문서번호 APCC-출장-16-1338(2016-12-01)

결재	선임연구원	팀장	부서장	원장
	11/30 Hongwei Yang	12/01 김선태	12/01 유진호	12/01 정홍상
협조				

TRAVEL REPORT FORM
출장보고서

I. **Reporter** 보고자

Department 소속	Position 직위(직급)	Name 성명	Travel Date 날짜	Note 비고
Climate Research	Research fellow	Hongwei Yang	13/Nov~25/Nov	

II. **Major Activities** 주요업무 수행내용

1. Main Contents and Activities 주요내용 및 활동
   (1)Met with Cordex SEA team.
   (2)Gave a talk named “Regional extreme temperature over the Maritime Continent”
   (3)Determined the Cordex SEA future plan in detail.

2. Relevance to APEC Climate Center’s Activities 결론 및 소감
   (1)Advertise the climate change studies at APCC beside our main seasonal prediction operation. Include both the dynamic downscaling and statistic downscaling studies.
   (2)Recomand our CORDEX related data to scientist
   (3)Convince the scientist to acknowledge APCC when they use our data
   (4)Show our contributions to CORDEX when the organiser apply a funding from , e.g., WCRP or World bank

III. **References** 참고사항

(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

1. Presented and Collected Materials 주요 수집자료

See attached pdf file

2. Suggestions and Remarks 건의사항

See attached pdf file

VNU University of Science
Faculty of Meteorology, Hydrology and Oceanography
Department of Meteorology and Climate Change
334 Nguyen Trai, Thanh Xuan district, Hanoi, VIETNAM
TEL: (+84) 4 35583811 Website: http://hmo.hus.vnu.edu.vn/en/

15th Sep 2016

Dr. Hongwei Yang
Research Fellow
APEC Climate Center

Invitation Letter to the 4th Workshop of SEACLID/CORDEX Southeast Asia Project and Empirical-Statistical Downscaling (ESD) for CORDEX Asia Meeting, 23rd – 25th November 2016, VNU University of Science, Hanoi Vietnam

Dear Dr. Hongwei Yang,

On behalf of the Local Organizing Committee of the 4th Workshop of SEACLID/CORDEX Southeast Asia Project and the ESD for CORDEX Asia Meeting, which will be hosted by the Department of Meteorology and Climate Change, Faculty of Meteorology, Hydrology and Oceanography, Hanoi University of Science (HUS), Vietnam National University (VNU) and the University of Science and Technology of Hanoi (USTH), I cordially invite you to participate in this workshop. Please use this invitation for entry visa application if your visit requires one.

We are also happy to inform you that your participation at this workshop will be funded using the World Climate Research Programme (WCRP) fund. This fund covers the cheapest online airfare (estimated **USD600**), accommodation (check-in on 23 November and check-out on 26th November) and per diem. We will book your accommodation at *May De Ville City Centre Hotel* (24 Han Thuyen Street, Hai Ba Trung District, Hanoi, Vietnam). I recommend you to purchase the air ticket online immediately to ensure the airfare is still within the estimation. Please send us the airfare receipt and itinerary once purchased. If the price of the air ticket is much higher, please consult Prof. Fredolin Tangang (email: ftangang@gmail.com) before purchasing it. If you are interested to participate at the meeting of ESD for CORDEX Asia, which will be held in the afternoon of 23 November 2016, please arrange your arrival in Hanoi in the morning of 23 November. Also, as a funded participant, you will be required to provide boarding passes and receipts to the LOC before you receive your per diem and airfare reimbursement.

Please find the workshop program in the attachment. For latest update of this workshop, please visit: http://www.ukm.edu.my/seaclid-cordex/. If you require any assistance please feel free to communicate with local organizing committee at :cordexsea.2016@gmail.com.

I am confident that your contribution to this workshop will provide valuable inputs for this project and also will enhance our collaboration in regional climate change issues, especially under the umbrella of CORDEX.

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We warmly welcome you to Vietnam and hope that the coming workshop will be an important milestone for the success of our regional collaboration.

Best Regards,

Phan Van Tan, Prof. Dr.

Professor of Meteorology and
Head of Regional Climate Modeling and Climate Change Group (REMOCLIC),
Hanoi University of Science (HUS), Vietnam National University (VNU)

The 4th Workshop of the Southeast Asia Regional Climate Downscaling (SEACLID)/ CORDEX Southeast Asia Project & Discussion on the Formation of Empirical-Statistical Downscaling (ESD) Group in CORDEX Asia

Hanoi, Vietnam

23-25 November 2016

Workshop venue: Le Van Thiem lecture hall, VNU University of Science, 19 Le Thanh Tong str., Hoan Kiem, Hanoi

WORKSHOP PROGRAM

November 23 (Wednesday)	Formation of Empirical-Statistical Downscaling (ESD) Group in CORDEX Asia
13.00 – 13.30	Registration
13.30 – 15.30	**Presentation Session** Chair: Prof. Dr. Ailikun (10-15 minutes presentations by main scientists and country representatives)
16.00 – 17.30	**Discussion Session** Dr Koji Dairaku Rapporteur: Prof. Dr. Fredolin Tangang and Ms Nguyen Tuyet

November 24 (Thursday)	Opening Session (Chair: Prof. Dr. Phan Van Tan, HUS)	
08.30 – 09.00	Registration	
09.00 – 09.20	Welcome Remarks	**Rector,** VNU Hanoi University of Science **Rector,** University of Science and Technology of Hanoi (USTH)
09.20 – 09.40	Opening Remarks	**Prof. Dr. Fredolin Tangang** Coordinator/Project Leader, SEACLID/CORDEX Southeast Asia The National University of Malaysia **Dr Iréne Lake,** Director, International Project Office for CORDEX (IPOC) SMHI
09.40 – 10.00	Keynote Address: Summary of APN CORDEX-Asia project	**Prof. Dr.Ailikun** Member, Asia-Pacific Network for Global Change Research (APN) / Director, Institute of Tibetan Plateau Research (ITP), Chinese Academy of Sciences (CAS), China
10.00 – 10.15	Group Photo	
10.15 – 10.30	Coffee Break	
November 24 (Thursday)	**Session 1** **Progress of SEACLID/CORDEX Southeast Asia (Regional-level analysis)** **Chair: Prof. Phan Van Tan**	
10.30 – 10.50	Overall Progress of SEACLID/CORDEX Southeast Asia Project	**Prof. Dr. Fredolin Tangang** Coordinator/Project Leader, SEACLID/CORDEX Southeast Asia The National University of Malaysia
10.50 – 11.10	CORDEX-SEA multi-model simulations of current and future temperature changes over Southeast Asia	**Dr. Rochelle Cayanan Coronel**, Manila Observatory, Philippines
11.10 – 11.30	CORDEX-SEA multi-model simulations of current and future rainfall changes over Southeast Asia	**Chung Jing Xiang**, National University of Malaysia
11.30 – 11.50	CORDEX-SEA multi-model simulations of current and future atmospheric circulation and monsoon changes over Southeast Asia	**Assoc. Prof. Dr. Thanh Ngo-Duc**, University of Science and Technology of Hanoi (USTH), Vietnam
11.50 – 12.10	CORDEX-SEA multi-model simulations of current and future extremes over Southeast Asia	**Supari,** National University of Malaysia / BMKG Indonesia
12.10 – 13.30	Lunch / Poster Viewing	

November 24 (Thursday)	Session 2 Progress of SEACLID/CORDEX Southeast Asia (Country-level analysis) Chair: Prof Dr Edvin Aldrian	
13.30 – 13.45	Changes in mean climate and extremes over Indonesia based on SEACLID/CORDEX-SEA simulations	**Dr Ardhasena Sopaheluwakan/** Utoyo Ajie Linarka, BMKG, Indonesia
13.45 – 14.00	Changes in mean climate and extremes over Vietnam based on multi-model simulations of CORDEX-SEA	**Nguyen Thi Tuyet**, VNU, Vietnam
14.00 – 14.15	Changes in mean climate and extremes over Malaysia based on multi-model simulations of CORDEX-SEA	**Dr. Ester Salimun,** National University of Malaysia
14.15 – 14.30	Changes in mean climate and extremes over the Philippines based on multi-model simulations of CORDEX-SEA	**Assoc. Prof. Dr. Gemma Narisma**, Manila Observatory / Ateneo de Manila University, Philippines
14.30 – 14.45	Changes in mean climate and extremes over Thailand based on multi-model simulations of CORDEX-SEA	**Kamphol Promjiraprawat**, Ramkhamhaeng University / **Dr Patama Singhruck,** Chulalongkorn University, Bangkok
14.45 – 15.05	Brief Poster Presentations (3 minutes each presentation) Chair: Dr. Faye Cruz	
15.05 – 15.40	Coffee break / Poster Viewing	
November 24 (Thursday)	Session 2 Progress of SEACLID/CORDEX Southeast Asia Chair: Assoc Prof Dr. Thanh Ngo-Duc	
15.40 – 16.00	Changes in mean and extremes of climate in HadGEM2-ES downscaled by PRECIS over the CORDEX Southeast Asia region	**David Hein**, Met Office Hadley Centre for Climate Science and Services, United Kingdom (**Remote Presentation via Skype**)
16.00 – 16.15	Present and future climate simulations over CORDEX Southeast Asia using NHRCM	**Dr. Faye Cruz**, Manila Observatory, Philippines
16.15 – 16.30	Projections of Climate Indices over the area of Thailand using SEACLID/CORDEX SEA products	**Dr. Waranyu Wongseree**, Faculty of Engineering, King Mongkut's University of Technology North Bangkok
16.30 – 16.45	Downscaling three GCMs for SEACLID/CORDEX-SEA using CCAM	**Dr John McGregor,** CSIRO, Australia
16.45 – 17.00	Statistical Downscaling of SEACLID/CORDEX SEA products over the Petchaburi and Prachuap Khiri Khan Coast river basins in the Southern Part of Thailand	**Dr Jerasorn Santisirisomboon**, Research Center of Regional Climate Change and Renewable Energy, Ramkhamhaeng University, Bangkok
17.00 – 17.15	Detection of Tropical Cyclones in a Downscaled Regional Climate: Model over the CORDEX-SEA Domain	**Jennifer B. Tibay,** Manila Observatory, Philippines

17.30 – 20.00	**Reception Dinner (KIV)**

November 25 (Friday)	**Session 3** **Other CORDEX-SEA presentations and other initiatives from within and outside the region** **Chair: Assoc. Prof. Dr. Gemma Narisma**	
08.30 – 08.50	How to draw a worst case scenario in the future world - Fruits of SOUSEI program	**Dr Izuru TAKAYABU**, Meteorological Research Institute, Japan
08.50 – 09.05	Analysis of the influence of sea surface temperature representation in downscaled regional climate using the SEACLID/CORDEX-Southeast Asia simulations	**Ms. Angela Monina T. Magnaye**, Manila Observatory, Philippines
09.05 – 09.20	Sensitivity of RegCM4 precipitation to treatments of convective parameterization over the Southeast Asian domain	**Dr Chi Yung Francis Tam**, Earth System Science Programme, the Chinese University of HongKong
09.20 – 09.35	Future Projections of Extreme Rainfall Events using Statistical Downscaling in Malaysia	**Noor Shazwani binti Osman** Universiti Teknologi Malaysia, Malaysia
09.35 – 09.50	Rainfall Diurnal Cycle over the Maritime Continent in the SEACLID/CORDEX-SEA multi-model simulations.	**Ahmad Fairudz Jamaluddin**, National University of Malaysia / MetMalaysia
09.50 – 10.20	Coffee Break/Poster Viewing	
November 25 (Friday)	**Session 3** **Other CORDEX-SEA presentations and related initiatives from within and outside the region** **Chair: Assoc. Prof. Dr. Liew Juneng**	
10.20 – 10.40	Regional Climate Modelling at the Rossby Centre of SMHI	**Dr Grigory Nikulin,** Swedish Meteorological and Hydrological Institute (SMHI), Sweden
10.40 – 10.55	Regional precipitation extremes over the MC	**Dr Hongwei Yang**, APEC Climate Center, Busan, Korea
10.55 – 11.10	The use of climate and weather data to support precise decision making for efficient agricultural resource allocation	**Prof Attachai Jintrawet**, Center for Agricultural Resource System Research, Chiang Mai University, Chiang Mai, Thailand
11.10 – 11.25	A combined statistical downscaling and disaggregation model of hourly precipitation in Hong Kong	**Dr. Fan Lijun**, Institute of Atmospheric Physics, Chinese Academy of Science, China
11.25– 11.40	High-resolution regional climate simulations for future climate projection in Japan and collaborations with Southeast Asia	**Dr. Hiroaki Kawase,** Meteorological Research Institute, Japan
11.40 – 11.55	Regional Climate Downscaling Activities carried out by IMHEN, Vietnam	**Dr Mai Van Khiem,** Director of Center for Meteorology and Climatology, IMHEN, Vietnam

