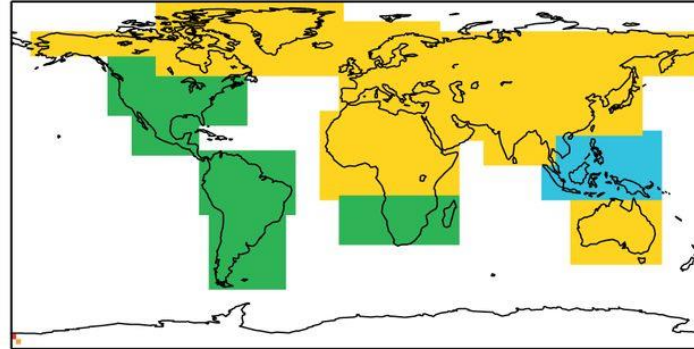
#R2. Predictable region from the view of meteorologist

Reliability categorization of precipitation forecasts

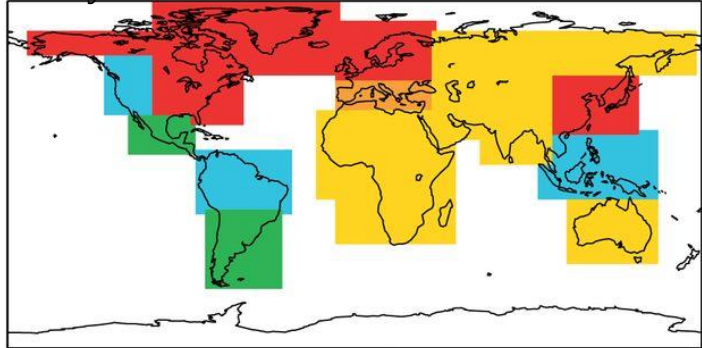
(a) Dry DJF



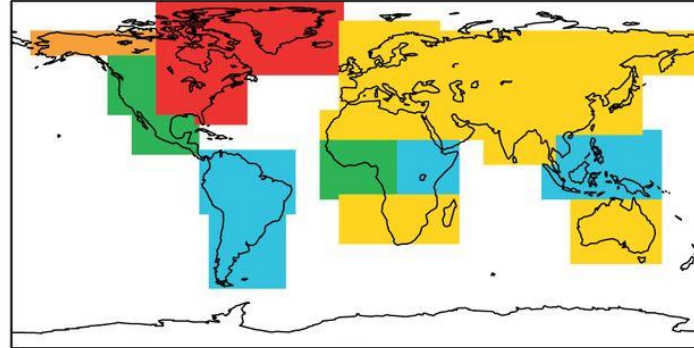
(b) Wet DJF



(c) Dry JJA



(d) Wet JJA



5 perfect 4 still useful 3 marginally useful 2 not useful 1 dangerous

The precipitation forecast over *Southeast Asia* is useful.

It is consistent among the events and seasons.

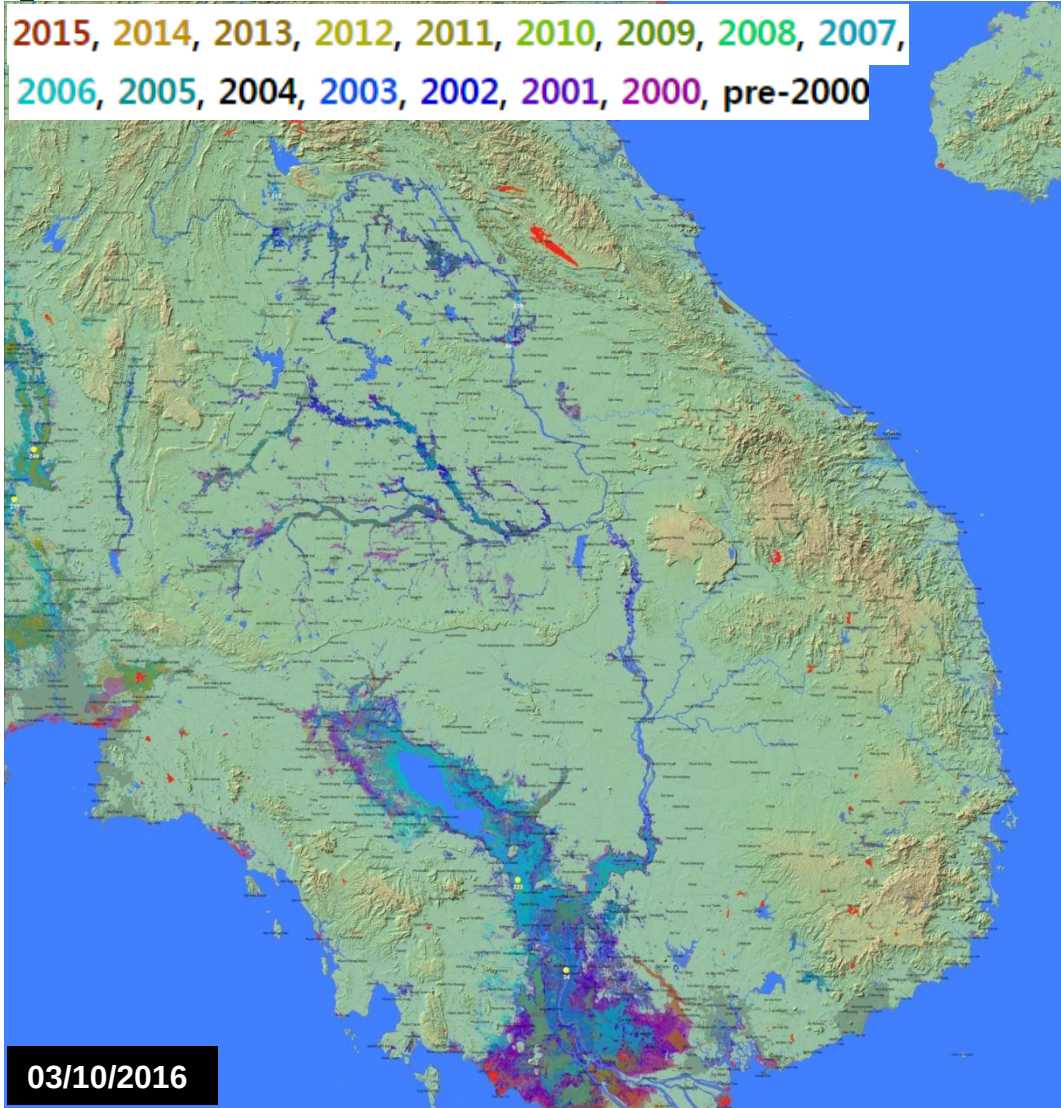
A. Weisheimer, and T. N. Palmer, J. R. Soc. Interface 2014;11:20131162

Better forecast? *practical use*



Selecting target area

2015, 2014, 2013, 2012, 2011, 2010, 2009, 2008, 2007,
2006, 2005, 2004, 2003, 2002, 2001, 2000, pre-2000



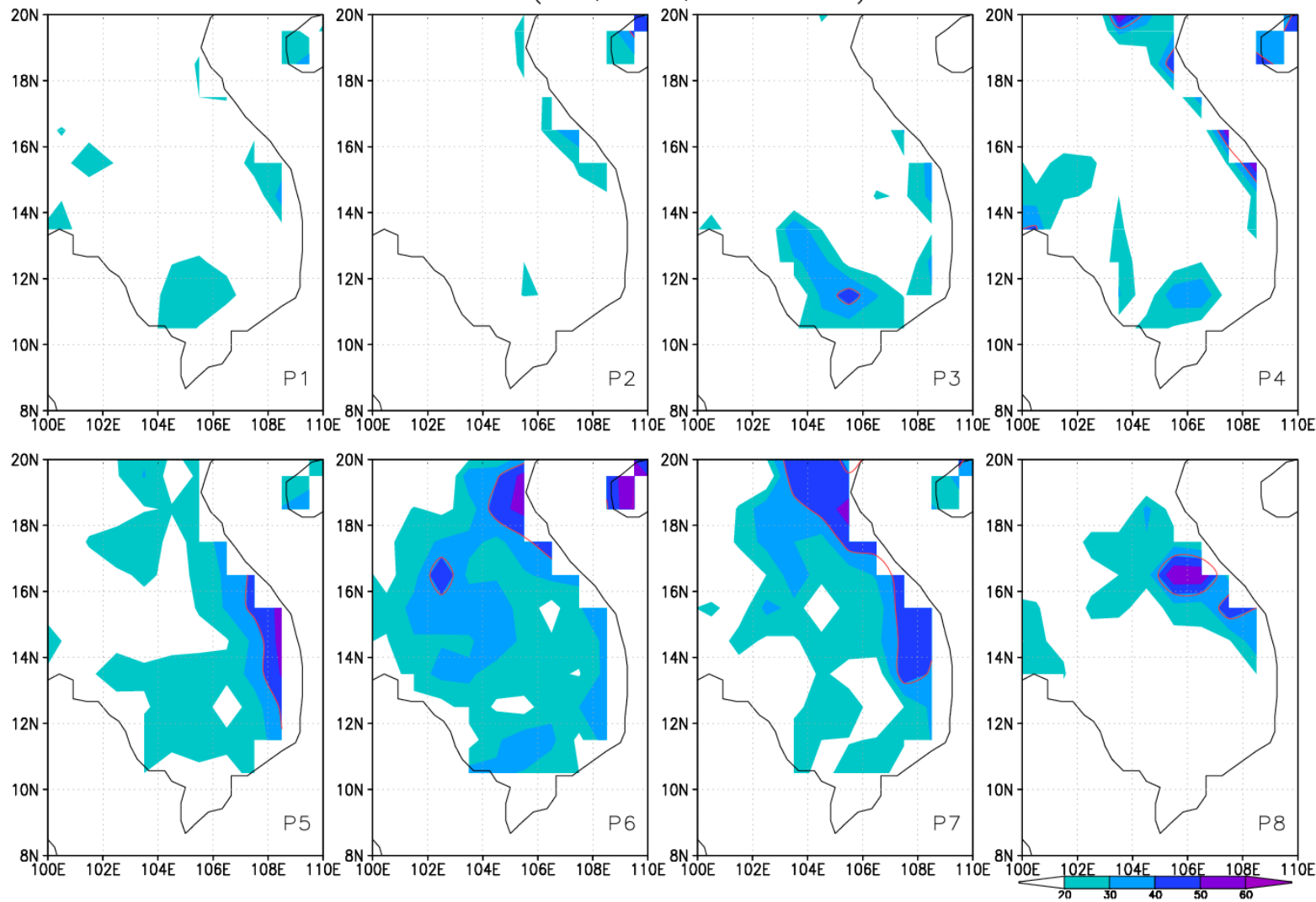
*#R3. Flood prone areas
with large rivers
from the view of hydrologist*

Better forecast? *practical use*



Relationship analysis (*Composite analysis : BSISO-Heavy rainfall probability*)

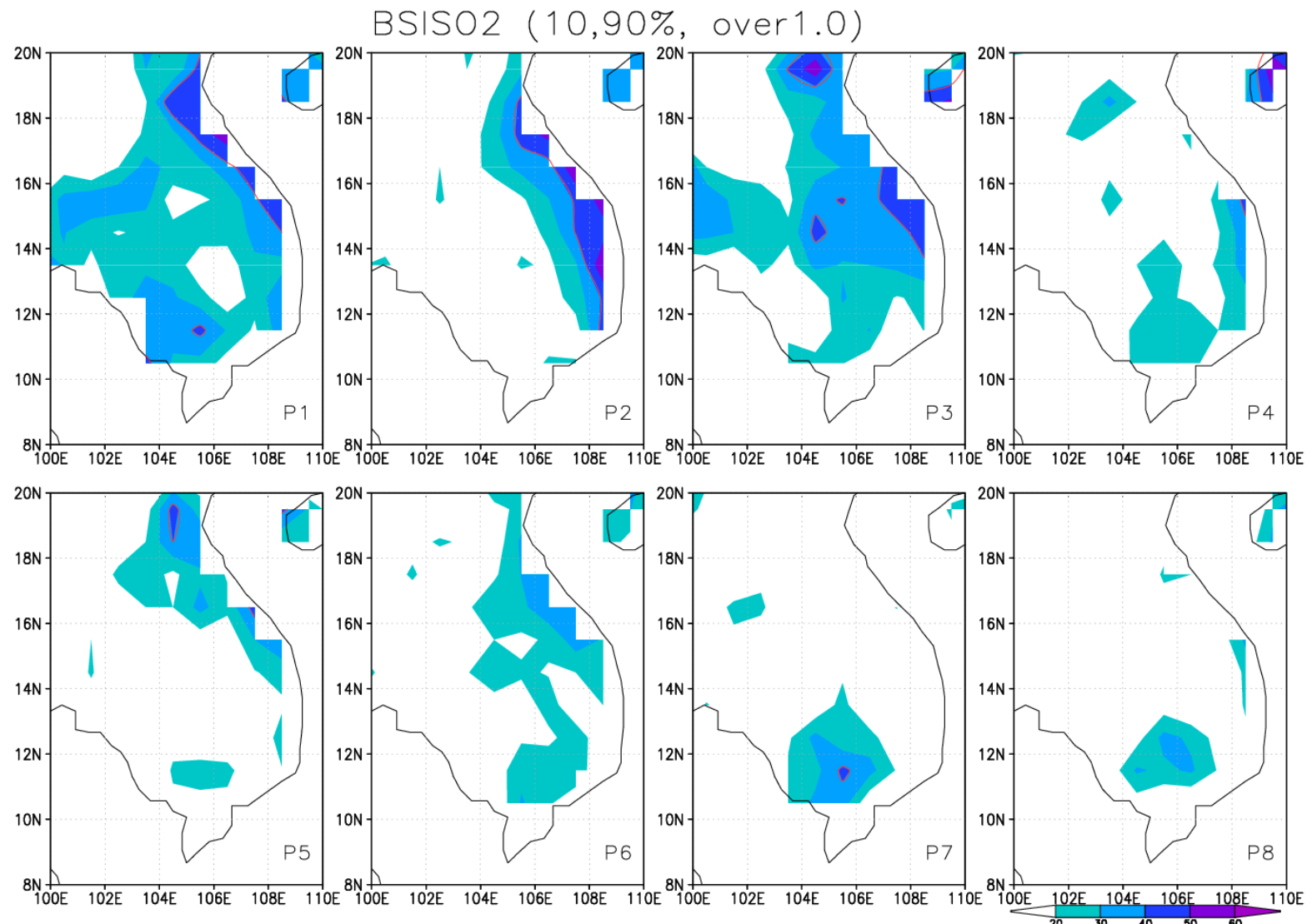
BSISO1 (10,90%, over1.0)



Better forecast? *practical use*



Relationship analysis (*Composite analysis : BSISO-Heavy rainfall probability*)

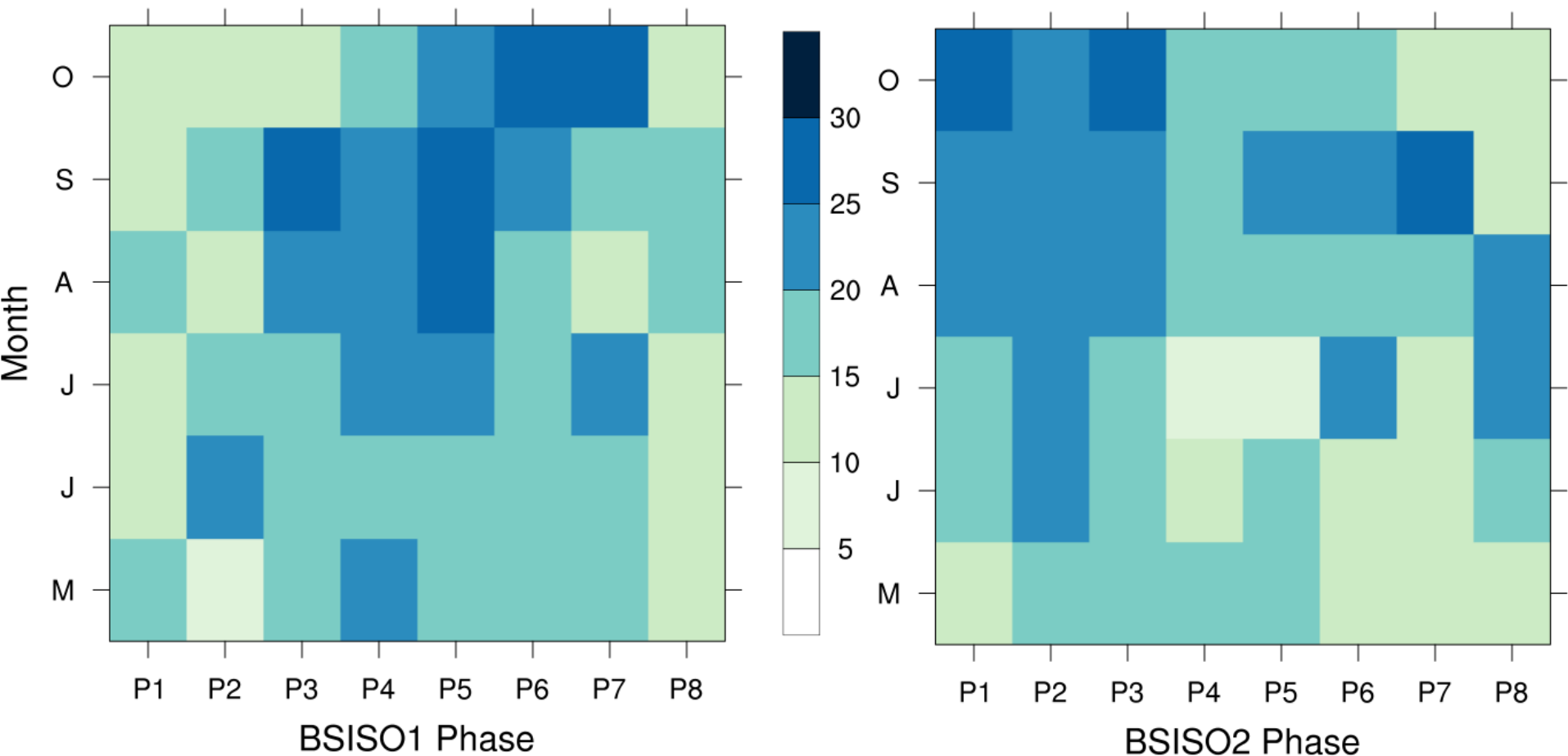


Better forecast? *practical use*



Relationship analysis (*Composite analysis : BSISO-Heavy rainfall probability*)

Probability of Heavy Rainfall occurrence [Mekong River]

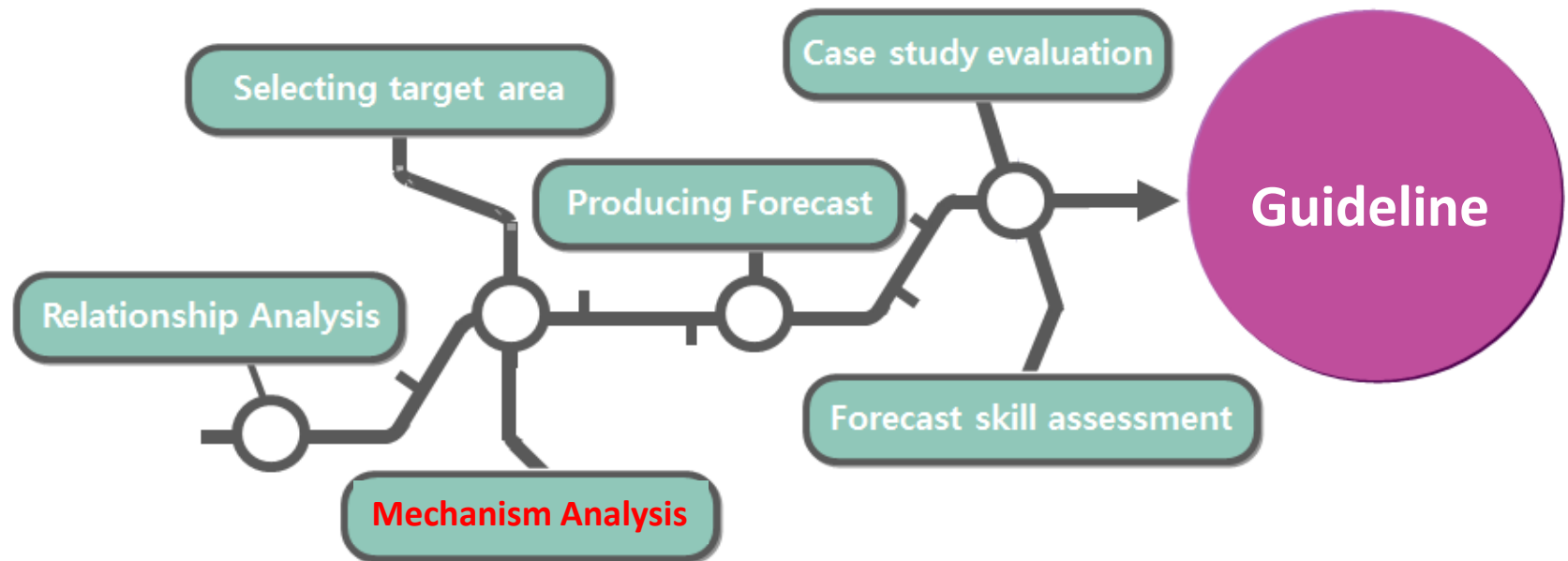


Better forecast? *practical use*



Strategy

'15 '16

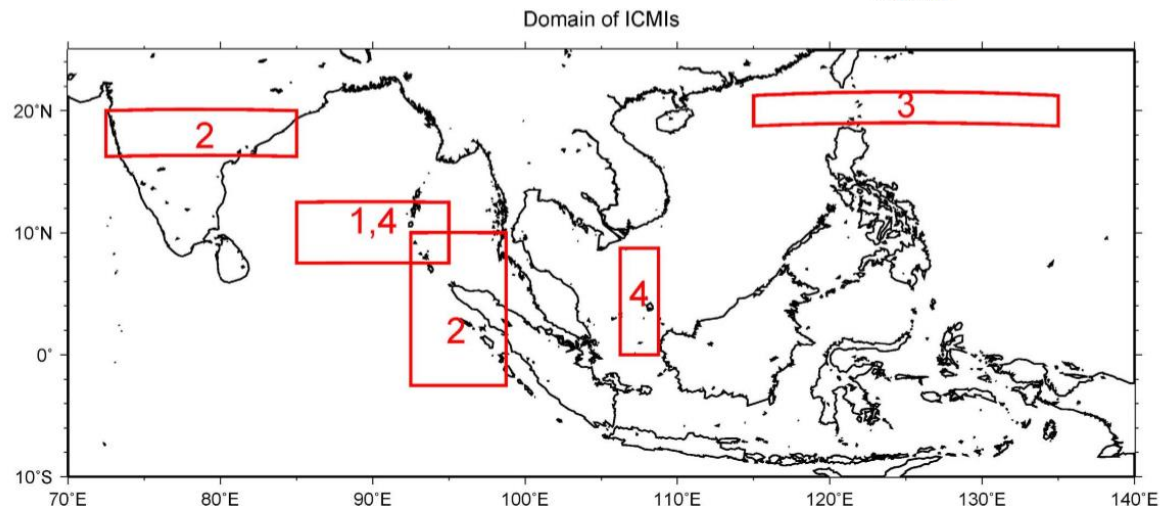
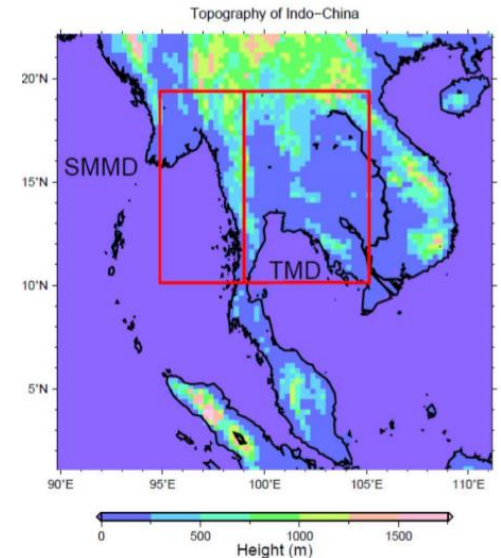


Better forecast? *practical use*



Mechanism Analysis (*BSISO-Extreme rainfall probability*)

Because the precipitation in Thailand is *influenced by local monsoon winds* rather than Indian monsoon or WNP monsoon, a new set of indices incorporating these winds was explored and these four indices are named the *Indo-China Monsoon Indices (ICMIs)*. These ICMIs *better explain the rainfall* over Thailand monsoon domain.



Tsai, C., Behera, S.K. & Waseda, T. (2015). Indo-China Monsoon Indices. *Sci. Rep.* 5, 8107; DOI:10.1038/srep08107

Figure 8 | Domain of ICMIs. The boxes represent the domains of ICMIs and the numbers represent the type of ICMIs.

Better forecast? *practical use*



Mechanism Analysis (*BSISO-Extreme rainfall probability*)

[MAM] TMD are influenced by the developing phase of the Southeastern Asian Summer Monsoon. This monsoon early signal can be detected ***from the changing zonal wind east of Sri Lanka.***

[JJA] The strengthening of ***the easterlies east of Hainan Island*** brings extra precipitation to TMD.

[SON] Normal/slow decaying Southeastern Asian Summer Monsoon and ***southerlies in south of Vietnam*** are necessary to bring extra precipitation to TMD.

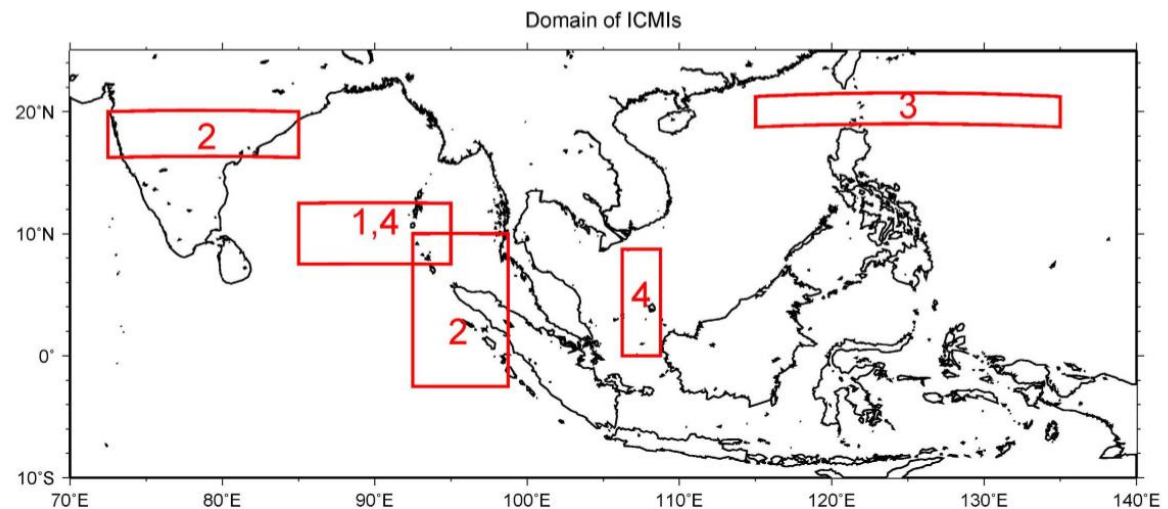
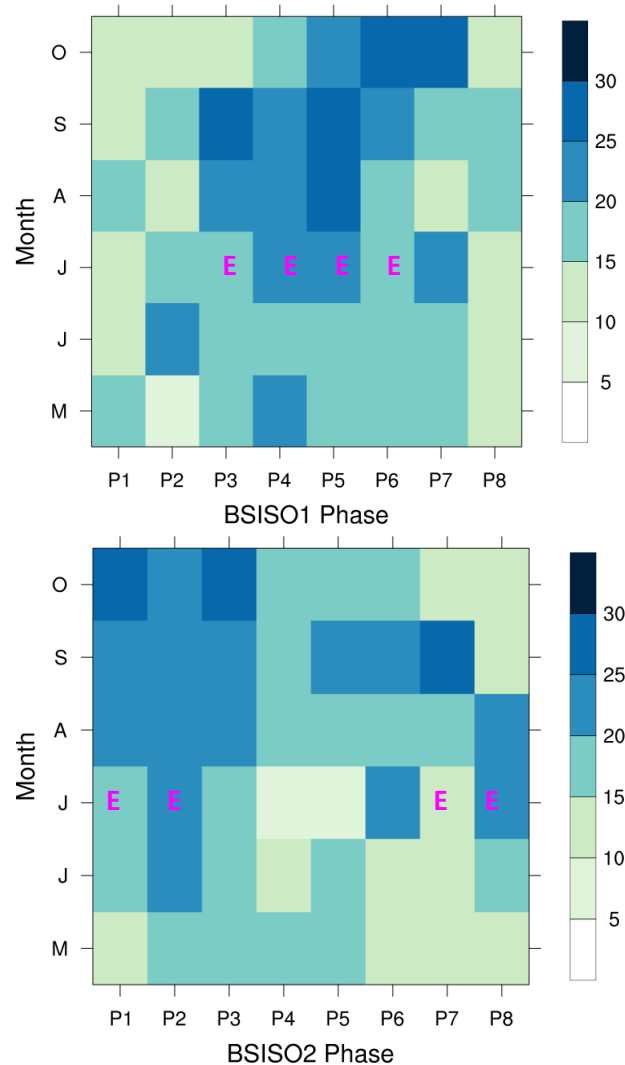
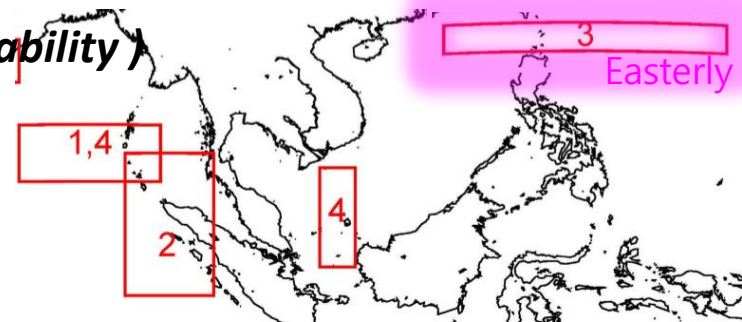
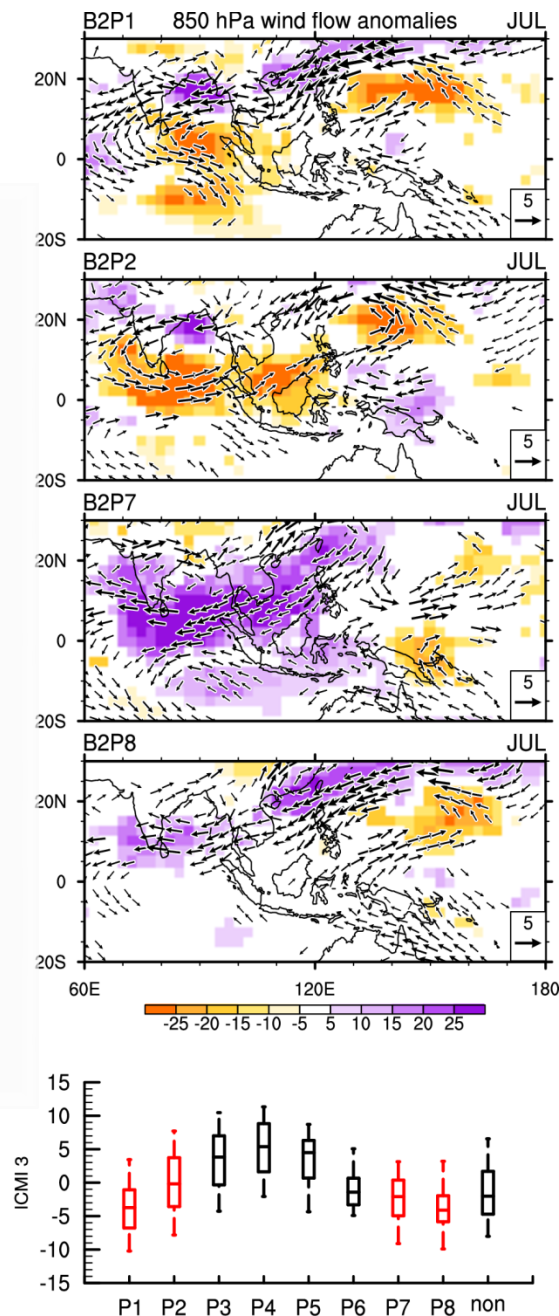
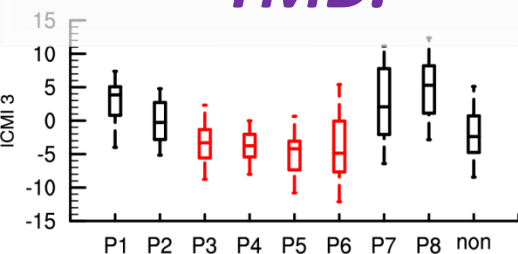


Figure 8 | Domain of ICMI. The boxes represent the domains of ICMI and the numbers represent the type of ICMI.



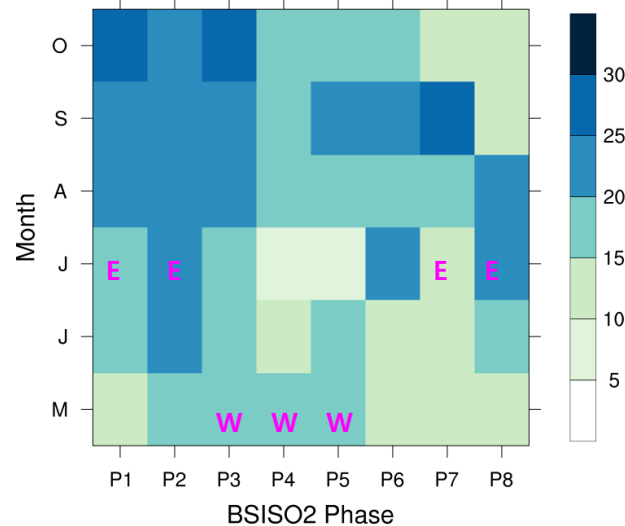
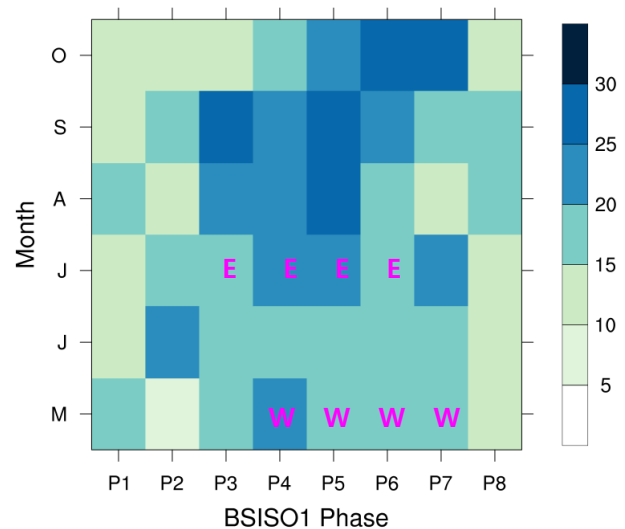
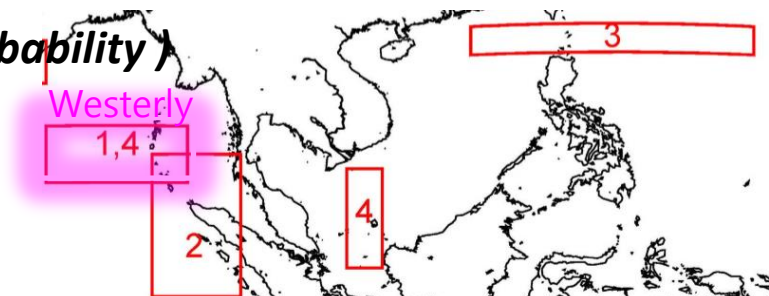
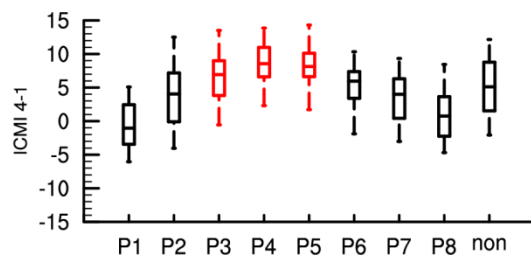
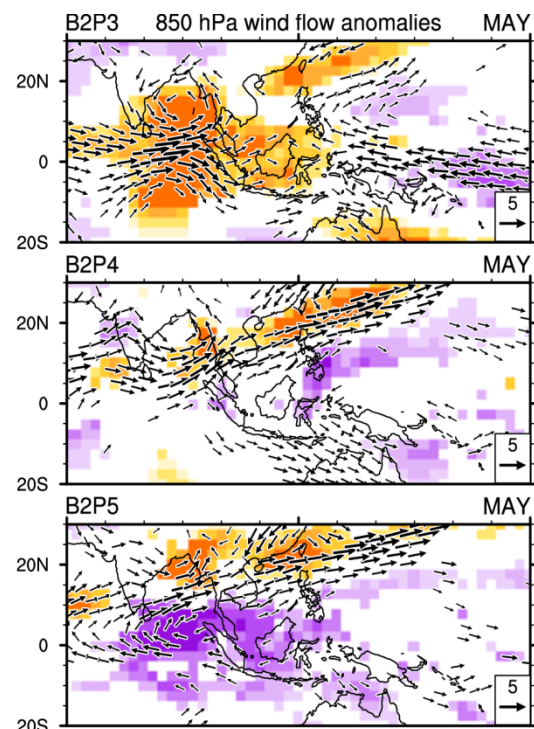
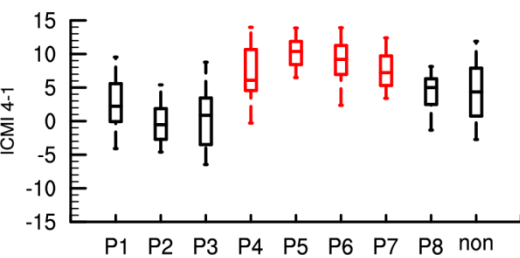
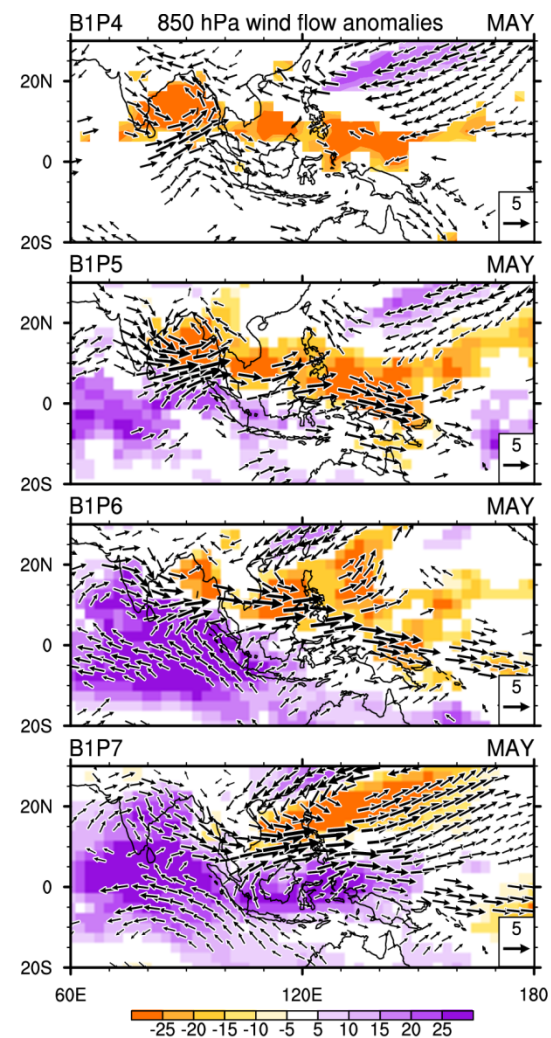
Mechanism Analysis (BSISO-Extreme rainfall probability)

BSISO can contribute to the favorable condition in making strong Indo-China monsoon and bringing extra precipitation to TMD.