11.55 – 12.10	Regional Climate Downscaling Activities carried out by NAHRIM, Malaysia	**Mohd Syazwan Faisal Bin Mohd,** NAHRIM, Malaysia
12.10 – 13.30	Lunch / Poster Viewing	
November 25 (Friday)	**Session 4** **Discussion # 1 (Topic: SEACLID/CORDEX Southeast Asia Downscaled Data & Products: Dissemination and bridging to users and stakeholders)** **Chair: Prof. Fredolin Tangang & Dr Gemma Narisma** **Rapporteur: Dr Faye Cruz / Dr Thanh Ngo-Duc**	
13.30 – 15.30	• Establishment of SEACLID/CORDEX SEA ESGF node and related issues (**Invite Dr Jerasorn Santisirisomboon of Ramkhamhaeng University to make a brief presentation on ESGF ~ 5-10 minutes**) • What are the best ways to disseminate SEACLID/CORDEX SEA key findings to users and stakeholders? (**Invite Dr Grigory Nikulin of SMHI to share experience of EURO-CORDEX in dealing with user groups ~ 5-10 minutes)** • What is the best way to bridge and engage user groups? (**Invite Prof. Dr. Attachai Jintrawet of Chiang Mai University to provide input from user perspectives~ 5-10 minutes)** • Data products limitations (Model biases and inadequacies): How to convey these to users? • Data products limitations (Model biases and inadequacies): Enhancing the products e.g. bias correction. Do we need go towards this? • Other related issues	
15.30 – 16.00	Coffee Break / Poster Viewing	
November 25 (Friday)	Session 5 **Discussion # 2 (Topic: Future collaboration: Opportunity and the way forward)** **Chair: Prof. Ailikun & Dr. Irene Lake** **Rapporteur: Dr Patama Singhruck / Dr Liew Juneng**	
16.00 – 17.30	• CORDEX: Status and future plan (**Invite Dr Irene Lake of CORDEX IPOC to make a brief presentation ~ 10 minutes**) • SEACLID/CORDEX Southeast Asia Phase 2 (**Invite Dr Jerasorn Santisirisomboon to briefly introduce the project~ 5 minutes**) • CORDEX Asia: how to enhance inter-domains collaboration? • Collaboration in Empirical-Statistical downscaling (ESD) (**Invite Dr Koji Dairaku / Prof. Ailikun to make a very brief presentation ~ 5 minutes**) • CORDEX and IPCC AR6, IPCC SR 1.5C (**Invite Prof Edvin Aldrian, IPCC WG1 Vice Chair to give a briefing ~ 5 minutes**) • Other related issues	
17.30 – 17.45	Closing Remarks	**Prof. Phan Van Tan (HUS)** **Assoc. Prof. Dr. Thanh Ngo-Duc (USTH)** **Prof. Fredolin Tangang (SEACLID/CORDEX-SEA)**
POSTERS		
1	Comparison Between CLM45 and BATS Land-Surface Scheme in RegCM 4.4.5.10 for Climate	**Ratna Satyaningsih/Jose Rizal/Adi Mulsandi**, BMKG, Indonesia

	Projection Baseline in Indonesia: A Sensitivity Study	
2	Future projection of extreme rainfall events in Malaysia using statistical downscaling	**Syafrina Abdul Halim,** International Islamic University, Malaysia
3	Surface Heat Fluxes from GCMs over the CORDEX-SEA	**Pipatthra Saesin**, Chulalongkorn University, Bangkok, Thailand
4	Regional climate analogue studies using CORDEX-SEA multi-model simulations	**Nguyen Thi Tuyet**, VNU, Vietnam
5	Development of High Resolution Ensemble Climate Projection Using Multi-Window Constructed Analogue Statistical Downscaling on Bengawan Solo Watershed	**Muhammad Ridho Syahputra,** Weather and Climate Prediction, Institut Teknologi Bandung
6	Influence of bias-correction on the Future projected change of the CORDEX-SEA regional climate model over Malaysia	**Ngai Sheau Tieh**, National University of Malaysia
7	Characterization of Daily and Monthly Precipitation Over Indochina Region	**Rattana Chhin / Prof Shigeo Yoden**, Cambodia/Kyoto University, Japan
8	The climatology and variability of the Malaysian Southwest Monsoon in the SEACLID/CORDEX-SEA multi-model simulations.	**Diong Jeong Yik**, National University of Malaysia / MetMalaysia

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Dynamcal downscaling for climate change.
Statistic downscaling for climate change.

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Since APCC is one of the CORDEX-SEA members, please mention APCC when the related proposal is written.

Regional extreme temperature over the Maritime Continent

Hongwei Yang

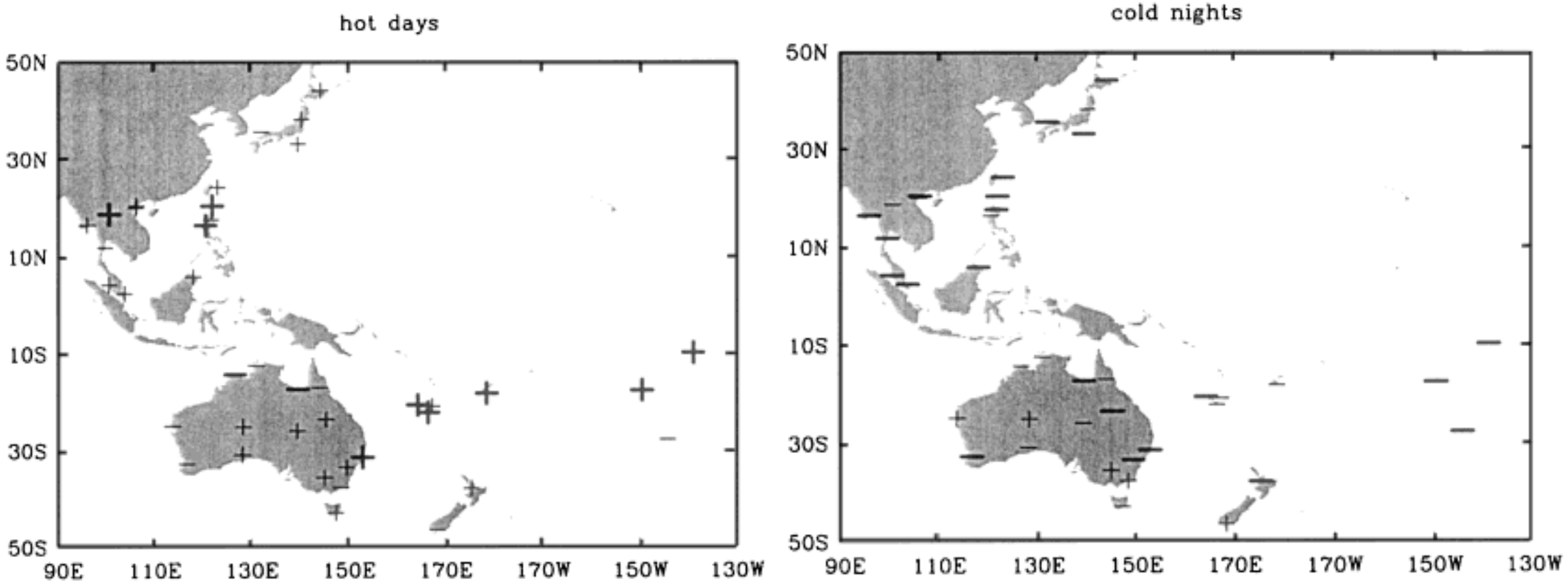
APCC

APCC APEC CLIMATE CENTER

Background

The global model future projection predicts the mean temperature in the Maritime Continent will increase by 2–5 °C (Solomon et al. 2007).

But small changes in the mean state can result in a large change in the probabilities of extreme events (Mearns et al., 1984; Wigley, 1985, 1988; Meehl et al., 2000).



Trend in the frequency of days with maximum temperature above the 1961–1990 mean 99th percentile (hot days), and minimum temperature below the 1961–1990 mean 1st percentile (cold nights).

Manton et al (2001)

ENSO influences maximum and minimum temperature variability especially around the Pacific Rim but often affecting cold and warm extremes differently. (Kenyon and Hegerl, 2008; Alexander et al., 2009)

Extreme frequency during active MJO periods is significantly higher than that in inactive MJO phases (Jones et al. 2004).

Thus, understanding the impacts of ENSO combined with MJO on the extreme temperature over the SEA region is important.

- **Observation**
- **Hindcast experiment**
- **Historical experiment**
- **Future projection**

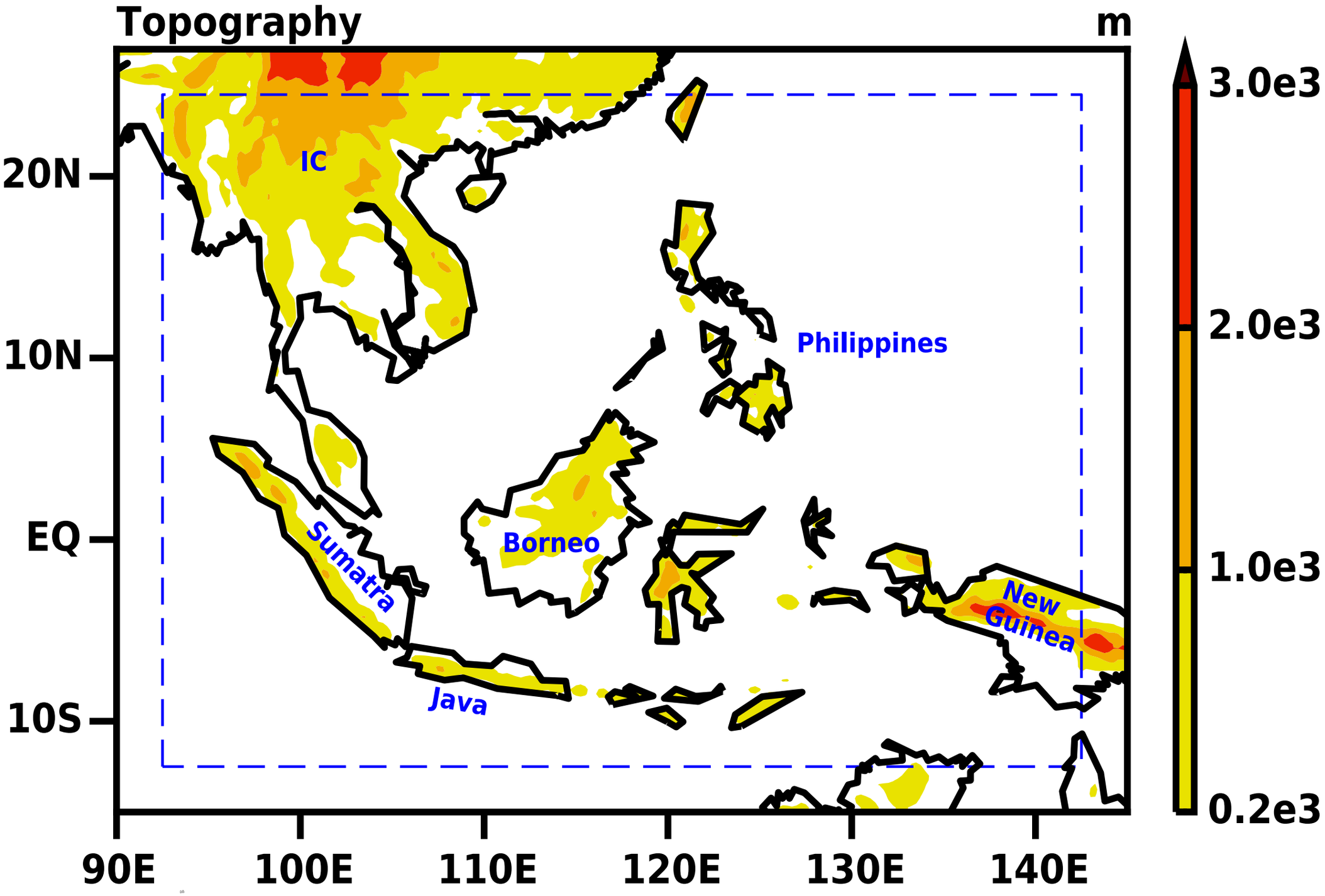
Extreme temperature indices

TX90p ***(warm day-times)***

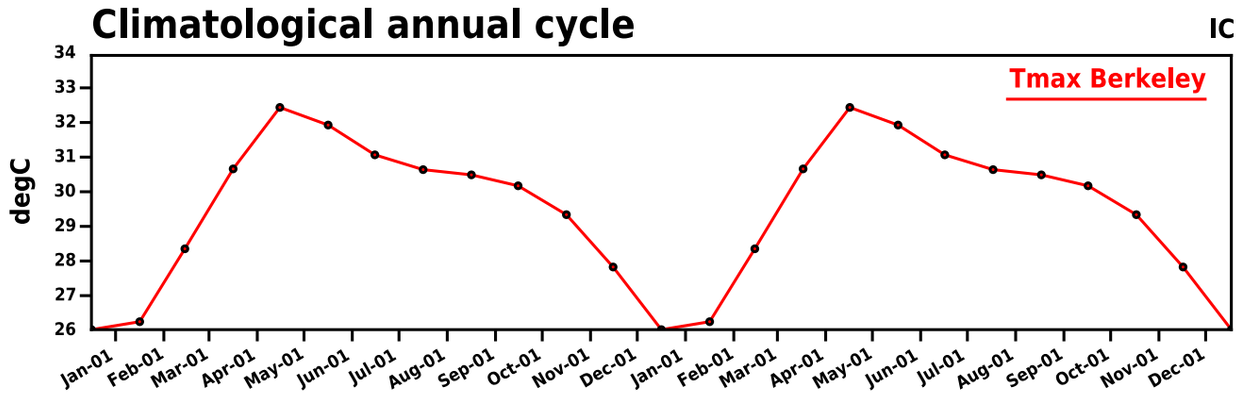
Number of days with TX > 90th percentile of daily max temp:
Let TXij be the daily maximum temperature on day i in period j and let TXin90 be the calendar day 90th percentile calculated for a 5-day window centred on each calender day in the base period ***1981-2005****. Then counted is the number of days where:*
TXij > TXin90
To avoid possible inhomogeneity across the in-base and out-base periods, the calculation for the base period (1981-2005) requires the use of a bootstrap processure. Details are described in Zhang et al. (2005) .

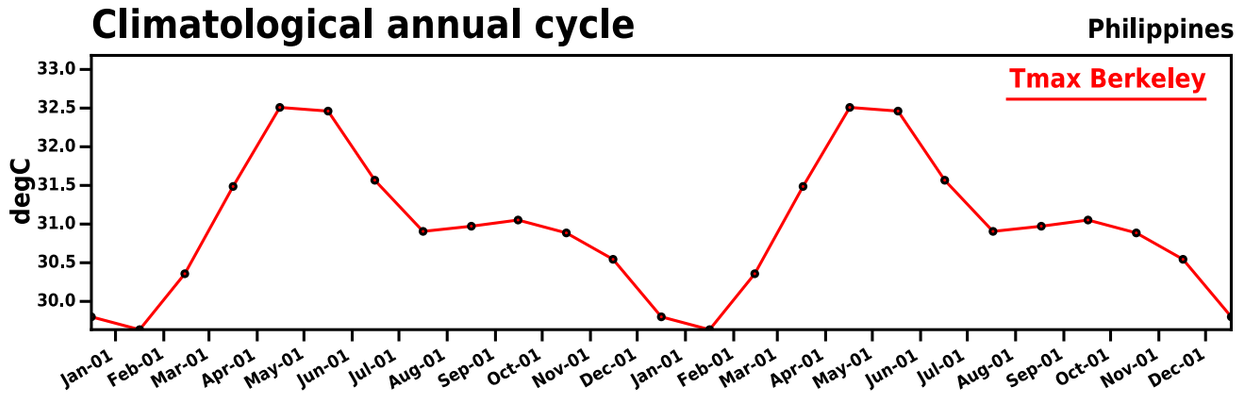
TN10p ***(cold nights)***

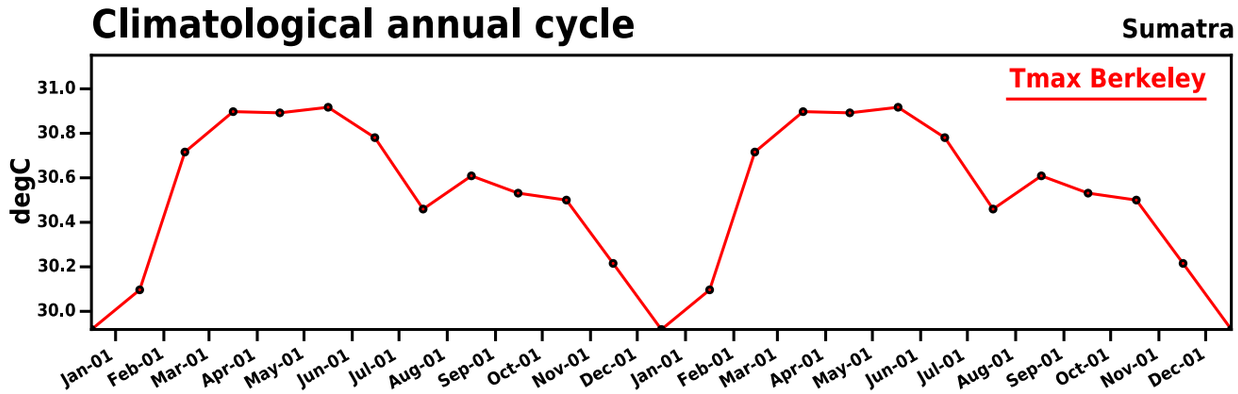
Days with TN < 10th percentile of daily min temperature.

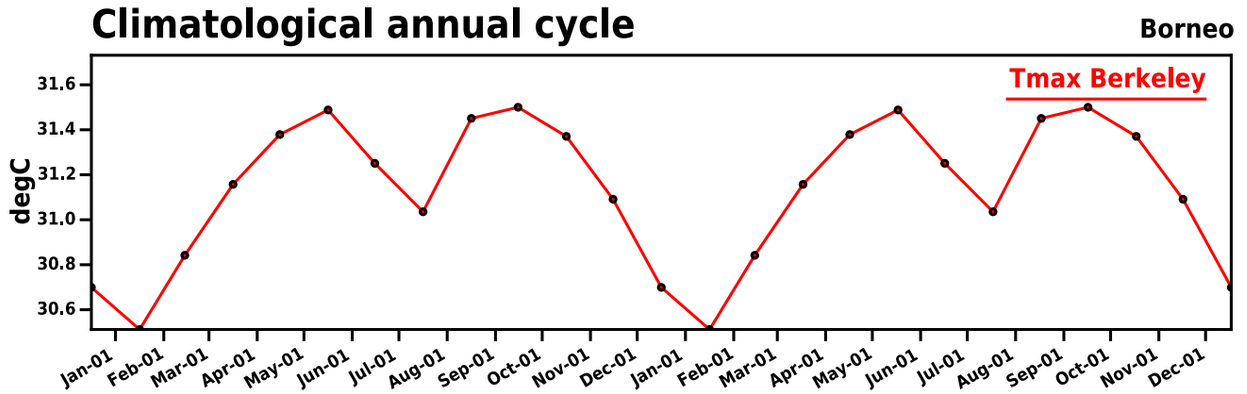

Topography
m
3.0e3
2.0e3
1.0e3
0.2e3
20N
10N
EQ
10S
90E
100E
110E
120E
130E
140E
IC
Philippines
Borneo
Sumatra
Java
New Guinea