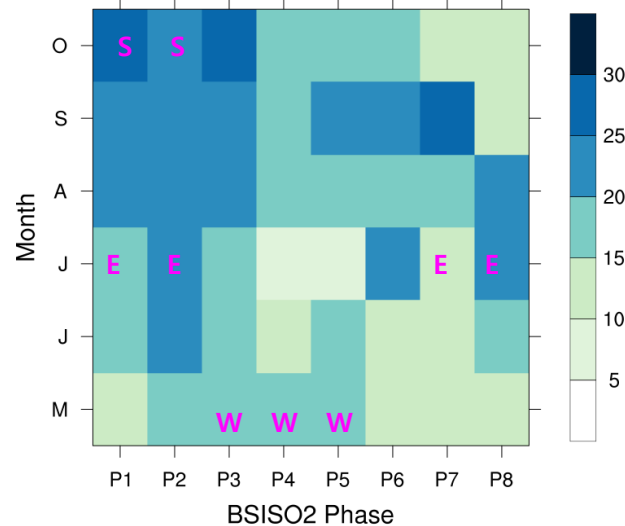
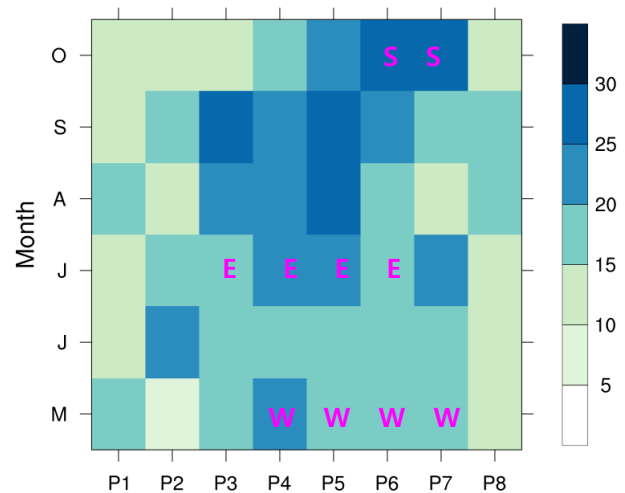
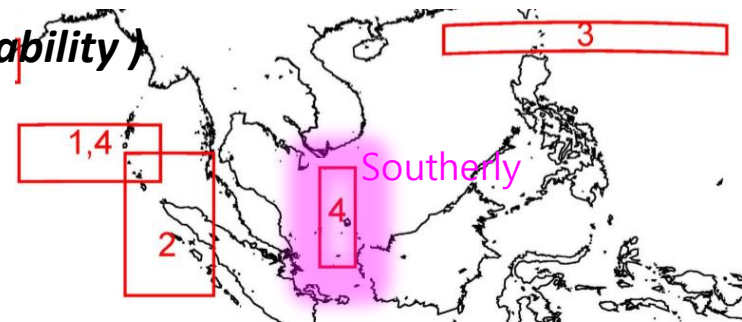
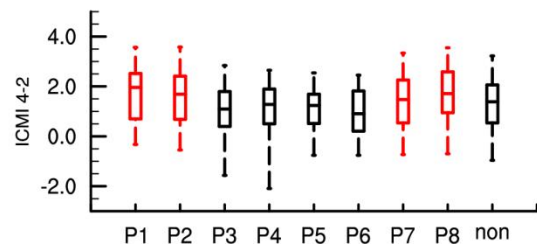
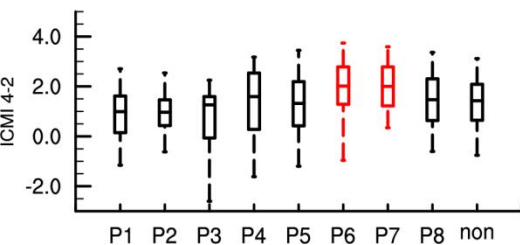
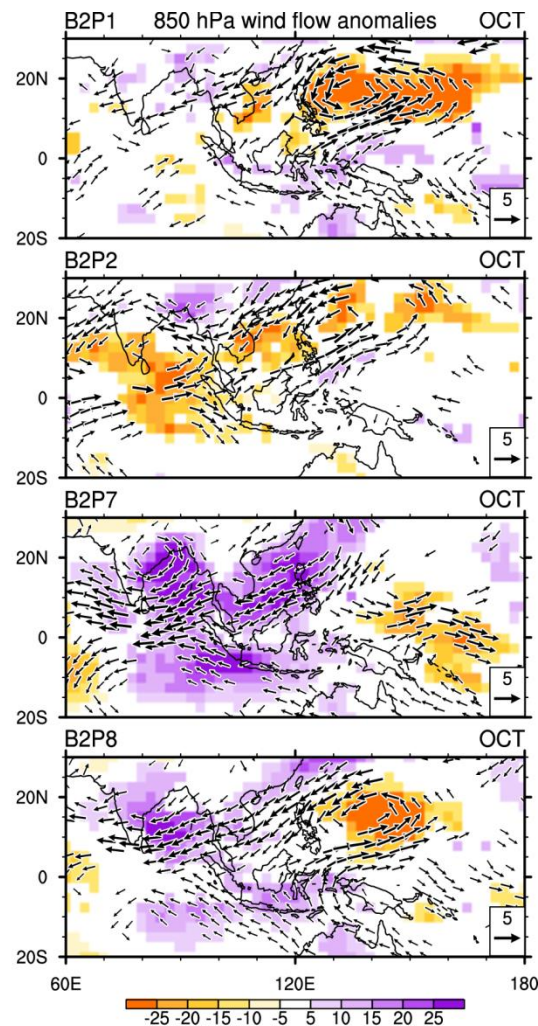
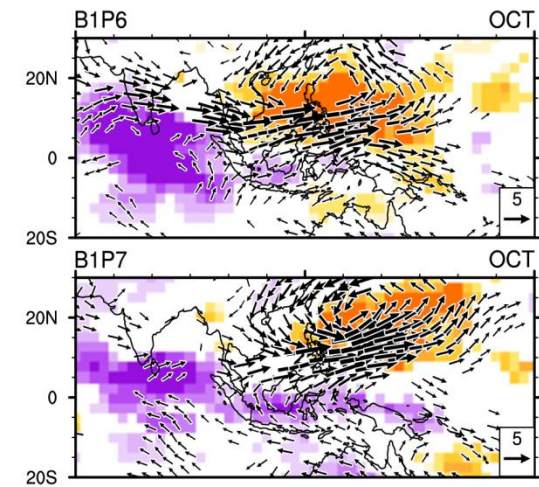


Mechanism Analysis (BSISO-Extreme rainfall probability)





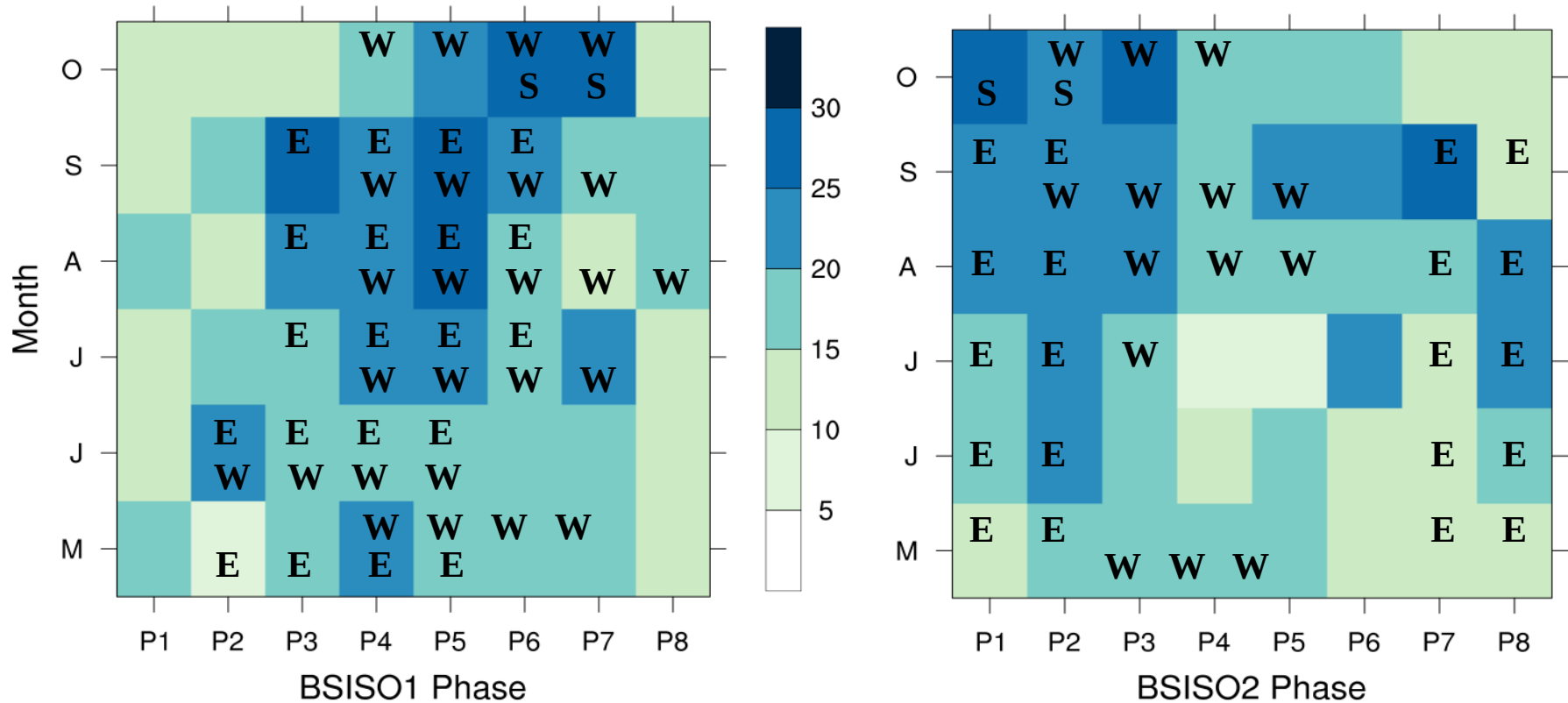
Mechanism Analysis (*BSISO-Extreme rainfall probability*)



Better forecast? *practical use*



Mechanism Analysis (*BSISO-Extreme rainfall probability*)



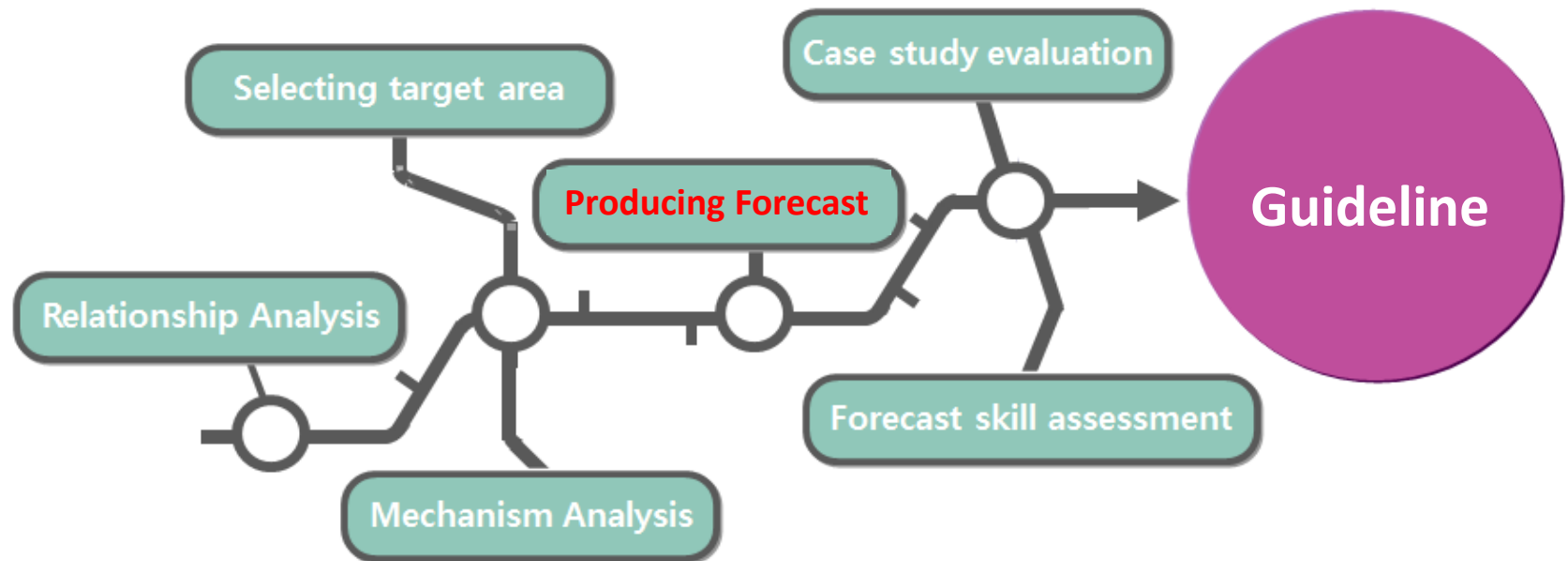
Probability table marked with favorable wind condition which can contribute strong Indo-China monsoon and bring heavy rainfall.

Better forecast? *practical use*



Strategy

'15 '16



Better forecast? *practical use*

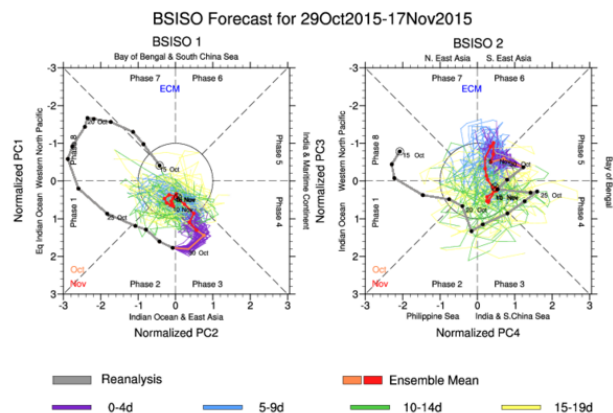


Producing Forecasts estimated by BSISO indices

BSISO real-time forecast

Note: Move cursor over product name to display. Click for additional information.

Phase Plots of BSISO Index Forecasts			
BOM	CFS	GFS	UKM
ECM	CWB		



YEAR	DAY	BSISO1	BSISO2	B1phs	B2phs
2015	262	0.395	0.734	P3	P6
2015	263	0.154	0.753	P3	P6
2015	264	0.190	0.223	P3	P6
2015	265	0.600	0.833	P3	P6

BSISO forecast index =
 $f(\text{Amplitude, Phase})$

Better forecast? *practical use*



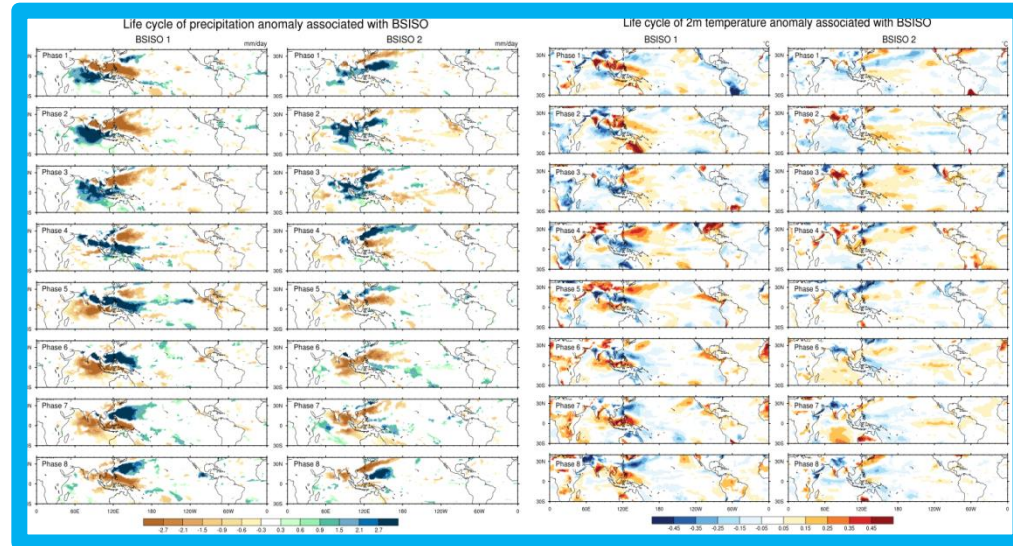
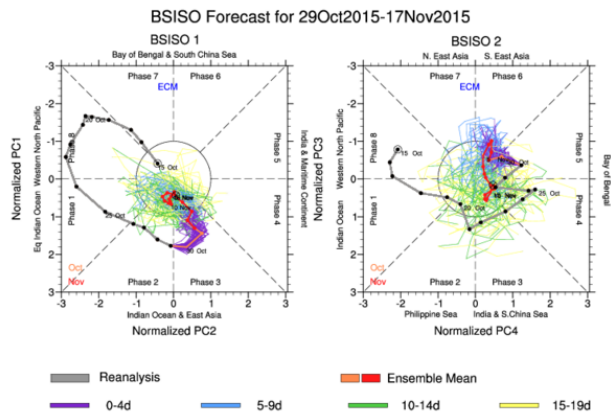
Producing Forecasts estimated by BSISO indices

Observational relationship

BSISO real-time forecast

Note: Move cursor over product name to display. Click for additional information.

Phase Plots of BSISO Index Forecasts			
BOM	CFS	GFS	UKM
ECM	CWB		



Composite Anomalies associated with the BSISO
[Mon, BSISO > 1.0]

YEAR	DAY	BSISO1	BSISO2	B1phs	B2phs
2015	262	0.395	0.734	P3	P6
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2015	265	0.600	0.833	P3	P6

BSISO forecast index =
f (Amplitude, Phase)

Better forecast? *practical use*



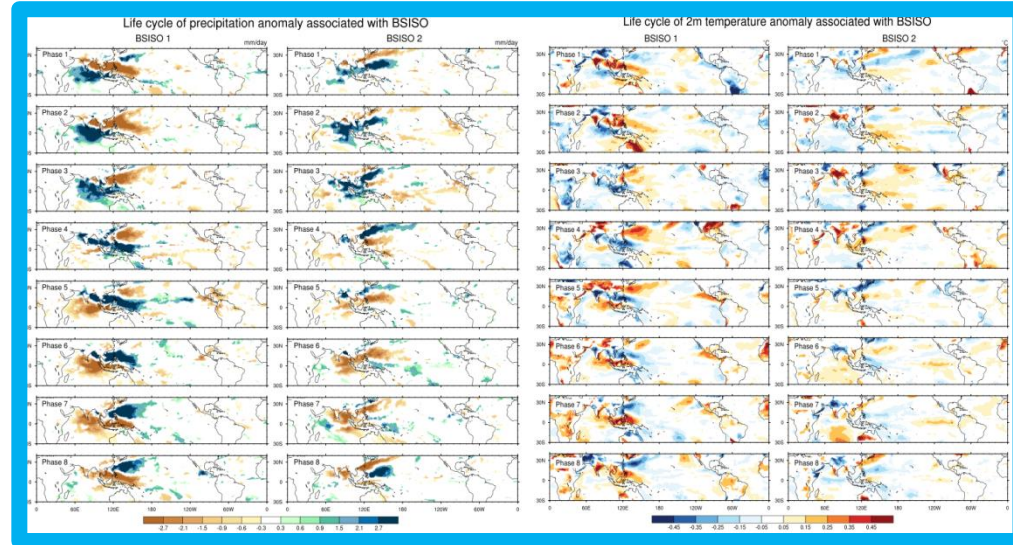
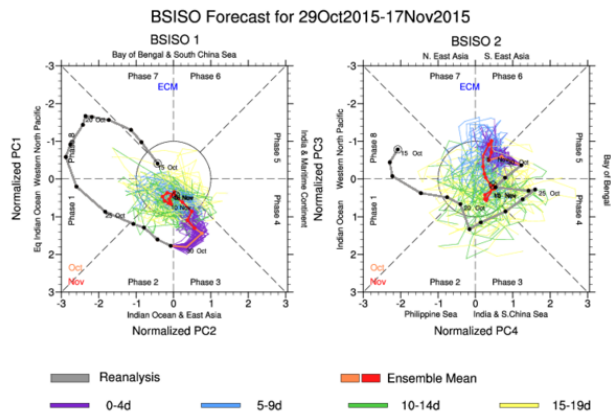
Producing Forecasts estimated by BSISO indices

Observational relationship

BSISO real-time forecast

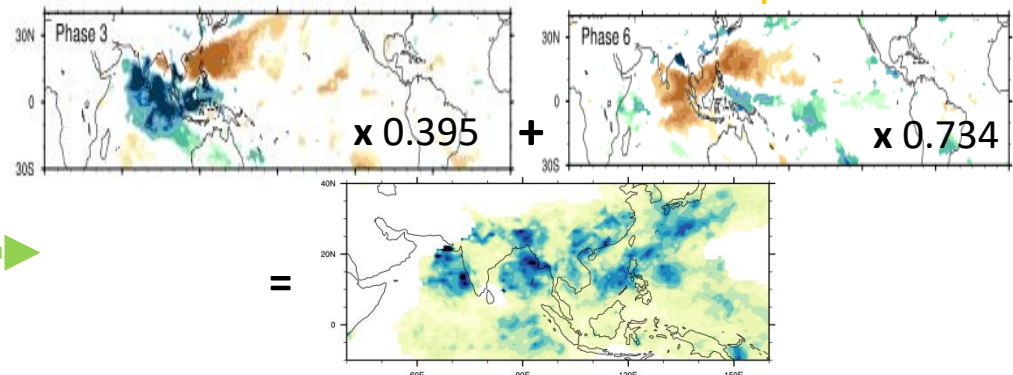
Note: Move cursor over product name to display. Click for additional information.

Phase Plots of BSISO Index Forecasts			
BOM	CFS	GFS	UKM
ECM	CWB		



Composite Anomalies associated with the BSISO
[Mon, BSISO > 1.0]

Prediction of anomalies associated with the BSISO
 $B1P3 \times \text{Amp}_{BSISO1} + B2P6 \times \text{Amp}_{BSISO2}$



YEAR	DAY	BSISO1	BSISO2	B1phs	B2phs
2015	262	0.395	0.734	P3	P6
2015	263	0.154	0.753	P3	P6
2015	264	0.190	0.223	P3	P6
2015	265	0.600	0.833	P3	P6

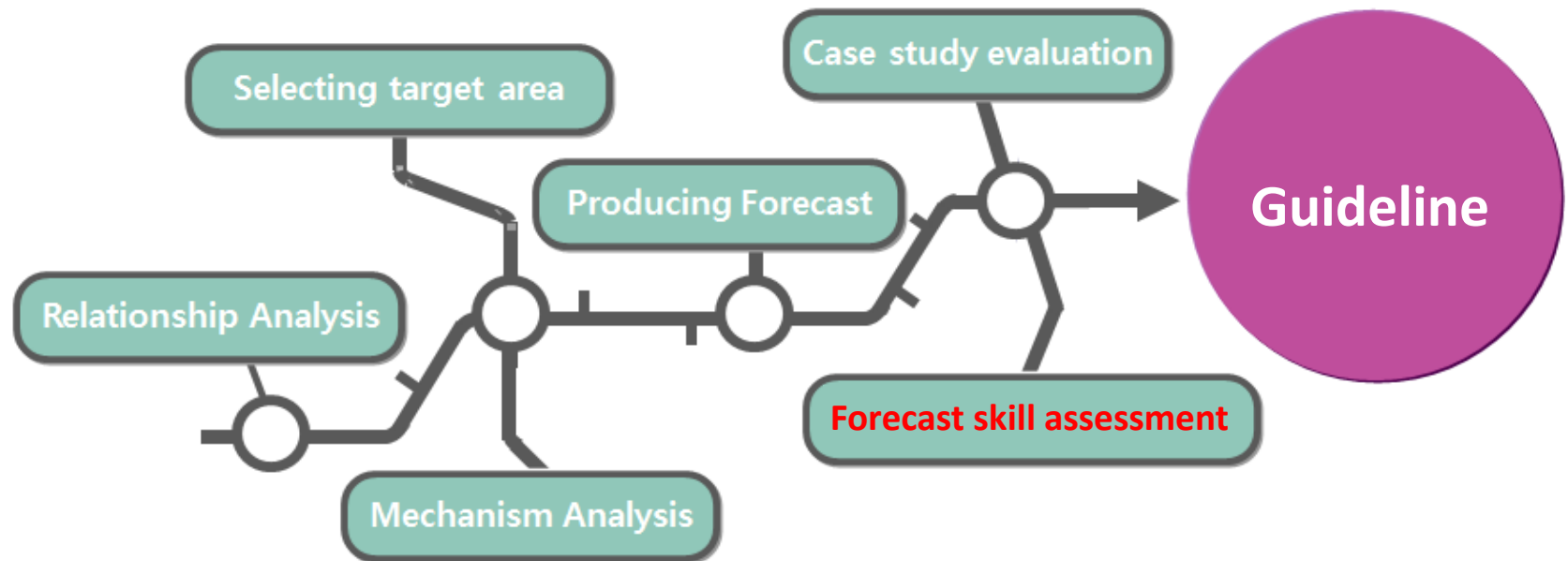
BSISO forecast index =
 $f(\text{Amplitude, Phase})$

Better forecast? *practical use*



Strategy

'15 '16



Better forecast? *practical use*



Forecast skill assessment : *Data and Verification metrics*

Period : 2013 ~ 2015

Season : MJJASO

Lead : WEEK1, WEEK2

	ECM	BOM	CFS	GFS	CWB
# of sample	104	80	285	300	29

Multi-category forecasts : **Brier Skill Score**

Contingency Table for multi-category forecasts

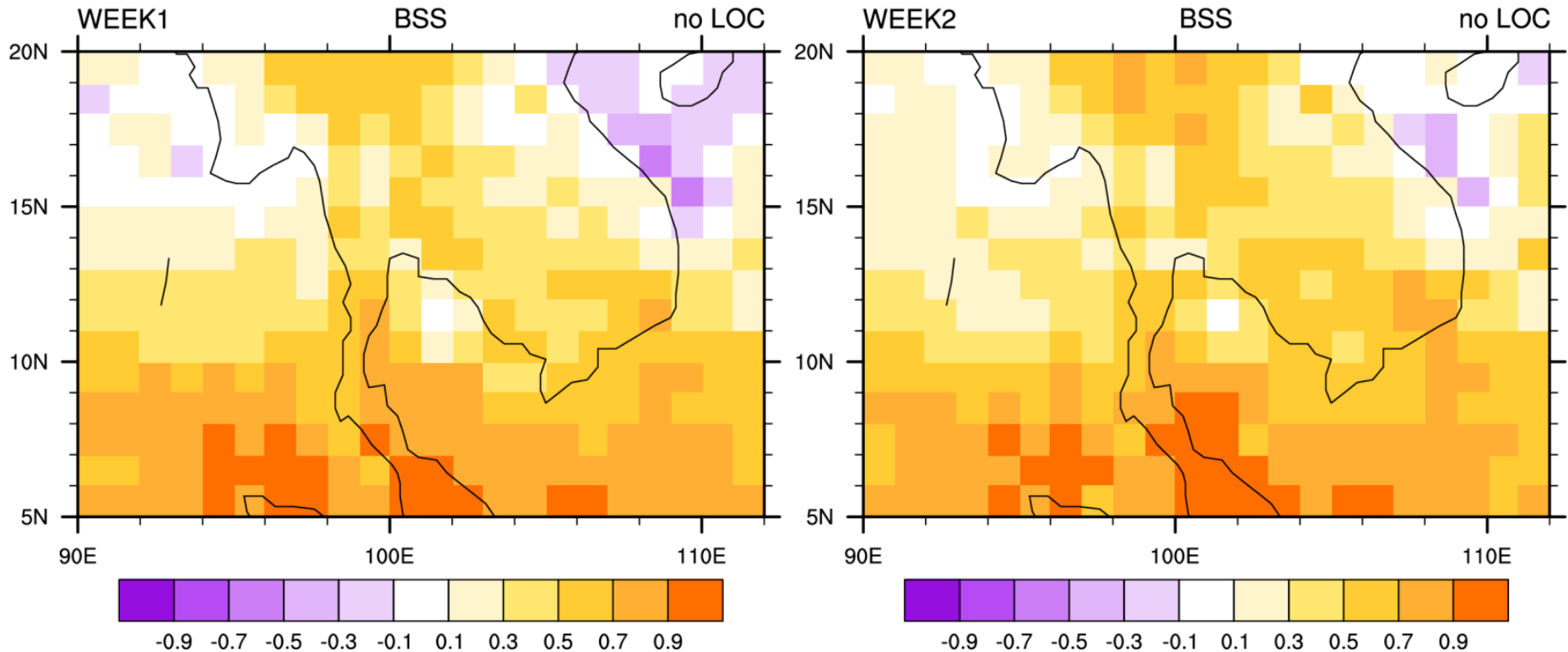
		Observed			
		1	2	3	Total
		PoHR $\leq$ 0.3 mm	$0.3 < \text{PoHR} < \text{THR}$	$\text{THR} \leq \text{PoHR}$	
Forecast	1	n(F1,O1)	n(F1,O2)	n(F1,O3)	N(F1)
	2	n(F2,O1)	n(F2,O2)	n(F2,O3)	N(F2)
	3	n(F3,O1)	n(F3,O2)	n(F3,O3)	N(F3)
Total		N(O1)	N(O2)	N(O3)	N

Better forecast? *practical use*



Forecast skill assessment

ECM Forecast Skill



Probability forecasts of heavy rainfall in Mekong river basin show *improvements over 30-50%* relative to climatological forecast at the lead time of WEEK2.

Better forecast? *practical use*

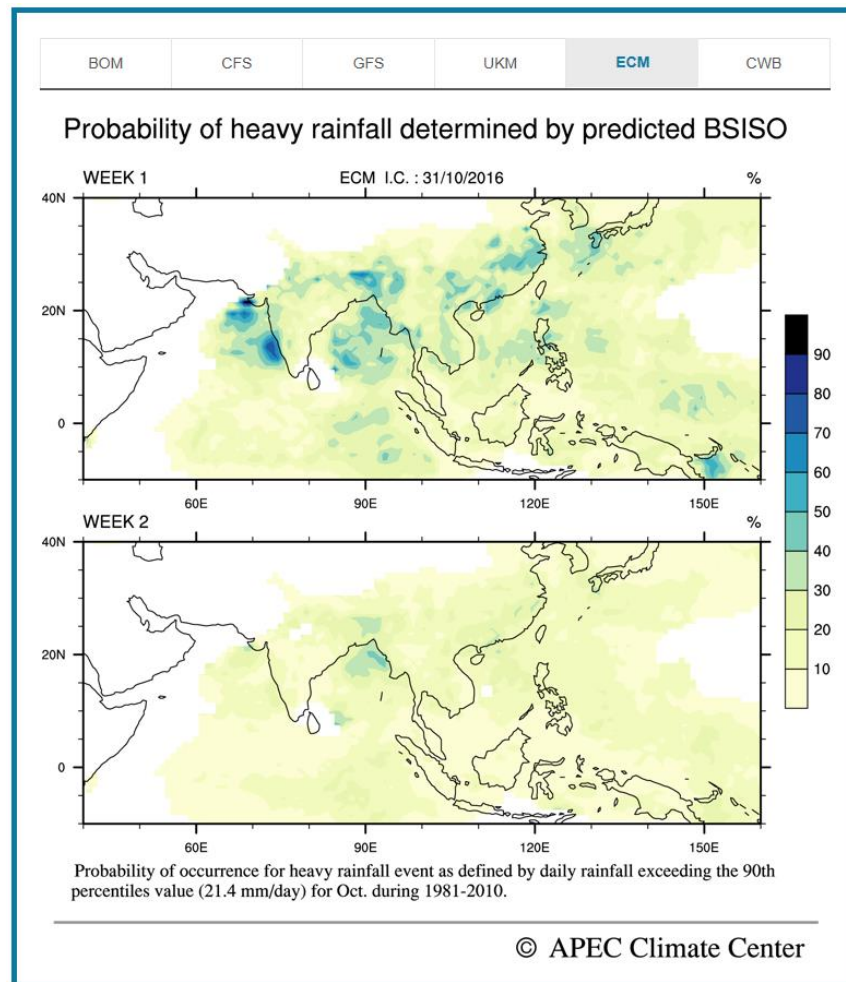


Delivery of user friendly forecast information

*On the APCC webpage
For upcoming week1 and week2
Everyday updated*

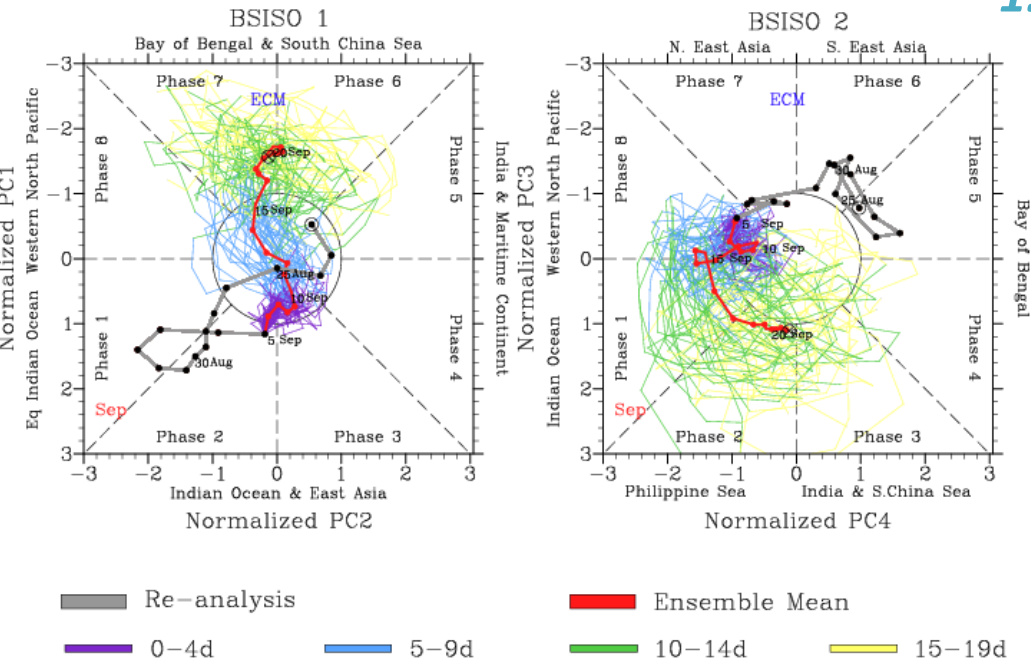
BSISO phase diagram may be difficult information for ordinary people.

So it is meaningful that simple index can be transformed into **user friendly information** such as rainfall.



Guidance

BSISO Forecast for 5Sep2013–24Sep2013



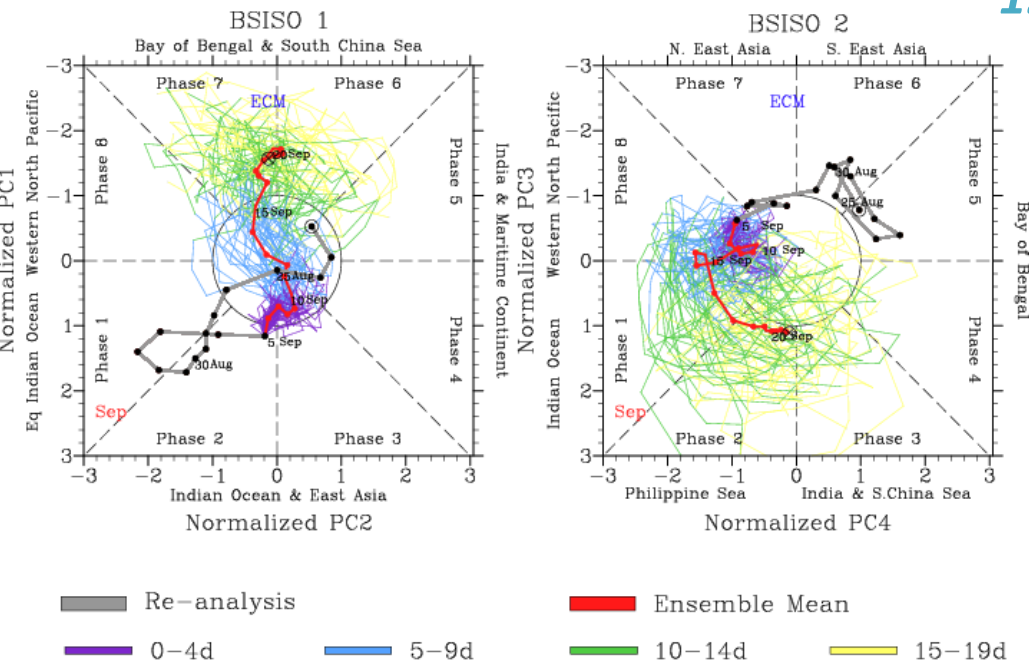
1. *Confirm the forecast of BSISO phase and amplitude for next two weeks*

→ 15-20Sep2013

B1P7-6, B2P1-2

Guidance

BSISO Forecast for **5Sep** 2013–24Sep2013



1. *Confirm the forecast of BSISO phase and amplitude for next two weeks*

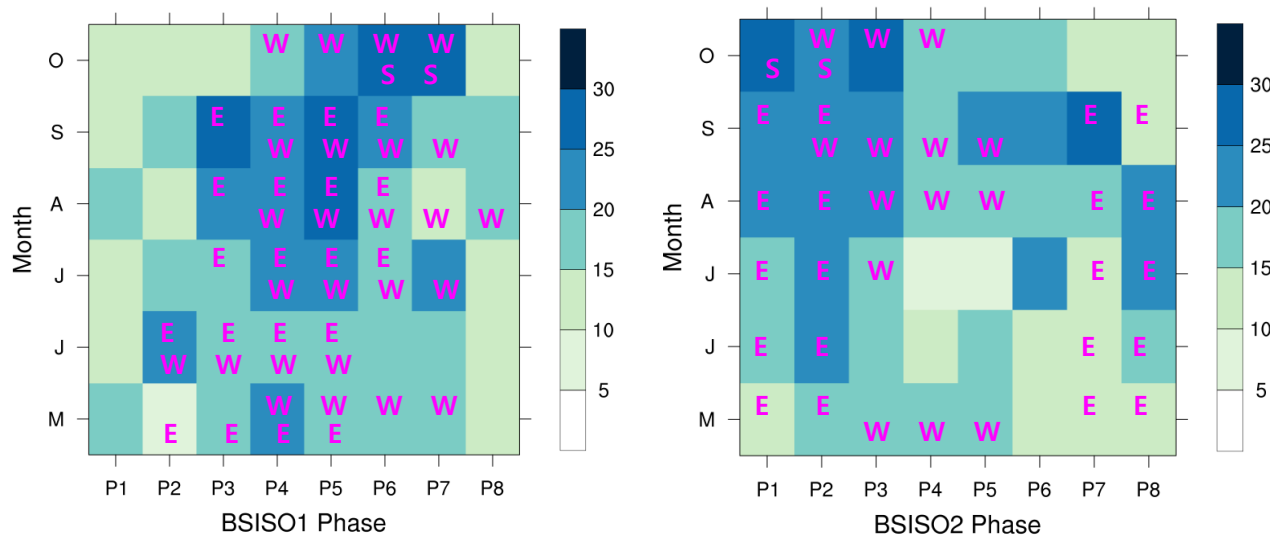
→ 15-20Sep2013

B1P7-6, B2P1-2

2. *Find the relationship btw BSISO phase and heavy rainfall probability in the research report.*

→ B1P7-6 (Sep) W,E ~20%

B2P1-2 (Sep) E,W ~25%

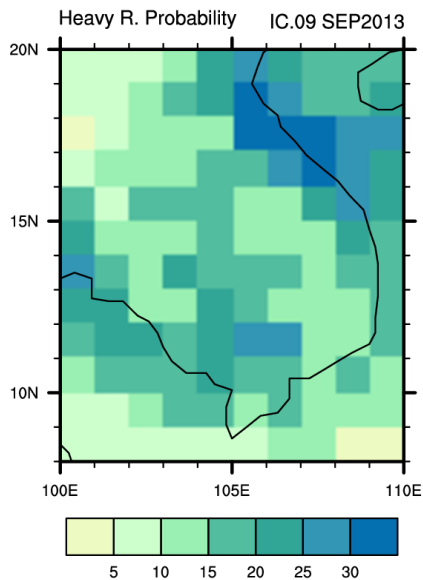


Guideline

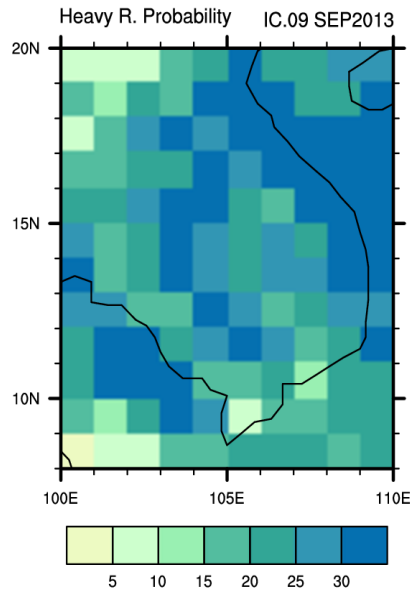
3. For easier viewing,
you can go to **heavy rainfall probability forecast map** in the **APCC website**.

ECM Forecast

WEEK1

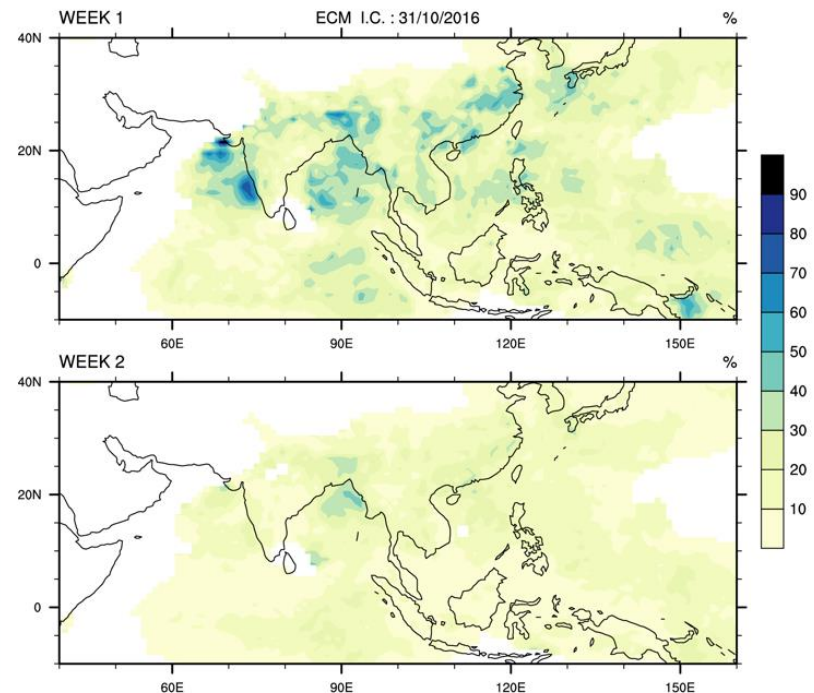


WEEK2



BOM CFS GFS UKM **ECM** CWB

Probability of heavy rainfall determined by predicted BSISO



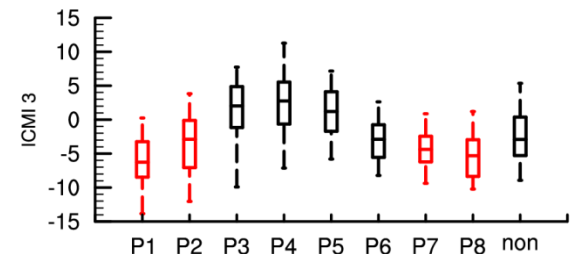
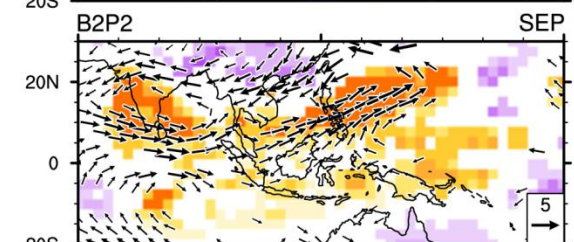
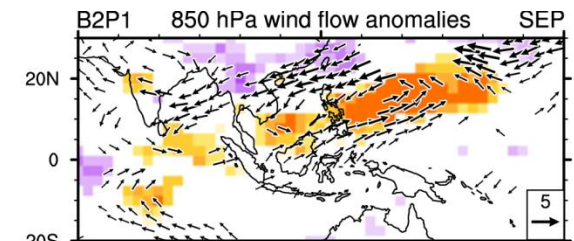
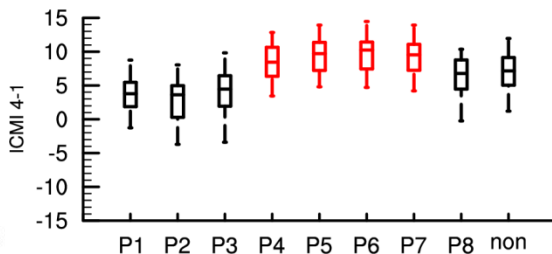
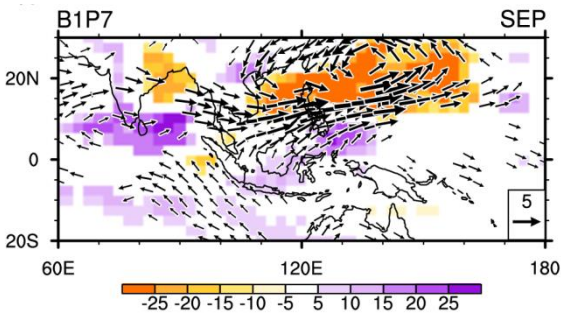
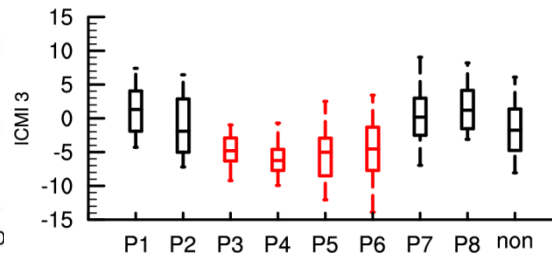
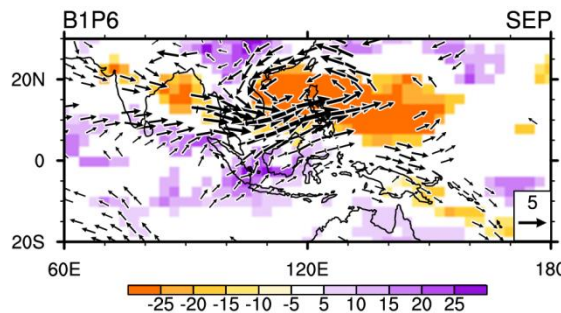
Probability of occurrence for heavy rainfall event as defined by daily rainfall exceeding the 90th percentiles value (21.4 mm/day) for Oct. during 1981-2010.

© APEC Climate Center

Guideline

4. If you want to know the cause of easterlies and circulation pattern ..
Look up it in the **mechanism** chapter or Appendix.

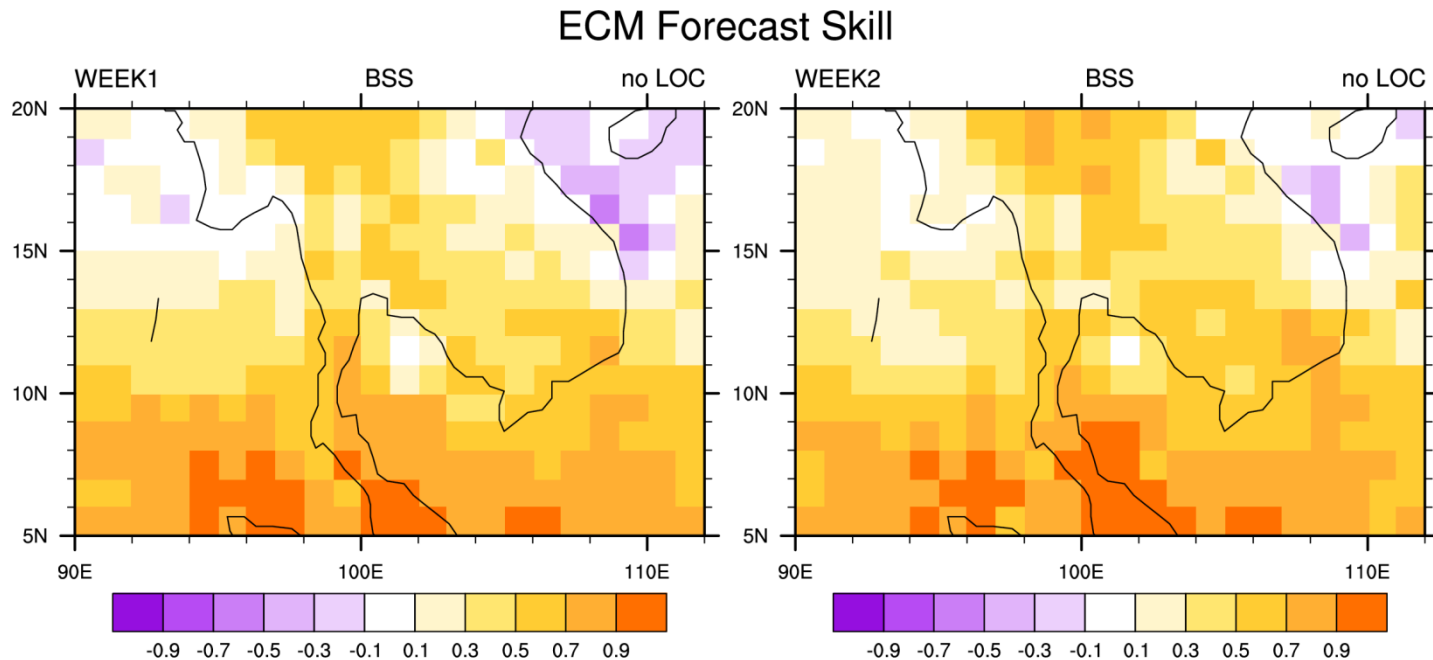
→ Indo-china peninsular has favorable condition for having easterly (westerly) wind due to a strong convective cell (anticyclonic cir.) located on the Philippine sea and the northwest Pacific (the Indian Ocean).



Guideline

5. There are some points to be duly considered.

→ Probability forecasts of heavy rainfall at 1-week and 2-week lead show improvements of 30% - 50% relative to climatological forecasts over the Mekong river.





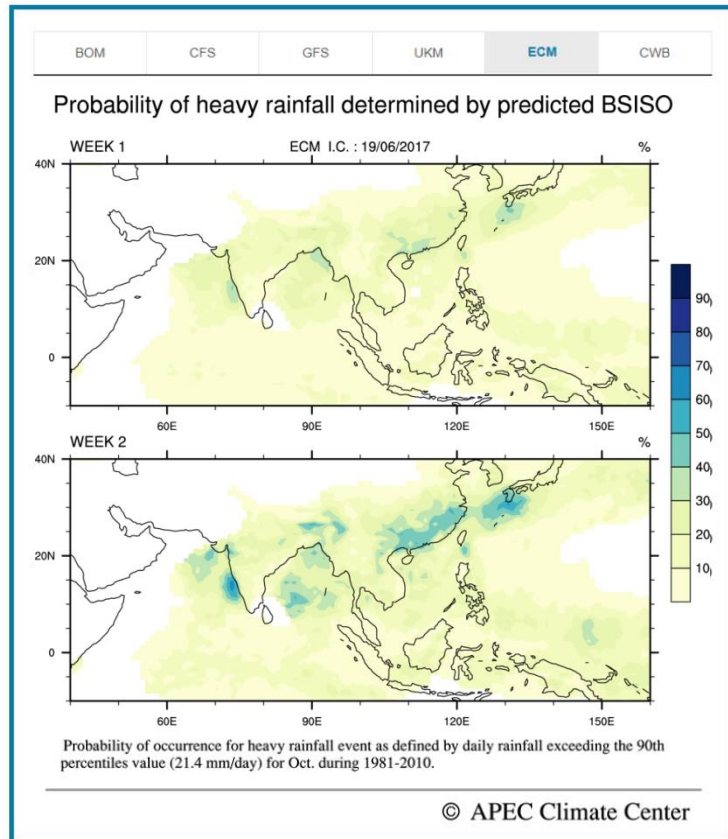
Better forecast from better recognition of the value

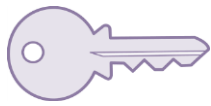


Development of a guideline to increase practical use of BSISO forecast

**Heavy rainfall forecast
based on BSISO index forecast [ECMWF]**

❖ Ex> Japan flood, 398mm/4hr, July 6, 2017

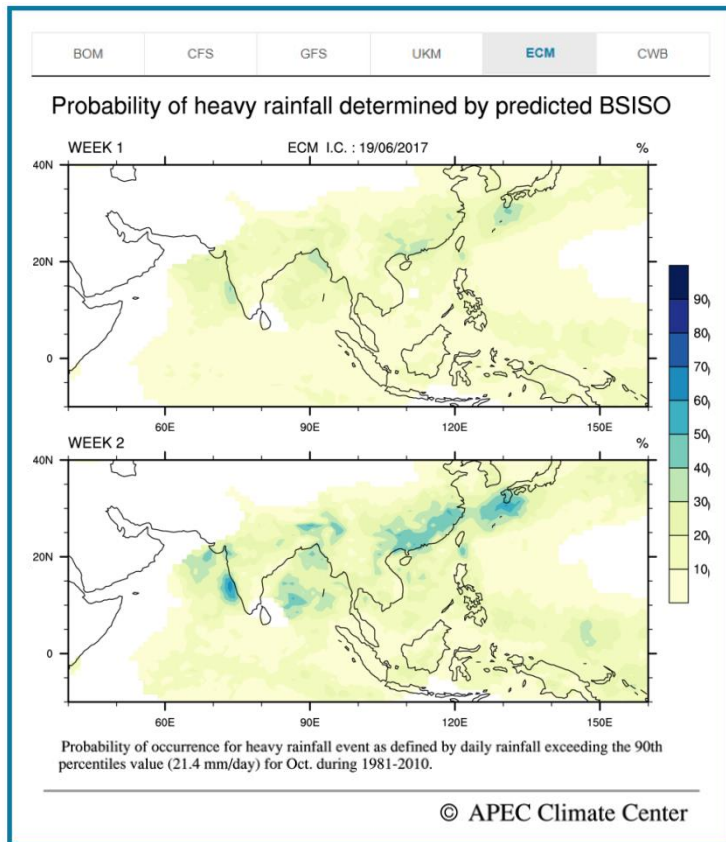




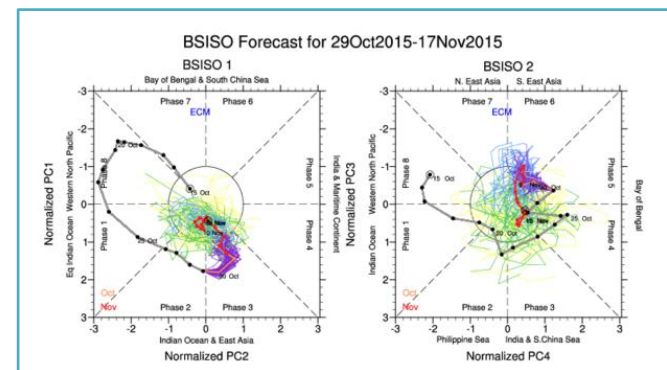
Better forecast by actionable information

Heavy rainfall forecast based on BSISO index forecast [ECMWF]

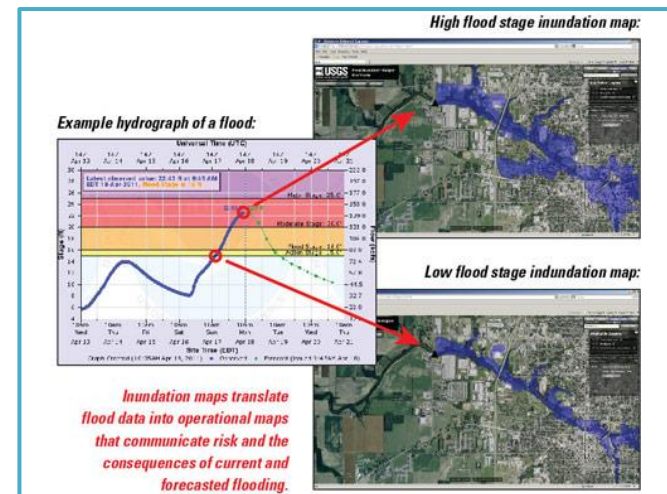
❖ Ex> Japan flood, 398mm/4hr, July 6, 2017



BSISO forecasts



Flood Inundation Mapping



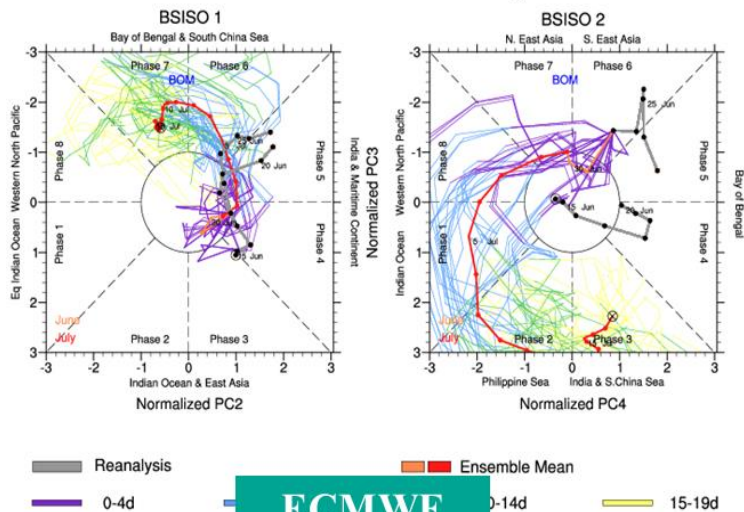
Application Possibility : Typhoon



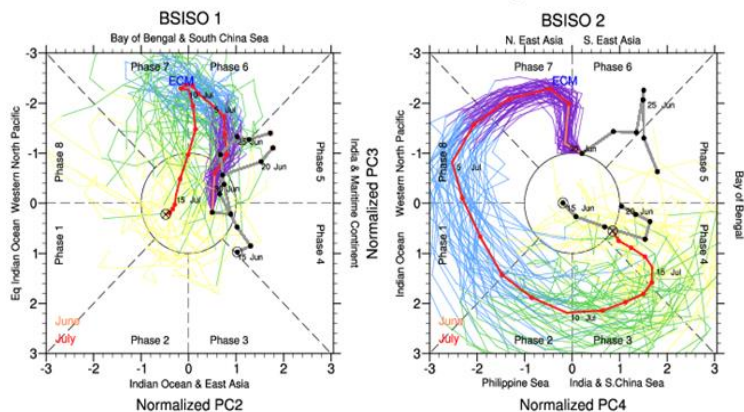
BSISO activity in 2015

BOM

BSISO Forecast for 28June2015-17July2015



BSISO Forecast for 29June2015-18July2015



❖ BSISO1, 2에 대한 Phase 변화

BOM	날짜	BSISO1	BSISO2
1	6/28	3	6
2	6/29	4	7
3	6/30	4	7
4	7/1	4	7
5	7/2	5	8
6	7/3	6	8
7	7/4	6	1
8	7/5	6	1
9	7/6	6	2
10	7/7	7	2
11	7/8	7	2
12	7/9	7	2
13	7/10	7	3
14	7/11	7	3
15	7/12	7	3
16	7/13	7	3
17	7/14	7	3
18	7/15	7	3
19	7/16	7	3
20	7/17	7	3

ECM	날짜	BSISO1	BSISO2
1	6/29	5	7
2	6/30	6	7
3	7/1	6	7
4	7/2	6	7
5	7/3	6	8
6	7/4	6	8
7	7/5	6	8
8	7/6	6	1
9	7/7	7	1
10	7/8	7	2
11	7/9	6	2
12	7/10	6	3
13	7/11	6	3
14	7/12	7	3
15	7/13	7	4
16	7/14	8	4
17	7/15	1	4
18	7/16	1	4
19	7/17	1	4
20	7/18	1	4

normalized amplitude가 1이상 인 경우

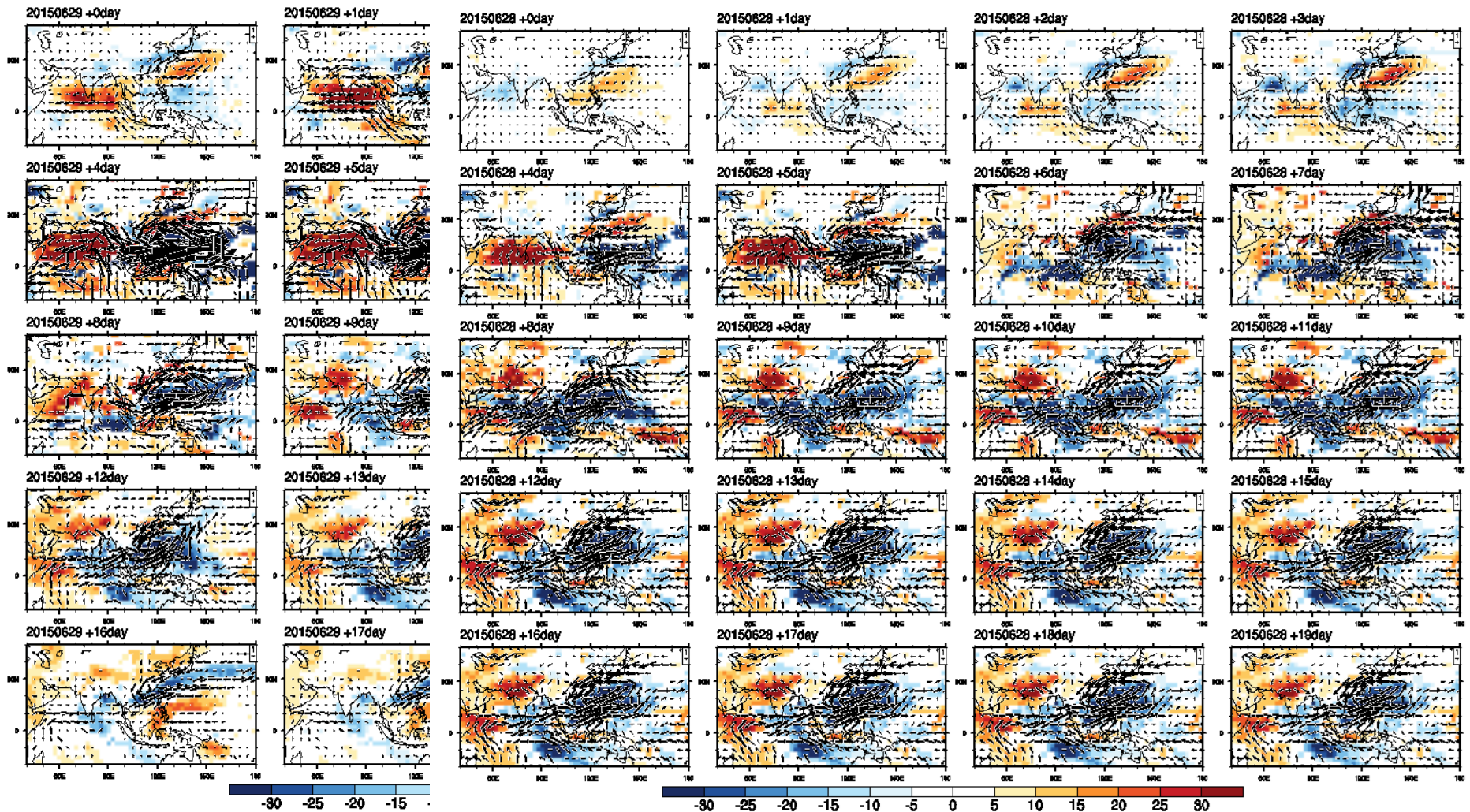
Application Possibility : Typhoon



BSISO activity in 2015

BSISO1+BSISO2 C

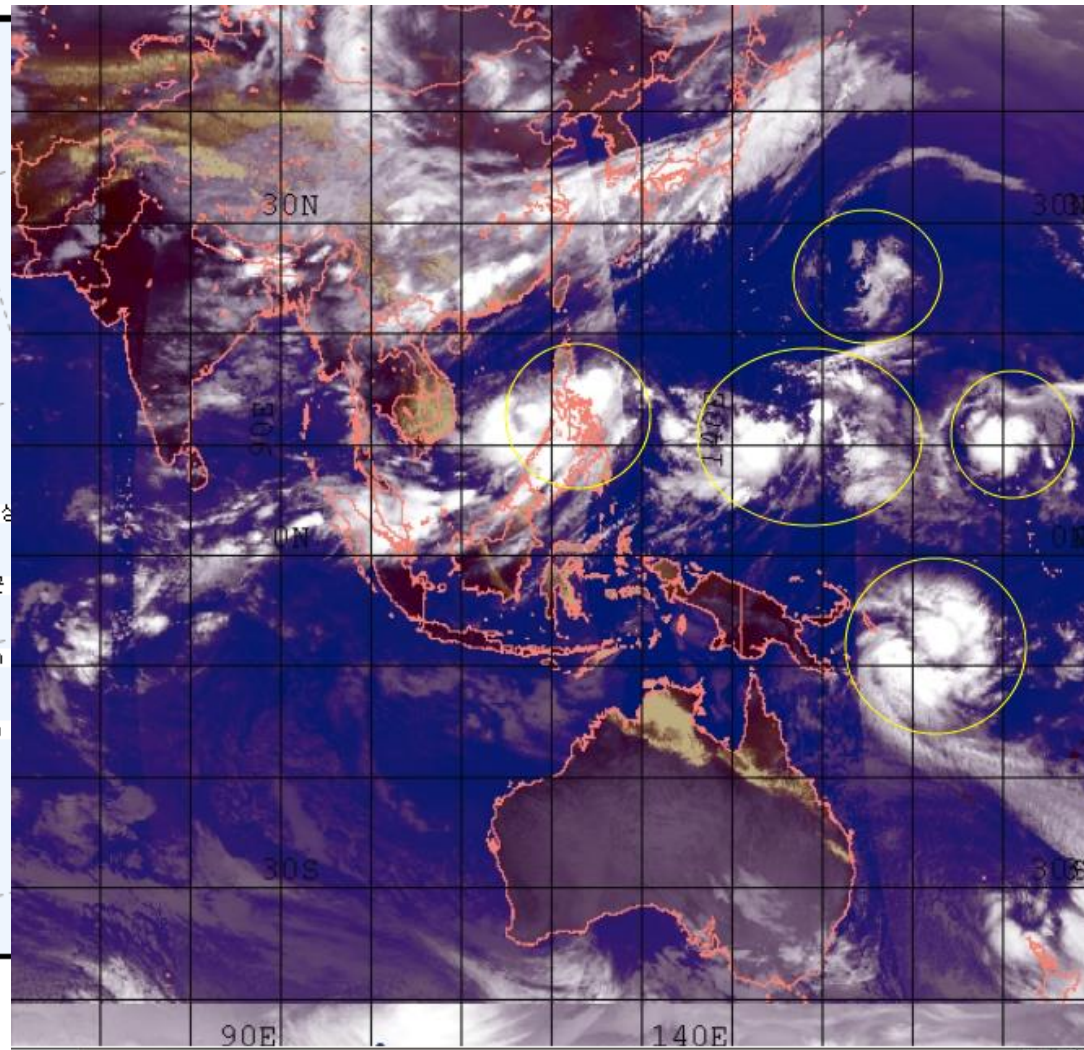
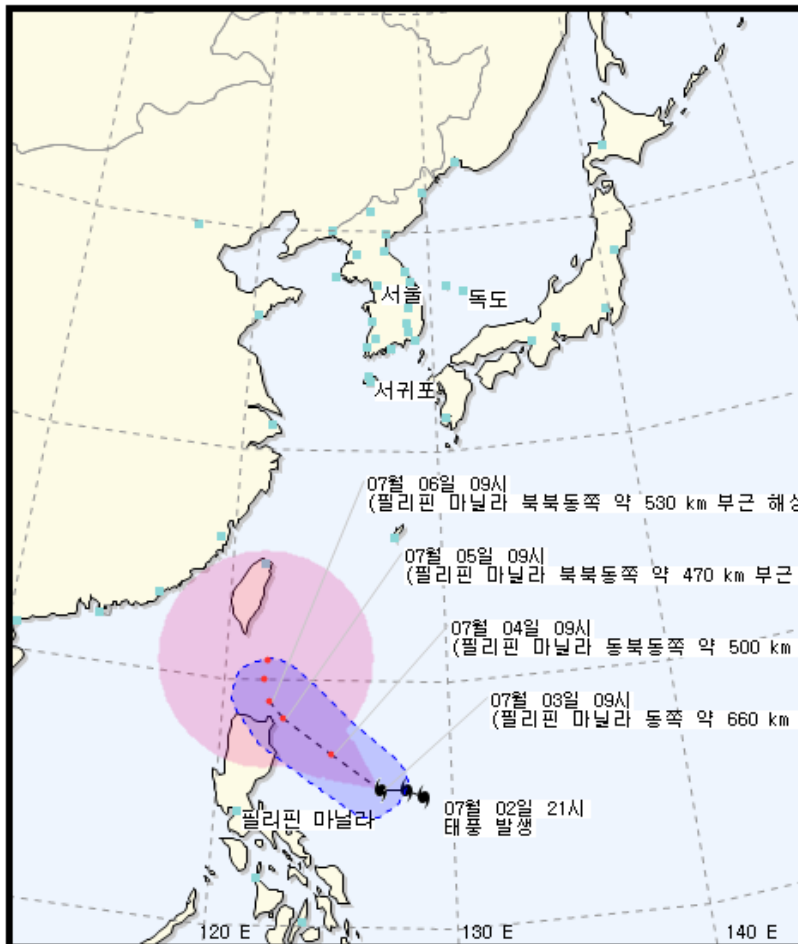
BSISO1+BSISO2 OLR&850hPa Wind anomaly (BOM)



Application Possibility : Typhoon



TC activity in 2015



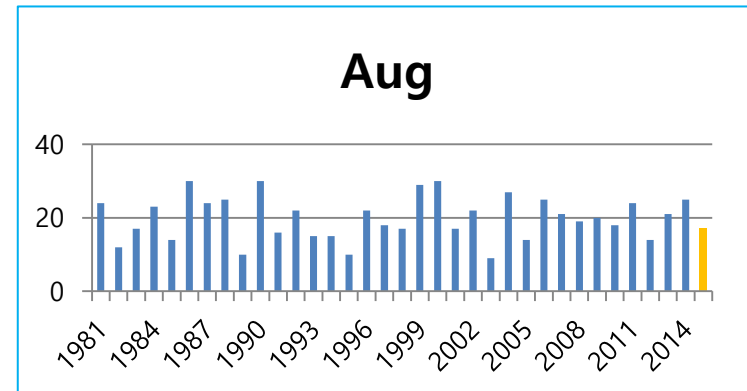
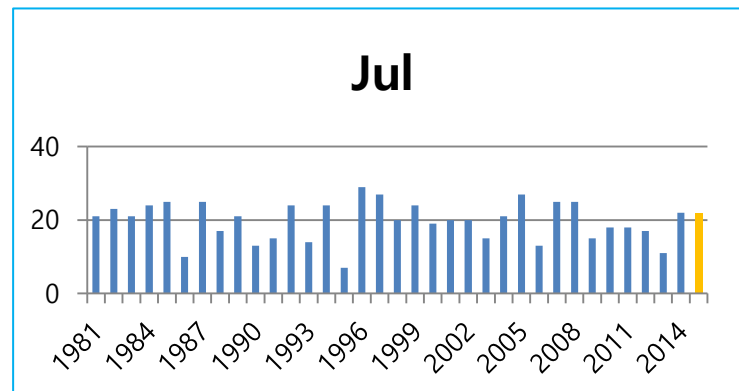
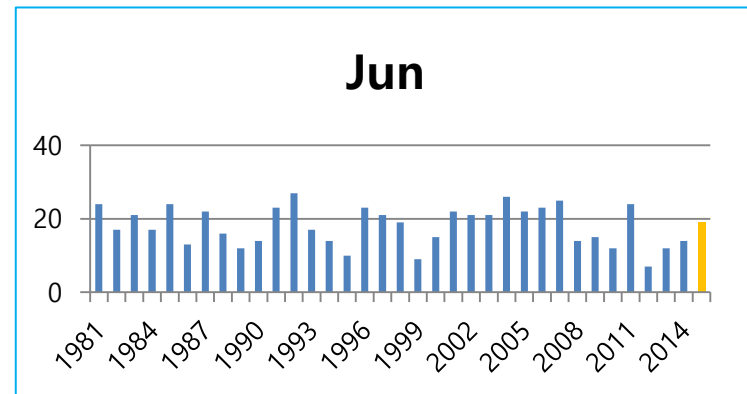
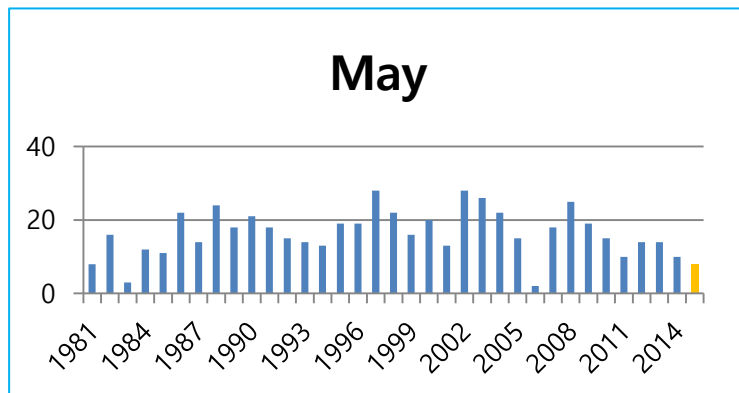
- 제10호 태풍 린파(LINFA)는 마카오에서 제출한 이름으로 연꽃을 의미함.
- 다음 정보는 오늘(3일) 16시 30분경에 발표될 예정임.
- 4일, 5일 후 태풍 위치가 유동적일 수 있으니, 이후 발표되는 기상정보에 유의바람.

Application Possibility : Typhoon



TC activity in 2015

Number of strong BSISO day (BSISO 1)

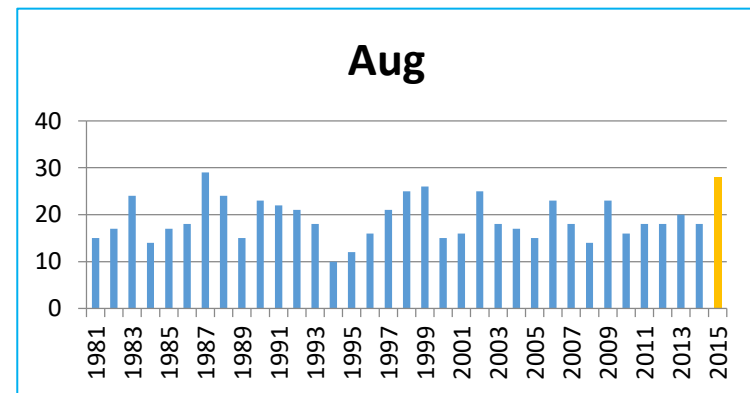
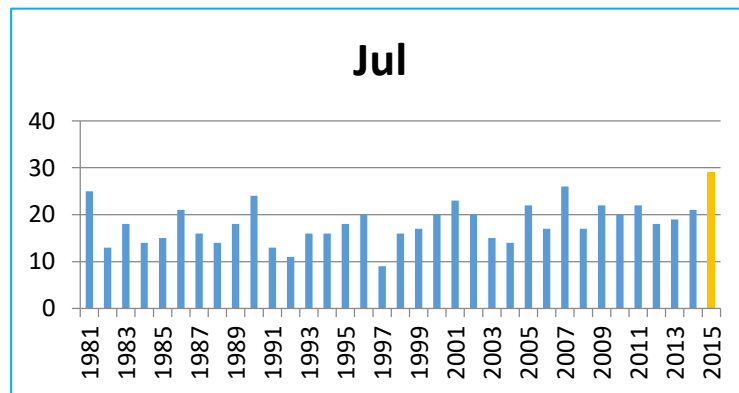
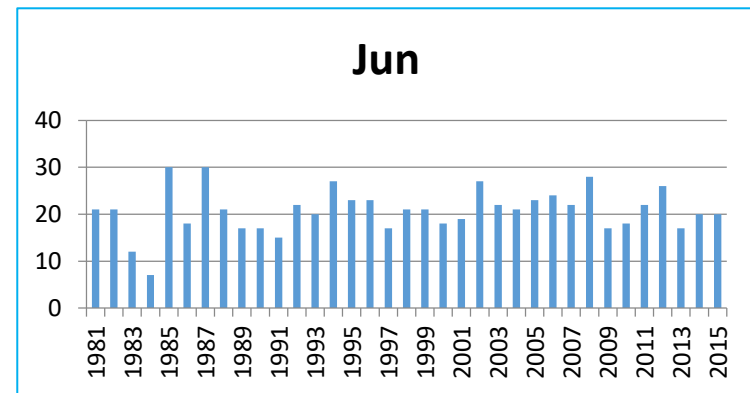
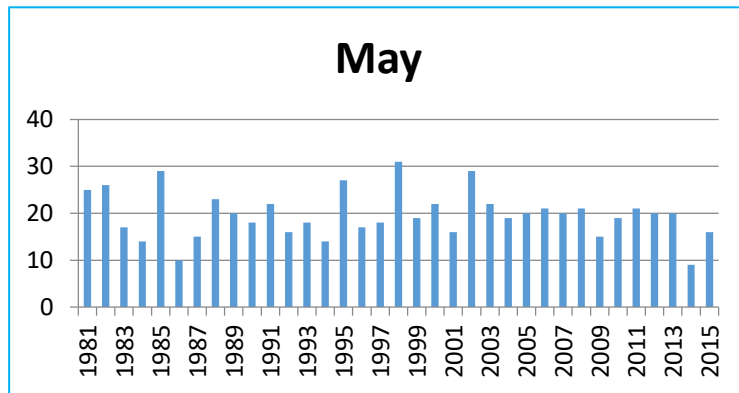


Application Possibility : Typhoon



TC activity in 2015

Number of strong BSISO day (BSISO 2)



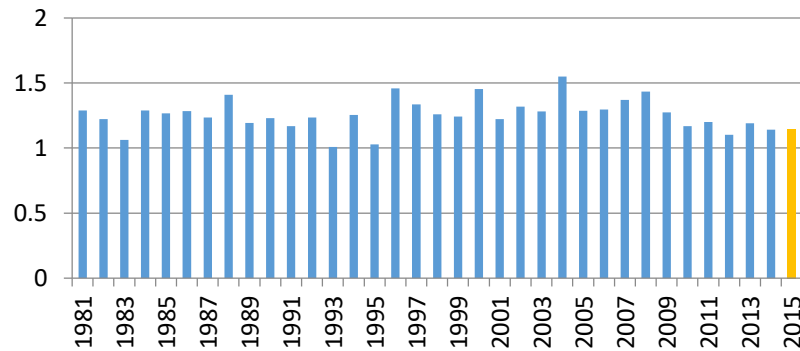
Application Possibility : Typhoon



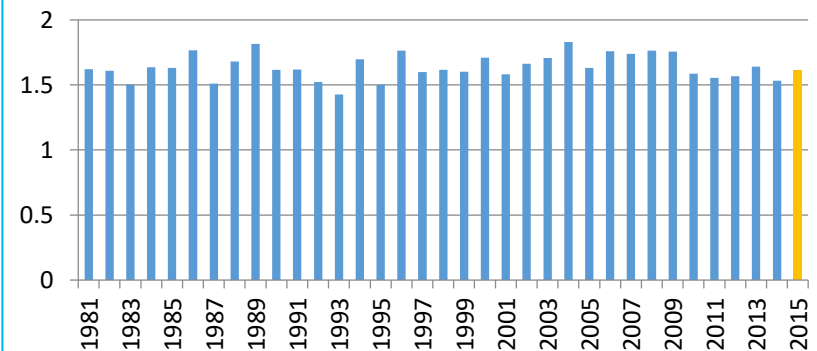
TC activity in 2015

Averaged BSISO amplitude

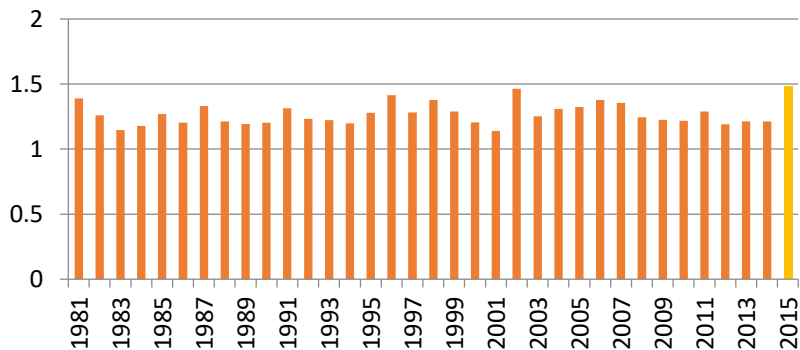
BSISO1



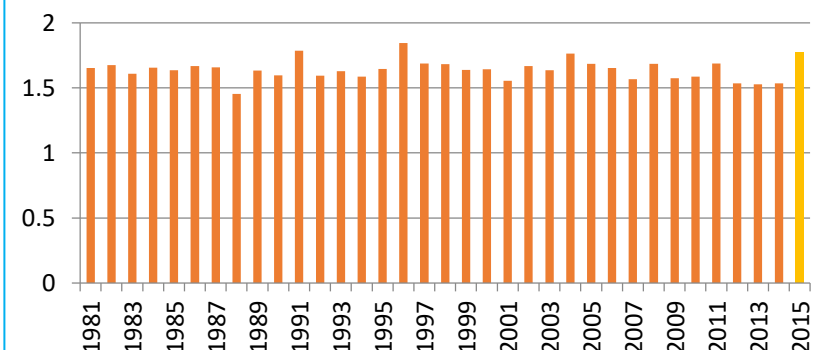
BSISO1(>1.0)



BSISO2



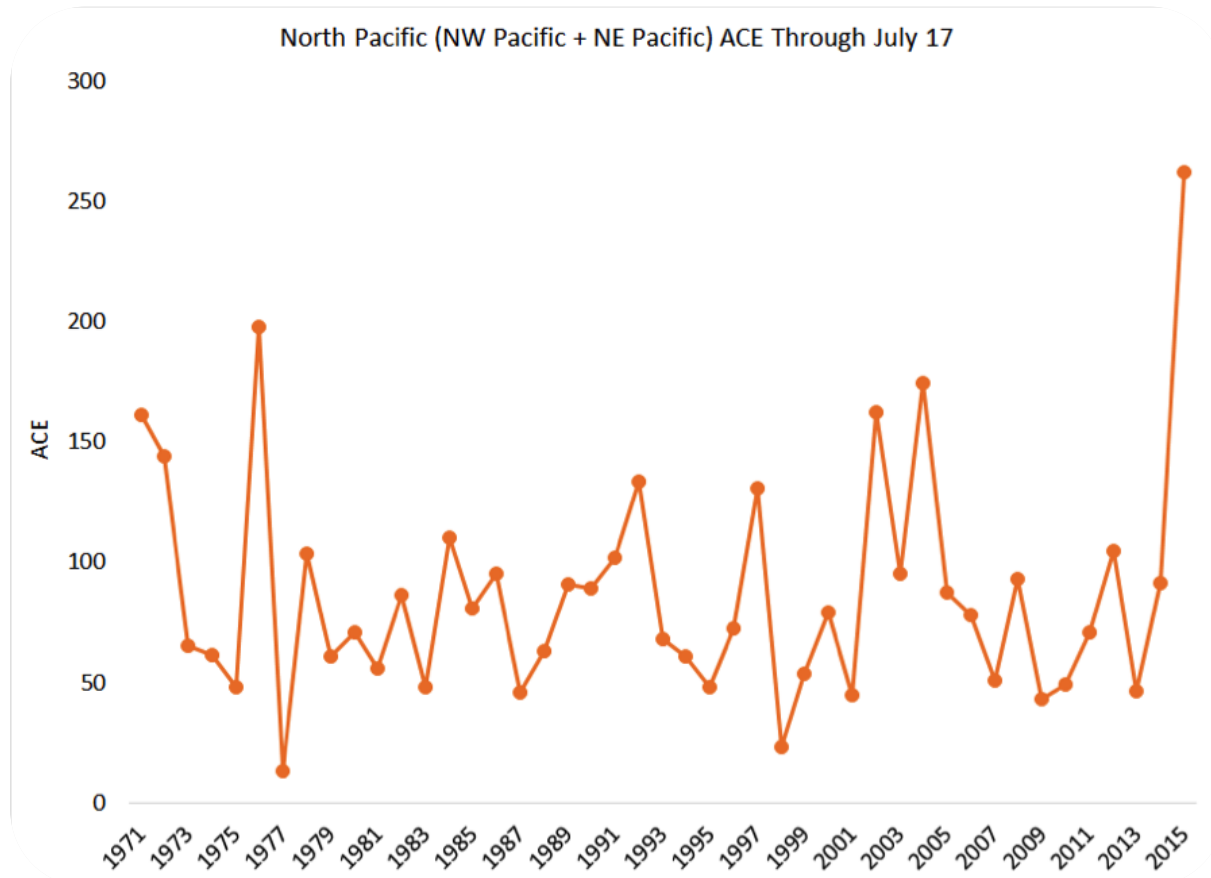
BSISO2(>1.0)



Application Possibility : Typhoon



TC activity in 2015



Source: Philip J. Klotzbach, Colorado State University

North Pacific ACE is 30% higher for this time of year than at any other time since 1971!

Application Possibility : Typhoon



TC activity in 2015

TC development in conjunction with El Nino/MJO

EL NINO MEETS MJO

When atmospheric and oceanic oscillations combine

By Chris Borg

Published: July 8, 2015 Views: 12,189

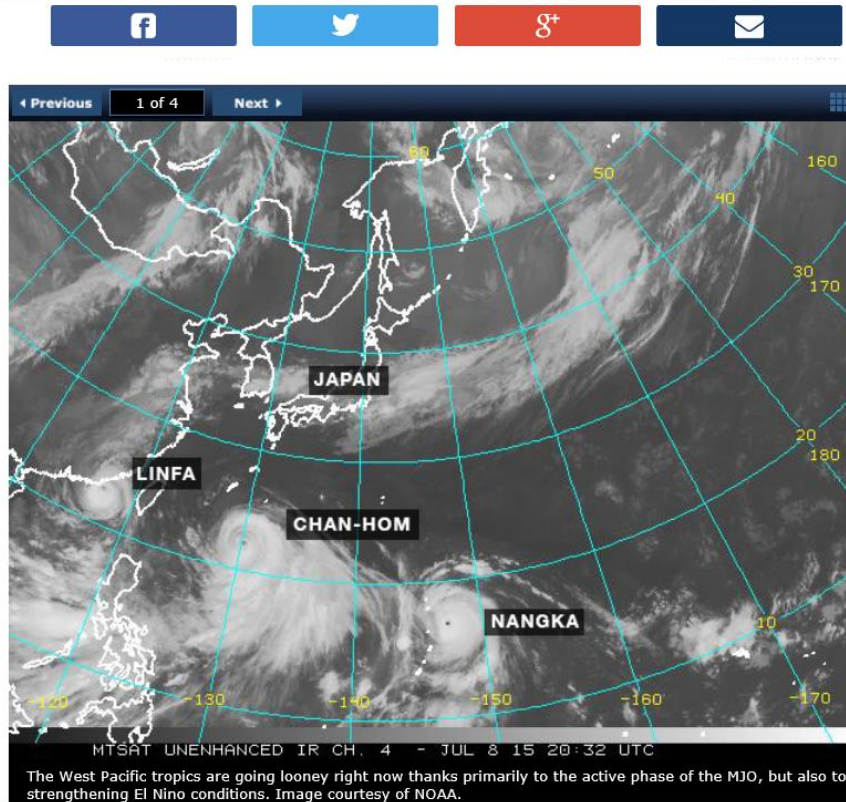
The words "El Nino" have made their way back into the news over the last few months by slowly, but surely, warming up waters of the tropical Pacific.

Now that El Nino has strengthened and is on the verge of breaking some temperature records in the central tropics, the world's best known atmospheric/oceanic event is being credited with causing nearly every weather anomaly anywhere in the Pacific. Of course not all of those claims are valid. While El Nino is definitely the star of the show, there are other players involved too. Like the MJO, for instance.