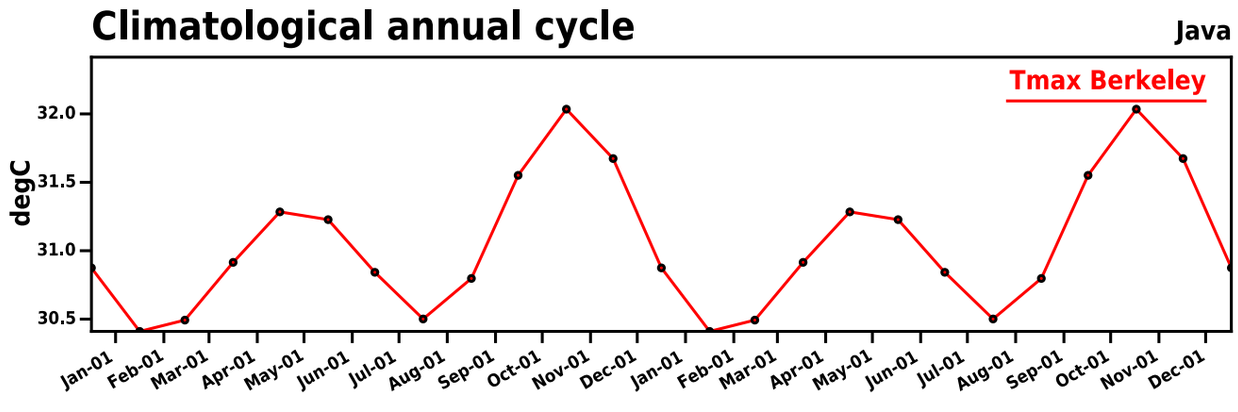
Tmax annual cycle

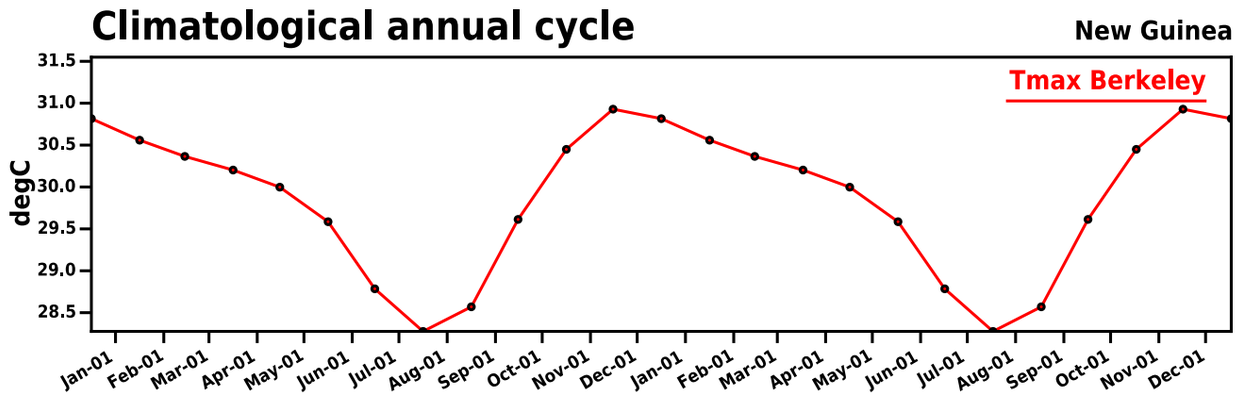




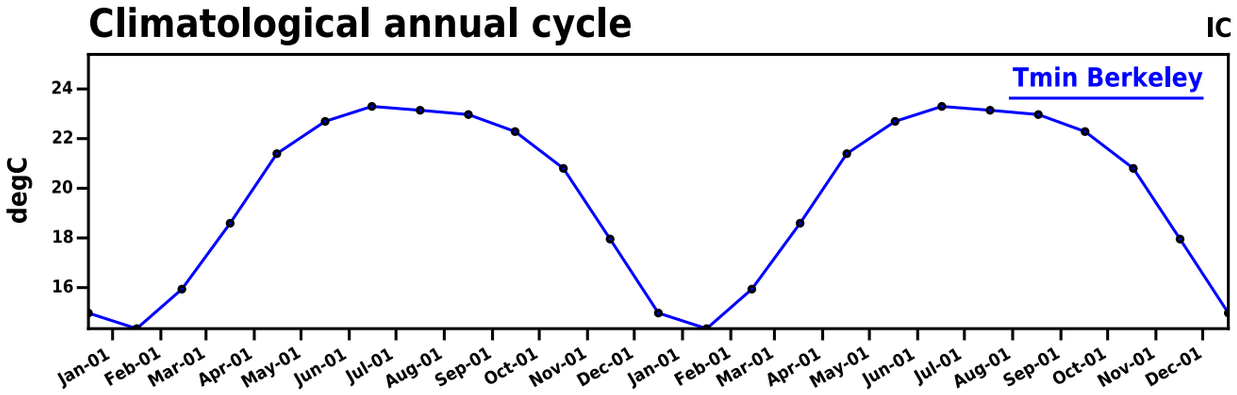


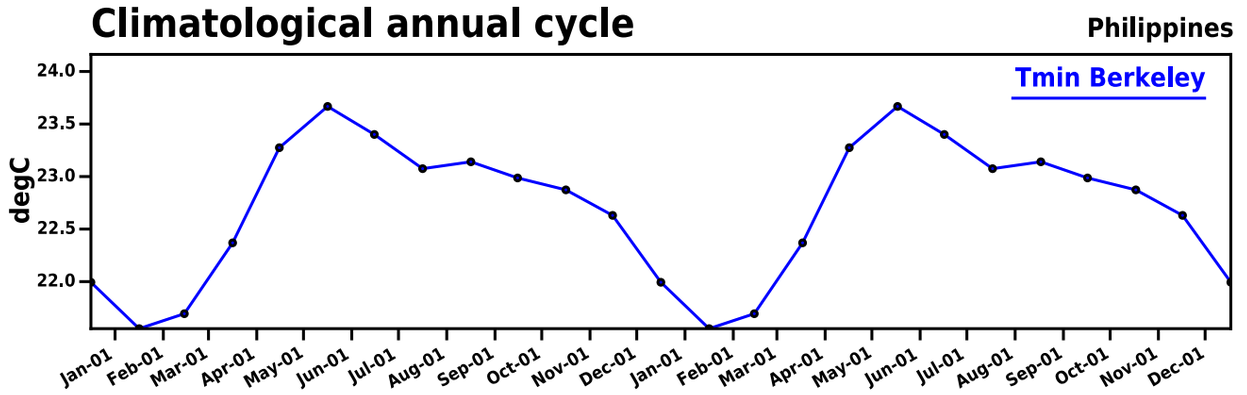


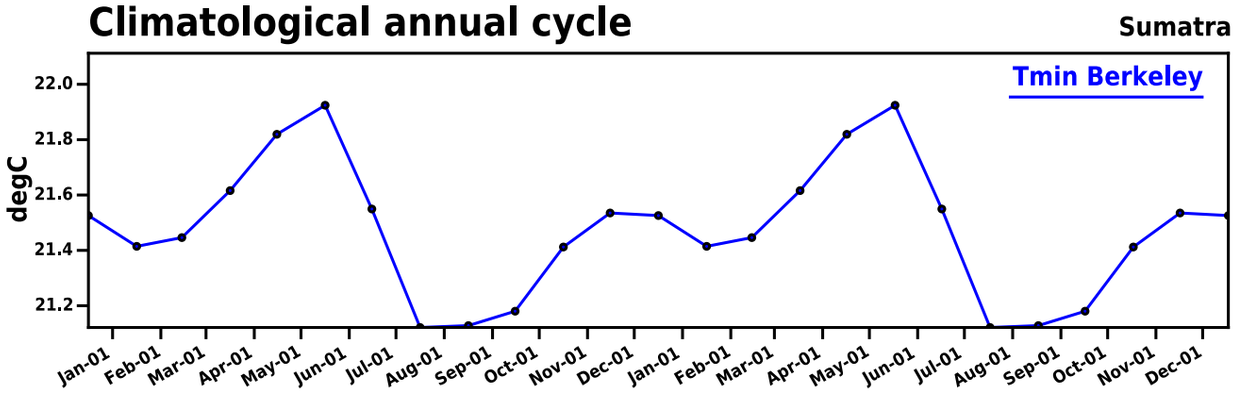


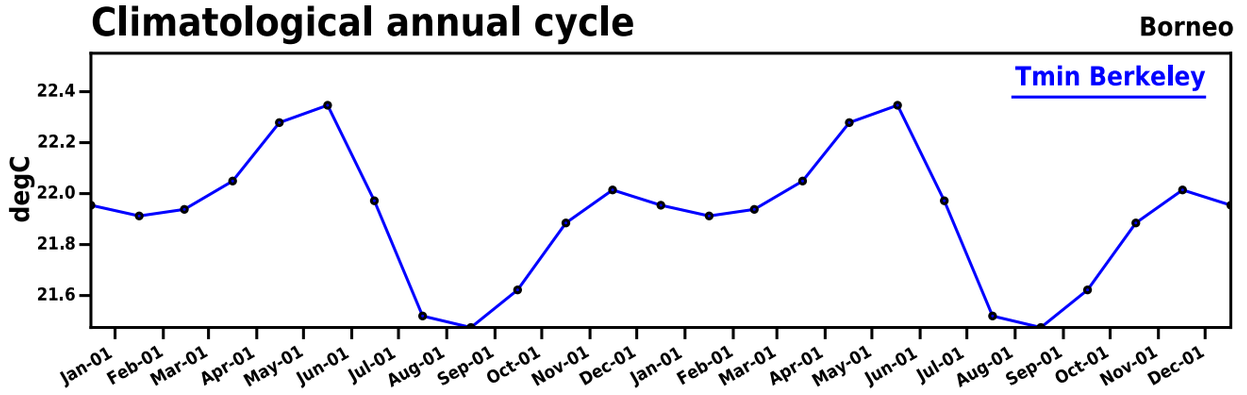


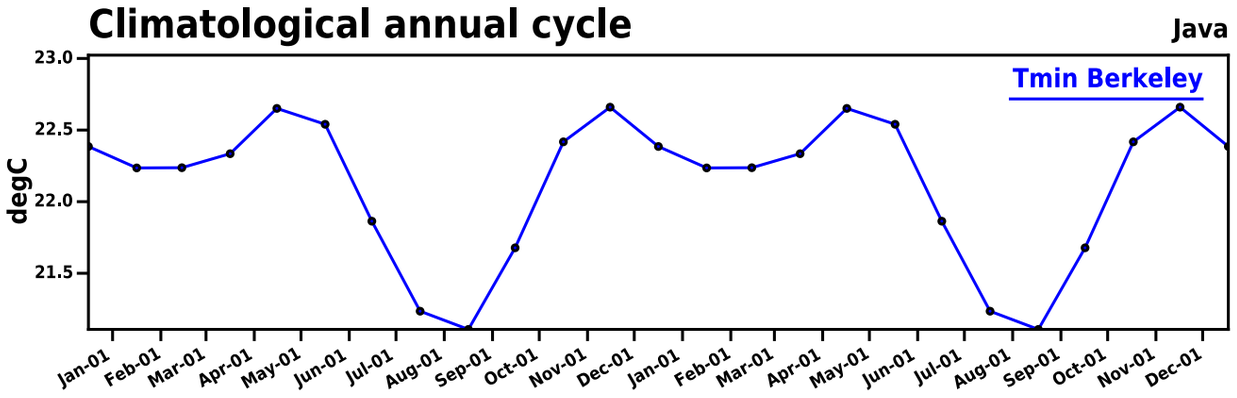
Tmin annual cycle

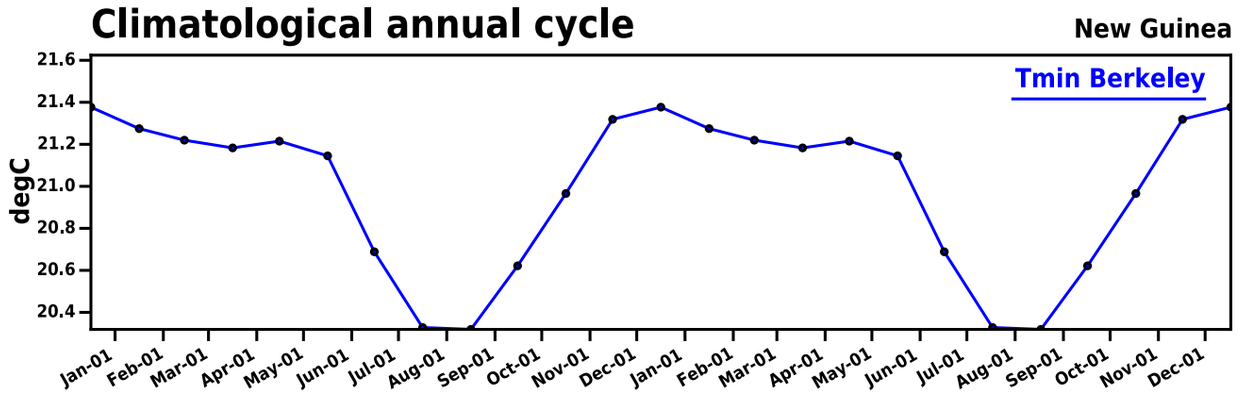












The order of the hot (cool) season from north to south is following the smooth transition of the heating source from Asian summer to Asian winter monsoon (Lau and Chan, 1983)

Correlation
IC
Philippines
Sumatra
Borneo
Java
New Guinea

Hot season
4~7
4~8
2~6
4~6
4~5/9~11
11~1

Tmax

Correlation
IC
Philippines
Sumatra
Borneo
Java
New Guinea

Cool season
12~2
1~2
7~9
7~9
7~8/1~2
7~8

Tmin

Correlation	Obs
IC	0.50*
Philippines	0.53*
Sumatra	0.64*
Borneo	0.49
Java	0.62*/0.08
New Guinea	0.19

Hot season
4~7
4~8
2~6
4~6
4~5/9~11
11~1

Monthly TX90p
Hot season
El nino, La Nina
lead-lag correlation

Correlation	Obs
IC	-0.63*
Philippines	-0.28
Sumatra	0.27
Borneo	0.24
Java	-0.97/0.64
New Guinea	-0.47

Cool season
12~2
1~2
7~9
7~9
7~8/1~2
7~8

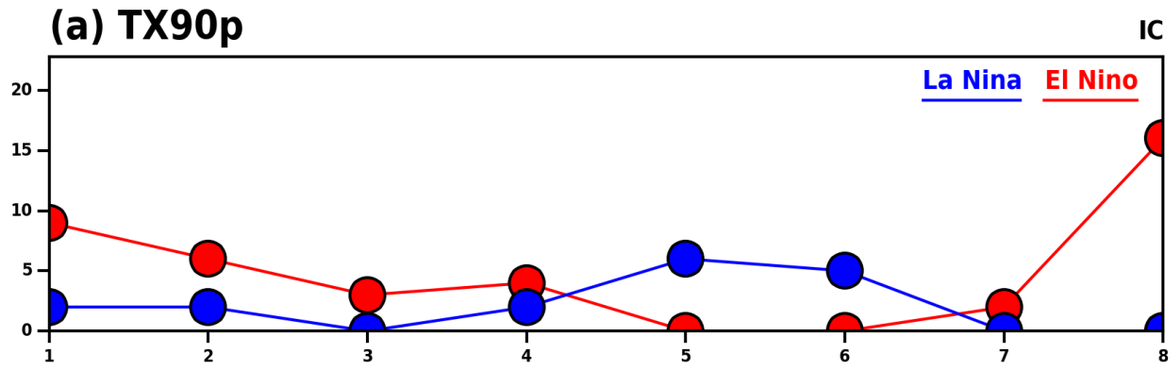
Monthly -TN10p
Cool season
El nino, La Nina
lead-lag correlation

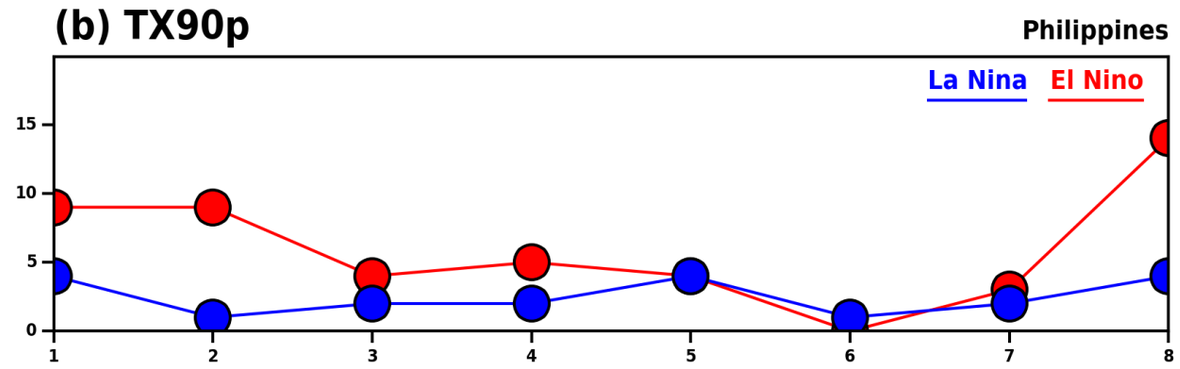
Generally, warm days has strong relationship with ENSO. cool nights has weak relationship with ENSO.

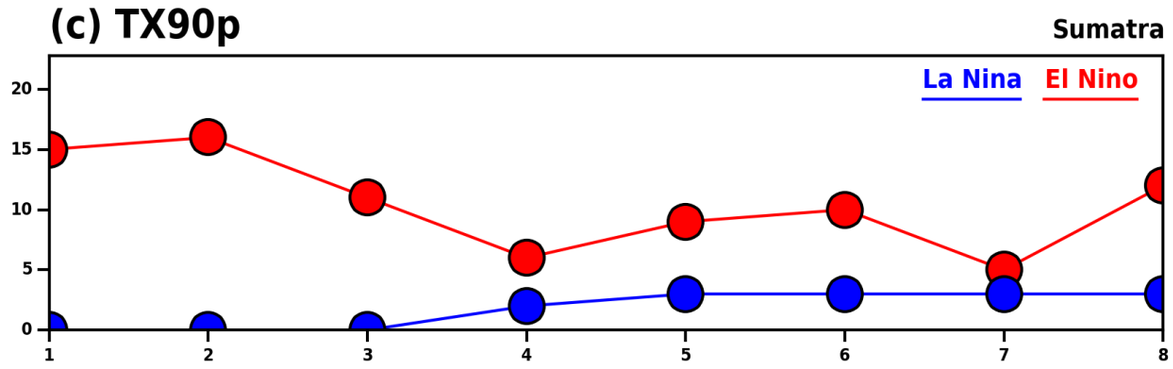
The relation between extreme temperature and ENSO can be explained by using capacitor theory (Xie et al, 2009): When ENSO becomes mature in boreal winter, the signal can be stored in Indian Ocean. After ENSO decay in Mar to May, that stored signal begin to return to Pacific Ocean. So the maritime continent is on the pathway of that heat waves.

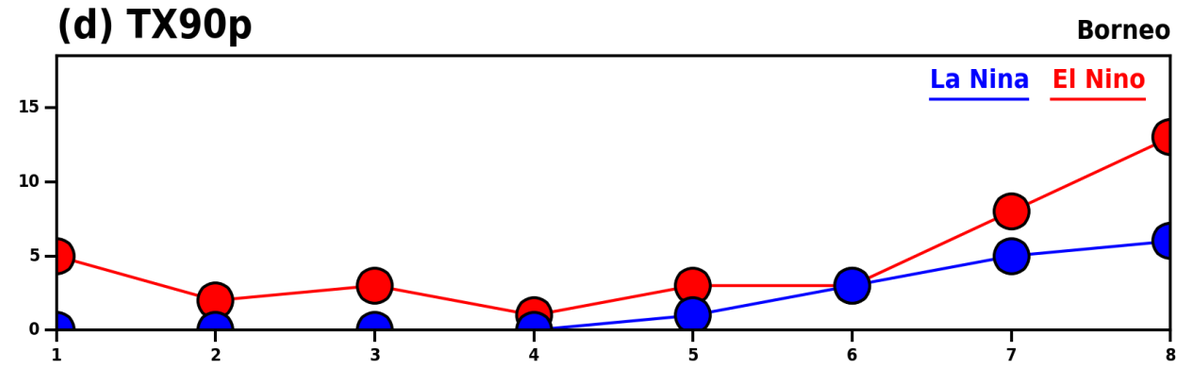
Correlation between localized MJO index (MJOI) and extreme temperature is kind of low. Therefore is not shown here.

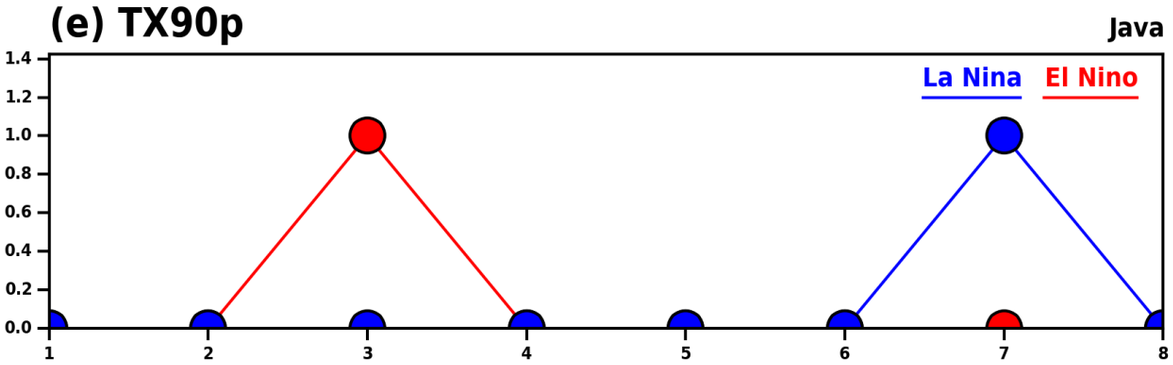
However, the composite study was conducted as follows.