Handhu Fahli: Male Atolls

Source: Chris Borg, Surfline



Application Possibility : Typhoon

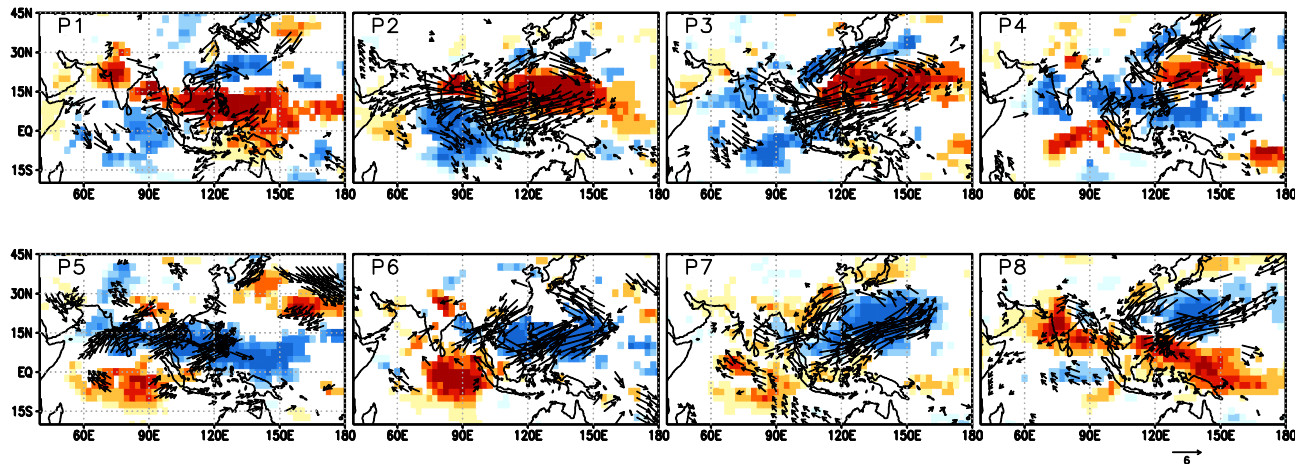


BSISO-TC activity relationship

OLR & 850hPa wind composite anomaly

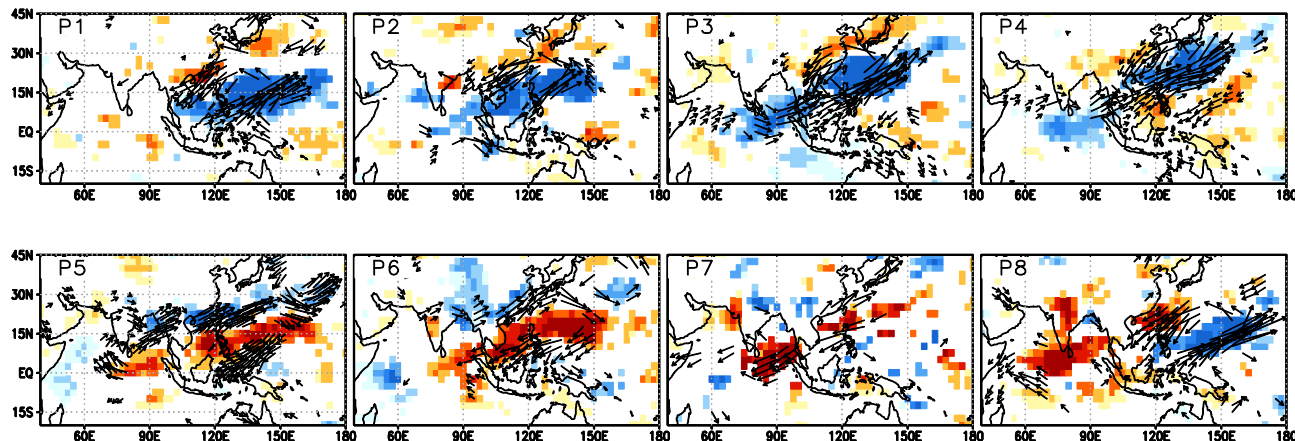
a)

BSISO1 AUG

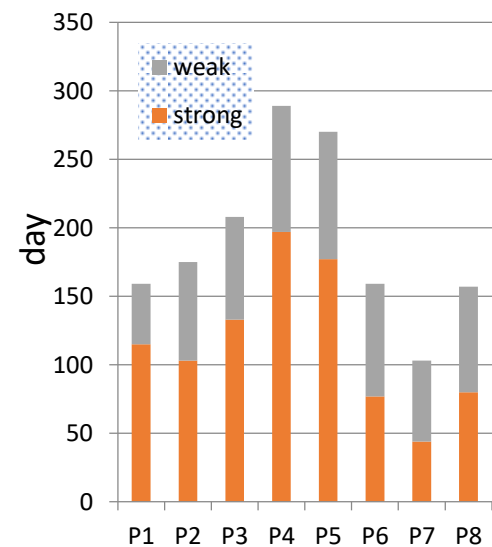
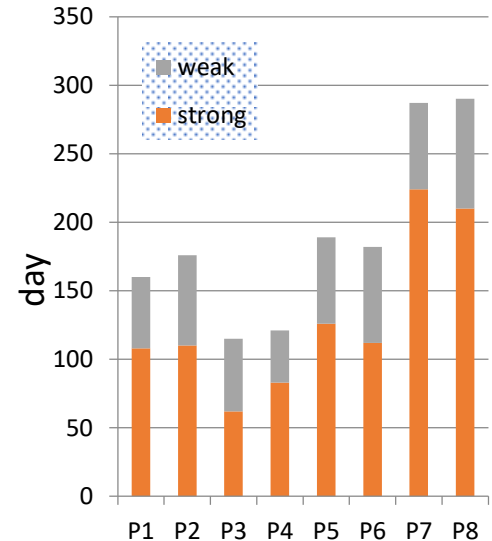


b)

BSISO2 AUG



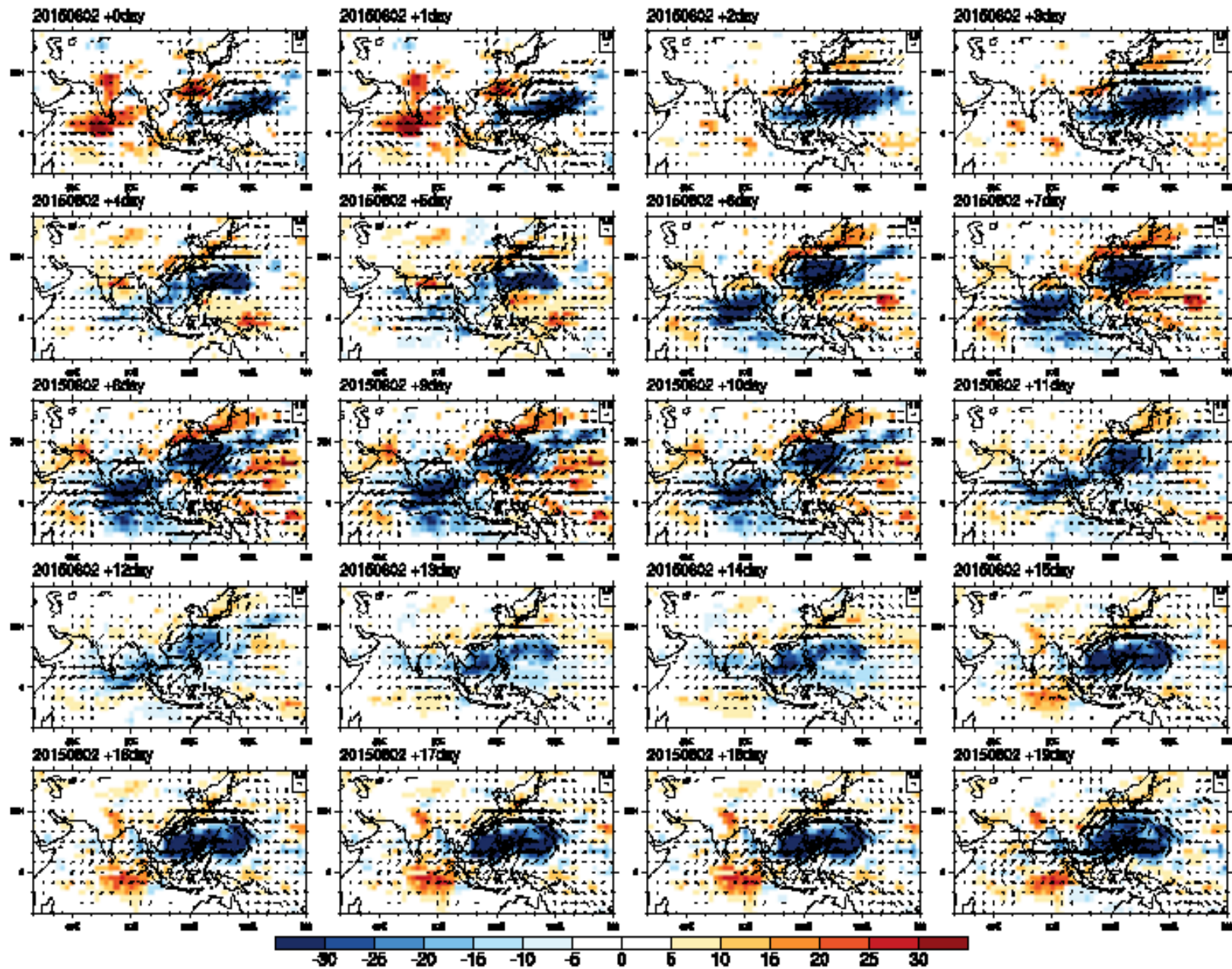
BSISO-TC relationship



Application Possibility : Typhoon

2016

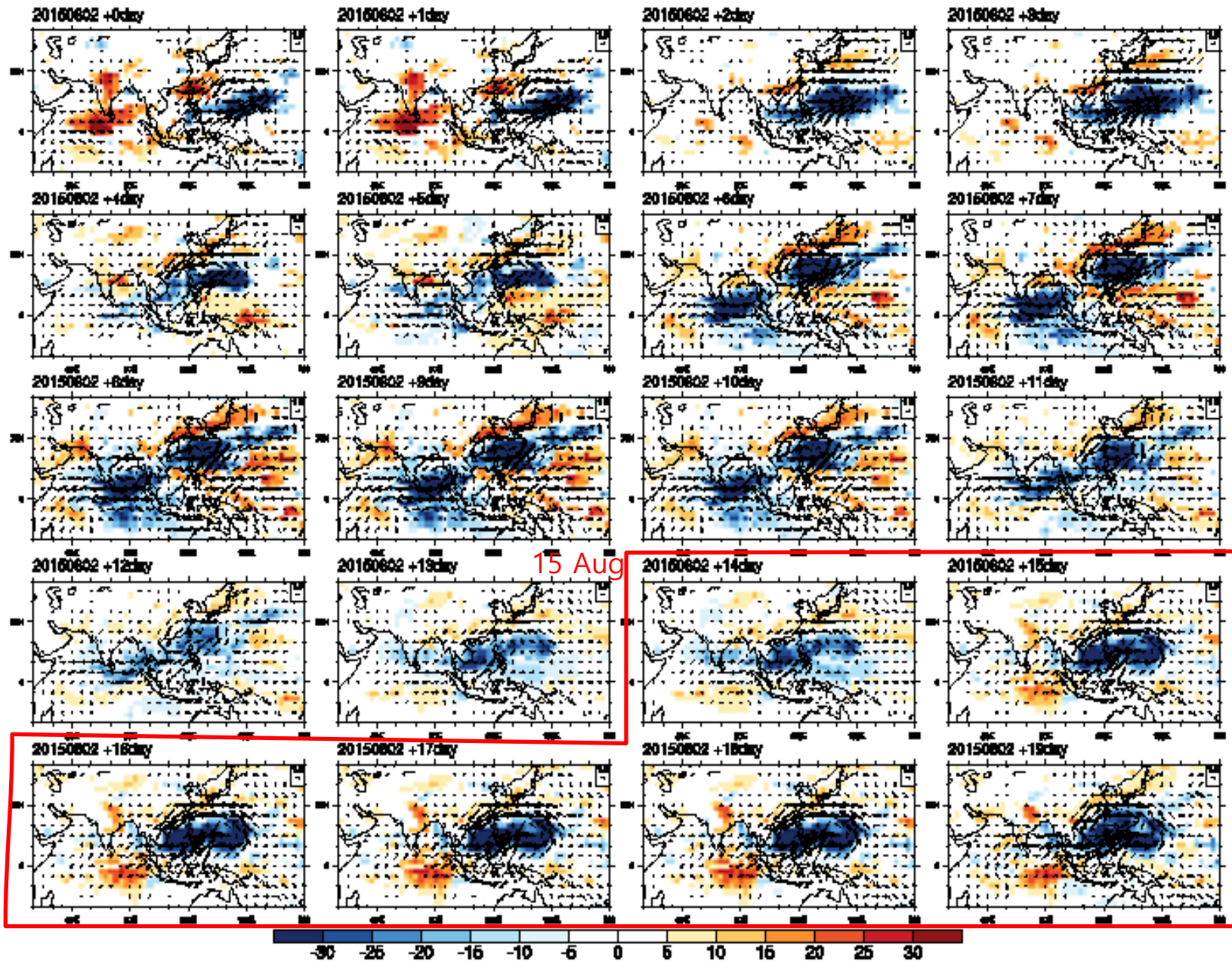
BSISO1+BSISO2 OLR&850hPa Wind anomaly (BOM) 2 AUG.~21 AUG.



Application Possibility : Typhoon

2016

BSISO1+BSISO2 OLR&850hPa Wind anomaly (BOM) 2 AUG.~21 AUG.



Application Possibility : Typhoon



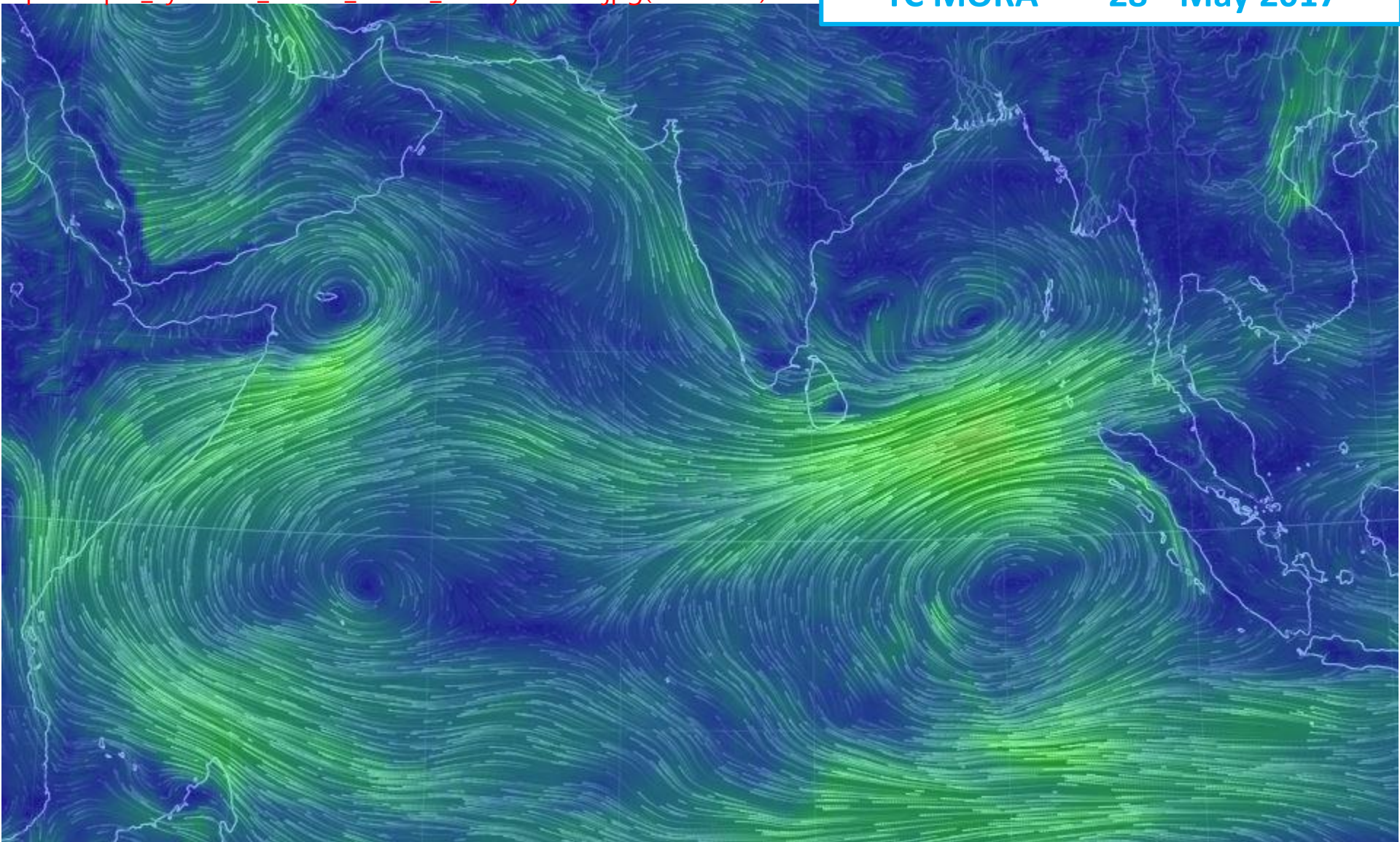
BSISO-TC activity relationship

Is there any relationship between strong BSISO activity and TC activity in 2015?

Can BSISO forecast give some information on early detection for typhoon formation?

→ *BSISO-WP TC relationship*

: Focused on the *TC related variables* (e.g. Nolan et al., 2007; Camargo et al., 2000)
Absolute vorticity at 850 hPa, relative humidity at 700 hPa, maximum potential intensity,
vertical shear between 850 and 200 hPa, Genesis Potential Index



Here is an interesting cyclonic formation in the Indian Ocean (see the attached image). One each in the Arabian Sea and Bay of Bengal and two more just south of the equator. Are they all interconnected? Any comments on this particular formation? I see that there are some studies on cross-equatorial twin cyclones, where each cyclone impact the growth and track of the other cyclone.

Here is one study: <http://onlinelibrary.wiley.com/doi/10.1029/2000JD000066/full>

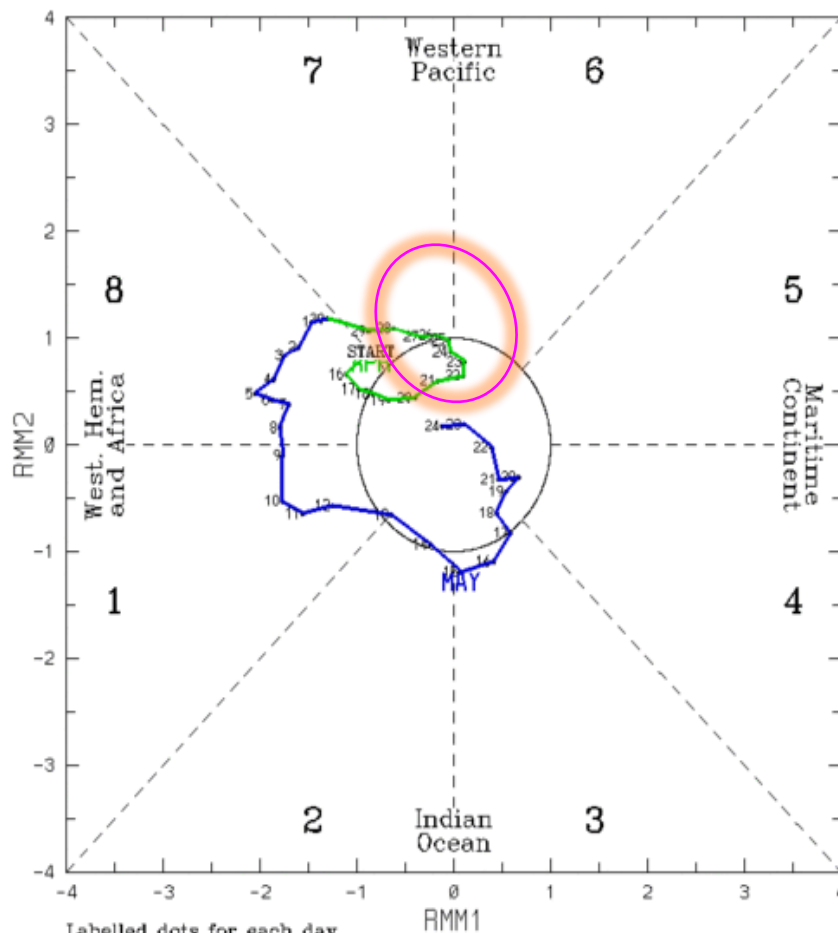
Regards, Roxy

Application Possibility : Typhoon



BSISO-TC activity relationship

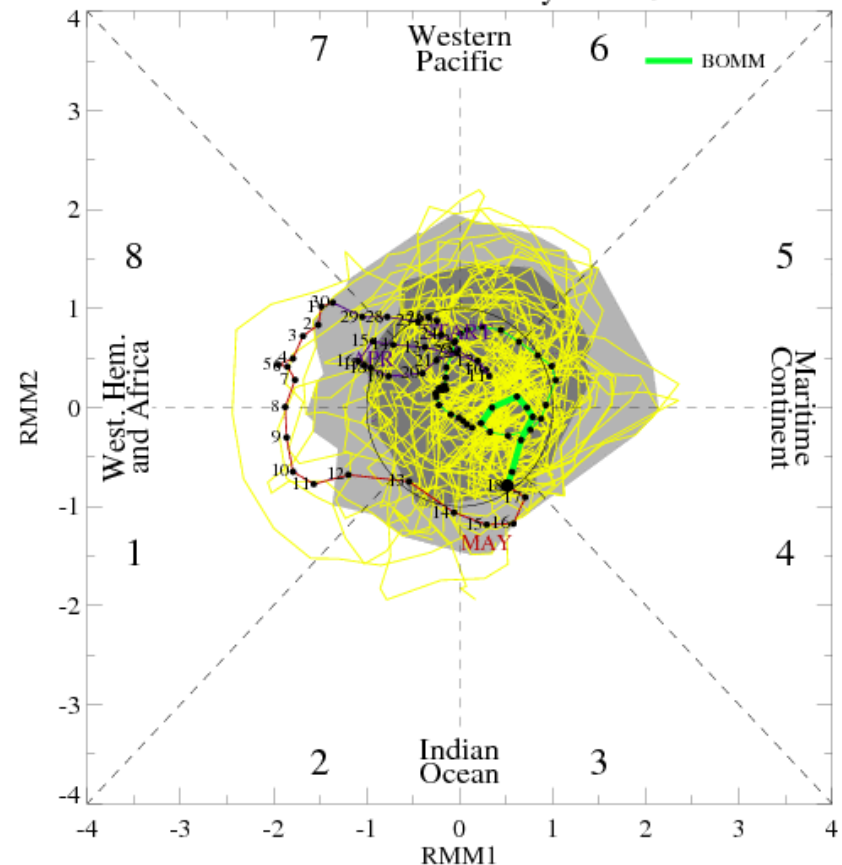
(RMM1, RMM2) phase space for 15-Apr-2017 to 24-May-2017



Labelled dots for each day.

Blue line is for May, green line is for Apr, red line is for Mar.

MJO Index Forecast for 18May2017-29Jun2017



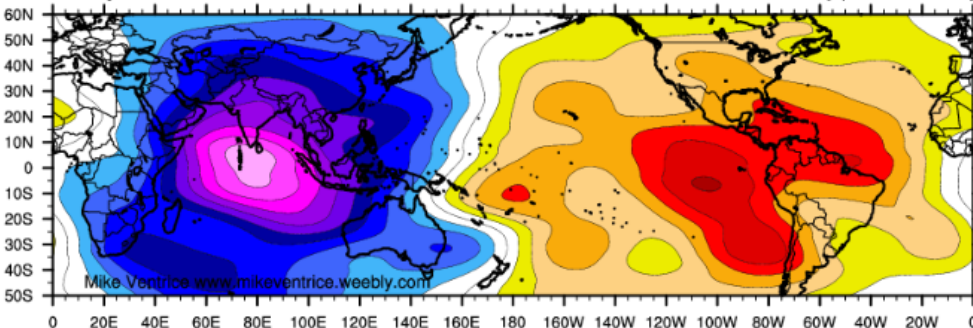
MJO filtered VP200 Forecast

TC MORA

28th May 2017

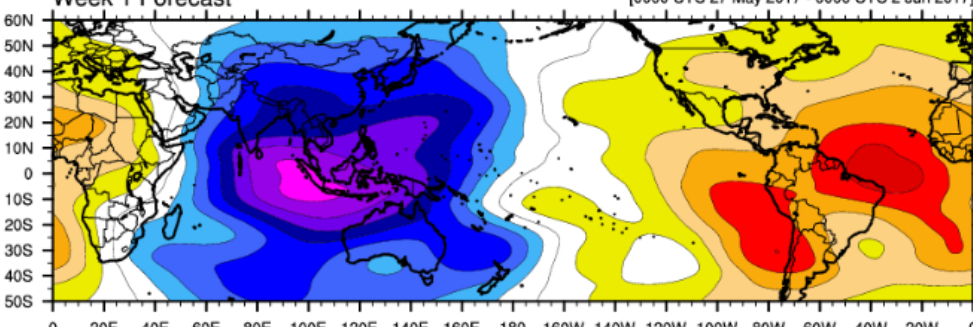
Today

[Updated: 5/26/2017]



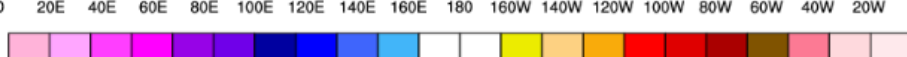
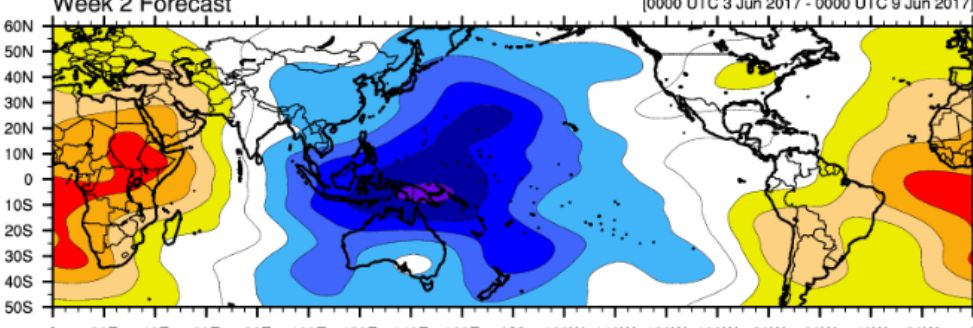
Week 1 Forecast

[0000 UTC 27 May 2017 - 0000 UTC 2 Jun 2017]



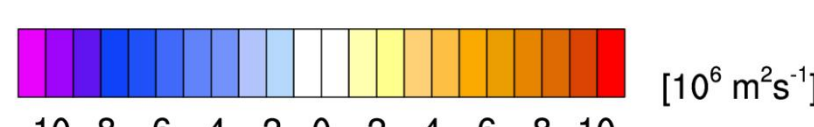
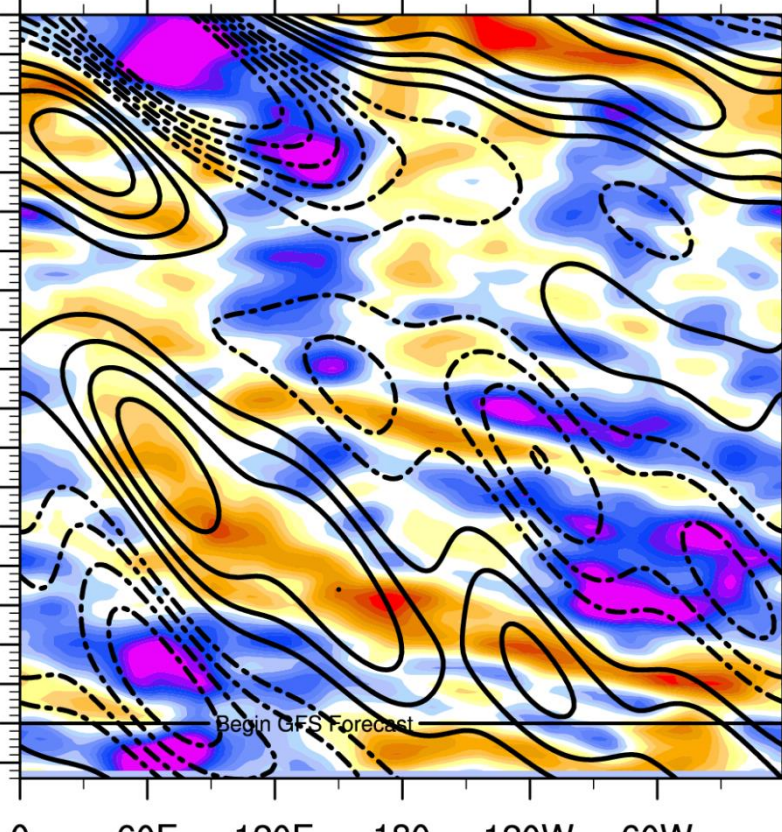
Week 2 Forecast

[0000 UTC 3 Jun 2017 - 0000 UTC 9 Jun 2017]



5S-5N: 200-hPa velocity potential anomalies

Feb 24
Mar 01
Mar 06
Mar 11
Mar 16
Mar 21
Mar 26
Mar 31
Apr 05
Apr 10
Apr 15
Apr 20
Apr 25
Apr 30
May 05
May 10
May 15
May 20
May 25
May 30



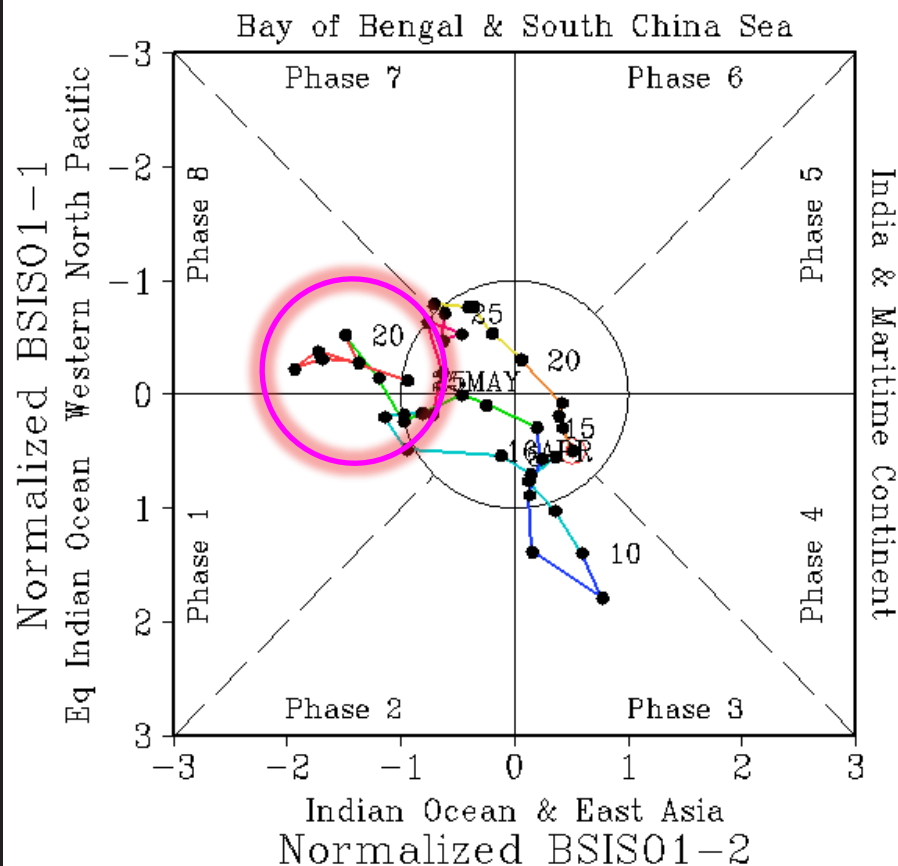
Application Possibility : Typhoon



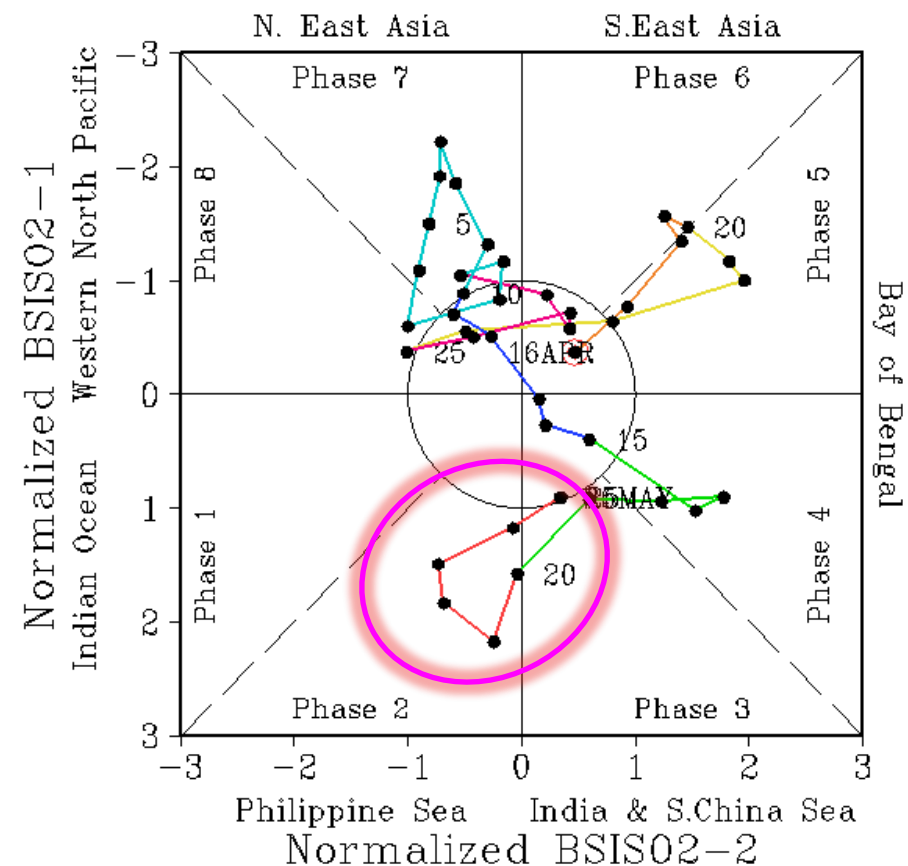
BSISO-TC activity relationship

BSISO Monitoring for 16Apr2017~25May2017

BSISO 1



BSISO 2

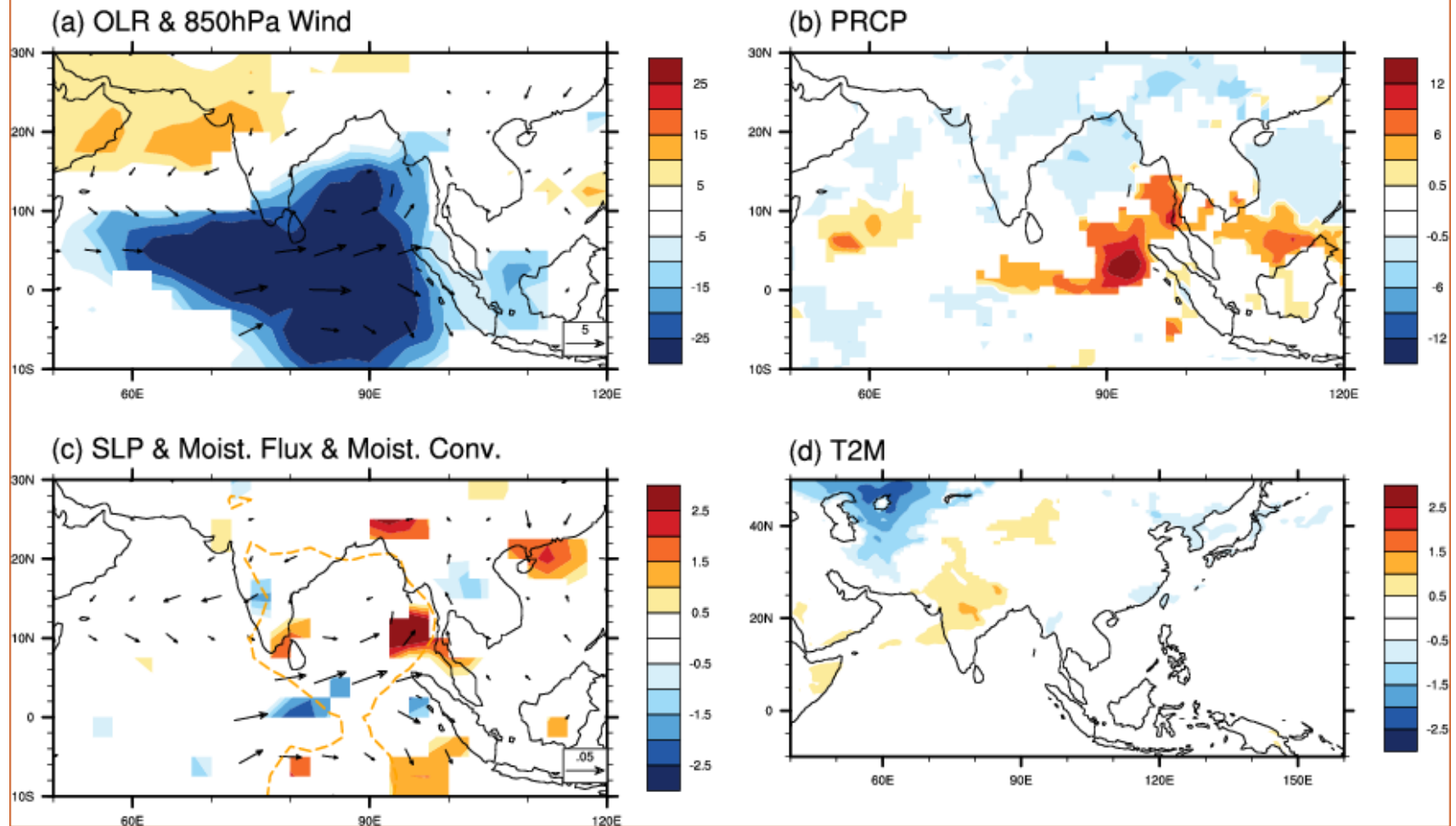


Application Possibility : Typhoon



BSISO-TC activity relationship

BOM fields estimated by BSISO index: 20170521(+4day)

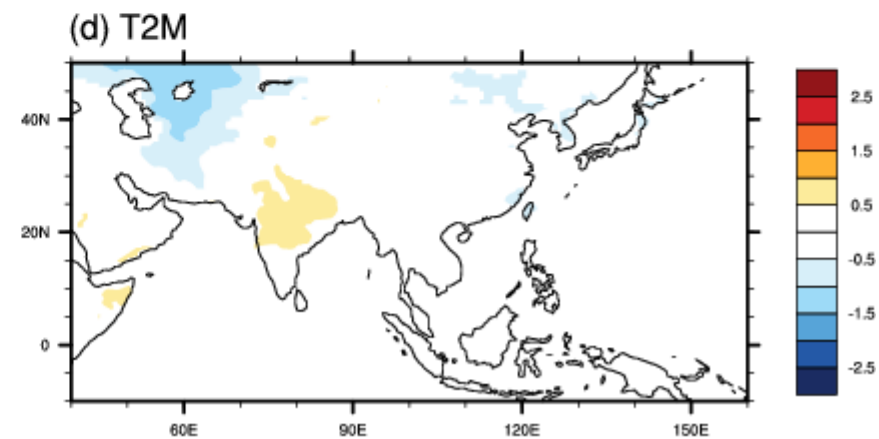
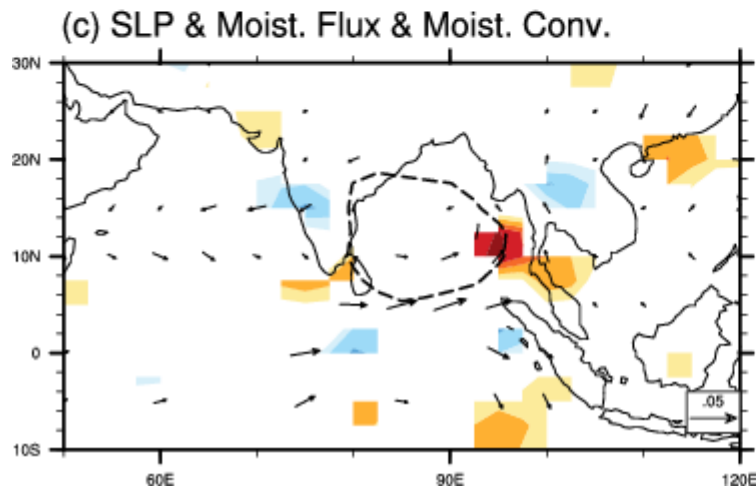
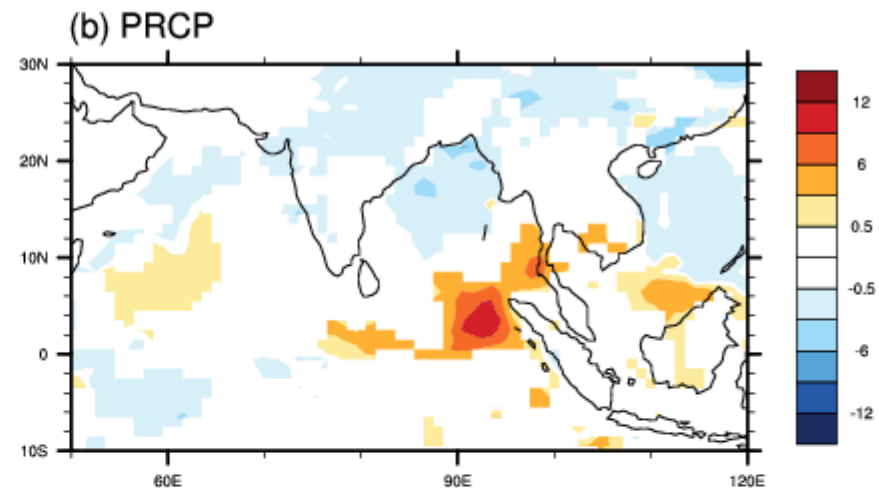
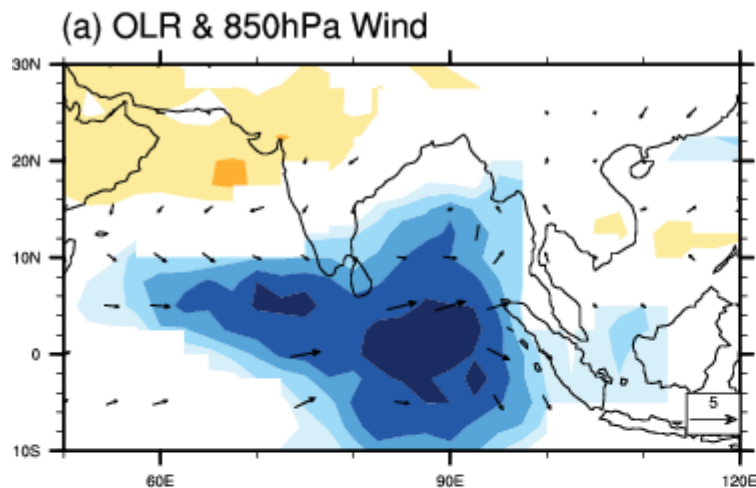


Application Possibility : Typhoon



BSISO-TC activity relationship

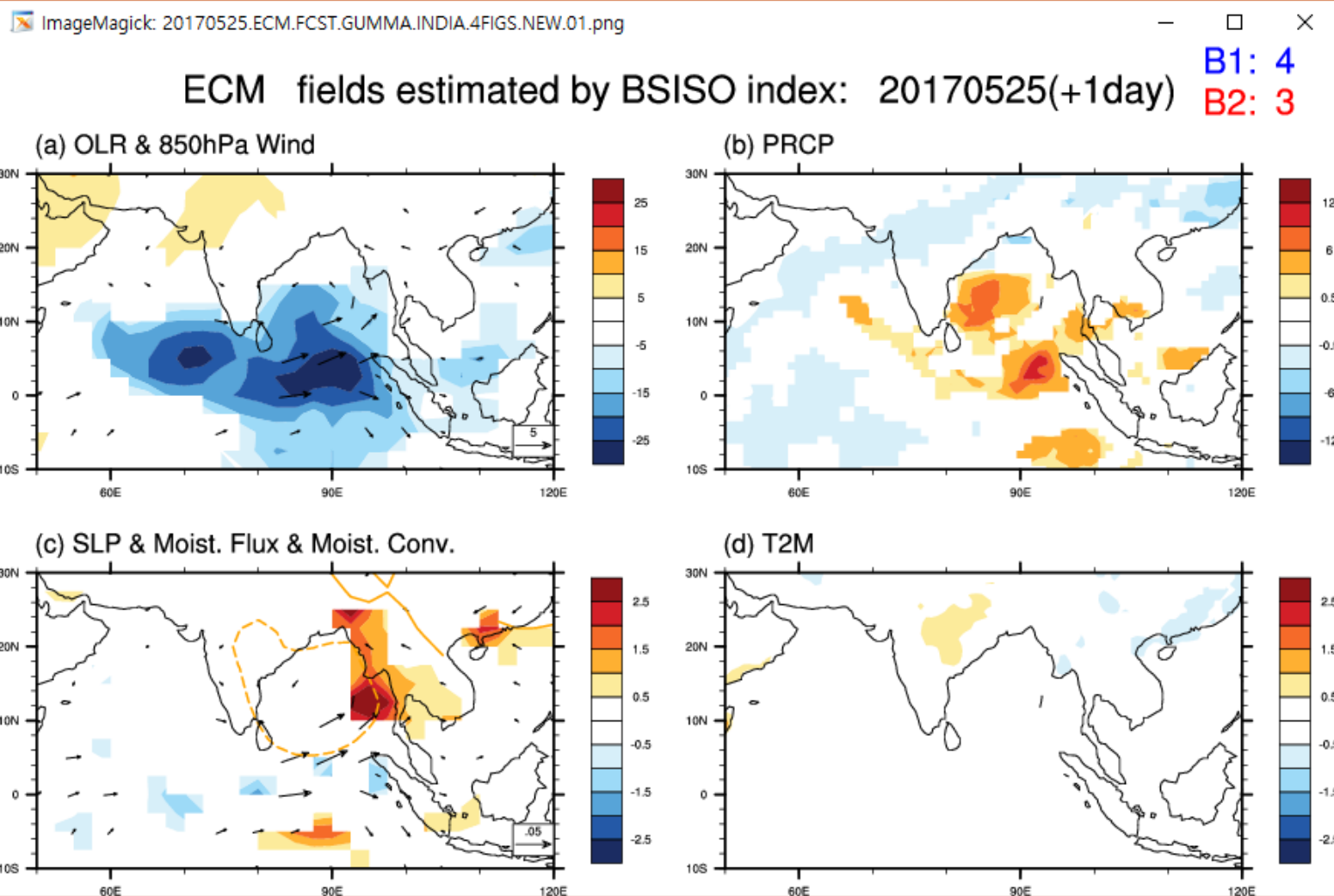
ECM fields estimated by BSISO index: 20170522(+3day)



Application Possibility : Typhoon



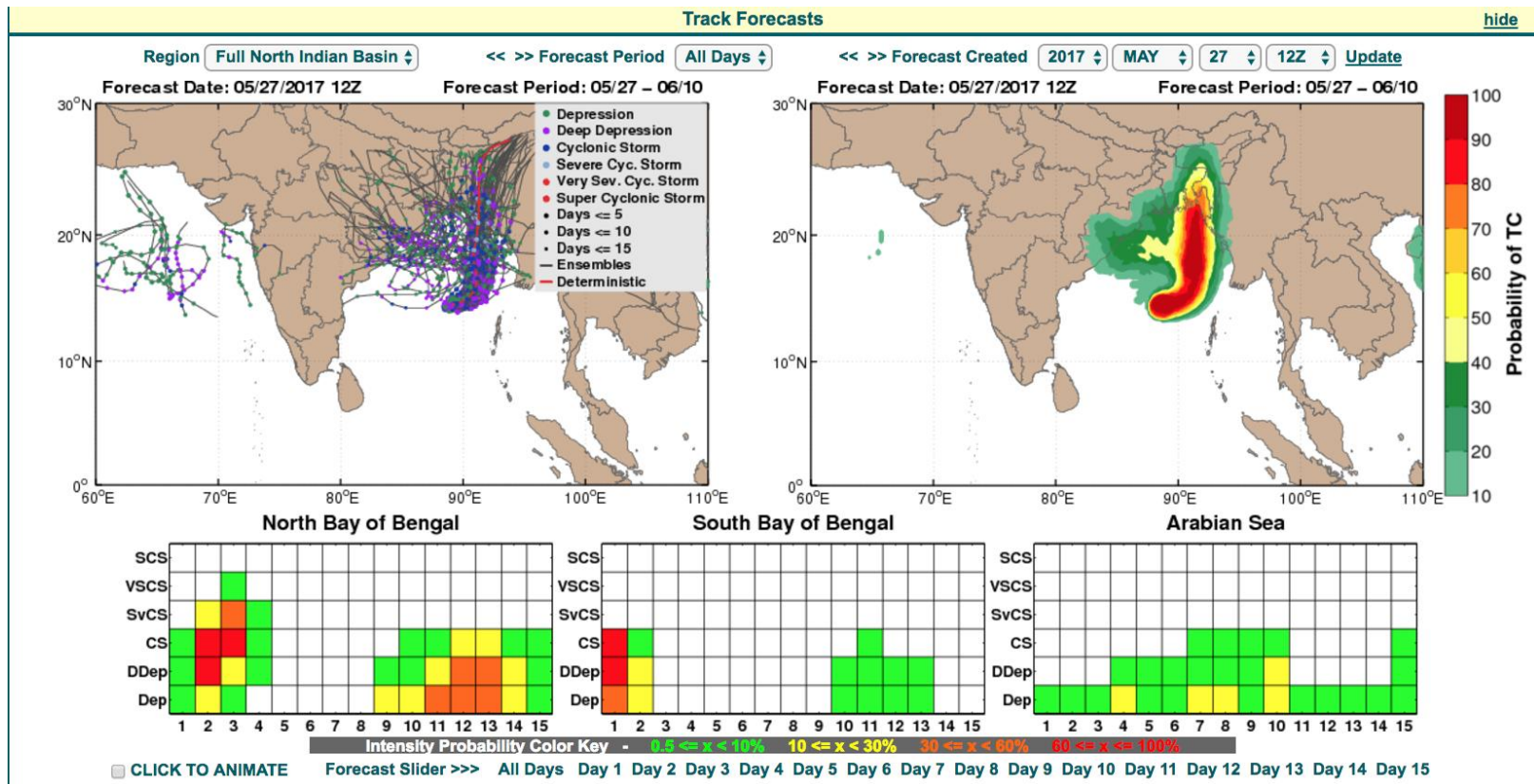
BSISO-TC activity relationship



Roxy

I am jumping in to discussion rather late. What you have shown is cyclonic circulations and not the cyclonic formation. These do not have vertical continuity in the vorticity field. These are not seen on the next days chart also. Such cyclonic circulations are seen to present every day on the Indian land area at lower and middle troposphere. These are formed by conversion of shear vorticity into curvature vorticity and from energetic's point of view Kz to Ke conversion. Sometimes these are formed due to meeting of winds from two directions which produces convergence and vorticity. These do not have vertical structure like lows, depressions. Their lifetime is also small (one day). They do not travel much.

jrk



Hi All,

Please see below the CFAN forecast for eminent TC approaching Bangladesh.. Surprisingly, no warnings from IMD, BMD, Bangladesh FFWC or RIMES. This is alarming (and disappointing) given that the CFAN EC-based forecast suggests a severe TC landfalling within 3 days!.

I will keep you posted. PW



India Meteorological Department,
Earth System Science Organisation,
(Ministry of Earth Sciences).

BULLETIN NO.: 01 (BOB 02/2017).

TIME OF ISSUE: 0900 HOURS IST

DATED: 28.05.2017.

FROM: INDIA METEOROLOGICAL DEPARTMENT (FAX NO. 24643965/24699216/24623220).

TO: CONTROL ROOM, NDM, MINISTRY OF HOME AFFAIRS (FAX NO. 23093750).

CONTROL ROOM NDMA (FAX NO. 26701729).

CABINET SECRETARIAT (FAX NO. 23793144).

PS TO HON'BLE MINISTER FOR S & T AND EARTH SCIENCES (FAX NO. 23316745).

SECRETARY, MOES, (FAX NO. 24629777).

SECRETARY, DST (FAX NO. 26863847/-2418).

H.Q. (INTEGRATED DEFENCE STAFF AND CDS) (FAX NO. 23005137/23005147).

DIRECTOR GENERAL, DOORDARSHAN (23385843).

DIRECTOR GENERAL, AIR (25843825).

PIB MOES (FAX NO. 23389042).

UNI (FAX NO. 23355841).

D.G. NATIONAL DISASTER RESPONSE FORCE (NDRF) (FAX NO. 26105912).

CHIEF SECRETARY, GOVT. OF WEST BENGAL (033-22144328).

CHIEF SECRETARY, GOVT. OF TRIPURA (0381-2414013).

CHIEF SECRETARY, GOVT. OF MANIPUR (0385-2452629, 0385-2451144).

CHIEF SECRETARY, GOVT. OF MIZORAM (0389-2322745, 0389-2314627).

CHIEF SECRETARY, ANDAMAN & NICOBAR ISLANDS (FAX No. 03192-223331).

Sub: Depression over Central Bay of Bengal.

Latest observations & satellite imagery indicate that a depression has formed over central Bay of Bengal and lay centred at 0530 hrs IST of today, the 28th May, 2017 near Latitude 14.0° N and Longitude 88.5° E, about 950 km south of Kolkata and 980 km south-southwest of Chittagong. The system is very likely to move north-northeastwards and reach Bangladesh coast by 30th May 2017 forenoon. It is very likely to intensify into a deep depression during next 24 hours.

Warning:

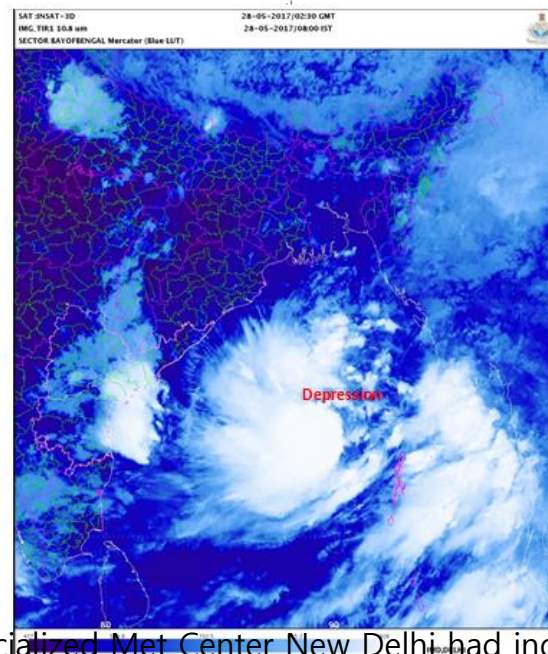
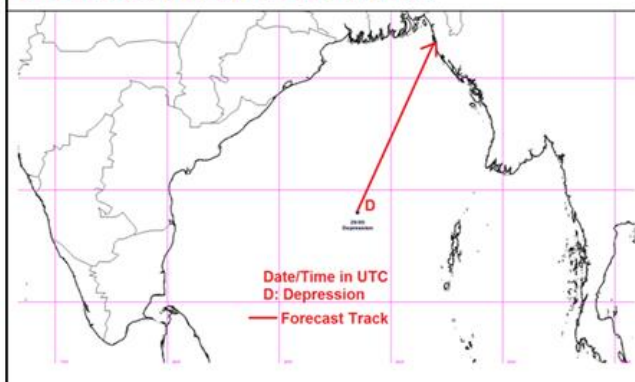
- (i) **Wind warning:** Squally winds speed reaching 40-50 kmph gusting to 60 kmph would prevail along & off Andaman Islands and adjoining Sea areas during next 48 hours.
- (ii) **Sea condition:** Sea condition would be rough to very rough along & off Andaman Islands during next 48 hours.
- (iii) **Fishermen Warning:** Fishermen are advised not to venture into sea along & off Andaman Islands during next 48 hrs. Fishermen out at sea are advised to return to the coast.

The next bulletin will be issued at 1130 hrs IST of 28th May 2016.

(Naresh Kumar),
Scientist-D,
RSMC, New Delhi.

Copy to: DFDD, Pune/ACWC Kolkata /ACWC Chennai/CWC Vishakhapatnam/CWC Bhubaneswar/MC Hyderabad.

OBSERVED POSITION AND FORECAST TRACK OF DEPRESSION OVER BAY OF BENGAL BASED ON 0000 UTC OF 28TH MAY, 2017



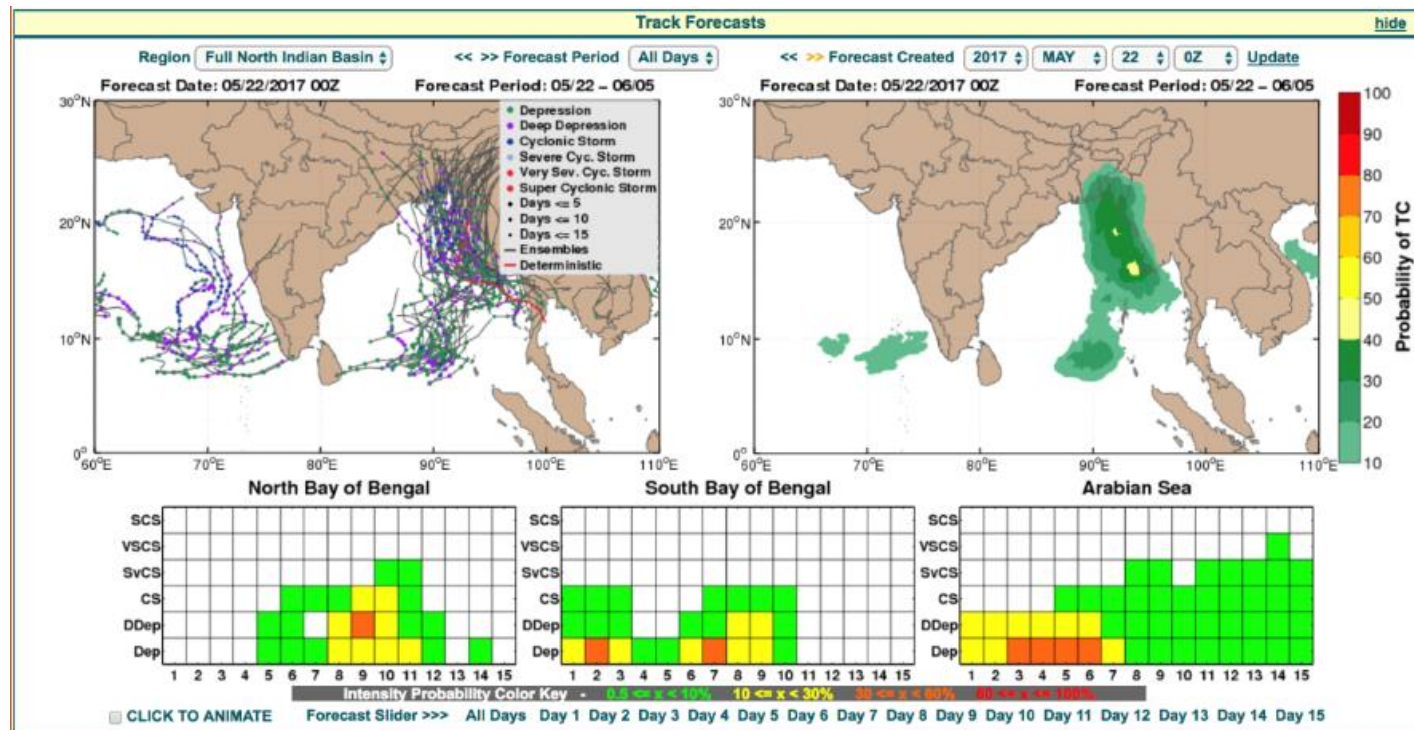
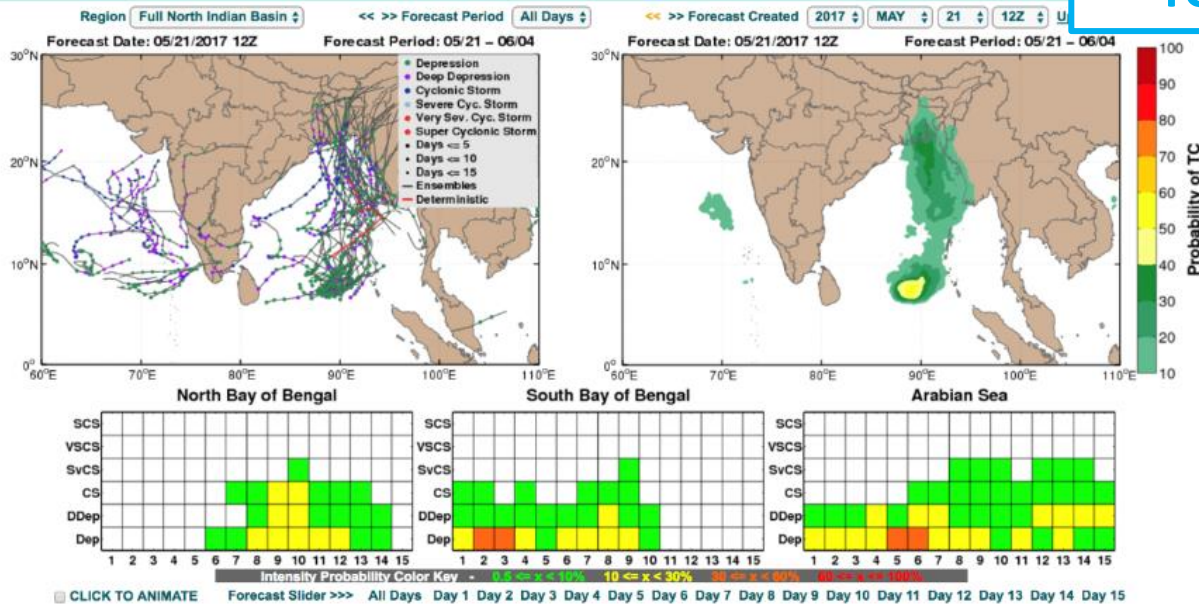
Dear All,

Related to this I would like to bring to your notice that IMD/Regional Specialized Met Center New Delhi had indicated in their morning Bulletin of **26th May with 51% to 75% probability of cyclogenesis in next 48 to 72 hrs.** Thereafter regular bulletins are being issued with raising probability to **76% to 100% on 27th morning.** Latest Bulletin is copied below. You may refer website www.rsmcnewdelhi.imd.gov.in for updates.

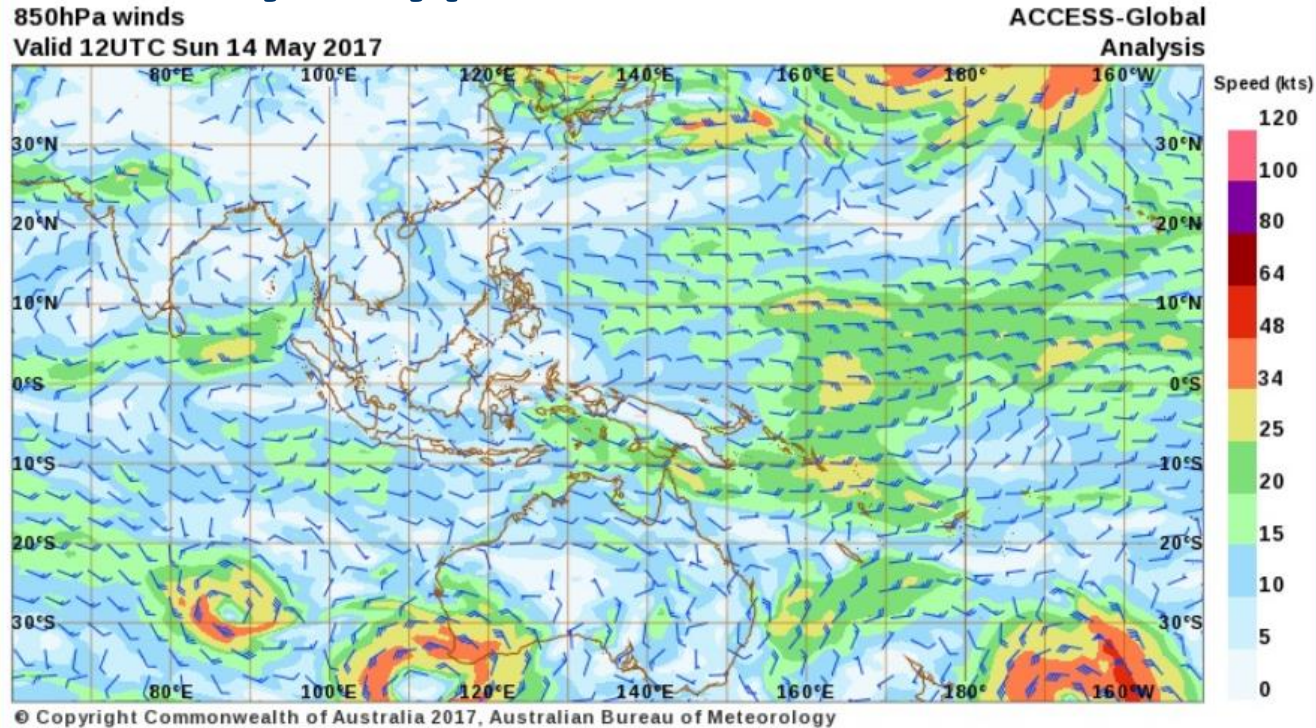
Sharing forecasts/warnings are most welcome. Let us all work towards safer world by providing timely warnings.

With best wishes, Ajit Tyagi

Track Forecasts



Application Possibility : Typhoon



Hi,

The 850hPa wind jet in the equatorial Indian Ocean:

This low level wind jet in the Indian Ocean has been there, almost stationary, for two weeks now.

To illustrate I have attached three 850hPa analyses from 12UTC on 14 May, 24 May and 29 May.

This jet was the main synoptic feature associated with the very heavy rainfall on the South and Southwest coasts of Sri Lanka around 24-25 May, which led to the devastating flooding and loss of life.

In addition, it was the central westerly as part of the structure of the twin cyclones, one of which became tropical storm Mora.

The twin cyclones have been discussed a bit already, and as pointed out they have the dynamical structure of an $n=1$ Rossby Wave. Still, to me its mysterious. What has maintained this feature for so long? Why stationary? (Rossby wave embedded in a background westerly flow?).

What effect has such a sustained wind had on the underlying ocean?

Any dynamical insights out there?

I'll get out of your way

John McB

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Asia China India

Sri Lanka floods: Nearly 500,000 displaced as death toll rises

27 May 2017 Asia

f t w e Share



The BBC's Azzam Ameen joins rescuers in Sri Lanka

At least 126 people have been killed and nearly 500,000 displaced in Sri Lanka following flooding and mudslides triggered by monsoon rains, the government says.

Top Stories

MI5 probes Manchester bomber 'warnings'

The security service will look into how it handled tip-offs about the threat posed by Salman Abedi.

22 minutes ago

BA flight disruption enters third day

3 hours ago

N Korea fires third missile in three weeks

2 hours ago

Features



The women accused of killing Kim Jong-nam

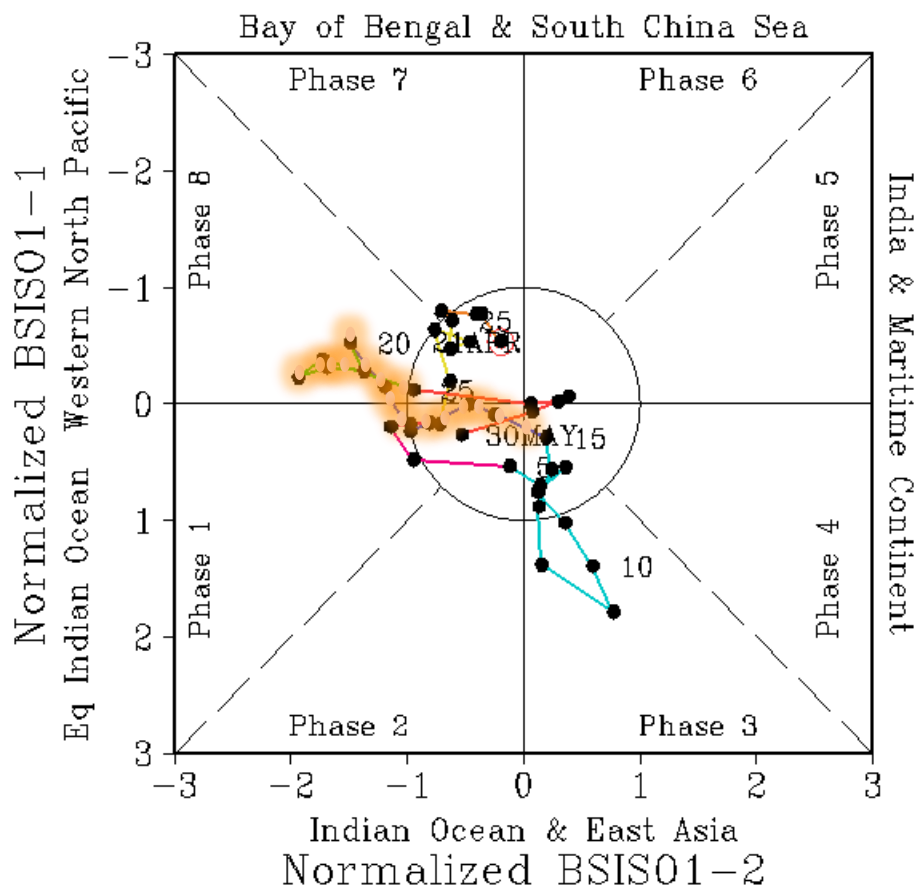
Peter

Thanks for sharing CFAN forecasting - it is rather surprising why there is no forecast from the regional met services. Any ideas of recent floods in Sri Lanka - every monsoon is so different and intriguing...and keeps us busy
<http://www.bbc.com/news/world-asia-40070660>

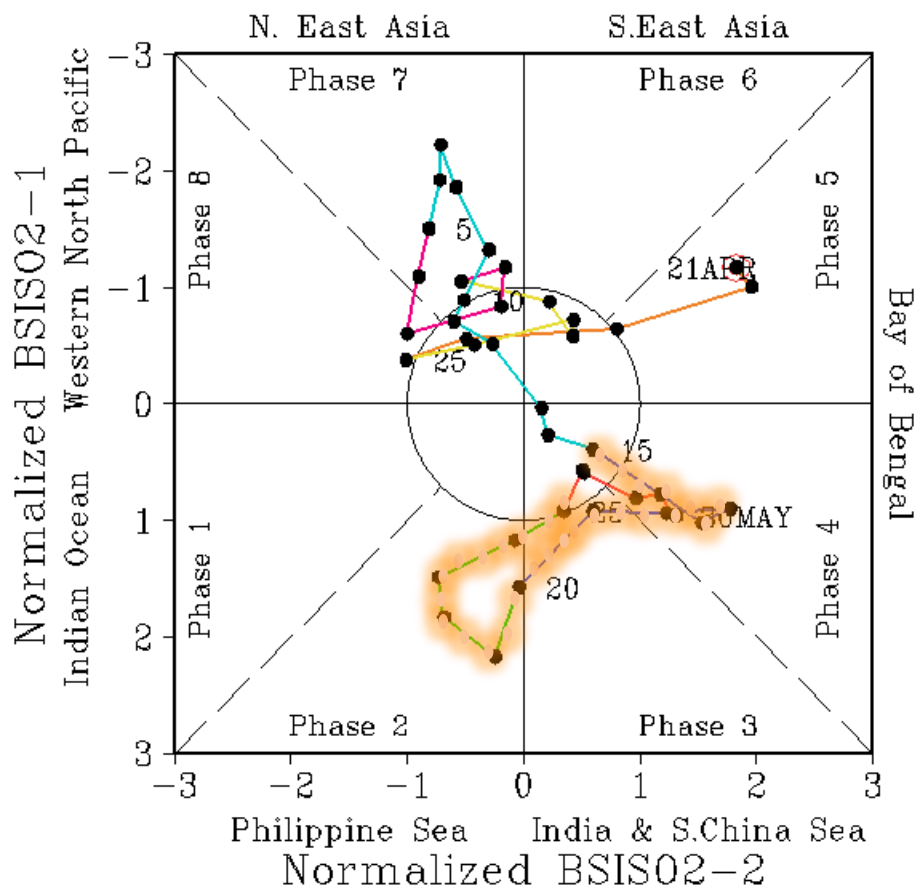
-Anna

BSISO Monitoring for 21Apr2017~30May2017

BSISO 1



BSISO 2



B1 is active in Phase 8

B2 is active in Phase 4-3-2

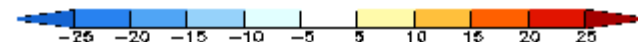
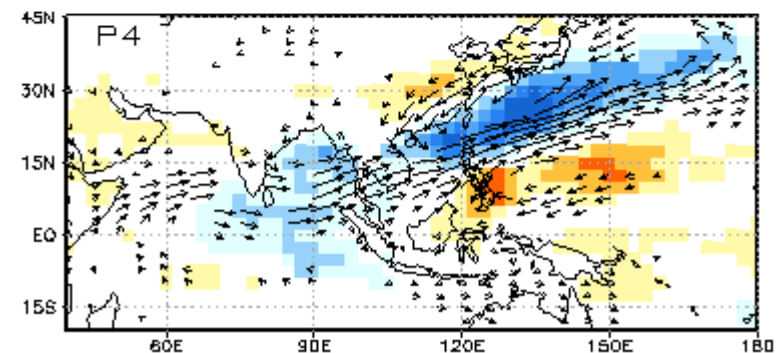
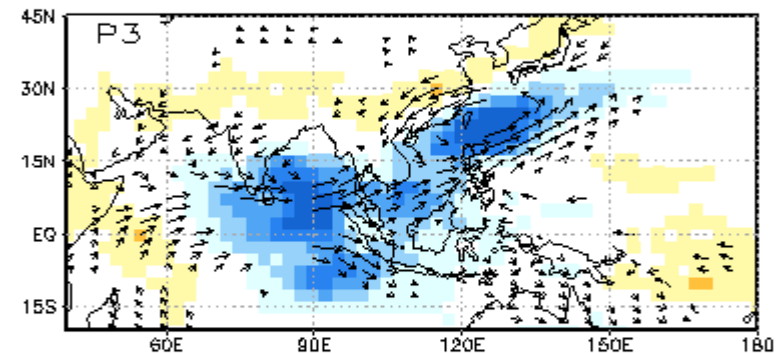
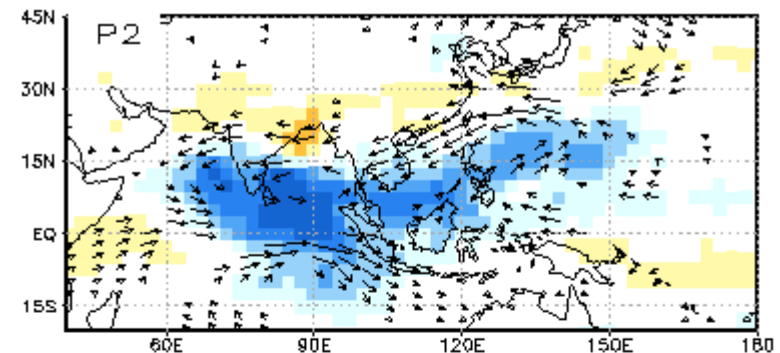
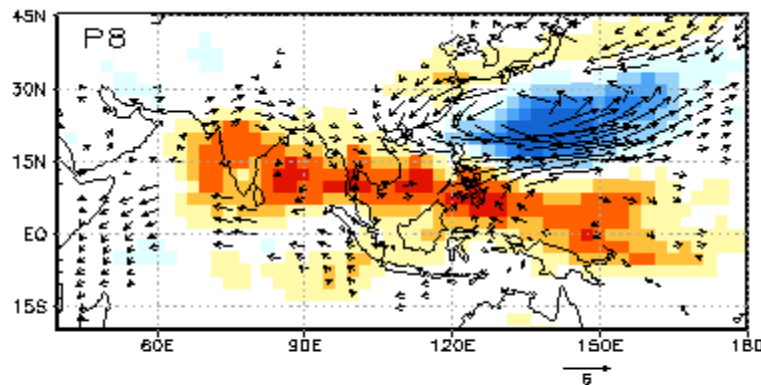
Application Possibility : Typhoon

BSISO2



BSISO-TC activity relationship

BSISO1



Thought that BSISO2 might contribute to stationary westerlies over the equatorial Indian ocean.

Application Possibility : Typhoon



BSISO-TC activity relationship

WNP TC

Deterministic forecast (ISGPI)

Probability forecast of TC Occurrence

Ongoing research



A new ISGPI for NH summer

$$\text{ISGPI}_{\text{MJJASO}} = (-0.51) * \omega_{500} + (-0.21) * V_{zs} + (0.20) * f_{\zeta_{r850}}$$

Region	ω_{500}	V_{zs}	$f_{\zeta_{r850}}$	Equation
Globe	0.68 ¹	0.72 ²	0.74 ³	$(-0.51) * \omega_{500} + (0.20) * f_{\zeta_{r850}} + (-0.21) * V_{zs}$
IO	0.72 ¹	0.79 ³	0.78 ²	$(-0.56) * \omega_{500} + (0.32) * f_{\zeta_{r850}} + (-0.12) * V_{zs}$
WNP	0.75 ¹	0.78 ²	0.80 ³	$(-0.55) * \omega_{500} + (0.22) * f_{\zeta_{r850}} + (-0.20) * V_{zs}$
ENP	0.81 ¹	0.84 ³	0.84 ²	$(-0.67) * \omega_{500} + (0.24) * f_{\zeta_{r850}} + (-0.02) * V_{zs}$
Western NAT	0.49 ³	0.48 ²	0.45 ¹	$(-0.16) * \omega_{500} + (0.46) * f_{\zeta_{r850}} + (-0.25) * V_{zs}$

BSISO modulation of tropical cyclone genesis and sub-seasonal prediction - A new intraseasonal GPI for Northern Hemisphere(NH) summer (May-Oct)

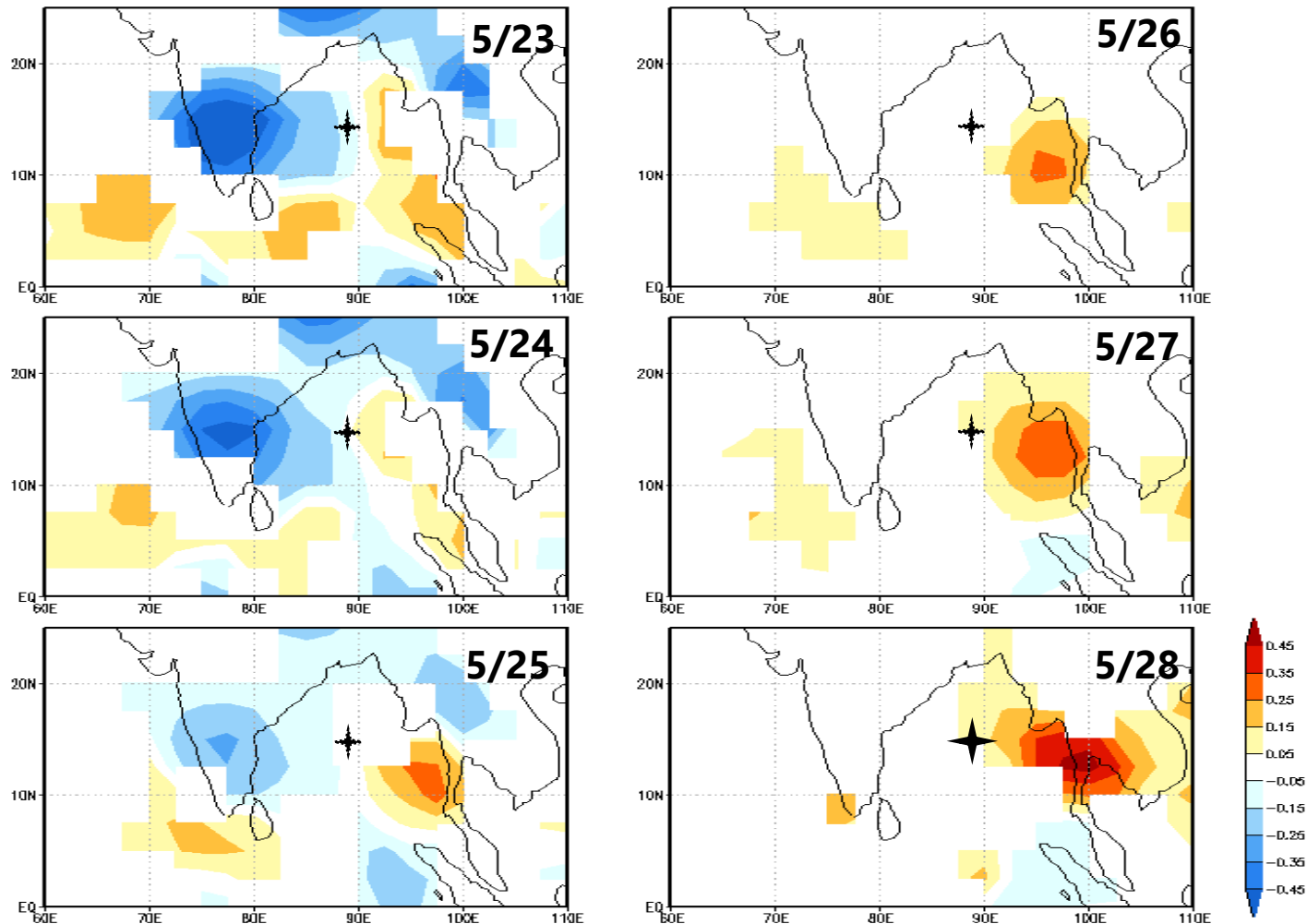
[Moon et al., 2017, submitted to J. Climate]

Application Possibility : Typhoon



BSISO-TC activity relationship

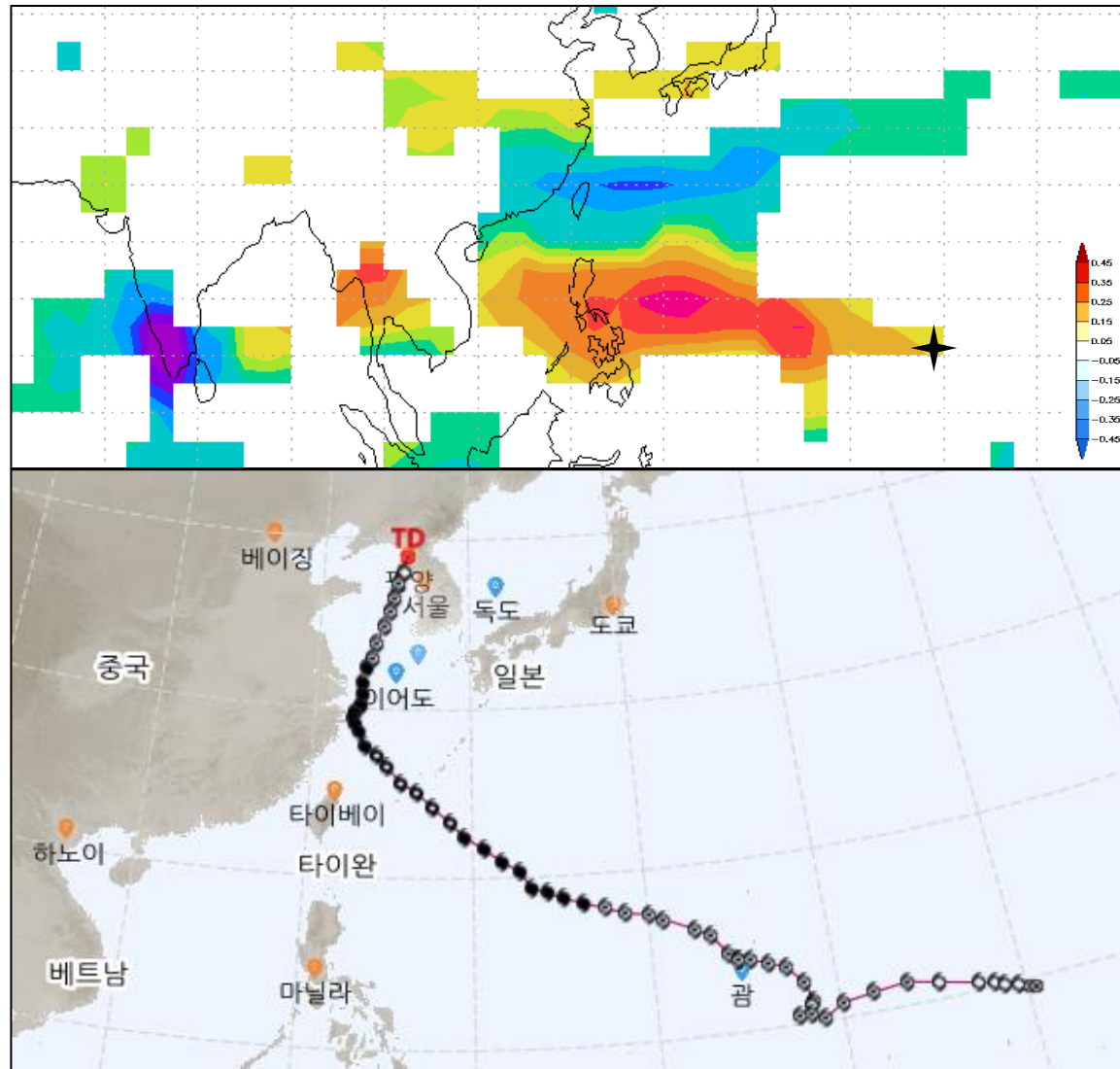
ISGPI estimated by BSISO indices



Application Possibility : Typhoon



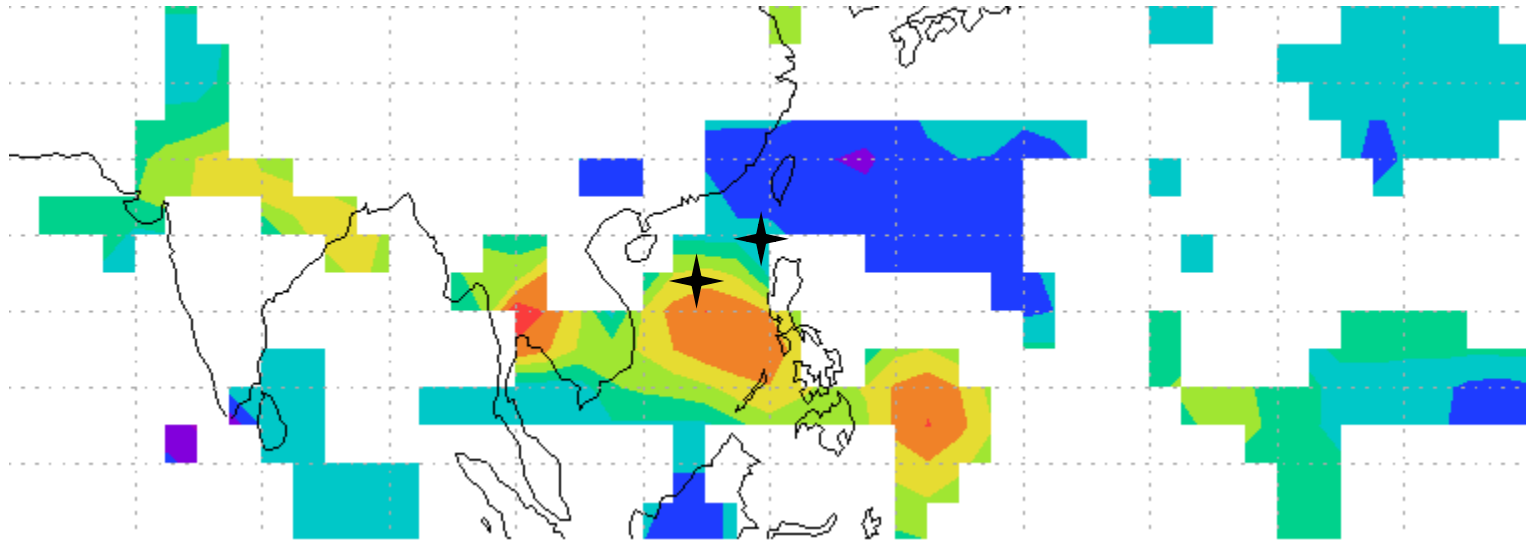
BSISO-TC activity relationship



Application Possibility : Typhoon



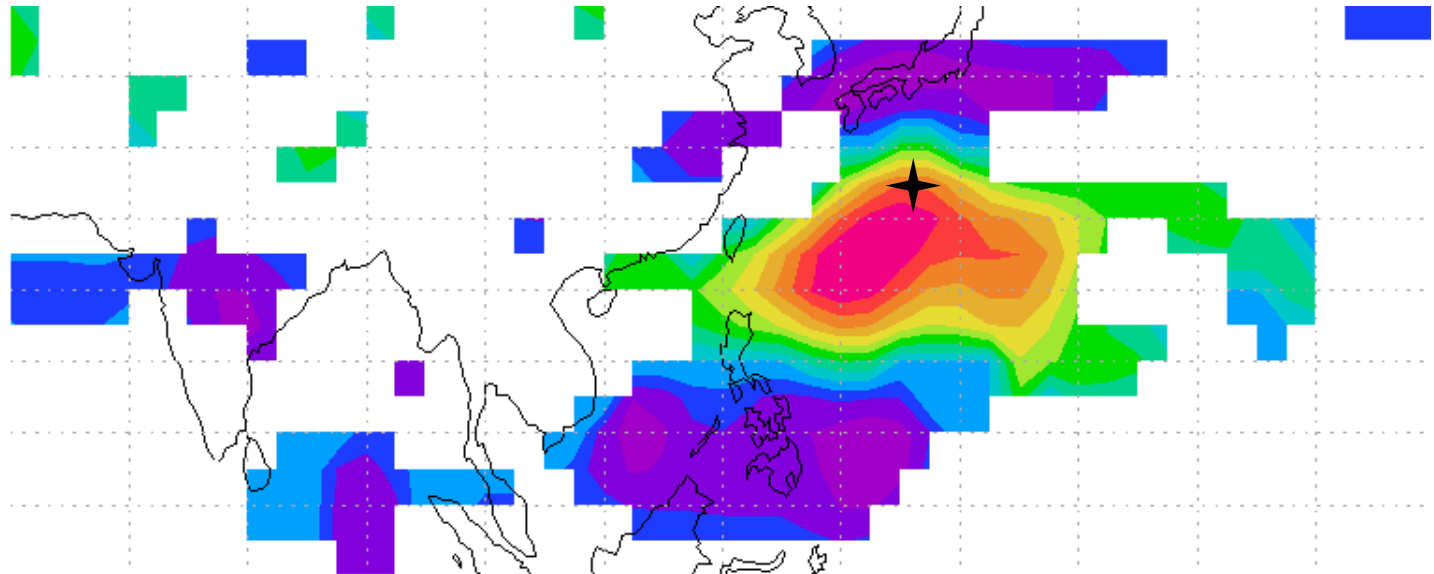
BSISO-TC activity relationship



Application Possibility : Typhoon



BSISO-TC activity relationship



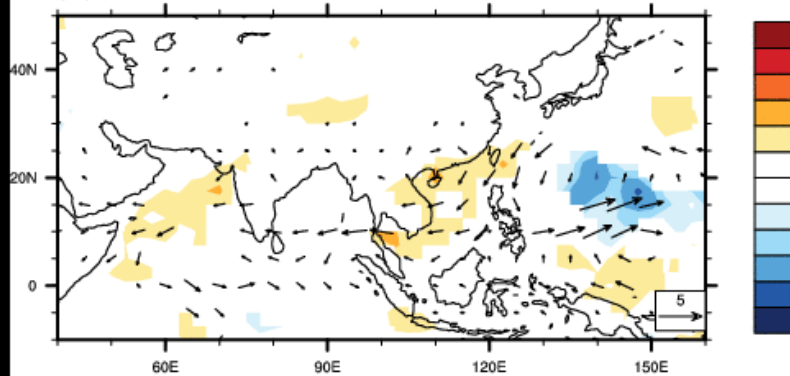
20 day forecasts estimated by BSISO forecast

Model : ECMWF

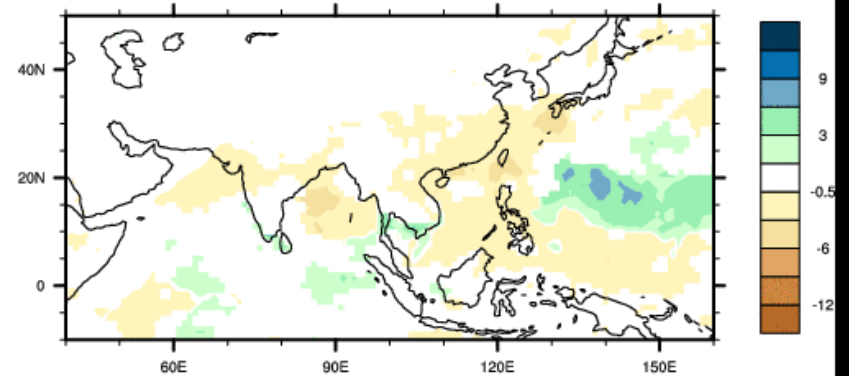
ECM fields estimated by BSISO index: 20171005(+0day) B1: 1

B2: 1

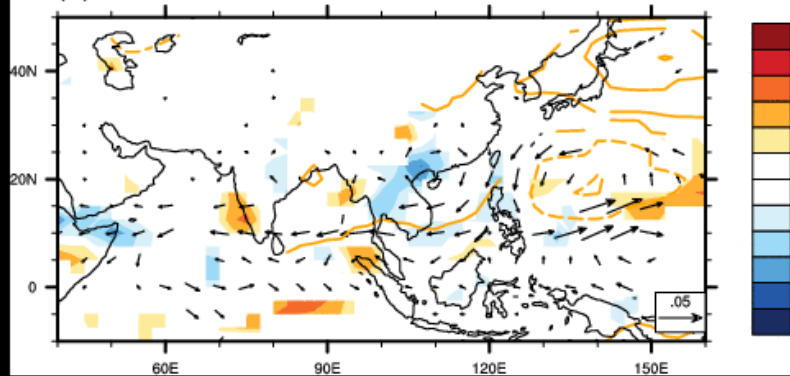
(a) OLR & 850hPa Wind



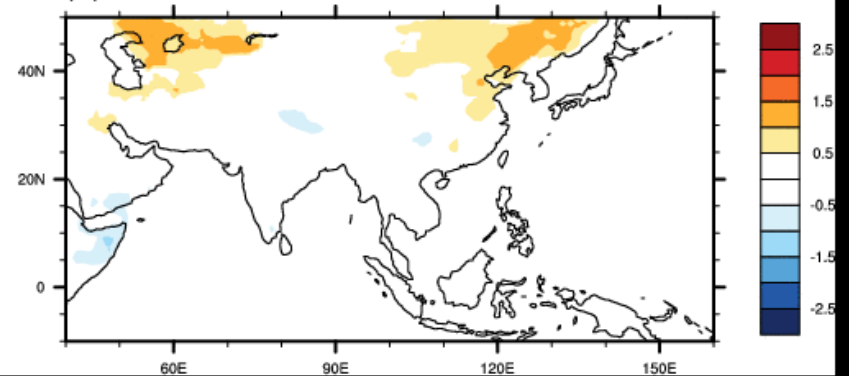
(b) PRCP



(c) SLP & Moist. Flux & Moist. Conv.