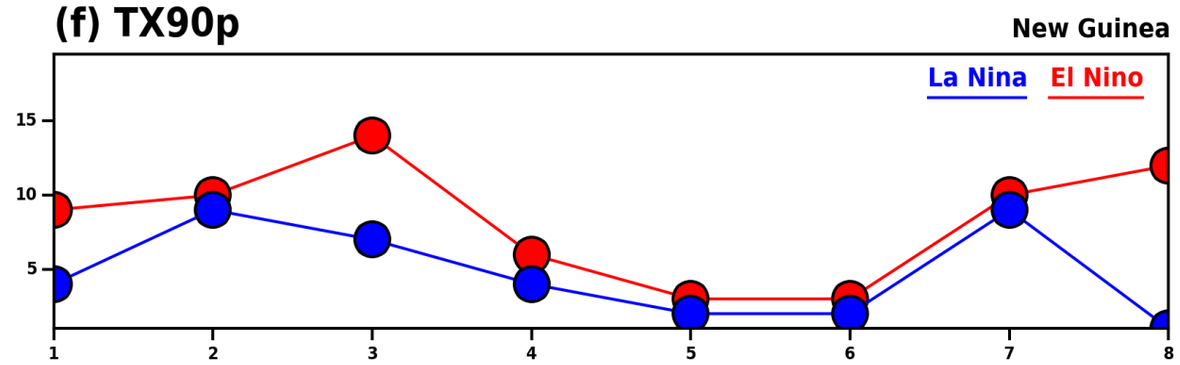




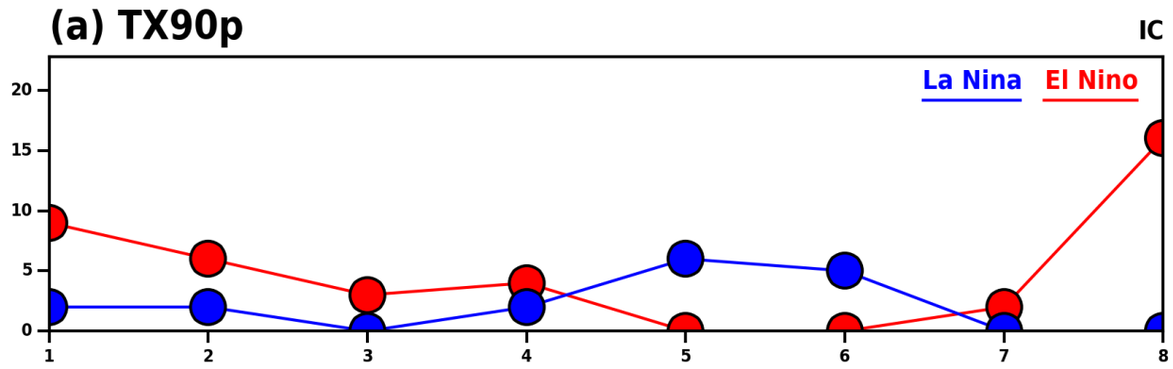


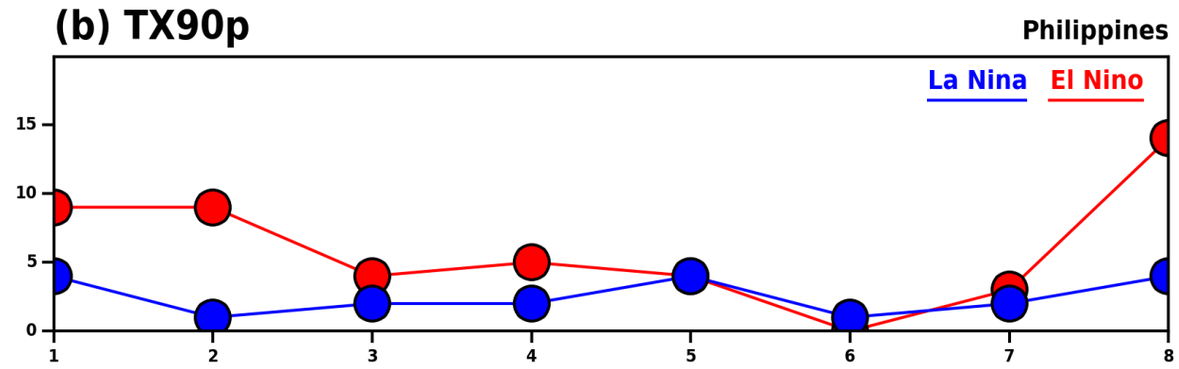


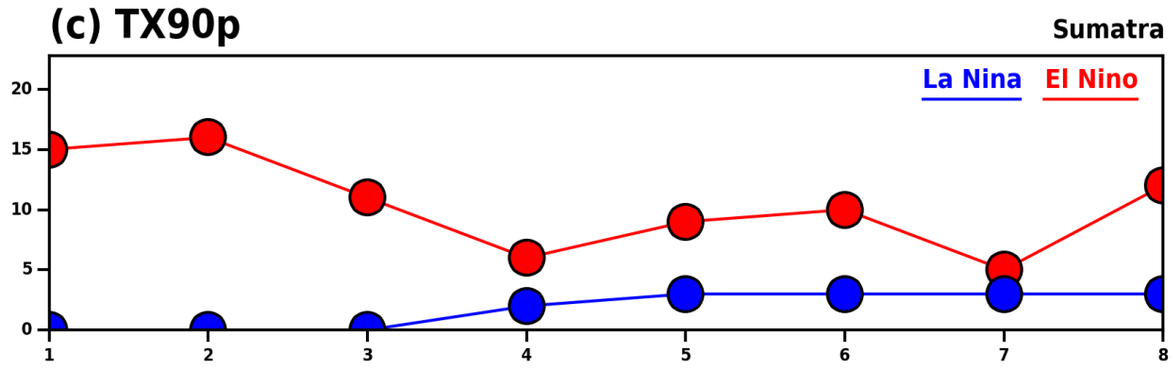


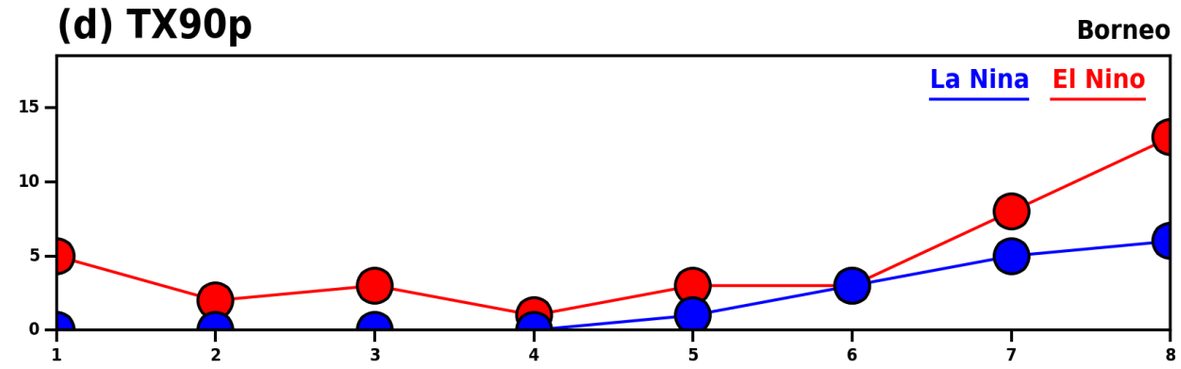


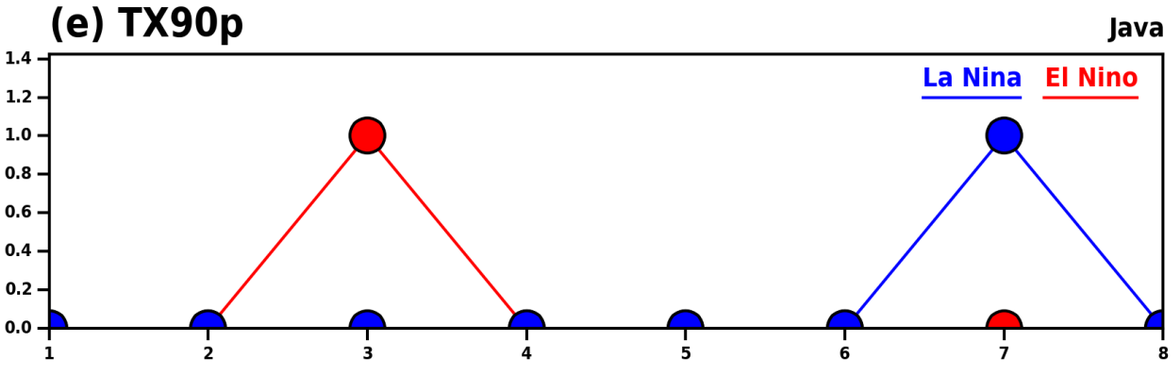
Warm days as a function of ENSO and MJO

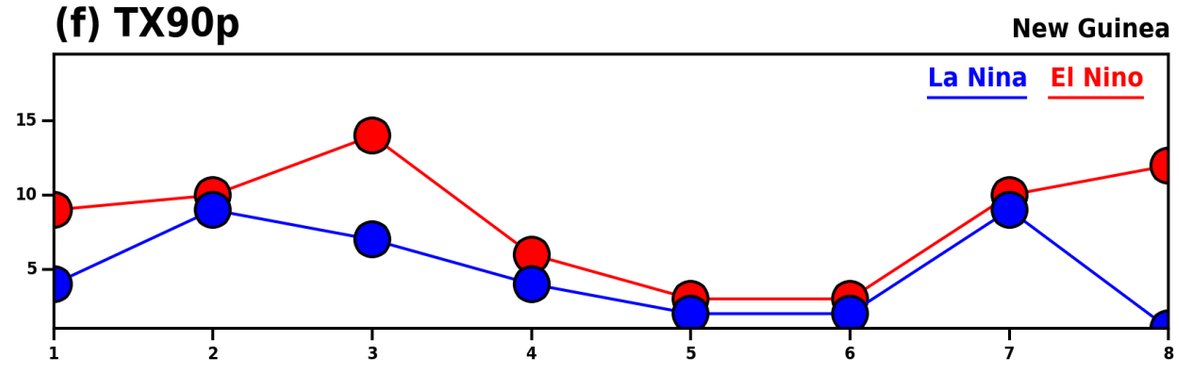




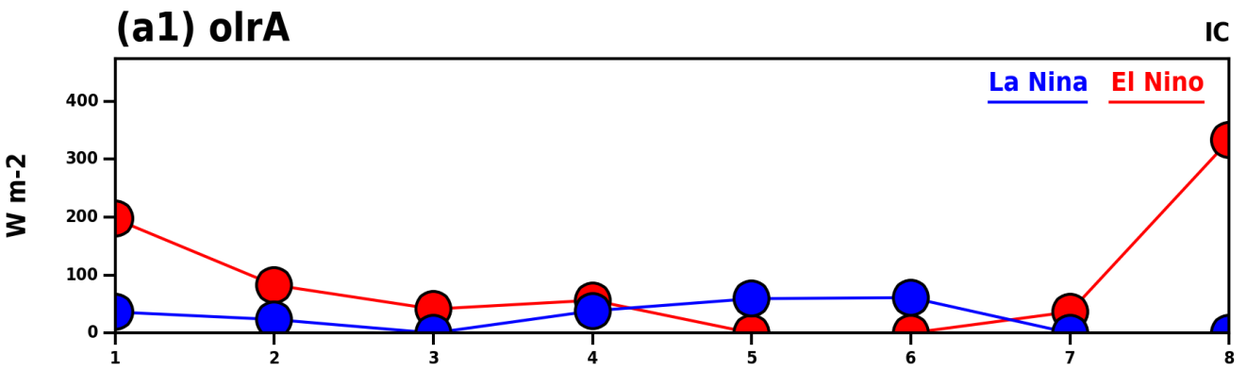


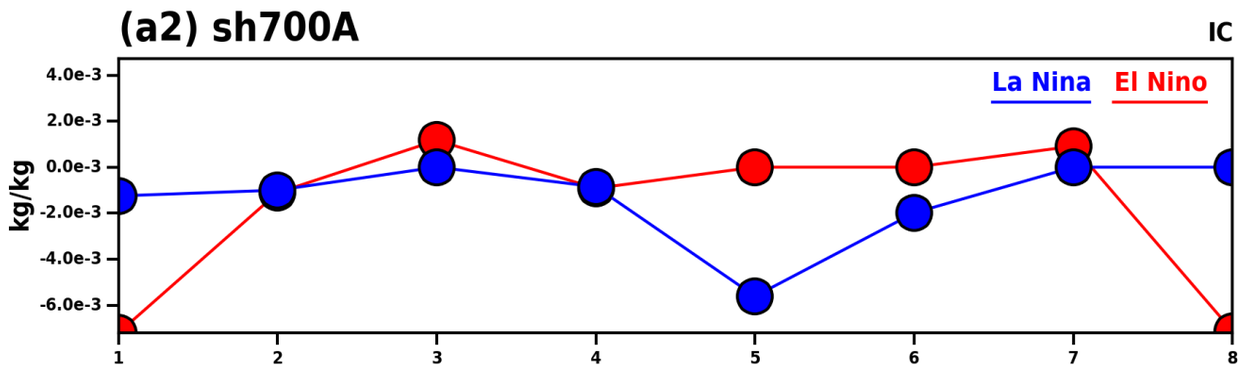


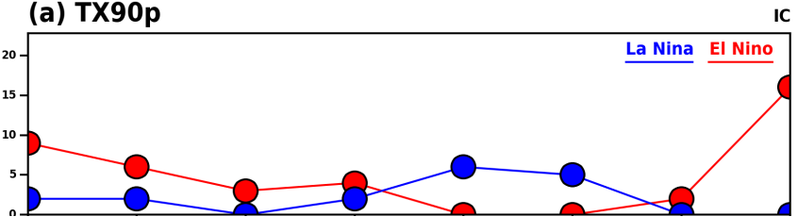


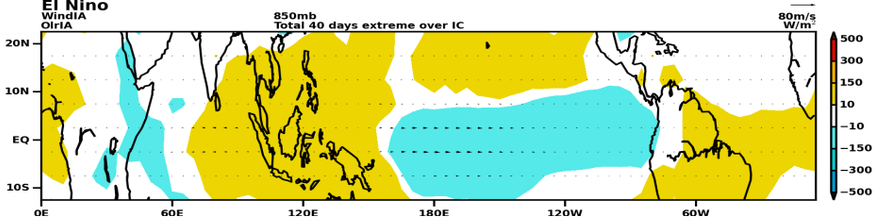


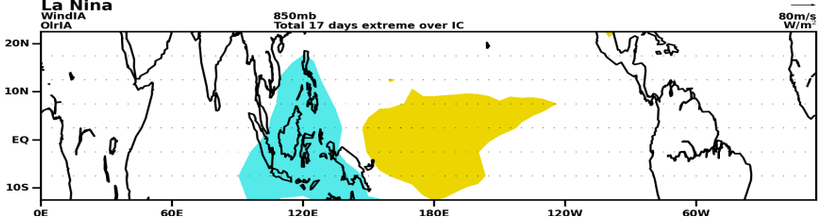
Extreme as a function of ENSO and MJO is consistent with the anomaly of OLR and SH at 700mb

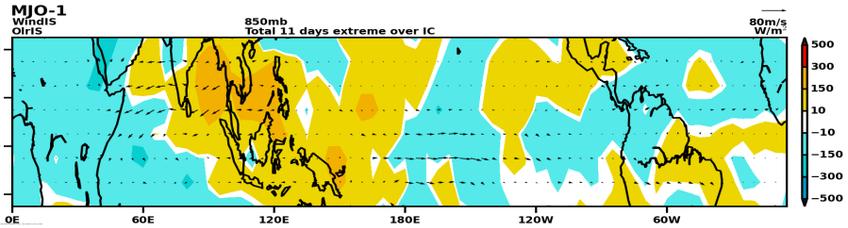


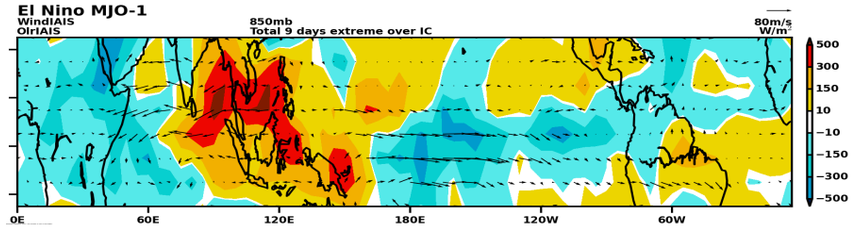


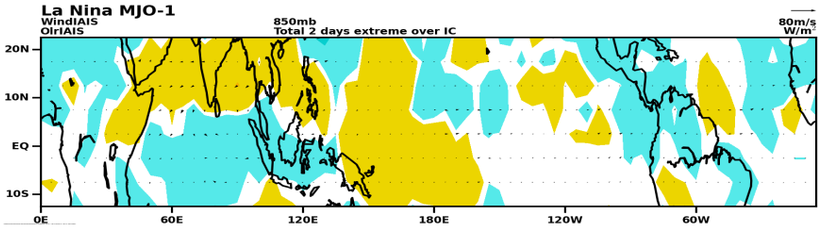

(a) TX90p
IC
La Nina
El Nino
20
15
10
5
0

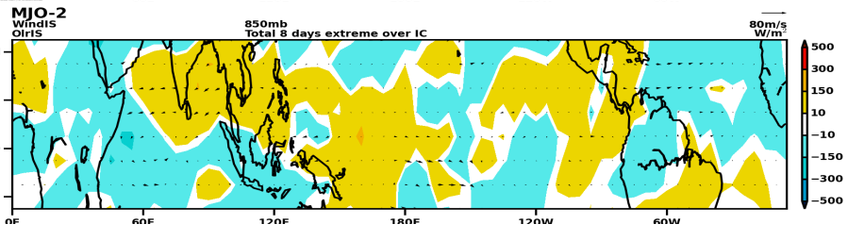

El Nino
WindIA
OlrIA
850mb
Total 40 days extreme over IC
80m/s
W/m²
20N
10N
EQ
10S
0E
60E
120E
180E
120W
60W
500
300
150
10
−10
−150
−300
−500

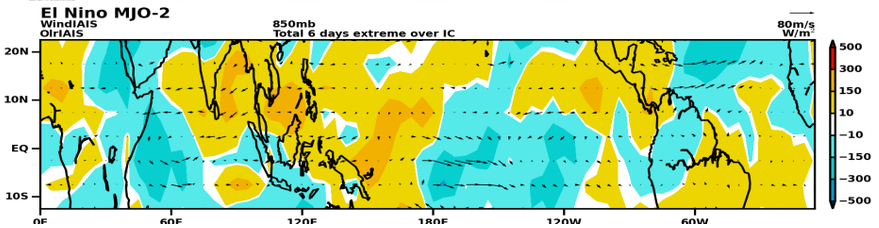

La Nina
WindIA
OlrIA
850mb
Total 17 days extreme over IC
80m/s
W/m²
20N
10N
EQ
10S
0E
60E
120E
180E
120W
60W

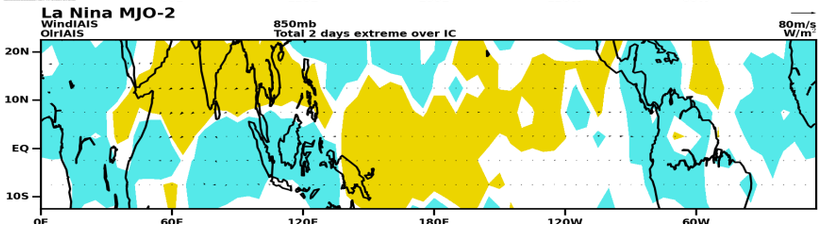

MJO-1
WindIS
OlrIS
850mb
Total 11 days extreme over IC
80m/s
W/m²
0E
60E
120E
180E
120W
60W
500
300
150
10
−10
−150
−300
−500

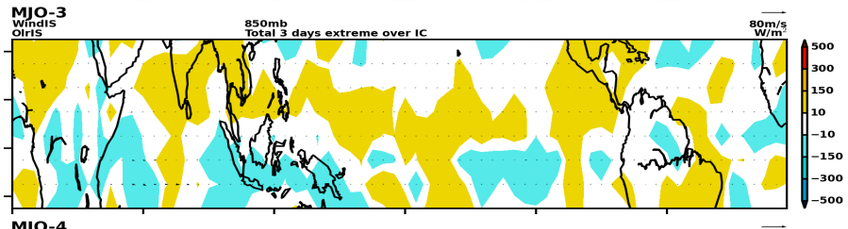

El Nino MJO-1
WindIAIS
OlrIAIS
850mb
Total 9 days extreme over IC
80m/s
W/m²
0E
60E
120E
180E
120W
60W
500
300
150
10
−10
−150
−300
−500

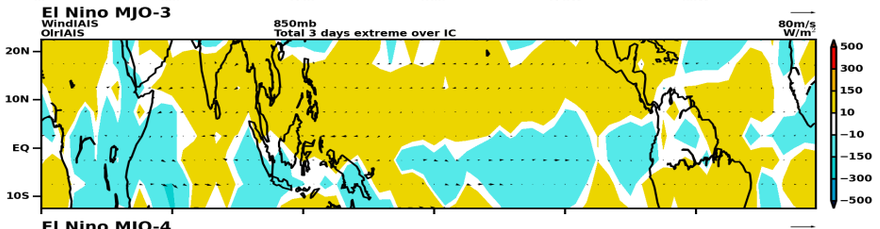

La Nina MJO-1
WindIAIS
OlrIAIS
850mb
Total 2 days extreme over IC
80m/s
W/m²
20N
10N
EQ
10S
0E
60E
120E
180E
120W
60W

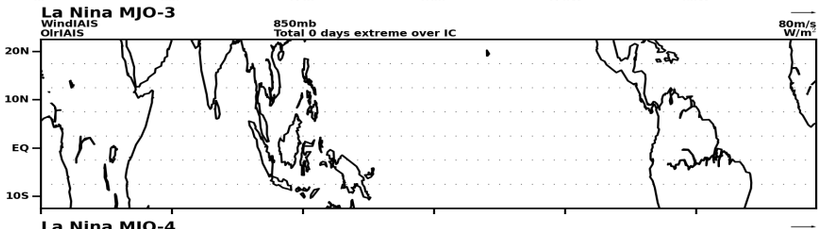

MJO-2
WindIS
OlrIS
850mb
Total 8 days extreme over IC
80m/s
W/m²
0E
60E
120E
180E
120W
60W
500
300
150
10
−10
−150
−300
−500

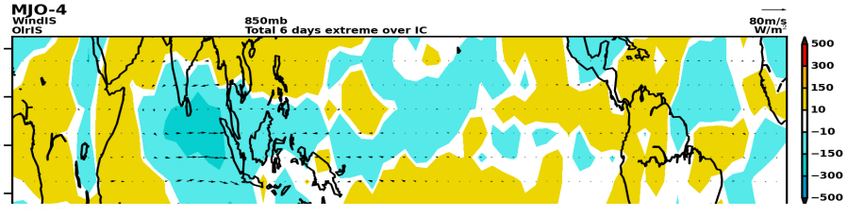

El Nino MJO-2
WindIAIS
OlrIAIS
850mb
Total 6 days extreme over IC
80m/s
W/m²
20N
10N
EQ
10S
0E
60E
120E
180E
120W
60W
500
300
150
10
−10
−150
−300
−500

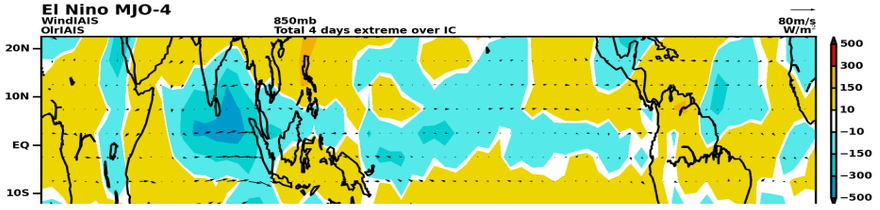

La Nina MJO-2
WindIAIS
OlrIAIS
850mb
Total 2 days extreme over IC
80m/s
W/m²
20N
10N
EQ
10S
0E
60E
120E
180E
120W
60W

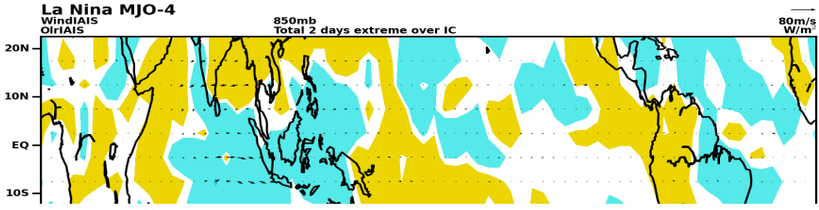

MJO-3
WindIS
OlrIS
850mb
Total 3 days extreme over IC
80m/s
W/m²
0E
60E
120E
180E
120W
60W
500
300
150
10
−10
−150
−300
−500