(d) T2M



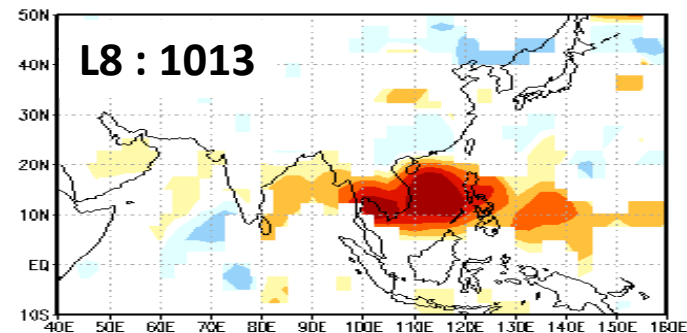
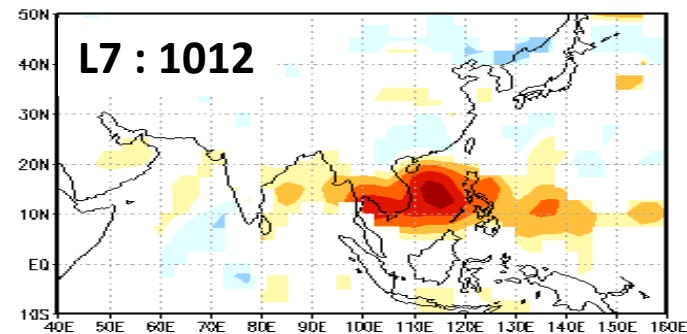
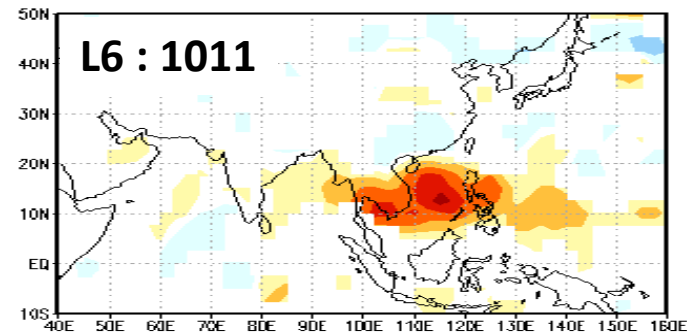
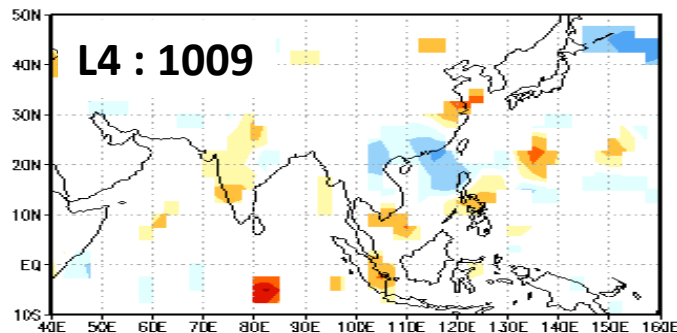
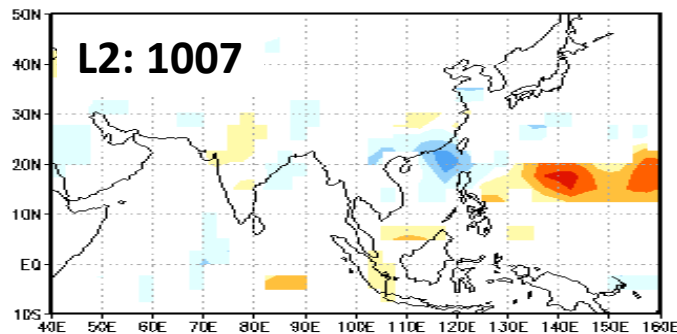
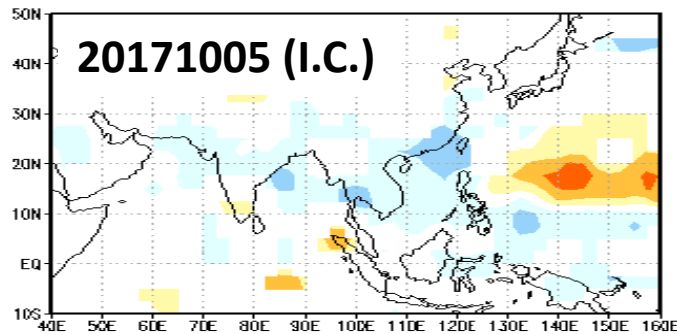
Application Possibility : Typhoon



BSISO-TC activity relationship

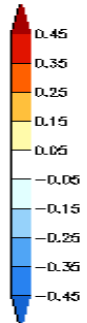
ISGPI forecast using BSISO forecast for TC Khanun (20)

Model : ECMWF



3PM 11th Oct.
TD

12AM 12th Oct
TC [123.6E, 18N]

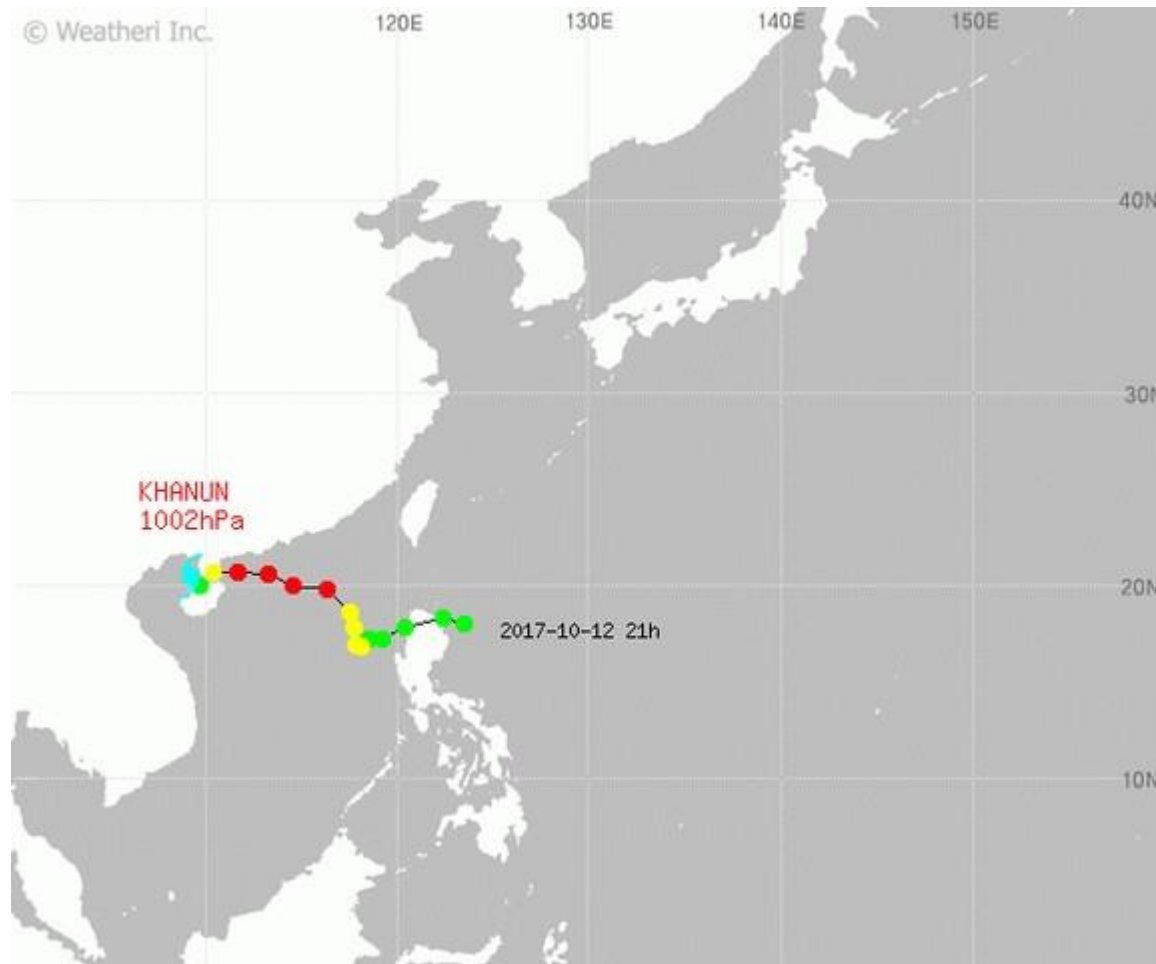


Application Possibility : Typhoon



BSISO-TC activity relationship

TC Khanun (20)



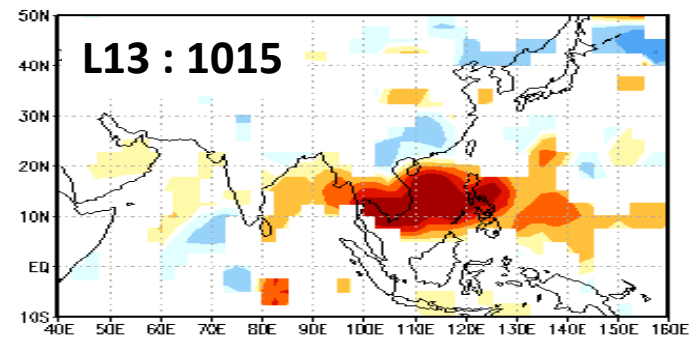
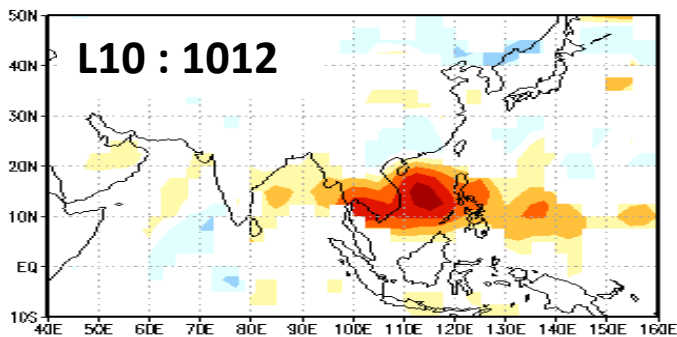
Application Possibility : Typhoon



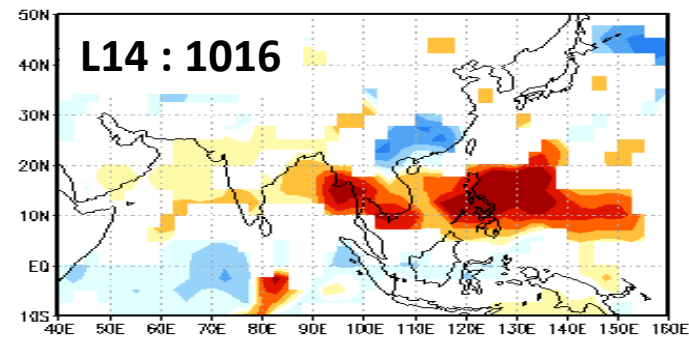
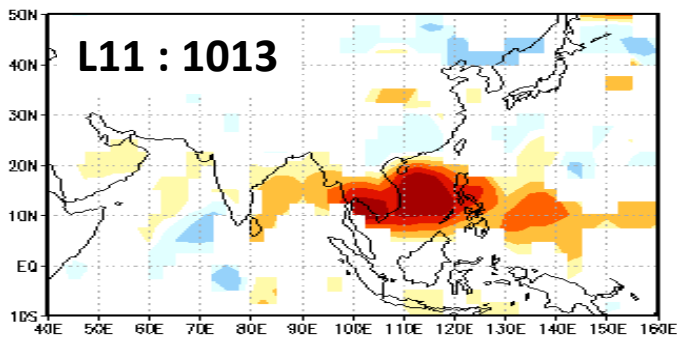
BSISO-TC activity relationship

ISGPI forecast using BSISO forecast for TC Lan (21)

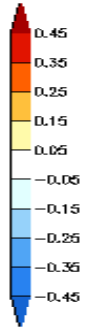
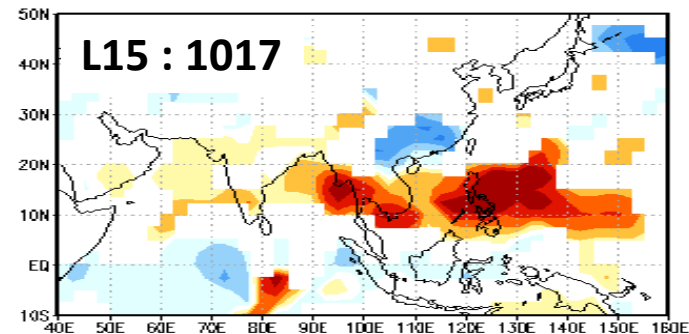
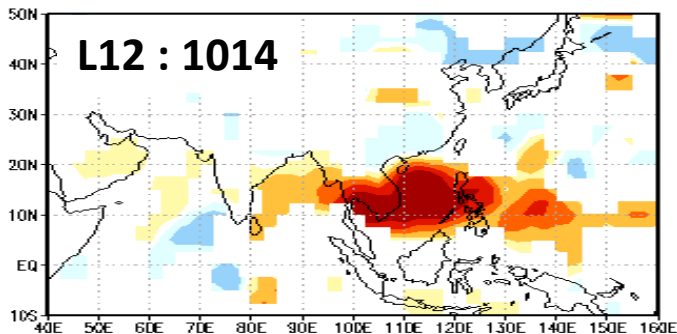
Model : ECMWF



15th Oct
TD



16th Oct
TC

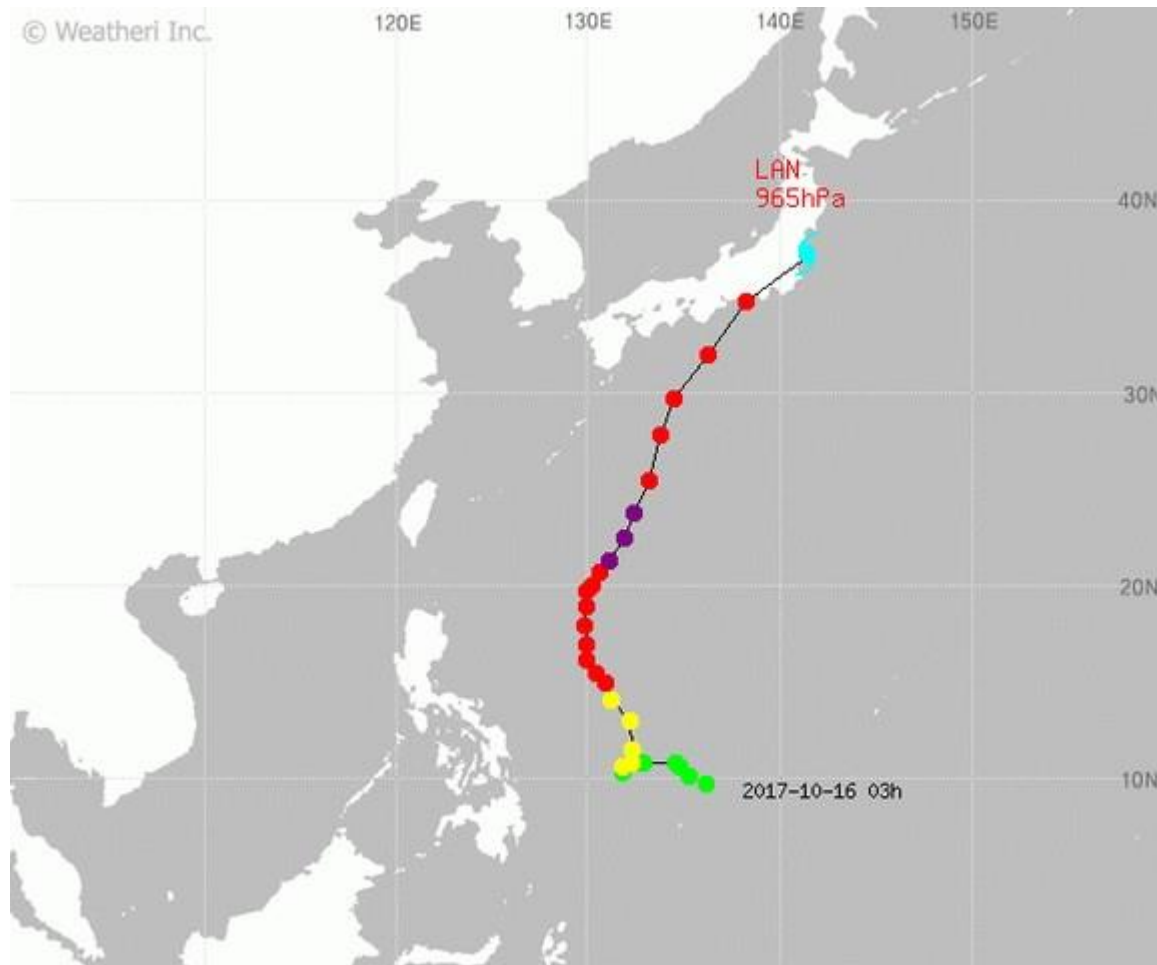


Application Possibility : Typhoon



BSISO-TC activity relationship

TC Lan (21)



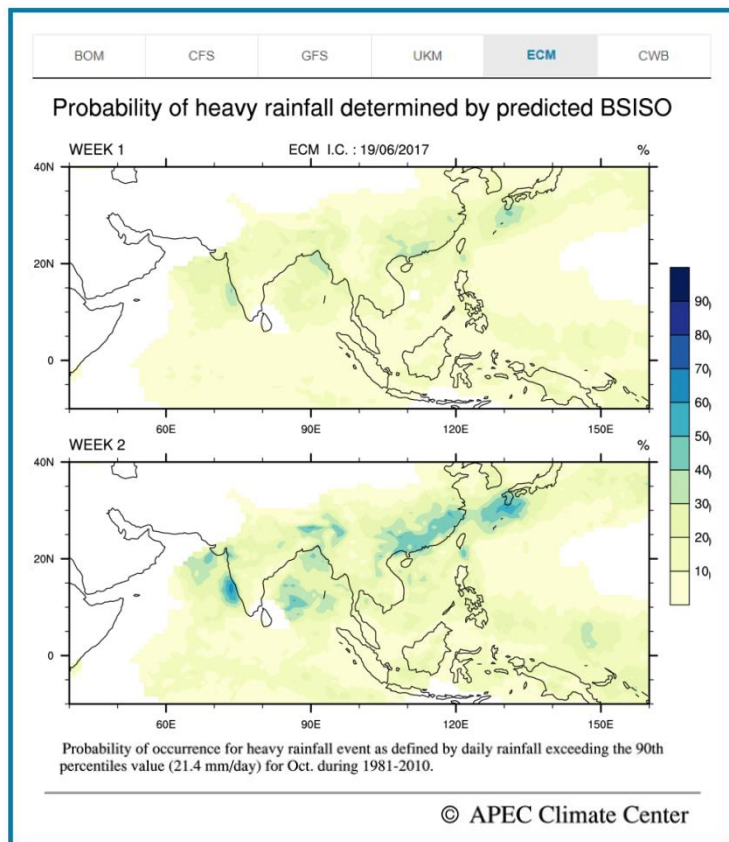


Better forecast from better recognition of the value

Development of a guideline to increase practical use of BSISO forecast

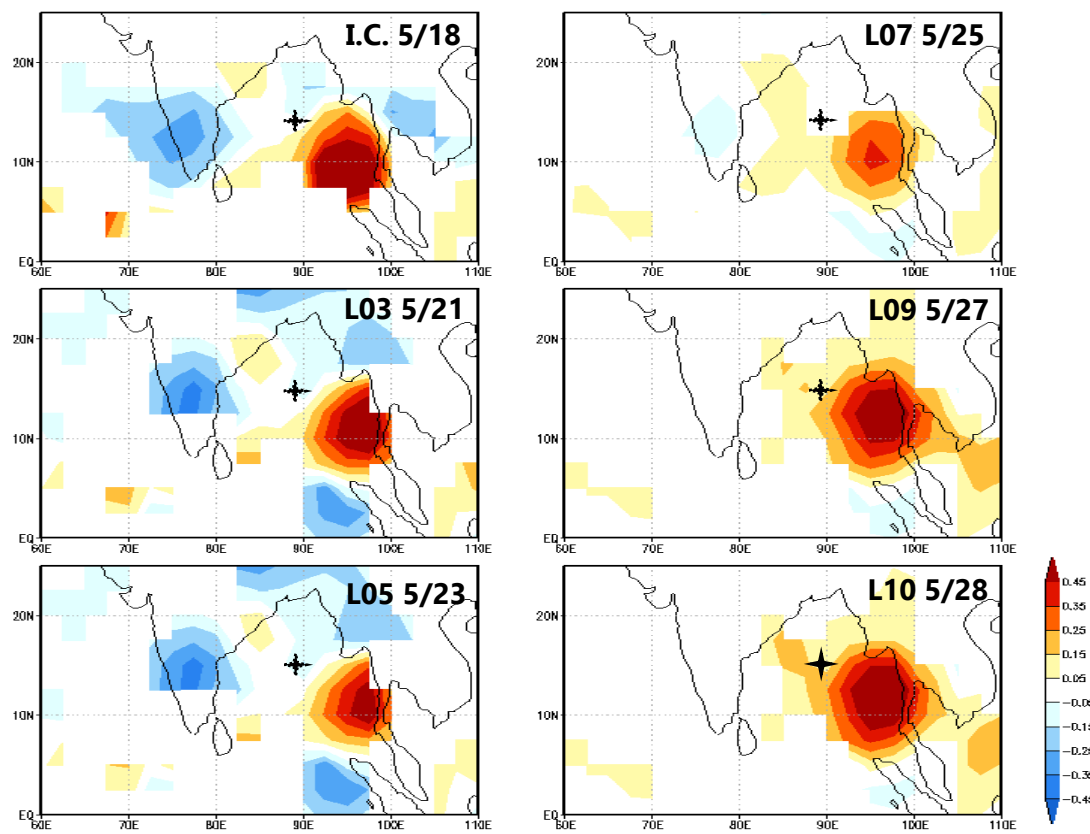
Heavy rainfall forecast based on BSISO index forecast [ECMWF]

❖ Ex> Japan flood, 398mm/4hr, July 6, 2017



ISGPI forecast estimated by BSISO index forecast [ECMWF]

❖ Ex> Tropical Cyclone Mora-17, May 28, 2017



Application Possibility



BSISO-extreme events relationship

'16



'17'18



'17'18



Application Possibility : Typhoon



BSISO-TC activity relationship

WNP TC

Deterministic forecast (ISGPI)

Probability forecast of TC Occurrence

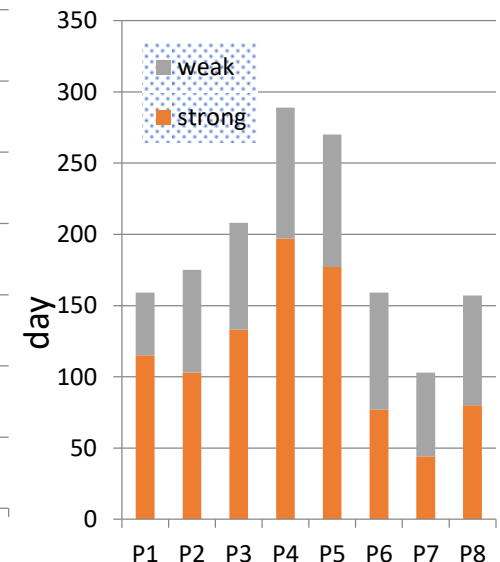
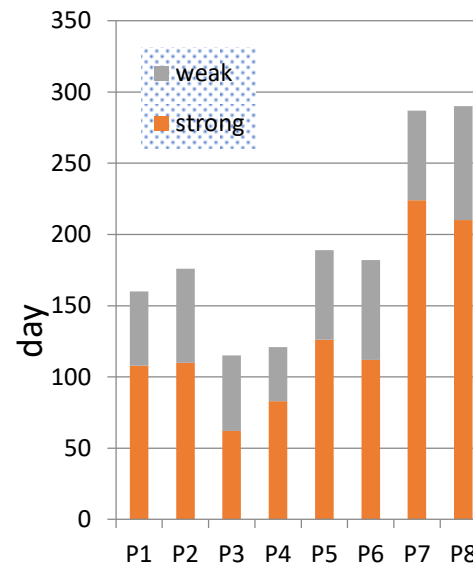
Ongoing research



When BSISO1 > 1.0 & P78 in Aug. for recent 10 years : 83 days
Among them, when TCs occur : 20 days
→ 24%

When BSISO2 > 1.0 & P1 in Aug. for recent 10 years : 47 days
Among them, when TCs occur : 10 days
→ 21%

BSISO-TC relationship

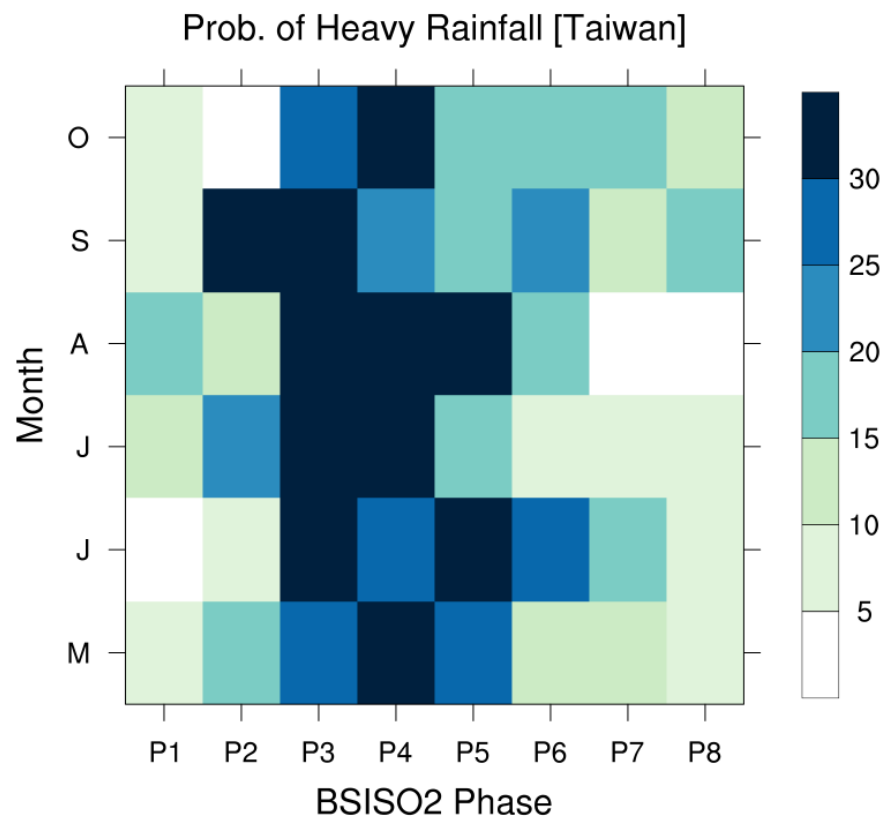
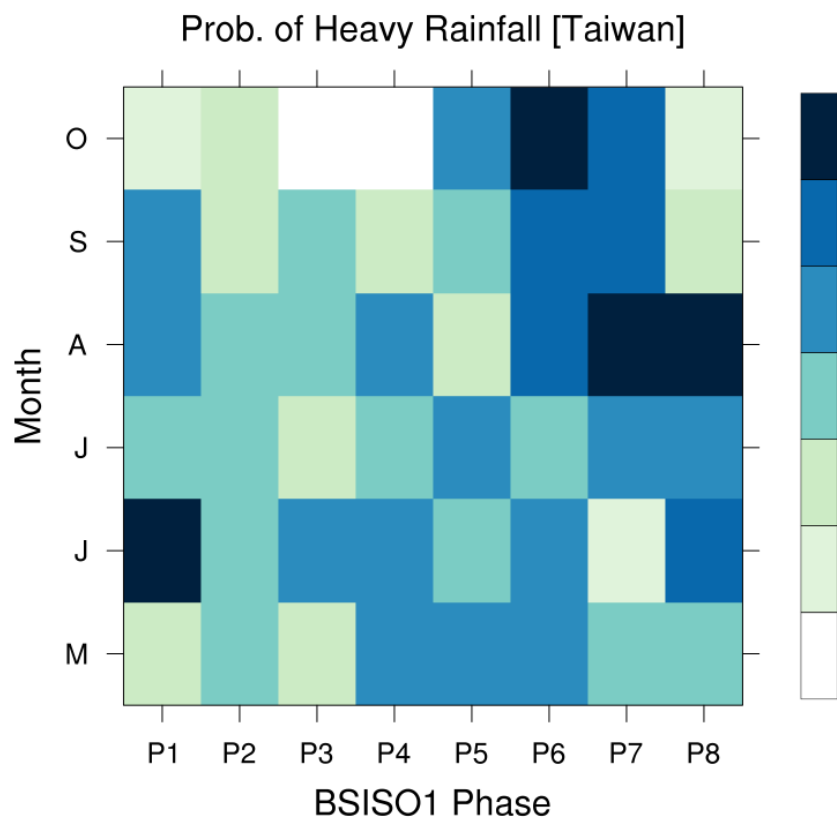


Better forecast? *practical use*



Relationship analysis (*Composite analysis : BSISO-Heavy rainfall probability*)

Probability of Heavy Rainfall occurrence [Taiwan]



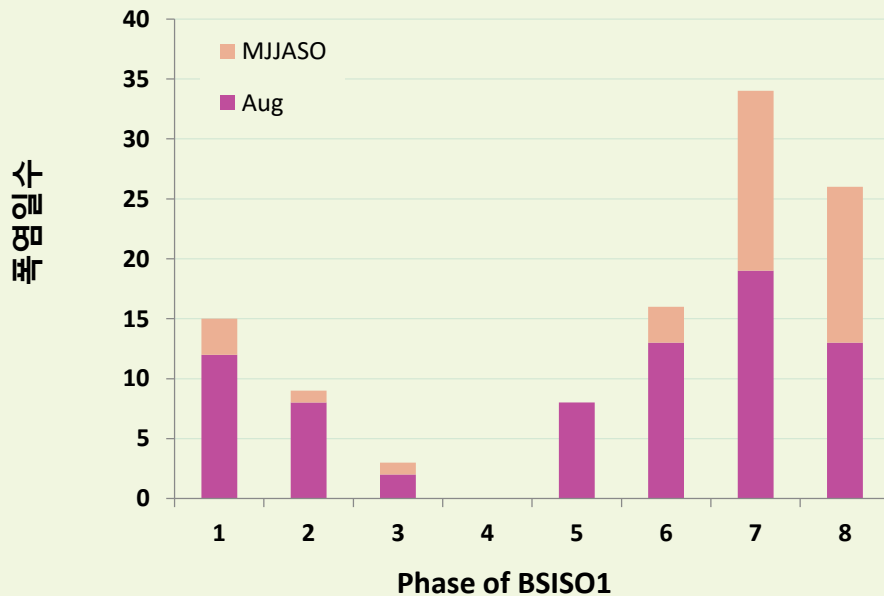


Thank you

Application Possibility : S.Korea heatwave



BSISO-heatwave relationship

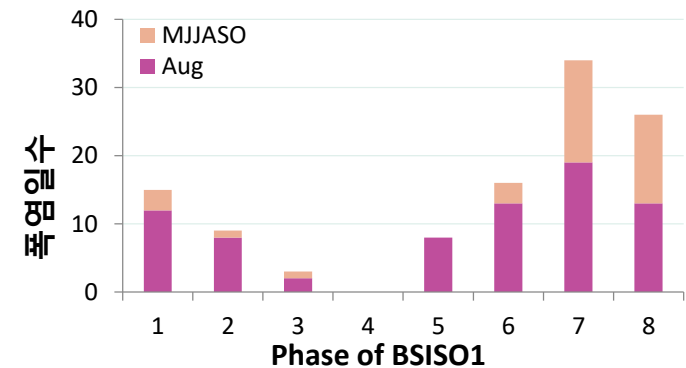
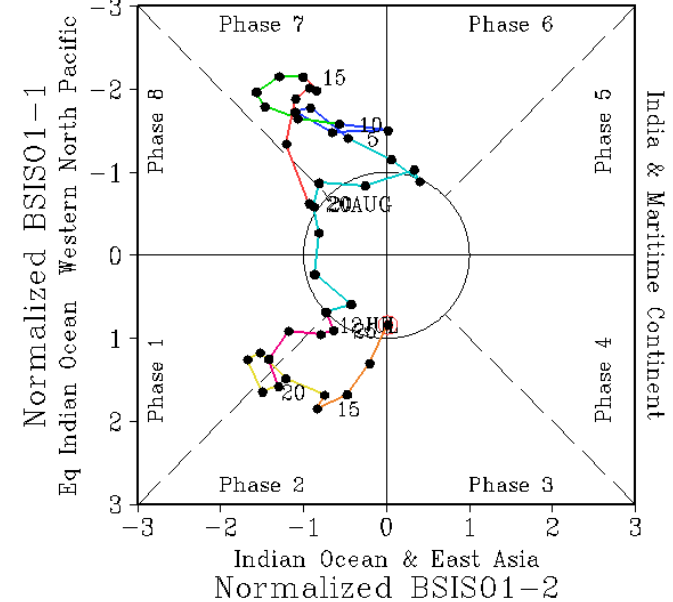
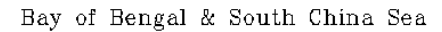


'17

폭염인 지점수가 30개 이상일 때 BSISO phase 에 따른 폭염일수
(한반도의 상당한 지역이 폭염으로 고생할 때 BSISO 와의 관련성)

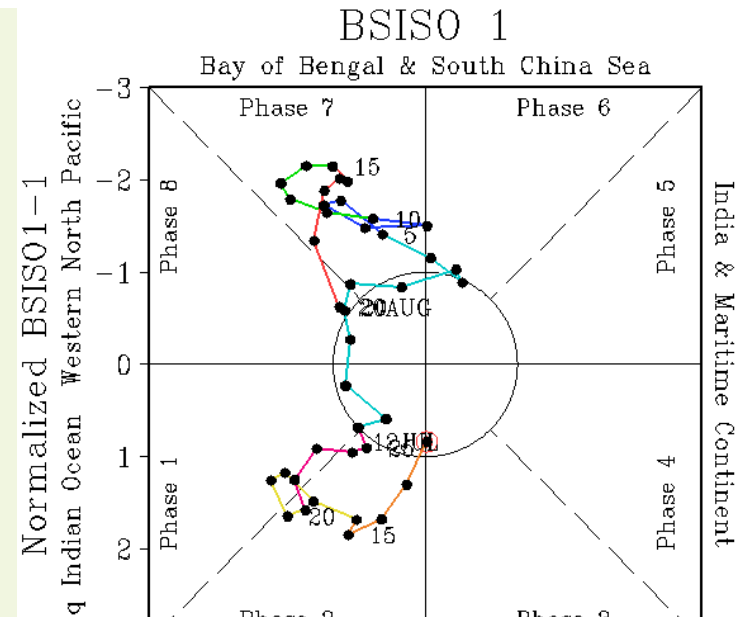
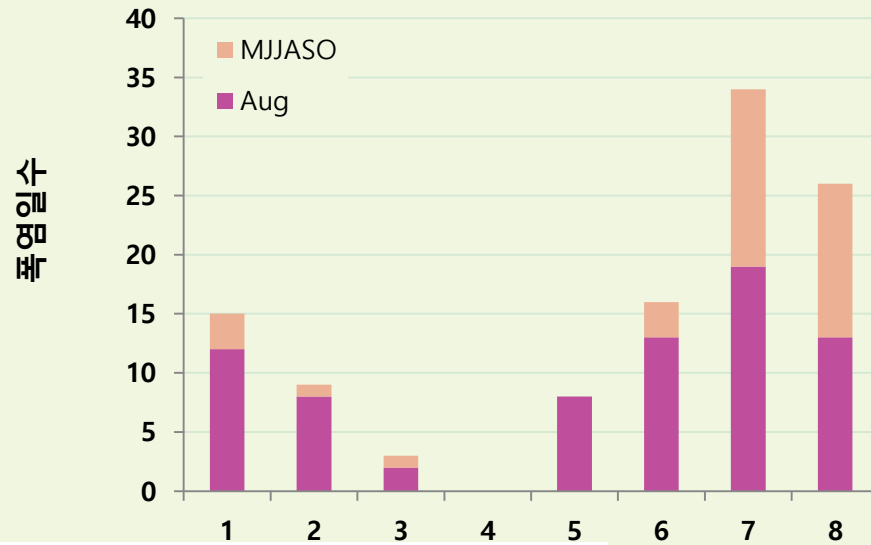
(* 폭염지수 from 이우섭 박사 (1981-2014))

Monitoring (7/12 ~ 8/20)

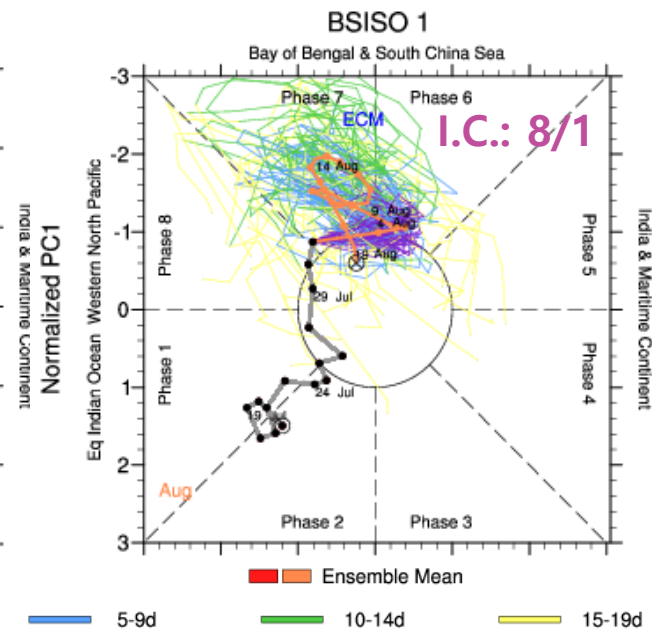
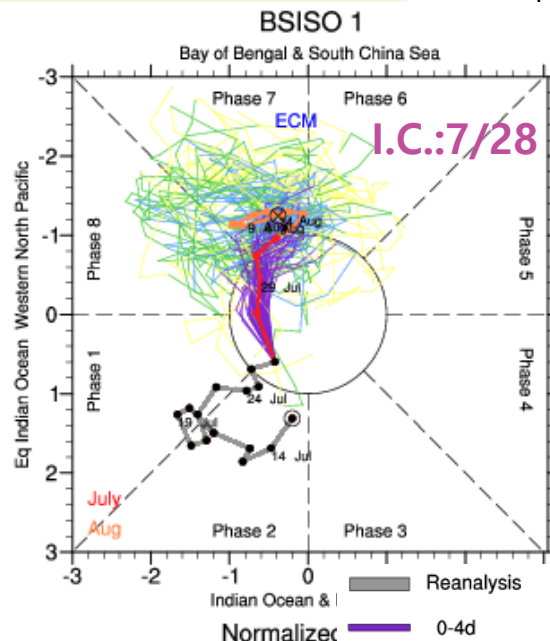
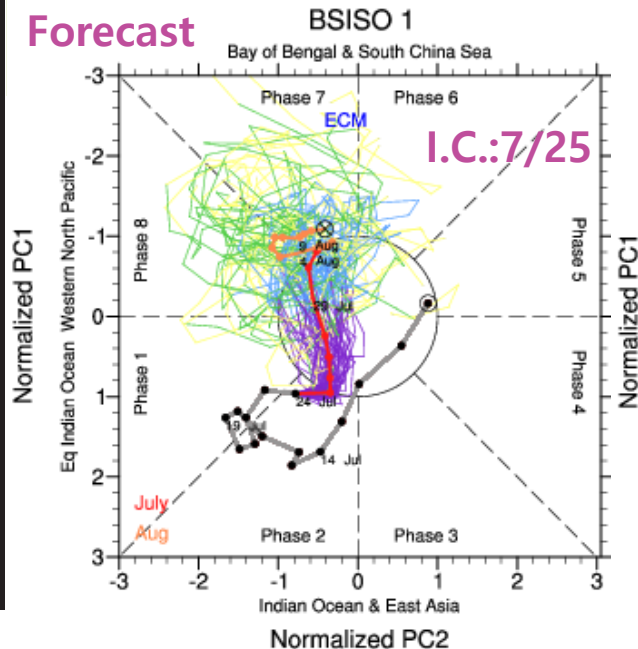


Application Possibility : S.Korea heatwave

Monitoring (7/12 ~ 8/20)

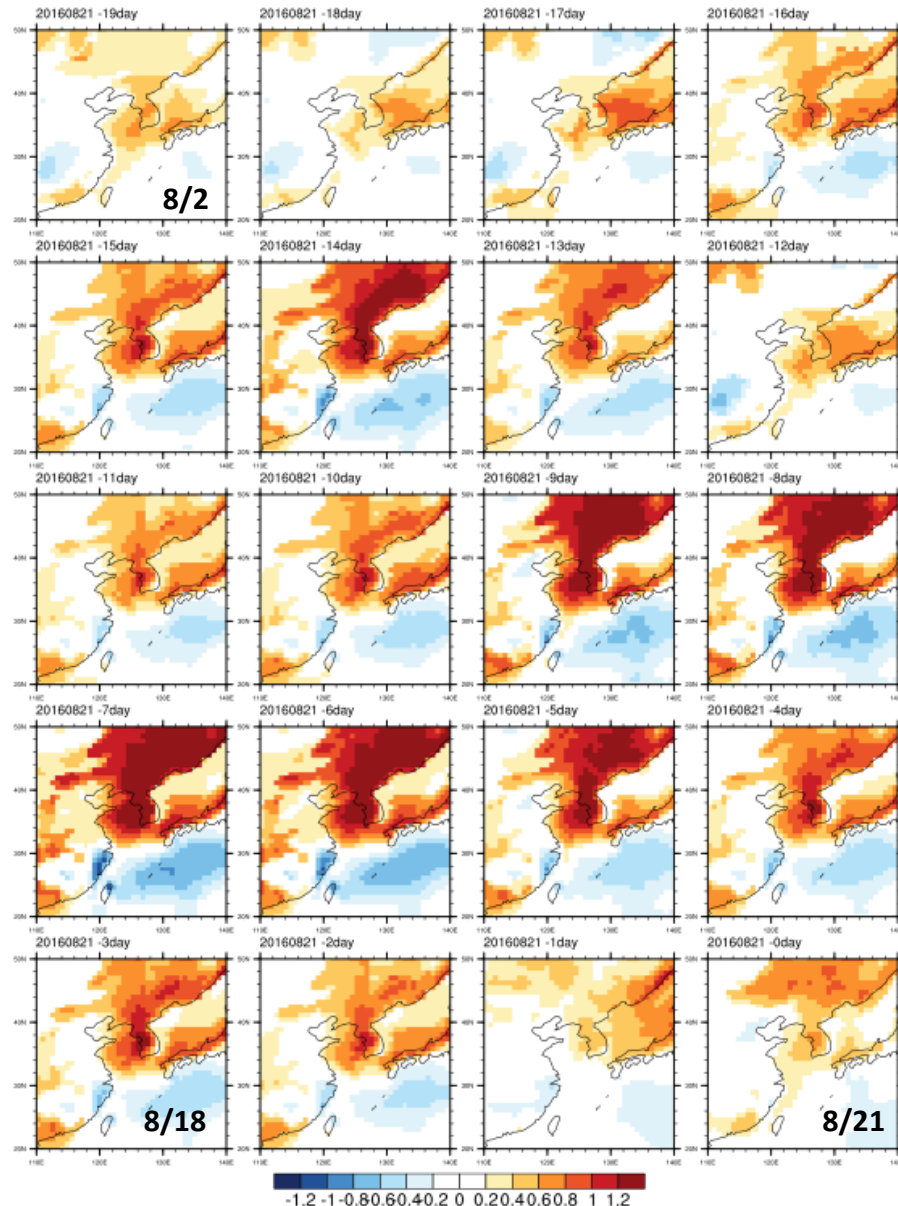


Forecast

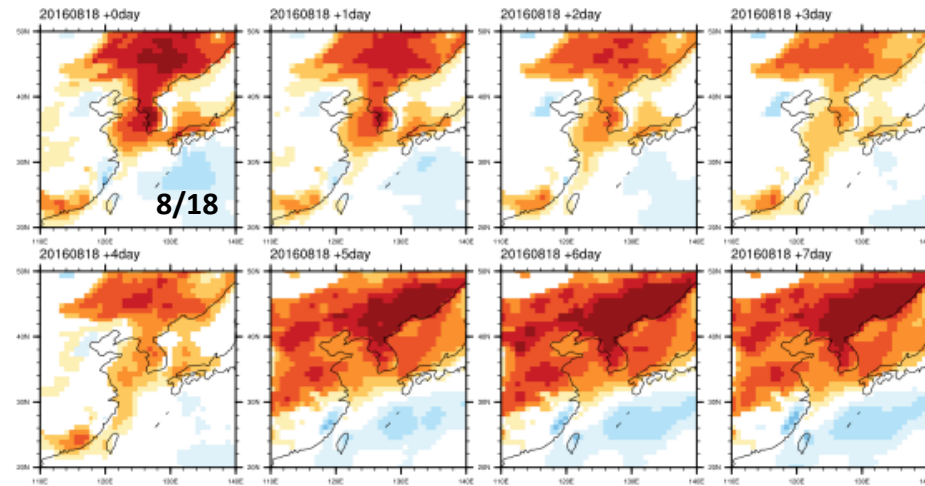


Application Possibility : S.Korea heatwave

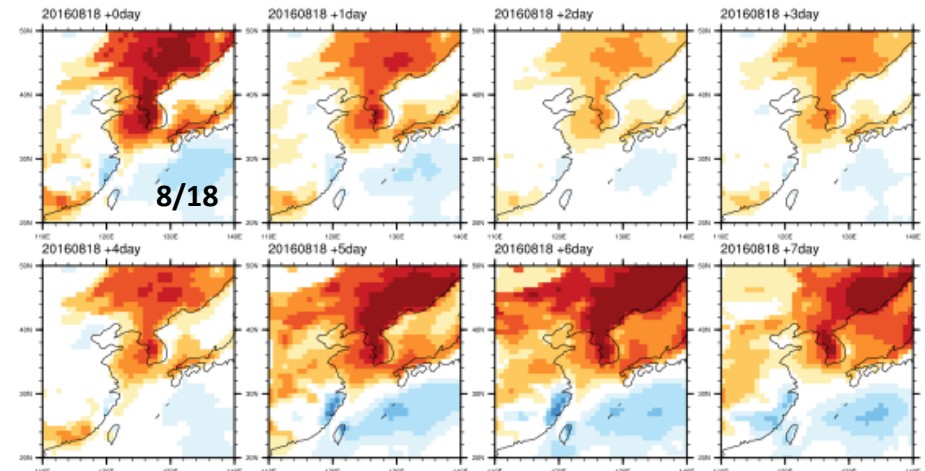
BSISO1+BSISO2 Temperature anomaly (MONITORING)



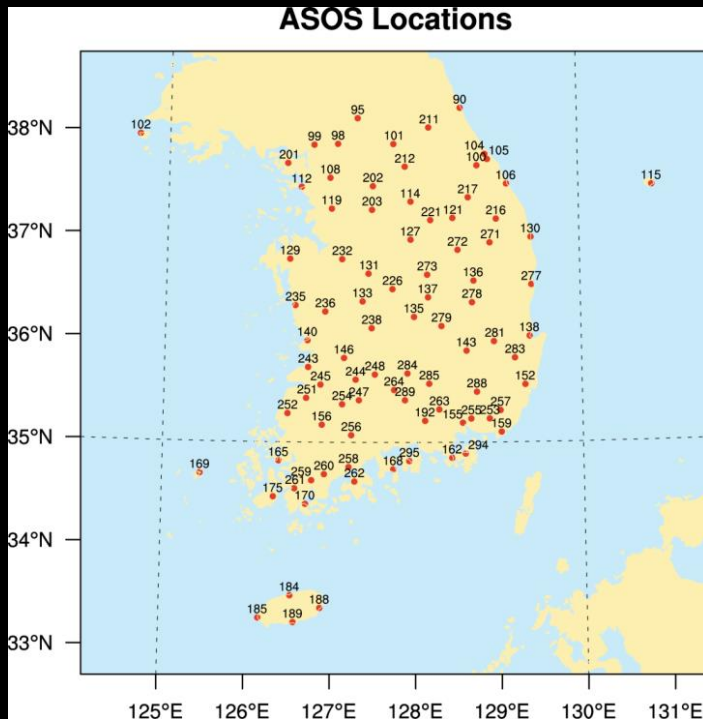
BSISO1+BSISO2 Temperature anomaly (BOM)



BSISO1+BSISO2 Temperature anomaly (ECM)



Application possibility [*S.Korea drought*]



Composite Analysis

1. 89 stations over Korean Peninsula
2. 1981~2010 (30yr)
3. MJJASO, **MAY**, JUN, JUL, AUG, JJ, JJA
4. Daily mean rainfall
5. over 1.5std of BSISO indices

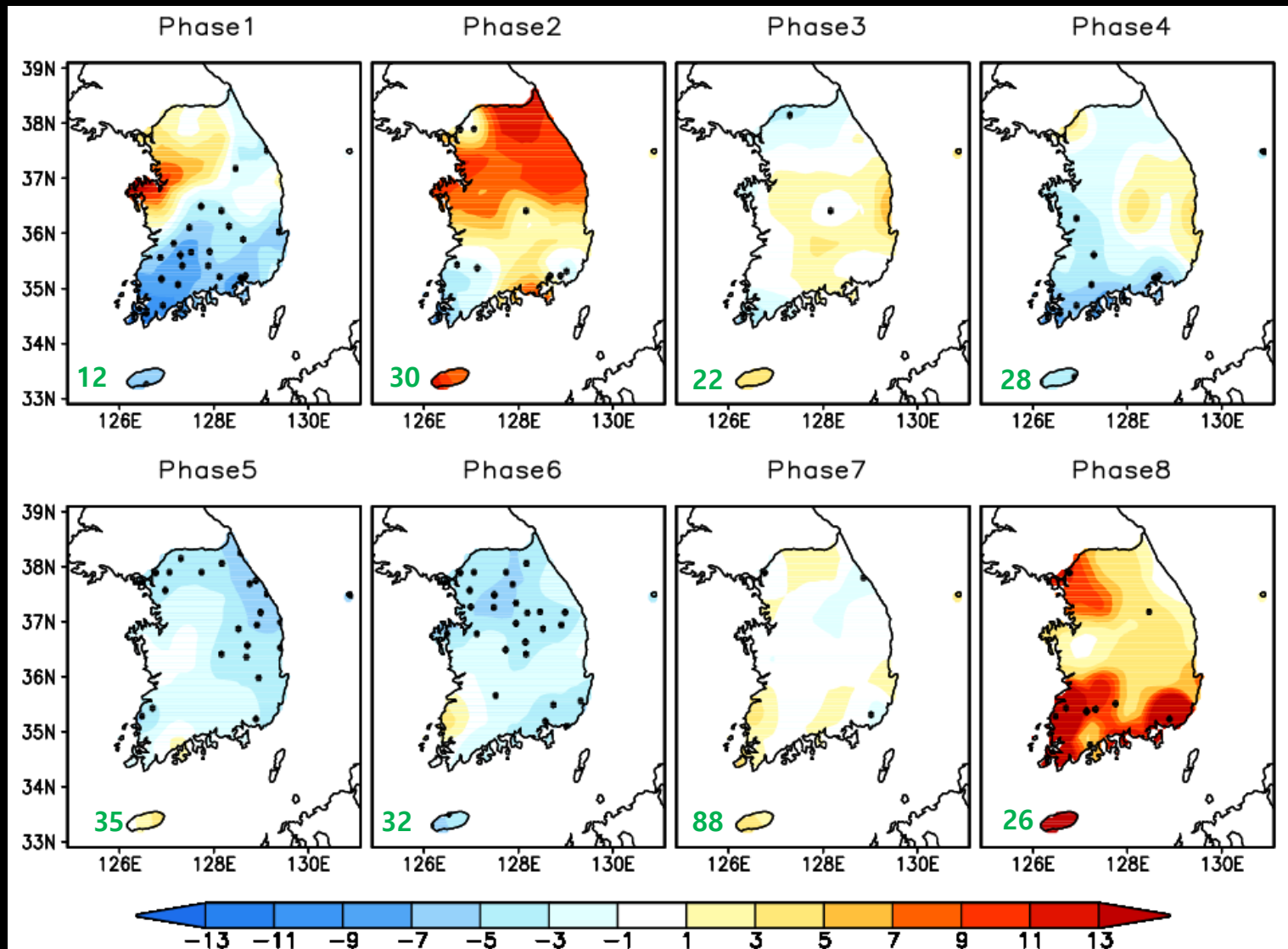
5월 (장마 전 건기)

: 겨울철 건기에 비해 강도는 약하지만 수자원 부족으로 농업을 비롯한 많은 산업에 피해를 초래

Application possibility [*S.Korea drought*]

Precipitation anomalies [*BSISO1:May*]

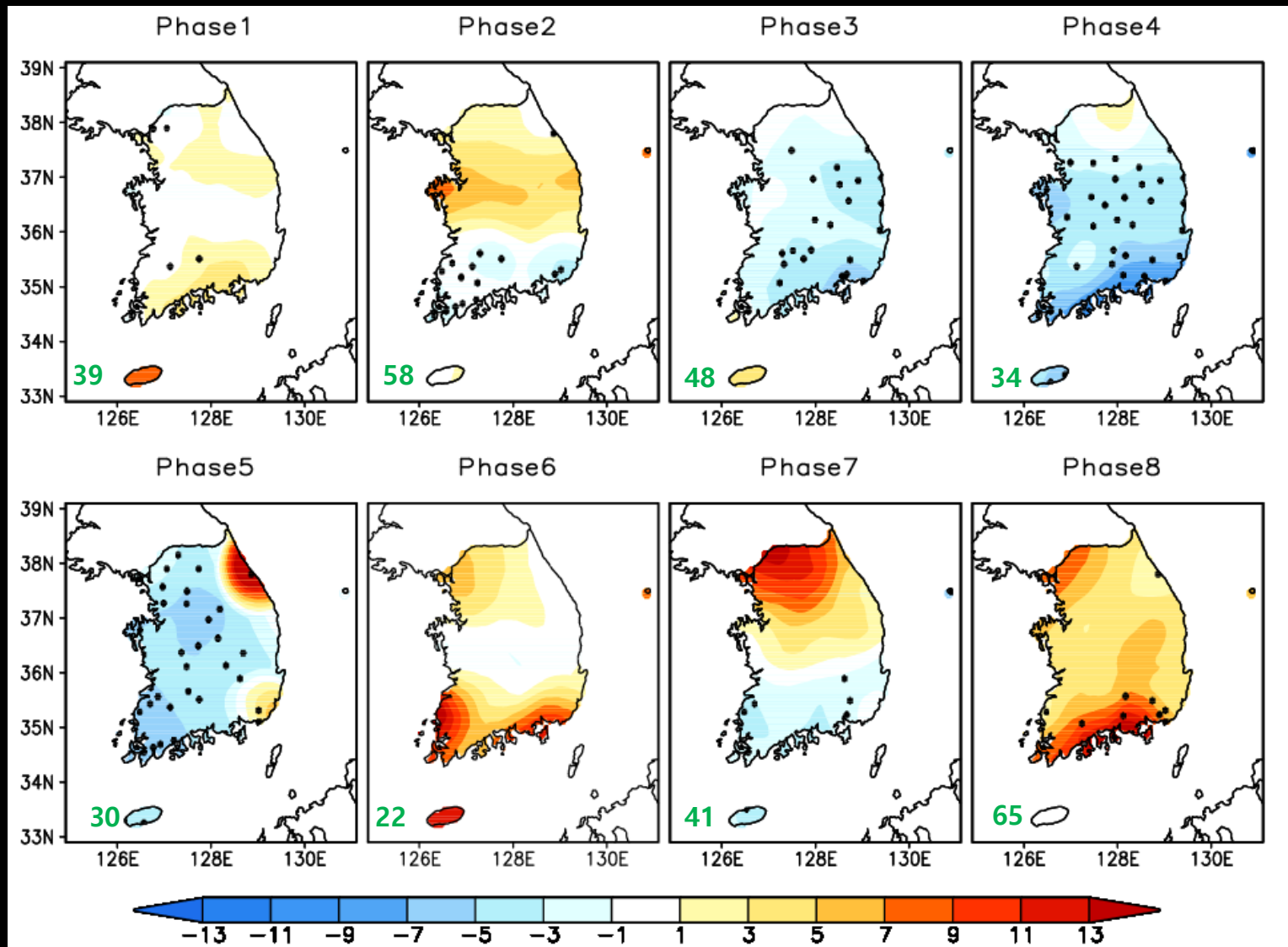
● black dot : station with significant value over 95% confidence level



Application possibility [*S.Korea drought*]

Precipitation anomalies [*BSISO2:May*]

● black dot : station with significant value over 95% confidence level

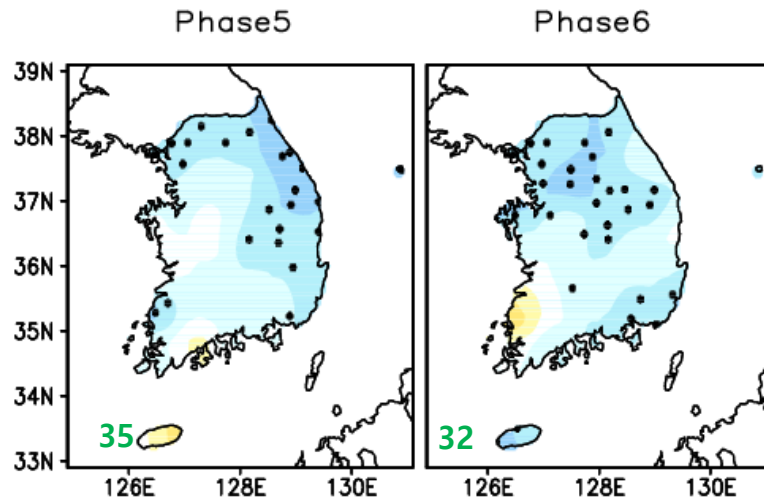


Application possibility [*S.Korea drought*]

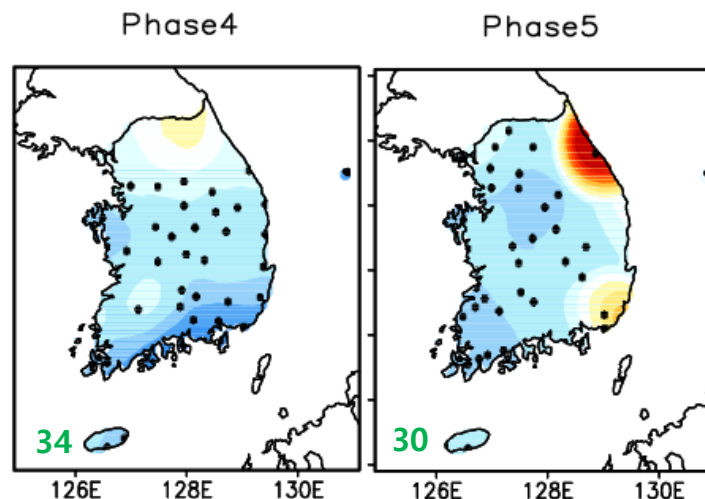
Precipitation anomalies [*BSISO:May*]

● black dot : station with significant value over 95% confidence level

BSISO 1



BSISO 2

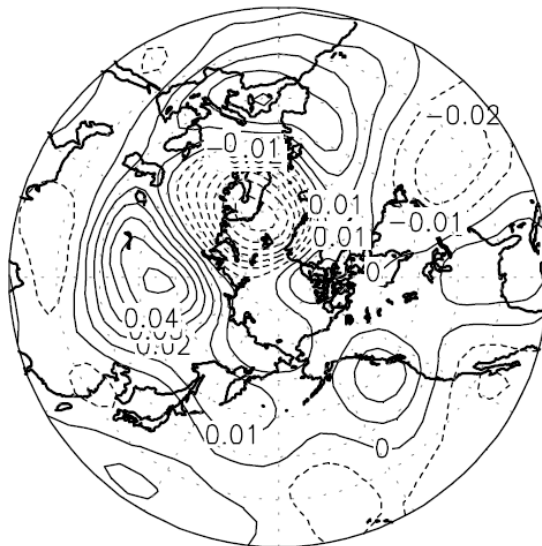


Application possibility [*S.Korea drought*]

Northern Hemispheric Circulation Responsible for the Spring Drought in Korea

1. *Scandinavia teleconnection pattern*
2. *North Pacific teleconnection pattern*

(c) 3rd (5.8%)



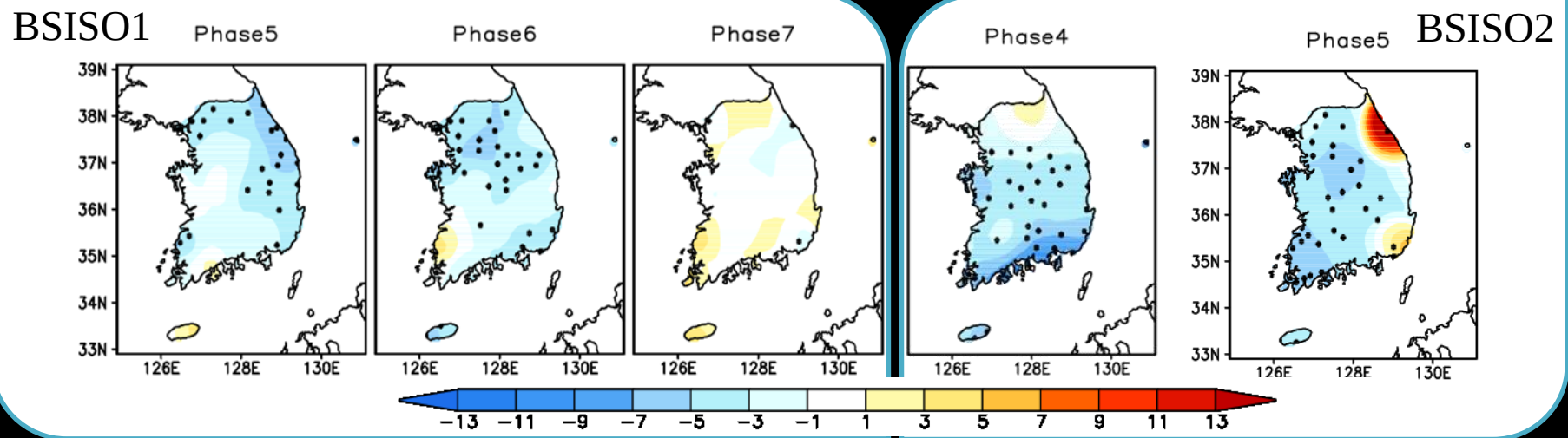
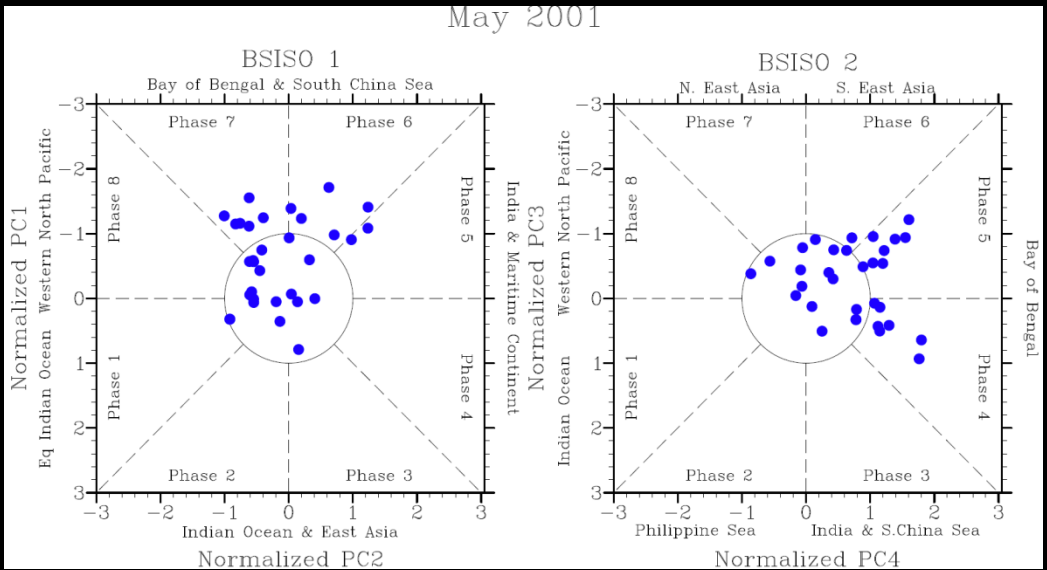
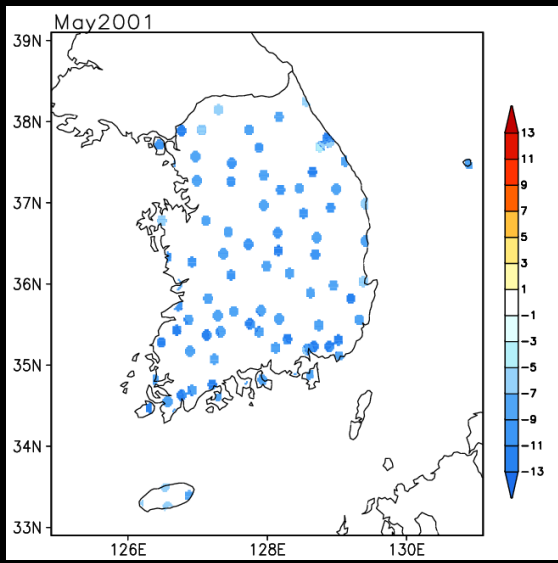
(d) 4th (5.6%)



Reference [Kim et al., 2005]

Application possibility [S.Korea drought]

Case Study [2001:May]



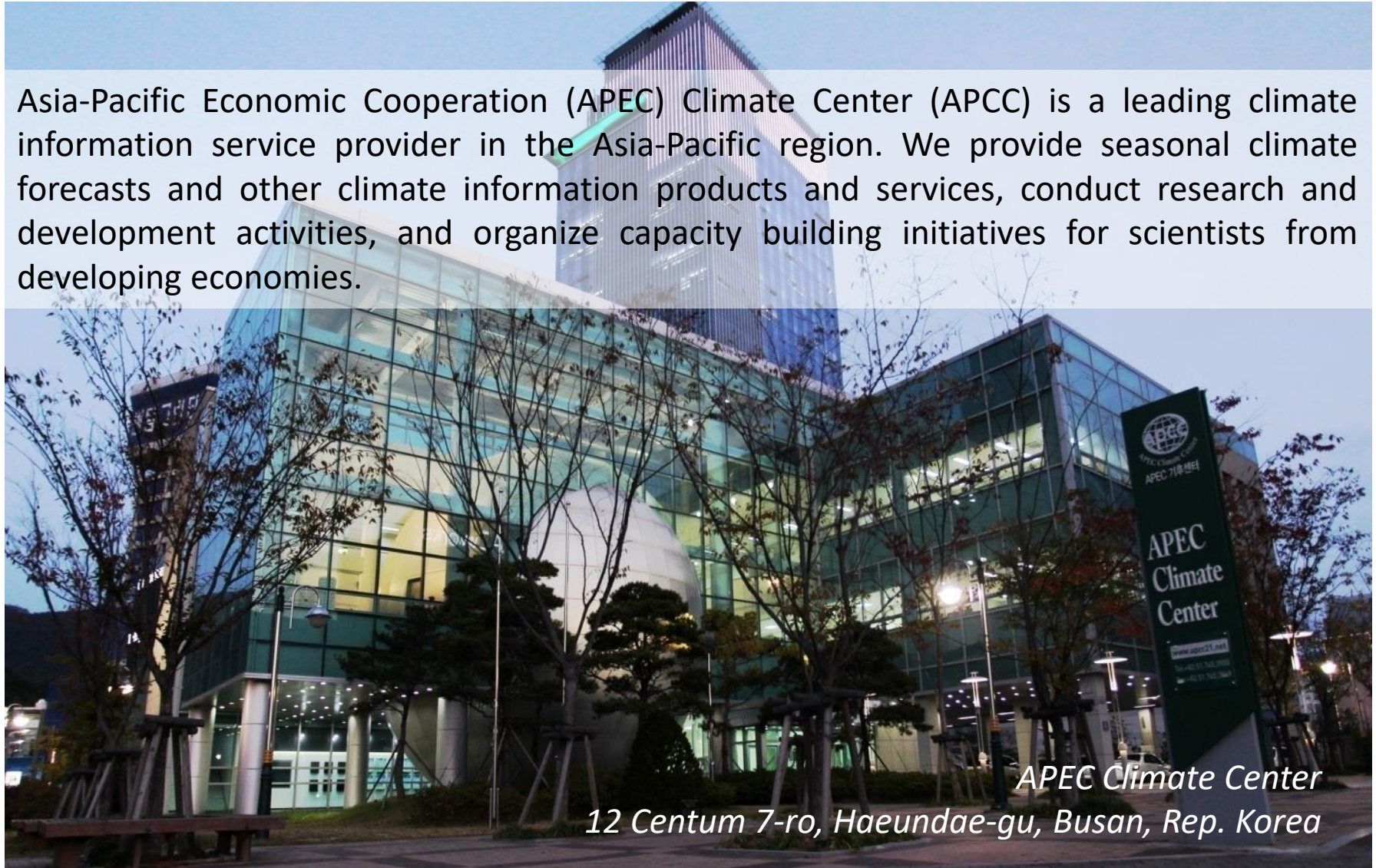
The APCC's Seasonal and Subseasonal Forecasting Activity

(Mar. 20, 2018)

Hae-Jeong Kim*, Yoo-Rim Jung and Young-Mi Min
APEC Climate Center

Overview of the APEC Climate Center

Asia-Pacific Economic Cooperation (APEC) Climate Center (APCC) is a leading climate information service provider in the Asia-Pacific region. We provide seasonal climate forecasts and other climate information products and services, conduct research and development activities, and organize capacity building initiatives for scientists from developing economies.



*APEC Climate Center
12 Centum 7-ro, Haeundae-gu, Busan, Rep. Korea*

Mission of the APEC Climate Center

To enhance the socio-economic well-being of member economies by utilizing up-to-date scientific knowledge and applying innovative climate prediction techniques.



Climate Prediction

APCC produces value-added, reliable, and real-time climate prediction information and provides the APEC region with it.



Interdisciplinary Research

APCC leads in the development of interdisciplinary research and application techniques at the climate-environment-society nexus.



Climate Information Services

APCC strives to be a key climate database center to distribute climate data, information products, and related tools.



International Cooperation

APCC guides developing countries from the APEC region toward building their own capacity to produce reliable climate prediction information.



Climate Prediction & Information Service

✓ <http://www.apcc21.org>



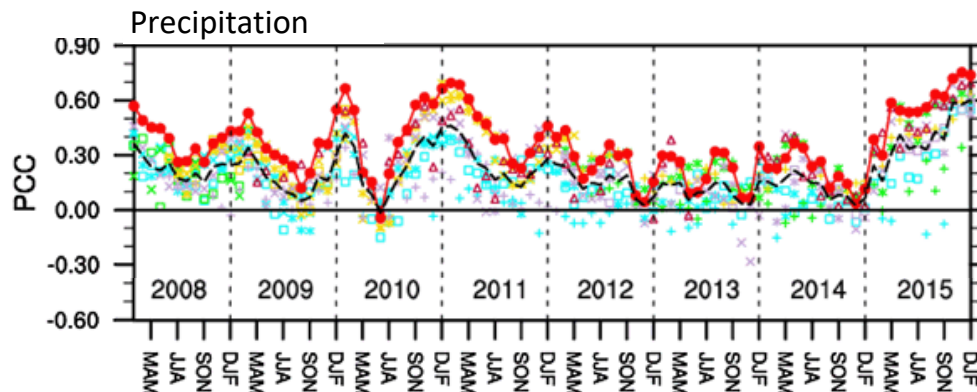
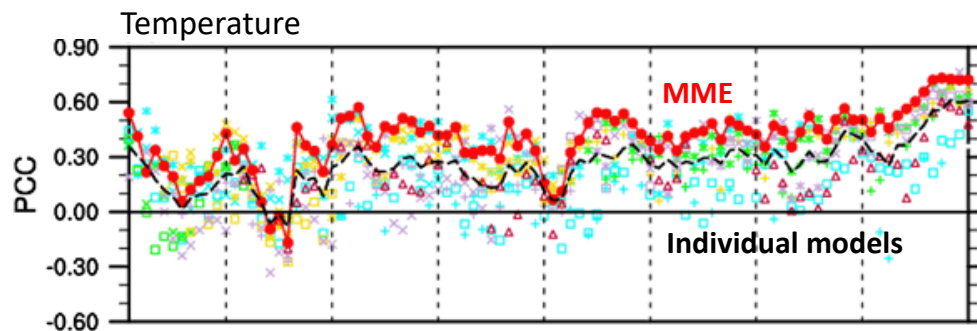
Climate Information

Information Service System

Seasonal Forecast

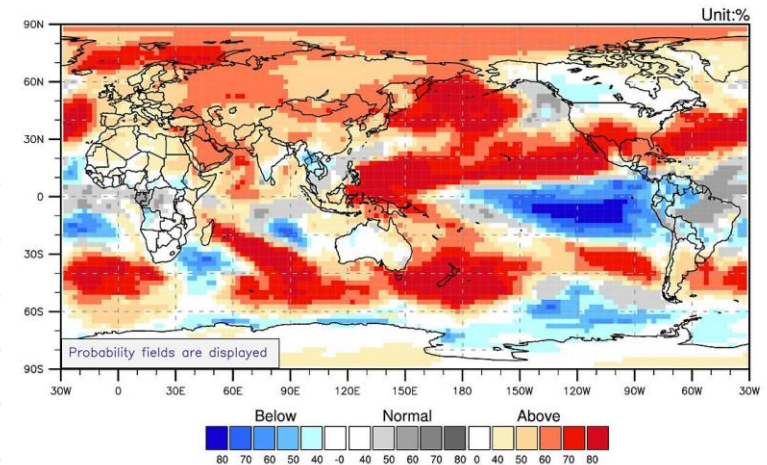
- Producing skillful real-time climate predictions and developing a value-added reliable climate prediction system based on a **Multi-Model Ensemble (MME)** technique.

Anomaly Pattern Correlation

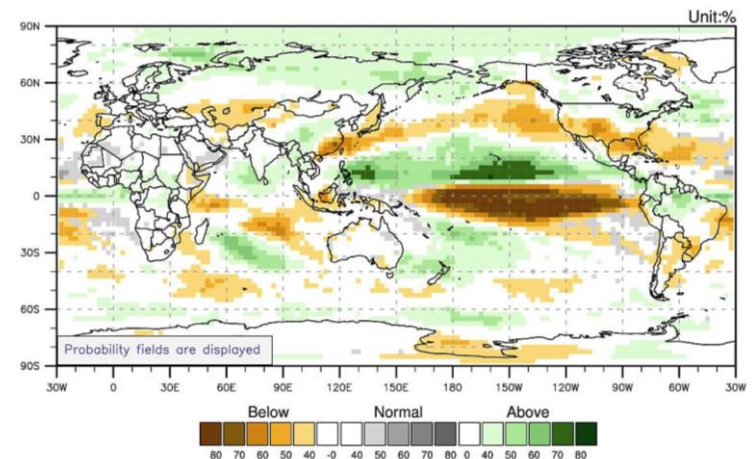


Min et al. (2017), Climate Dynamics

Temperature at 2m for March-May 2018



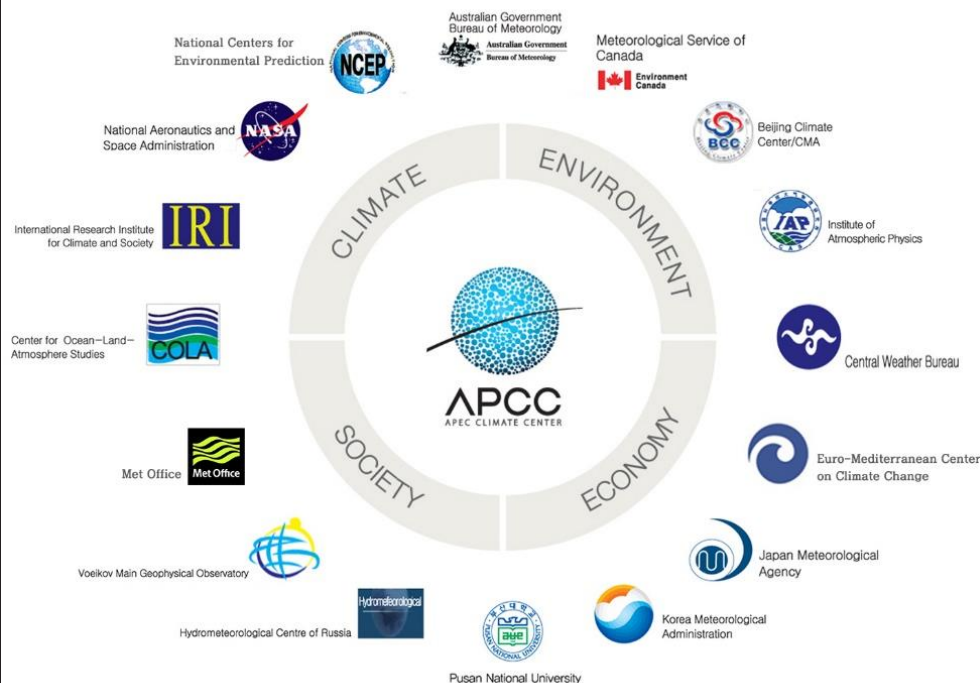
Precipitation for March-May 2018



APCC MME Prediction System

- The world's largest MME system based on international cooperation to generate monthly rolling 3-month and 6-month MME climate outlooks.

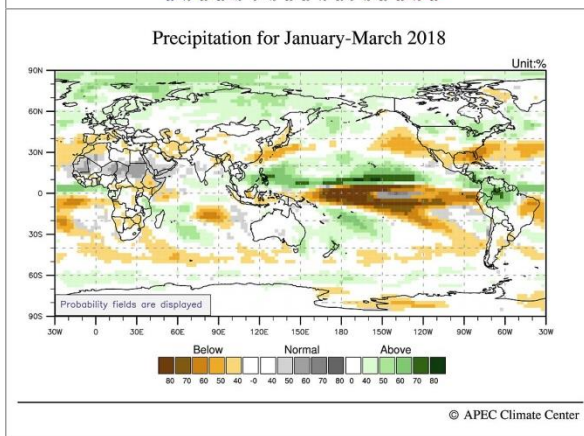
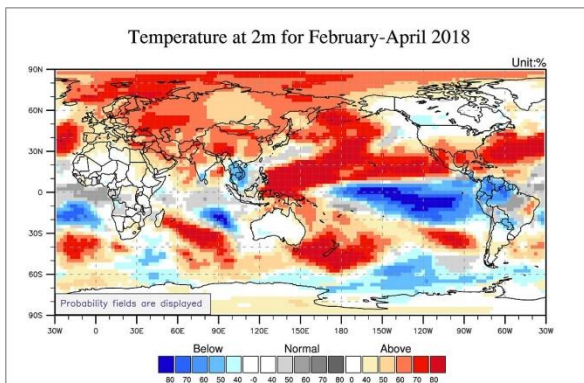
Multi-institutional Cooperation



Economy	Organization/Institute
Australia	Bureau of Meteorology (BoM)
Canada	Meteorological Service of Canada (MSC)
China	Beijing Climate Center (BCC) Institute of Atmospheric Physics of China (IAP)
Chinese Taipei	Central Weather Bureau of Chinese Taipei (CWB)
Italy	Euro-Mediterranean Center on Climate Change (CMCC)
Japan	Japan Meteorological Agency (JMA)
Korea	Korea Meteorological Administration (KMA) Pusan National University (PNU)
Peru	Servicio Nacional de Meteorología e Hidrología (SENAMHI)
Russia	Hydrometeorological Centre of Russia (HMC) Main Geophysical Observatory of Russia (MGO)
UK	Met Office
USA	Center for Ocean-Land-Atmosphere Studies (COLA) International Research Institute for Climate and Society (IRI) National Aeronautics and Space Administration (NASA) National Center for Environmental Prediction (NCEP) / National Ocean and Atmospheric Administration (NOAA)

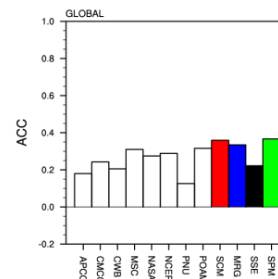
Seasonal Forecast Products

- Monthly & Seasonal mean forecast of Tsfc, Prec, T850, Z500, SLP, SST, UV (deterministic & probabilistic)
- Verification results (hindcast, realtime forecast)
- ENSO Outlook



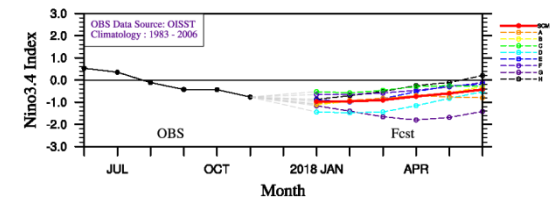
© APEC Climate Center

Anomaly Correlation Coeff. : T2M, JFM (1983-2006)



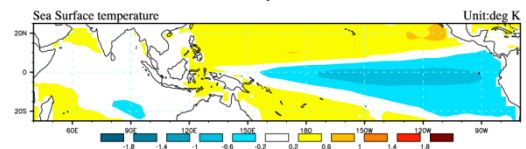
© APEC Climate Center

Nino3.4 Index for 2018 JFMAMJ



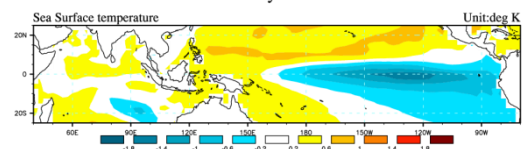
© APEC Climate Center

SST Anomaly for AMJ 2018



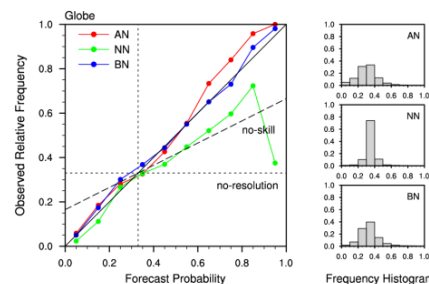
© APEC Climate Center

SST Anomaly for JFM 2018



© APEC Climate Center

Reliability Diagram : PREC, JFM (1983-2006)



© APEC Climate Center



Climate Prediction & Information Service

✓ <http://www.apcc21.org>



Seasonal
Forecast



BSISO
Forecast



Climate
Monitoring



CLIK



Data
Service

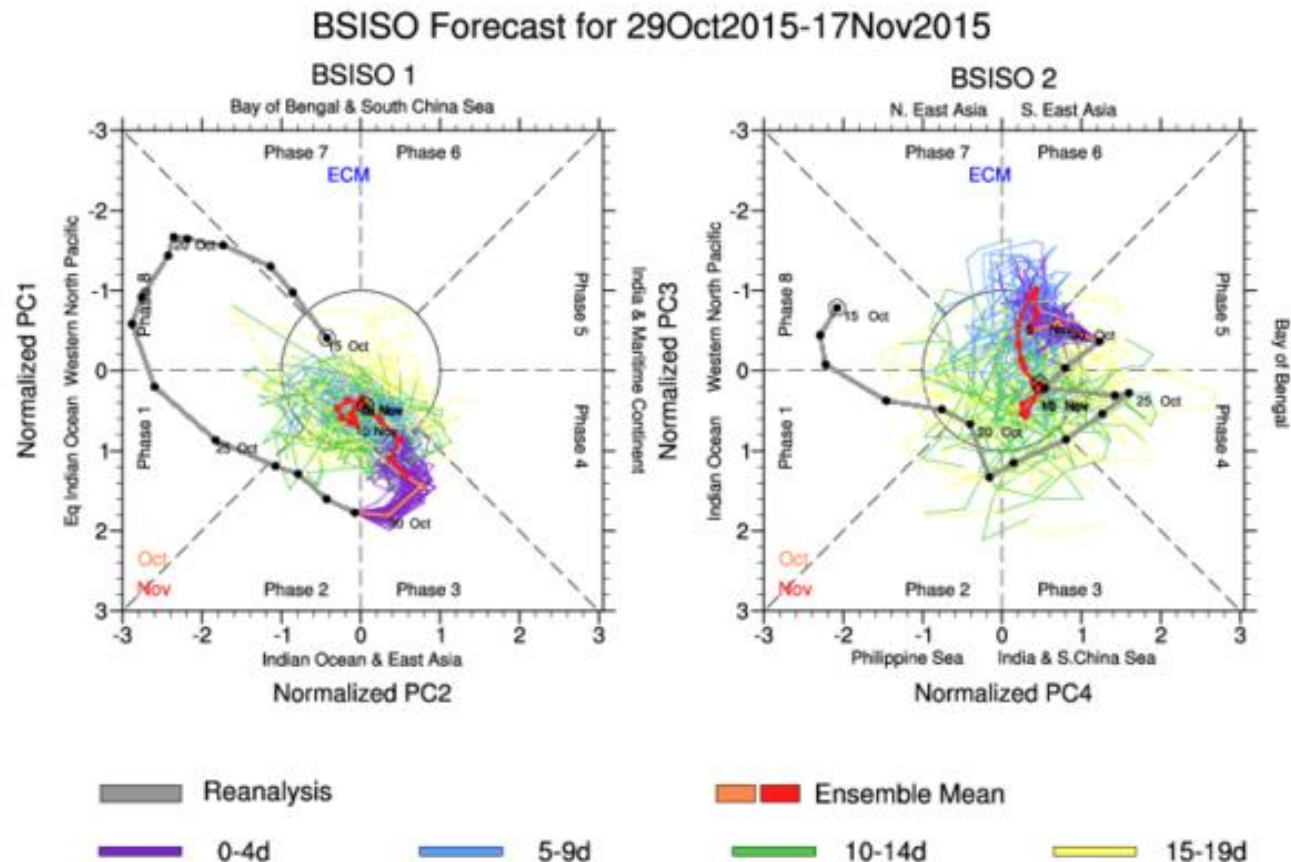


CLIPs

Expansion into subseasonal forecast
by providing BSISO real-time forecasts

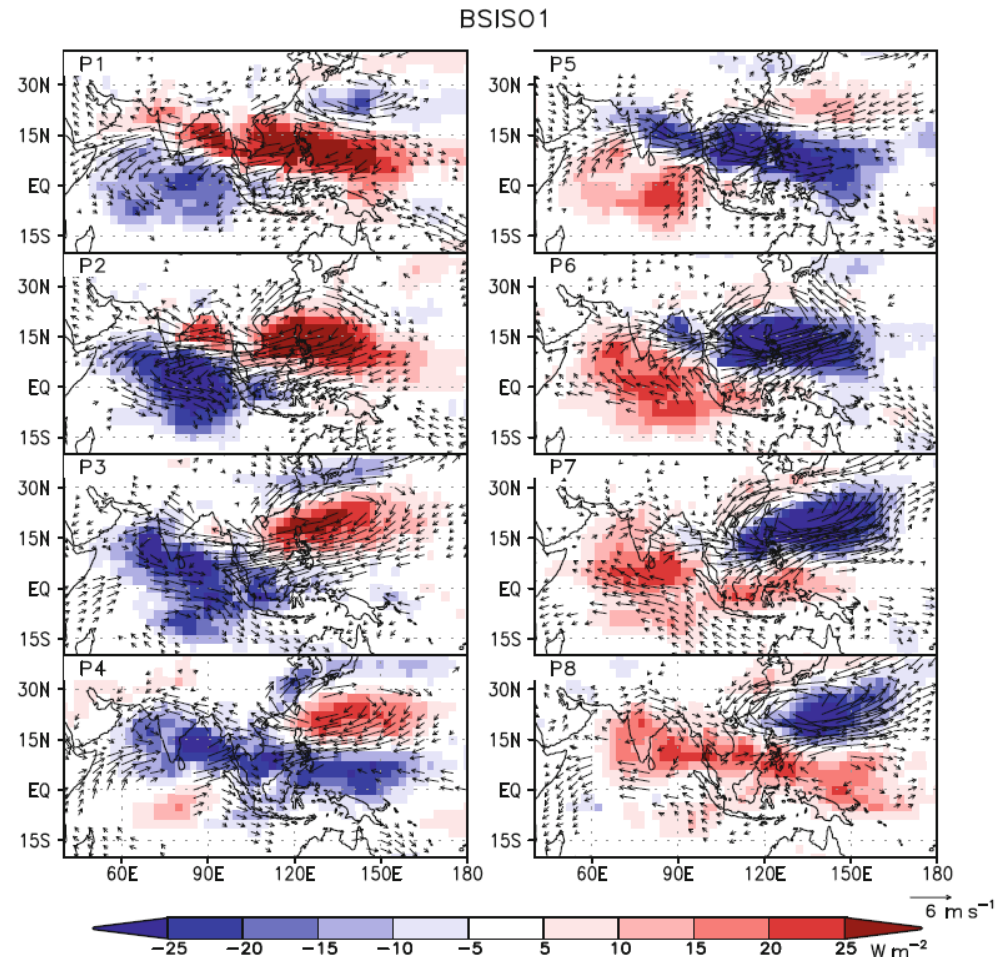
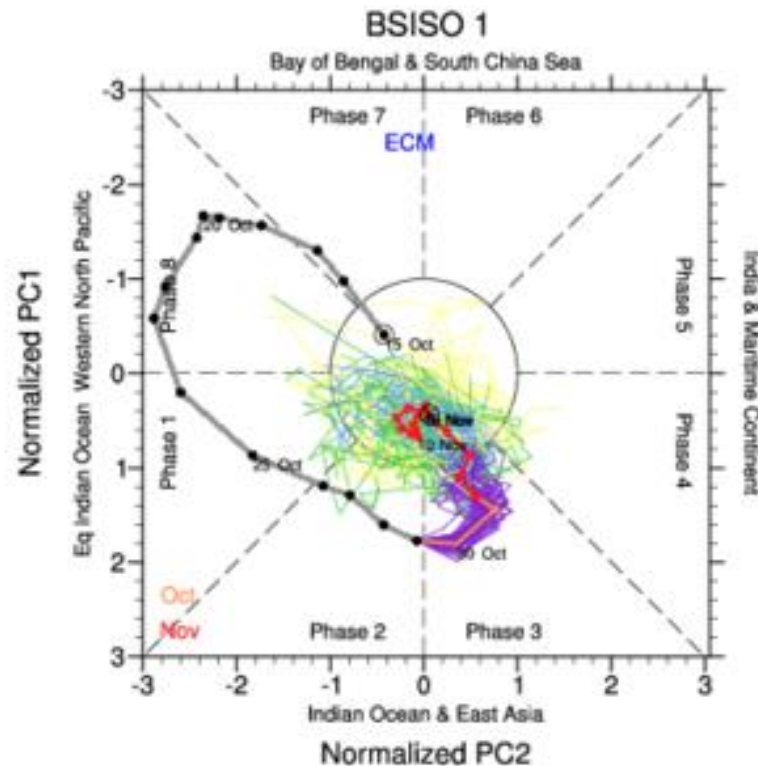
BSISO(Boreal Summer Intraseasonal Oscillation) Prediction

- Since 2013, APCC has expanded climate service from seasonal to subseasonal timescale by providing BSISO real-time forecasts for upcoming 20 days. It is available from May to October at APCC webpage.
- For the real-time forecast, the Lee et al. (2013) BSISO index is applied.