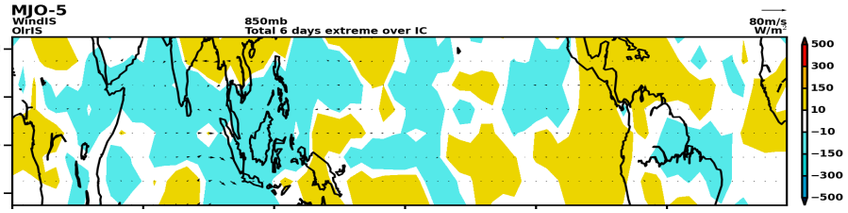

El Nino MJO-3
WindIAIS
OlrIAIS
850mb
Total 3 days extreme over IC
80m/s
W/m²
20N
10N
EQ
10S
0E
60E
120E
180E
120W
60W
500
300
150
10
−10
−150
−300
−500

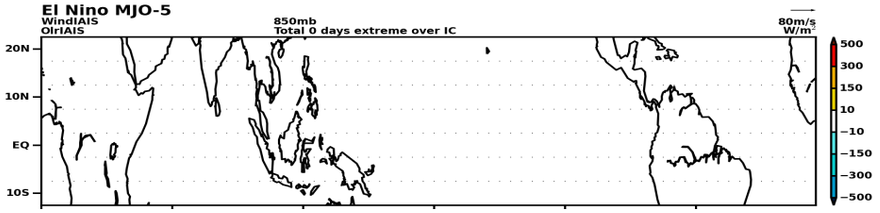

La Nina MJO-3
WindIAIS
OlrIAIS
850mb
Total 0 days extreme over IC
80m/s
W/m²
20N
10N
EQ
10S
0E
60E
120E
180E
120W
60W

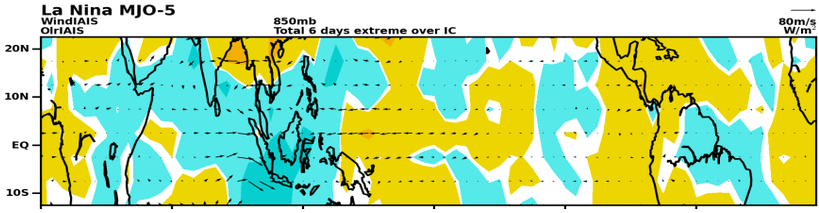

MJO-4
WindIS
OlrIS
850mb
Total 6 days extreme over IC
80m/s
W/m²
0E
60E
120E
180E
120W
60W
500
300
150
10
−10
−150
−300
−500

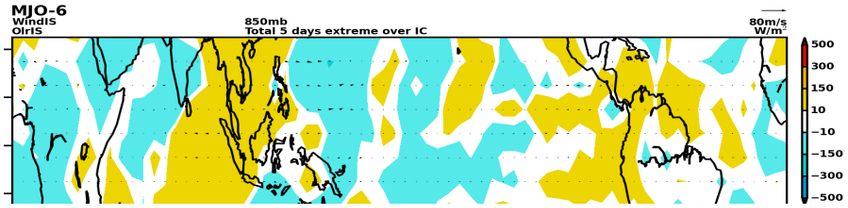

El Nino MJO-4
WindIAIS
OlrIAIS
850mb
Total 4 days extreme over IC
80m/s
W/m²
20N
10N
EQ
10S
0E
60E
120E
180E
120W
60W
500
300
150
10
−10
−150
−300
−500

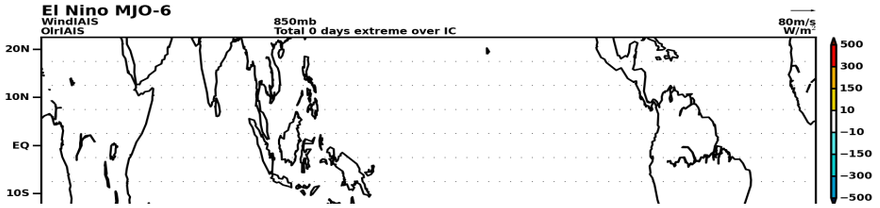

La Nina MJO-4
WindIAIS
OlrIAIS
850mb
Total 2 days extreme over IC
80m/s
W/m²
20N
10N
EQ
10S
0E
60E
120E
180E
120W
60W

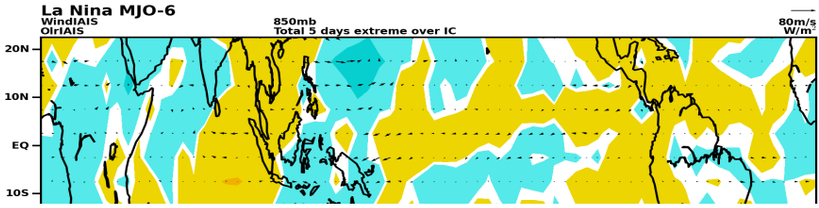

MJO-5
WindIS
OlrIS
850mb
Total 6 days extreme over IC
80m/s
W/m²
0E
60E
120E
180E
120W
60W
500
300
150
10
−10
−150
−300
−500

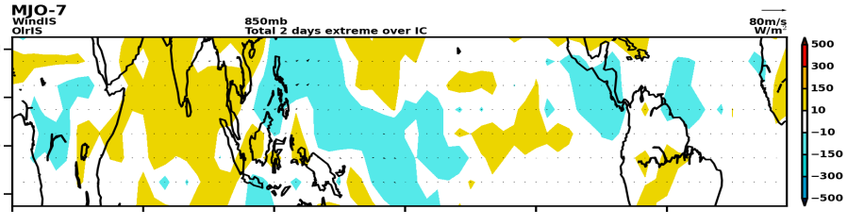

El Nino MJO-5
WindIAIS
OlrIAIS
850mb
Total 0 days extreme over IC
80m/s
W/m²
20N
10N
EQ
10S
0E
60E
120E
180E
120W
60W
500
300
150
10
−10
−150
−300
−500

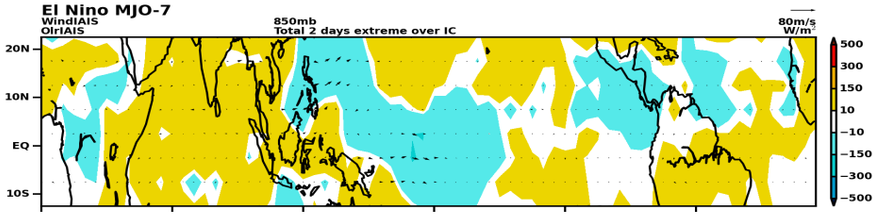

La Nina MJO-5
WindIAIS
OlrIAIS
850mb
Total 6 days extreme over IC
80m/s
W/m²
20N
10N
EQ
10S
0E
60E
120E
180E
120W
60W

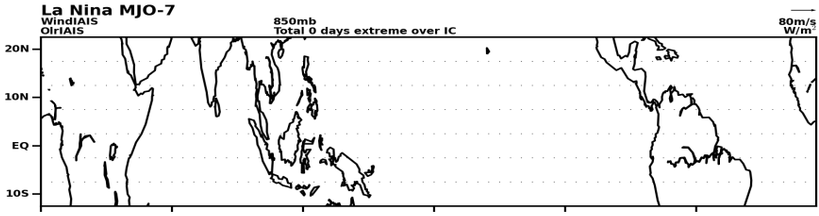

MJO-6
WindIS
OlrIS
850mb
Total 5 days extreme over IC
80m/s
W/m²
0E
60E
120E
180E
120W
60W
500
300
150
10
−10
−150
−300
−500

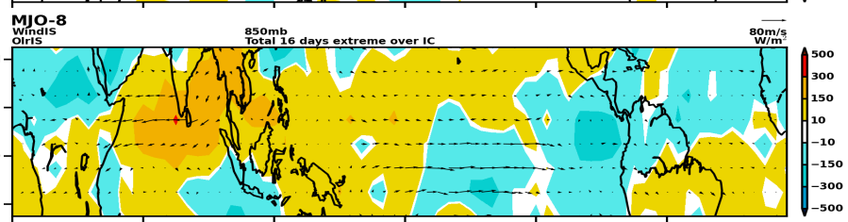

El Nino MJO-6
WindIAIS
OlrIAIS
850mb
Total 0 days extreme over IC
80m/s
W/m²
20N
10N
EQ
10S
0E
60E
120E
180E
120W
60W
500
300
150
10
−10
−150
−300
−500

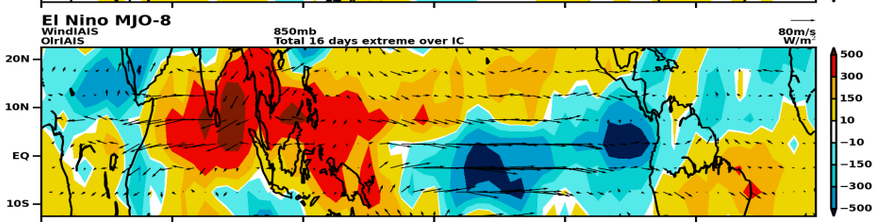

La Nina MJO-6
WindIAIS
OlrIAIS
850mb
Total 5 days extreme over IC
80m/s
W/m²
20N
10N
EQ
10S
0E
60E
120E
180E
120W
60W

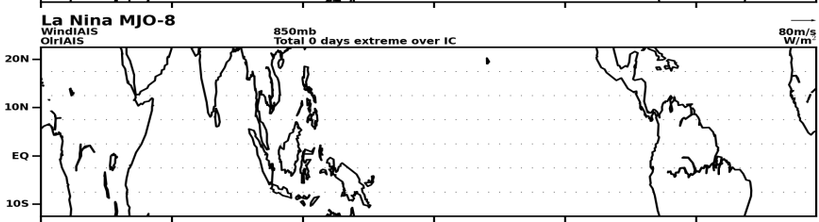

MJO-7
WindIS
OlrIS
850mb
Total 2 days extreme over IC
80m/s
W/m²
0E
60E
120E
180E
120W
60W
500
300
150
10
−10
−150
−300
−500


El Nino MJO-7
WindIAIS
OlrIAIS
850mb
Total 2 days extreme over IC
80m/s
W/m²
20N
10N
EQ
10S
0E
60E
120E
180E
120W
60W
500
300
150
10
−10
−150
−300
−500


La Nina MJO-7
WindIAIS
OlrIAIS
850mb
Total 0 days extreme over IC
80m/s
W/m²
20N
10N
EQ
10S
0E
60E
120E
180E
120W
60W

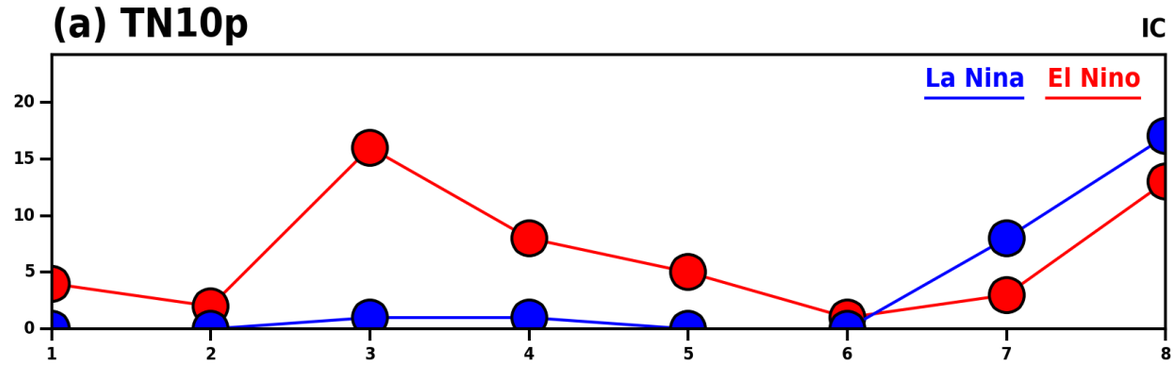

MJO-8
WindIS
OlrIS
850mb
Total 16 days extreme over IC
80m/s
W/m²
0E
60E
120E
180E
120W
60W
500
300
150
10
−10
−150
−300
−500