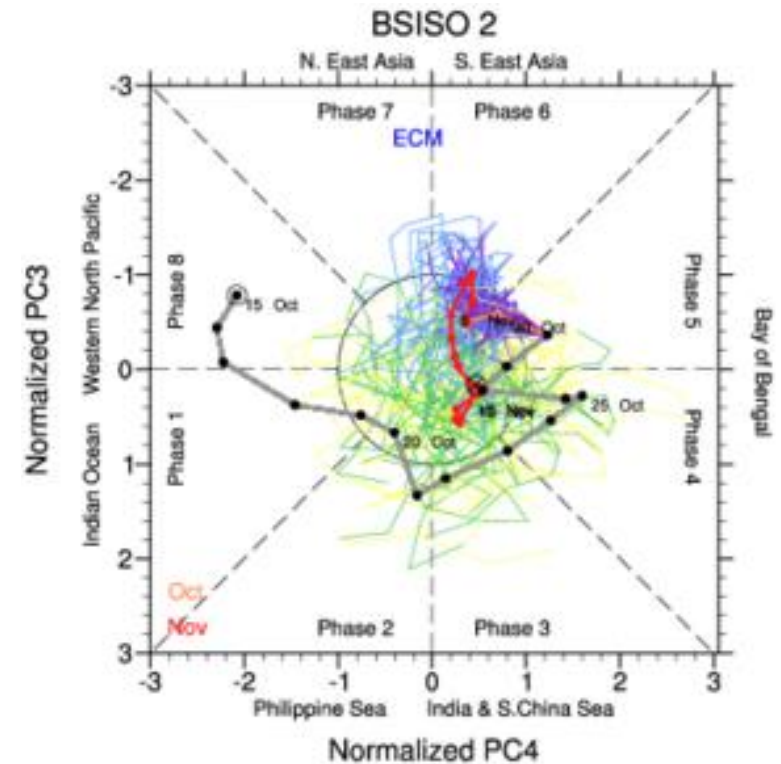
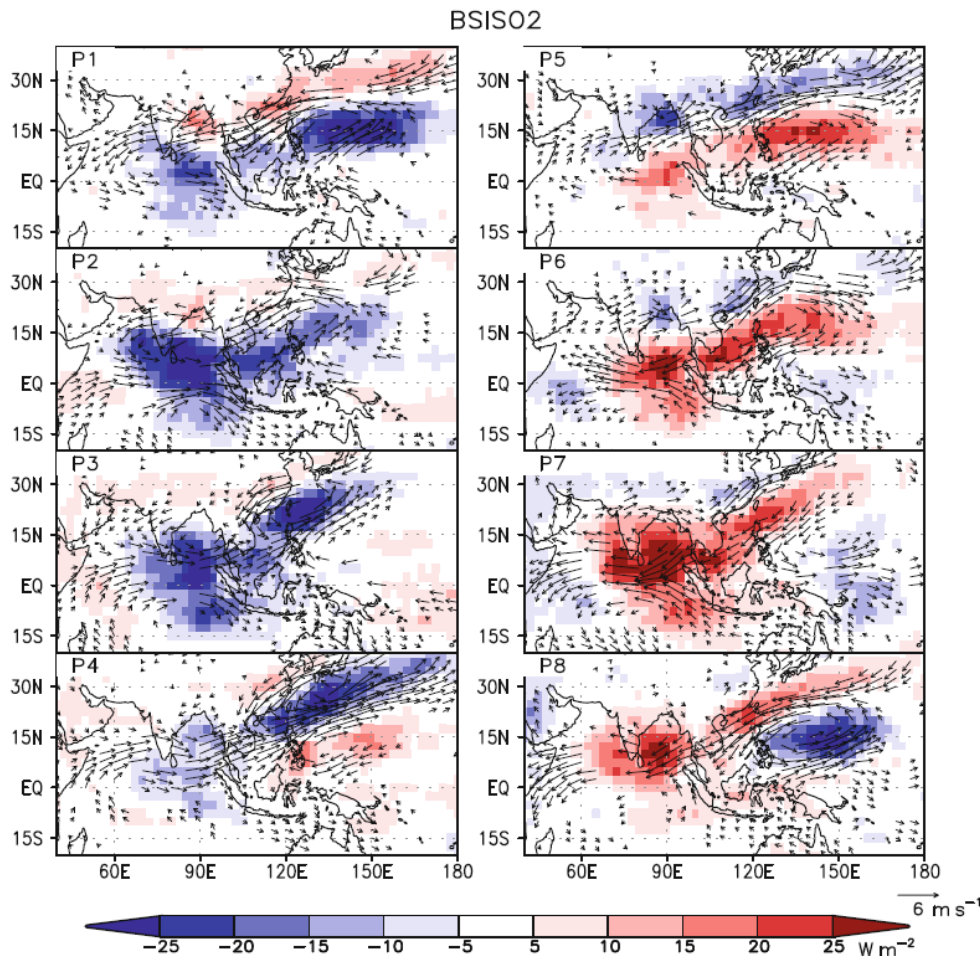
BSISO(Boreal Summer Intraseasonal Oscillation) Prediction

- BSISO1 : canonical northward propagating BSISO over ASM region with 30-60 days quasi-oscillating period



BSISO(Boreal Summer Intraseasonal Oscillation) Prediction

- BSISO2 : pre-monsoon and onset mode with periods of both around 30 days and 10-20 days



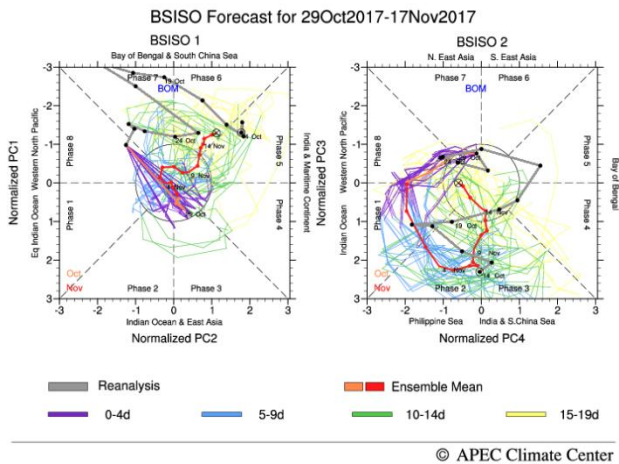
APCC BSISO Prediction System

- In corporation with MJO Task Force, Multi-Institutional Cooperation

Institute	Model	Ensemble Size	Forecast Period	Update frequency	Resolution
NCEP	Climate Forecast System	4	40 days	Once a day	T126 L64
	Global Forecast System	1	16 days	Once a day	T574, T190 L64
Australia	POAMA 2.4 multi-week model	33	40 days	Twice per week	T47 L17
ECMWF	ECMWF Ensemble Prediction System	51	32 days	Twice per week	T639, T319 L62
UK Met Office	MOGREPS-15	24	15 days	Once a day	60km L70
Taiwan CWB	CWB EPS T119	6	40 days	Every 5 days	T119 L30

BSISO Forecast Products

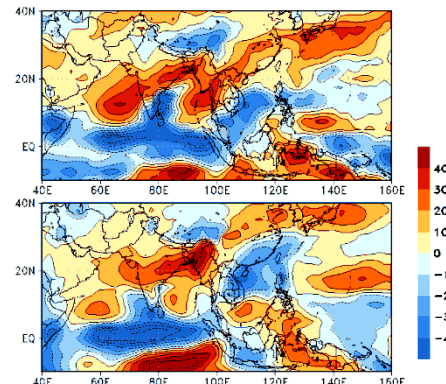
- Daily forecast of BSISO index
- 5-day mean OLR anomaly
- Probability of heavy rainfall for week1&2 predicted by BSISO index
- Verification results (hindcast, realtime forecast)



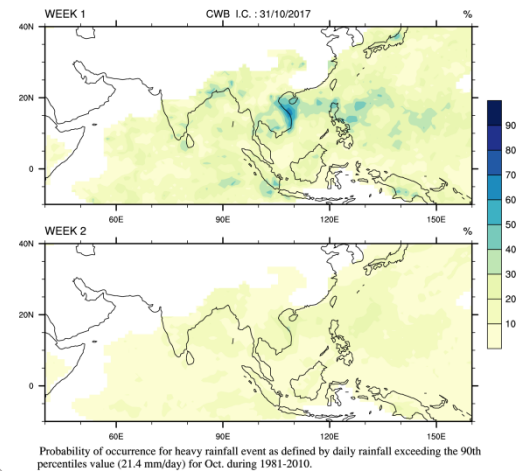
Initial Date
(30/10/2017)

Days 1-5 Ave
forecast

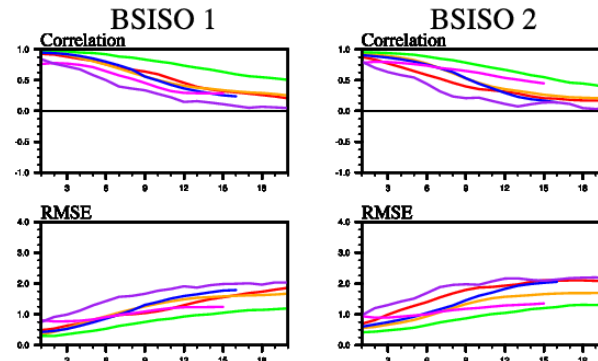
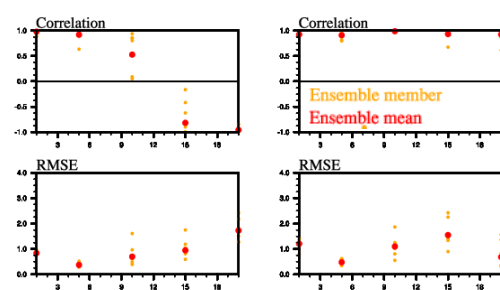
Days 6-10 Ave
forecast



Probability of heavy rainfall determined by predicted BSISO



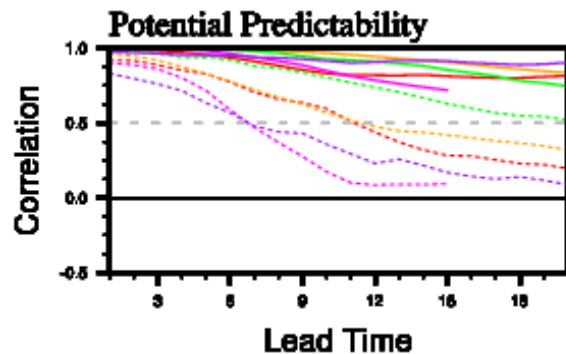
BSISO verification for 31Oct 2017 (CWB)



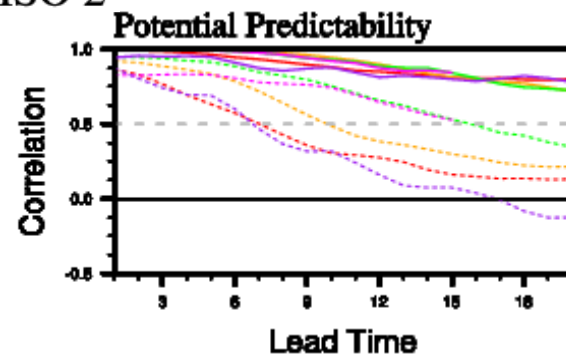
BOM
CFS
ECM
UKM
CWB

Performance of APCC BSISO

BSISO 1

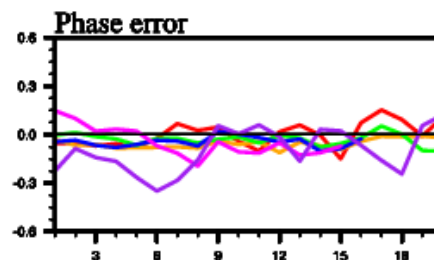
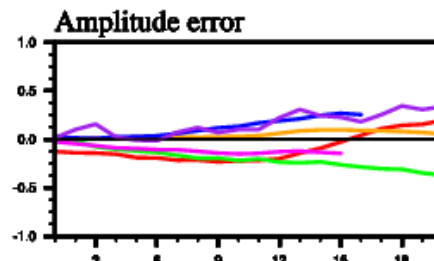
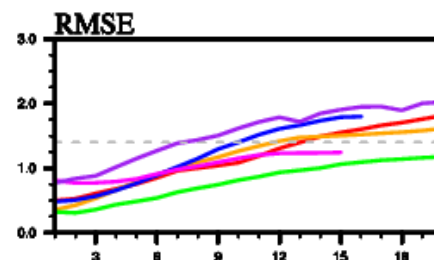
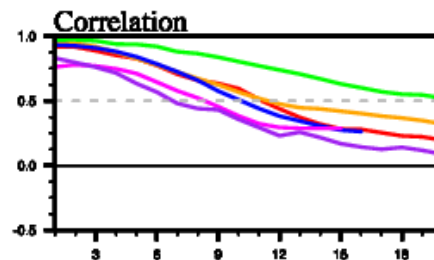


BSISO 2



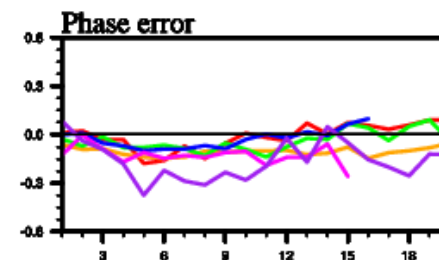
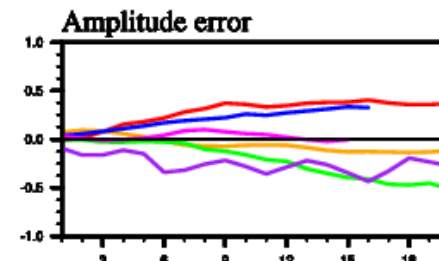
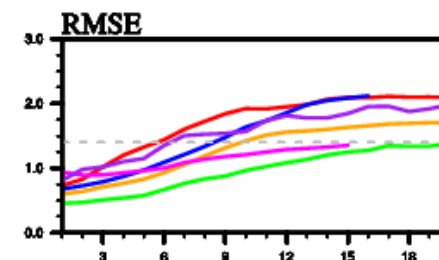
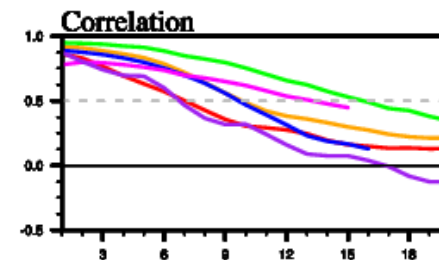
BOM CFS ECM UKM CWB

BSISO 1



Lead time

BSISO 2



Lead time

Better forecast? *practical use*



**Reliable
forecast**



**Reasonable
interpretation**



**Recognition
of the value**



**Actionable
information**



Better forecast from better understanding on BSISO

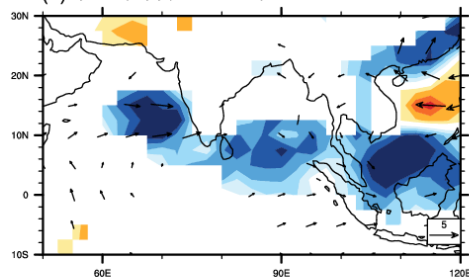
Extended forecast over Asia-monsoon region estimated by BSISO forecasts

OBS fields estimated by BSISO index: 20160630

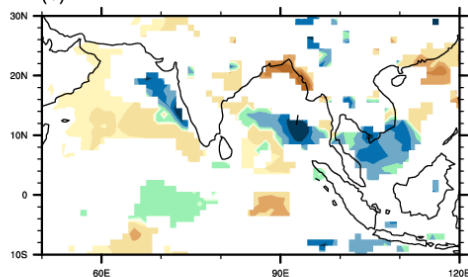
B1: 4

B2: 8

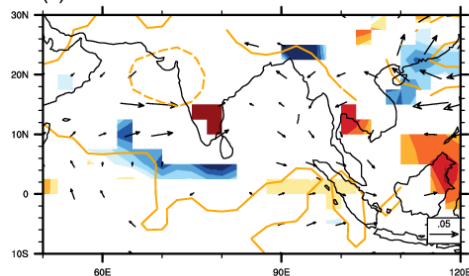
(a) OLR & 850hPa Wind



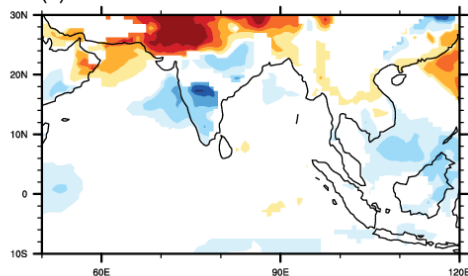
(b) PRCP



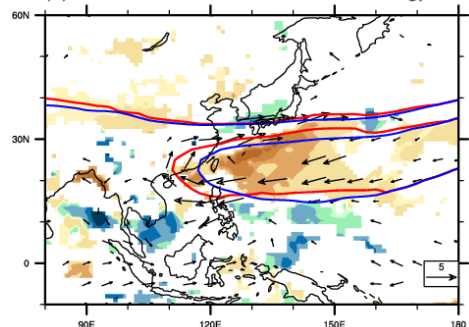
(c) SLP & Moist. Flux & Moist. Conv.



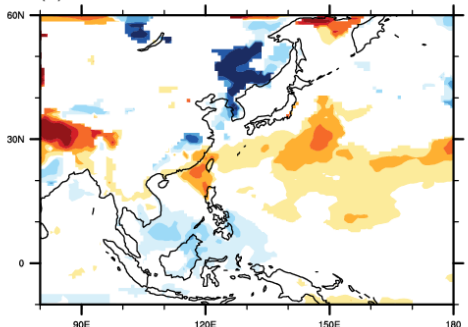
(d) T2M



(a) PRCP & 850hPa Wind & 5820/5880gpm



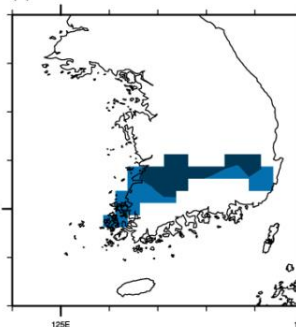
(b) T2M



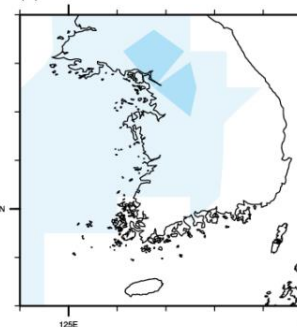
Monitoring, Forecast, Verification

- ❖ Asia monsoon region
: General circulation pattern,
Tropical cyclone, Heavy rainfall
- ❖ India
: Monsoon onset, Heat wave
- ❖ East Asia including S.Korea
: Meiyu, Changma, Extreme heat

(c) PRCP



(d) T2M





Better forecast from better understanding on BSISO

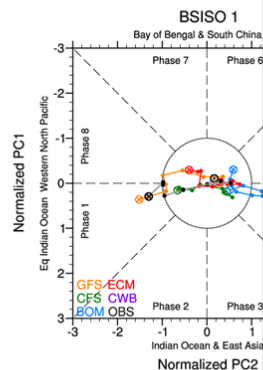
Extended forecast over Asia-monsoon region estimated by BSISO forecasts

Forming into the BSISO Weekly Bulletin (at the pilot stage for regular operation)

❖ Updated every Monday from May to Oct.

BSI

Verification



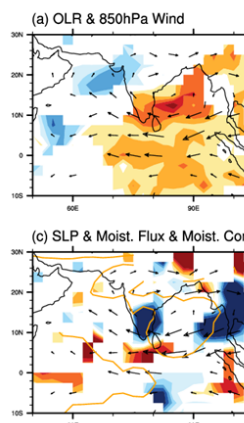
- Period : 08 June ~ 16 June
- BSISO 1 : nonactive 한 상태로 지 모델들이 nonactive 한
- BSISO 2 : 약하게 유지되다가 P5- 모델들이 관측의 경향을

Monitoring

2. Indian monsoon area

- 현재 +IOD
- BSISO와 관련된 대기 순환장도
- BSISO 로 인해 Anomalous 동풍 Indo monsoon 이 약화되거나 북

OBS fields



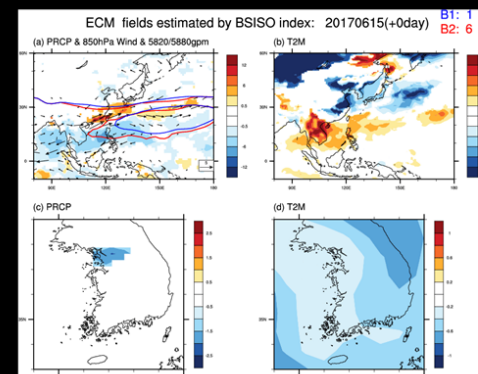
Forecast

1. ECMWF (I.C. 15Jun)

- : BSISO1 : P18→nonactive→P34
- : BSISO2 : P4→nonactive

[S.Korea]

- L15~20 : 장마 전선 남부(심지어 중 부) 상륙 (30일)
- 장마비는 평년 or 평년 보다 적을 것으로
- 북태평양 고기압 (5880gpm) 서쪽으로 확장
- L0~5 : 동해안 cool
- L6~14 : 남한(한반도) cool
- L15~20 : 북서부(북한) cool
- 기온 ano 의 중국-한국 동서 대비



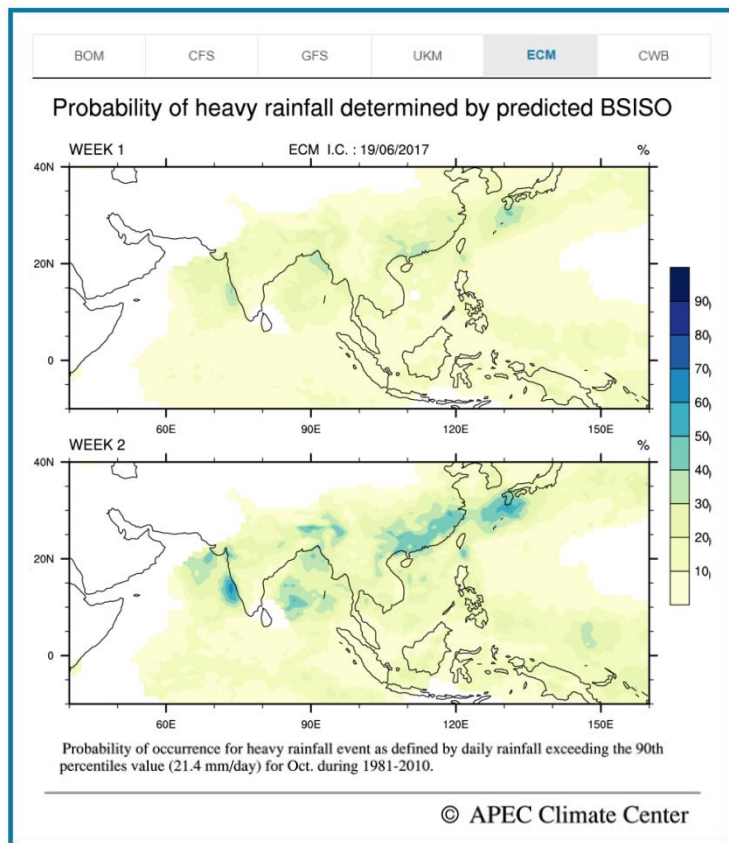


Better forecast from better recognition of the value

Development of a guideline to increase practical use of BSISO forecast

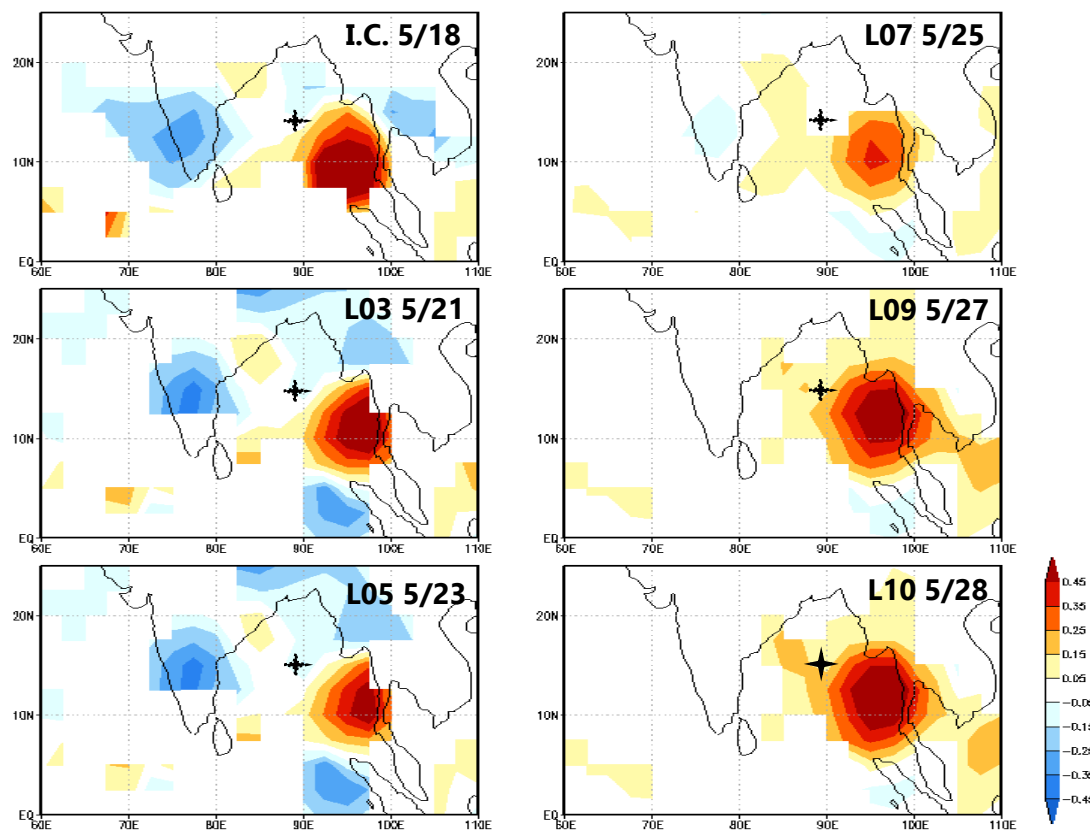
Heavy rainfall forecast based on BSISO index forecast [ECMWF]

❖ Ex> Japan flood, 398mm/4hr, July 6, 2017



ISGPI forecast estimated by BSISO index forecast [ECMWF]

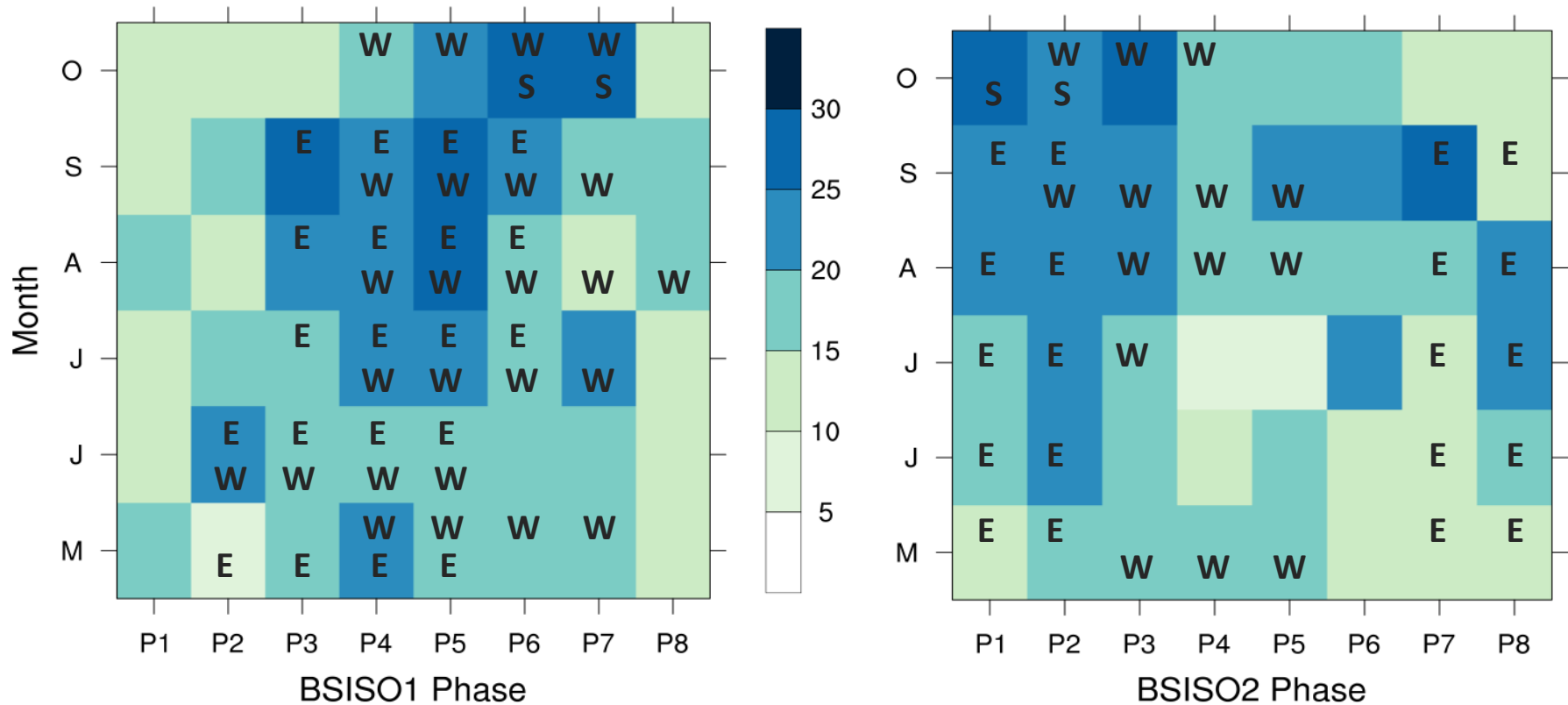
❖ Ex> Tropical Cyclone Mora-17, May 28, 2017



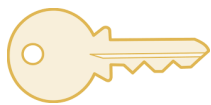


Better forecast from better recognition of the value

Development of a guideline to increase practical use of BSISO forecast

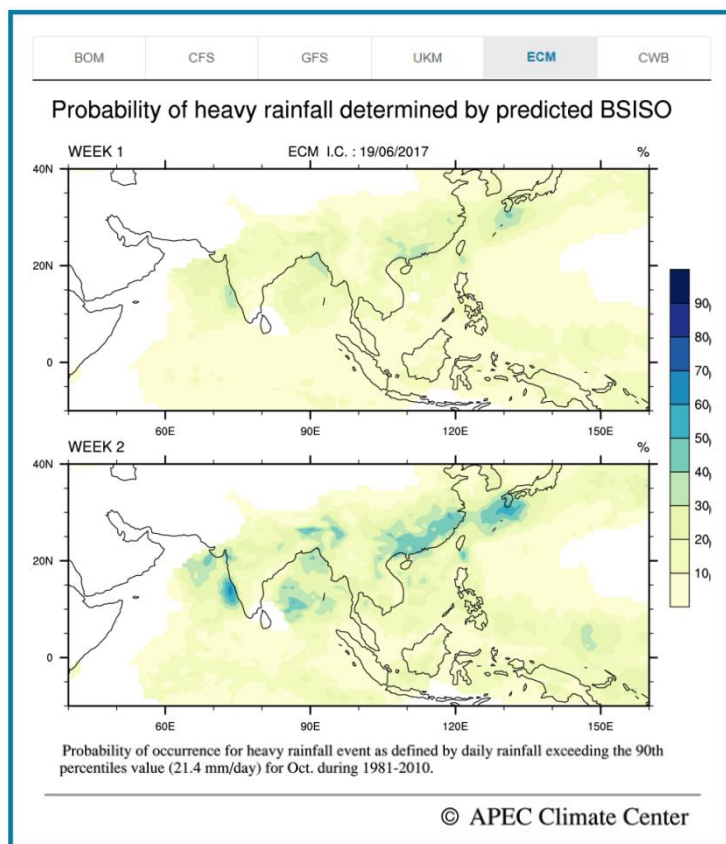


Probability table marked with favorable wind condition which can contribute strong Indo-China monsoon and bring heavy rainfall.

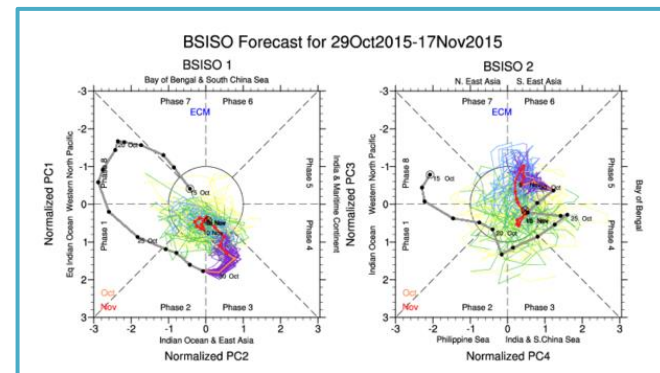


Better forecast by actionable information

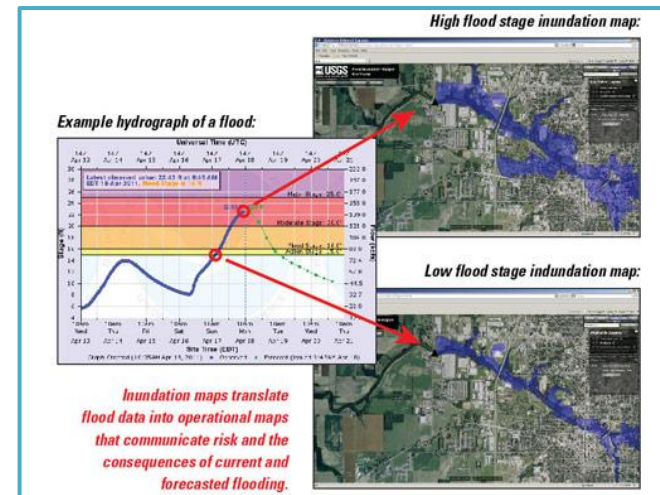
Heavy rainfall forecast



BSISO forecasts



Flood Inundation Mapping

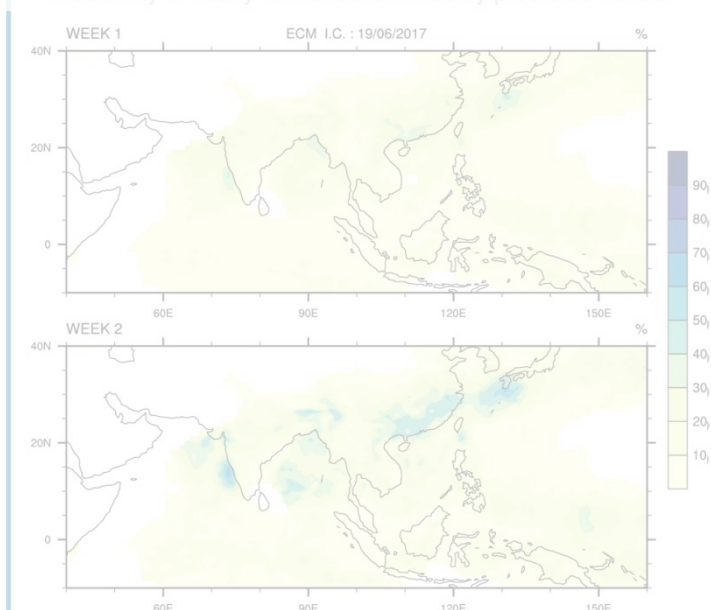




Better forecast by actionable information



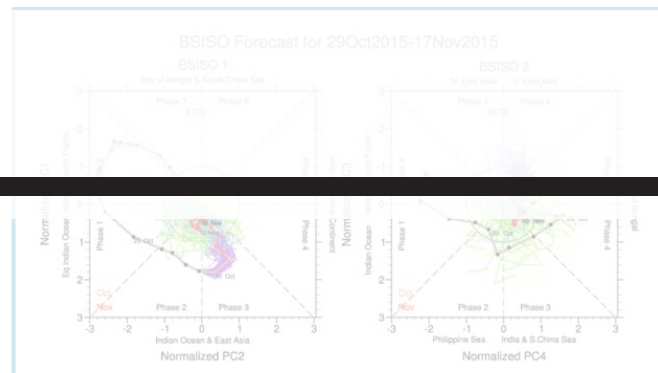
Heavy rainfall forecast Interdisciplinary Research



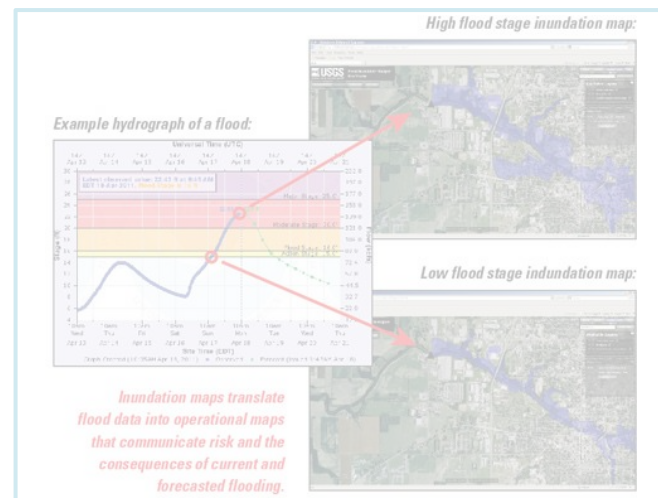
Probability of occurrence for heavy rainfall event as defined by daily rainfall exceeding the 90th percentiles value (21.4 mm/day) for Oct. during 1981-2010.

© APEC Climate Center

BSISO forecasts



Flood Inundation Mapping



International Cooperation



✓ APCC's S2S Training Program (1-week)

- Every 2 years, APCC has trained about 20 participants from developing countries
- 2014 : S2S to cope with high impact weather
- 2016 : S2S to cope with extreme hydrological events
- 2018 : S2S prediction and APCC

Summary

- APEC Climate Center (APCC) is a leading operational center providing seasonal forecast based on the **Multi-Model Ensemble** (MME) prediction system.
- MME seasonal prediction is one of the **most reliable** seasonal forecast information at present.
- APCC has produced **real-time BSISO forecast** using multi-models based on the international cooperation.
- The goal of APCC's BSISO forecasting activity is to produce better forecast by promoting **practical use** of real-time BSISO information.

Summary

- Along with pursuing **more reliable forecast**, we've made an effort to **improve our understanding** on BSISO forecast and created **user friendly information**.
- In order **to arouse the people to the value of BSISO** forecast, the possibility of BSISO application is estimated and which would be the cornerstone for making **actionable information**.
- APCC's BSISO forecasting activity has become the origin of **APCC's S2S Training program** that takes places every two years.



THANK YOU

(<http://www.apcc21.org>)



Thank you