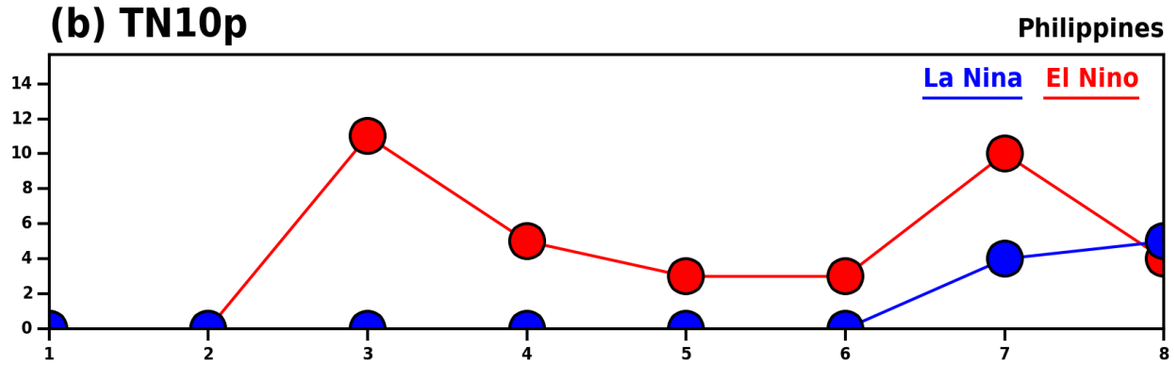

El Nino MJO-8
WindIAIS
OlrIAIS
850mb
Total 16 days extreme over IC
80m/s
W/m²
20N
10N
EQ
10S
0E
60E
120E
180E
120W
60W
500
300
150
10
−10
−150
−300
−500

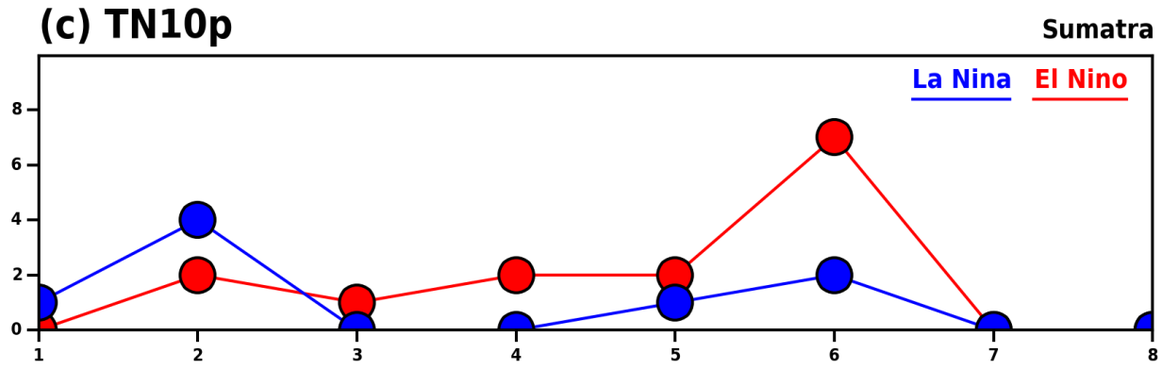

La Nina MJO-8
WindIAIS
OlrIAIS
850mb
Total 0 days extreme over IC
80m/s
W/m²
20N
10N
EQ
10S
0E
60E
120E
180E
120W
60W

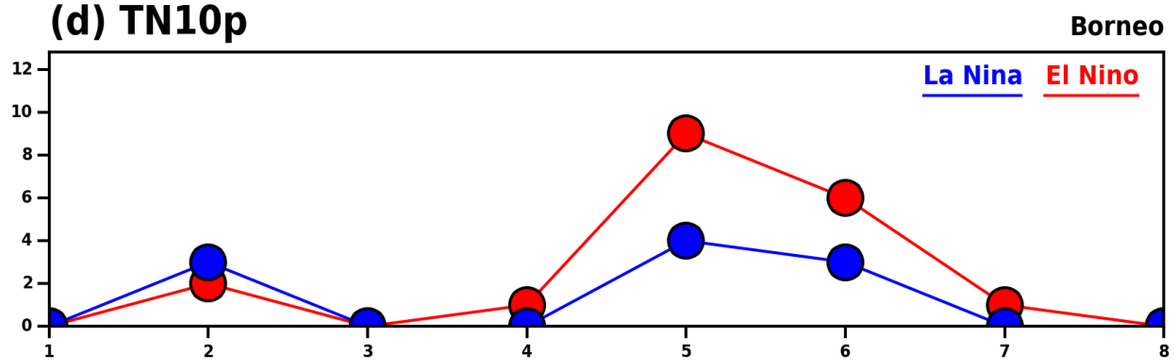
When the lower convergence and divergence anomaly of MJO traveled east, it encountered the subsidence (ascent) anomaly of ENSO. The overlapped downdraft anomaly would increase OLR and increase hot days and cool nights, therefore enhance the extremes

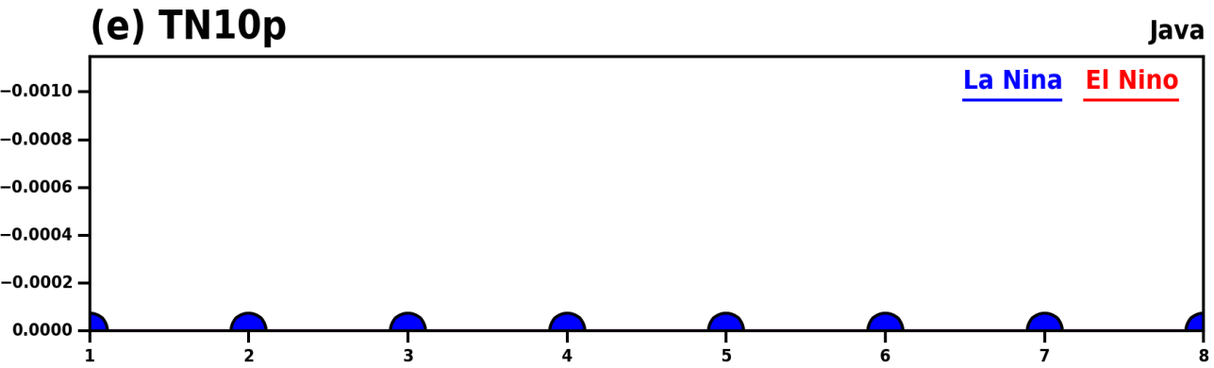
Thus, El Nino events are generally favorable extreme tempetures over the Maritime Continent, but modulated by MJO.


(a) TN10p
IC
La Nina
El Nino
20
15
10
5
0
1
2
3
4
5
6
7
8


(b) TN10p
Philippines
La Nina
El Nino
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8


(c) TN10p
Sumatra
La Nina
El Nino
8
6
4
2
0
1
2
3
4
5
6
7
8


(d) TN10p
Borneo
La Nina
El Nino
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8


(e) TN10p
Java
La Nina
El Nino
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−0.0006
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1
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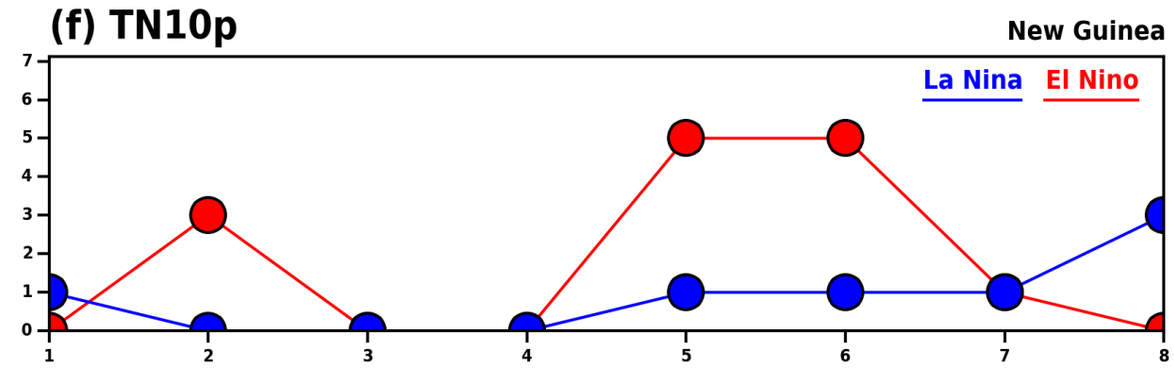
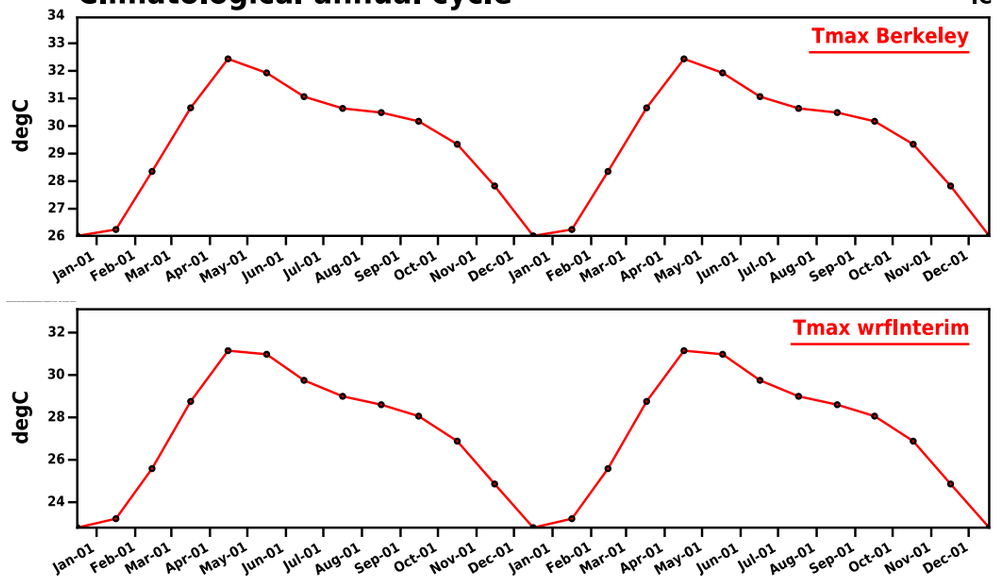
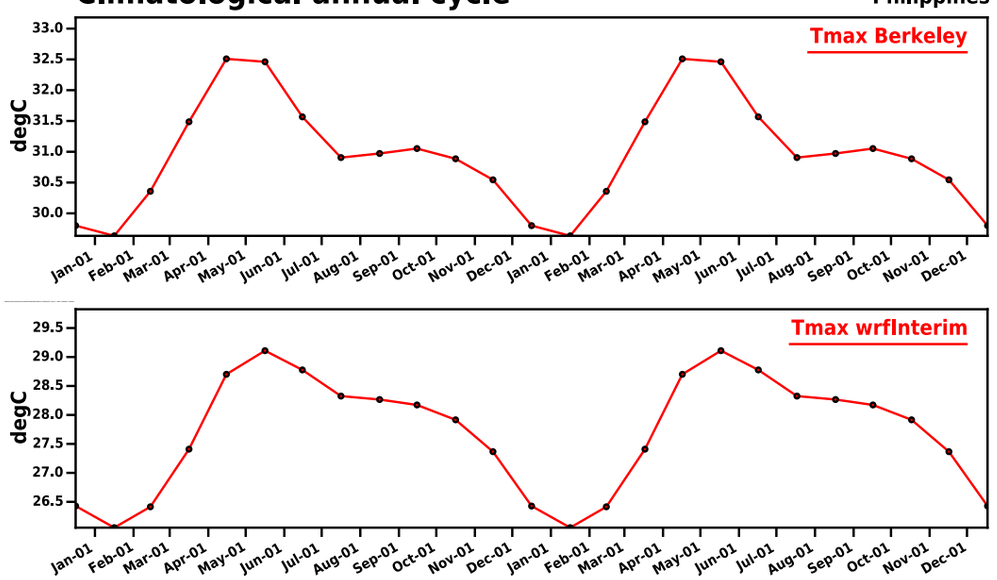

(f) TN10p
New Guinea
La Nina
El Nino
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
8

Hindcast experiment

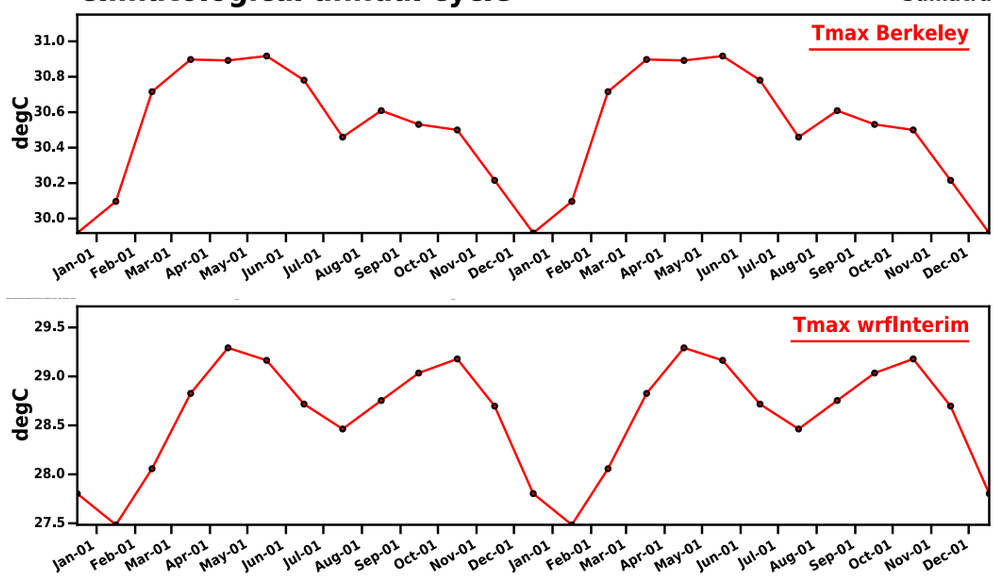
Climatological annual cycle — IC



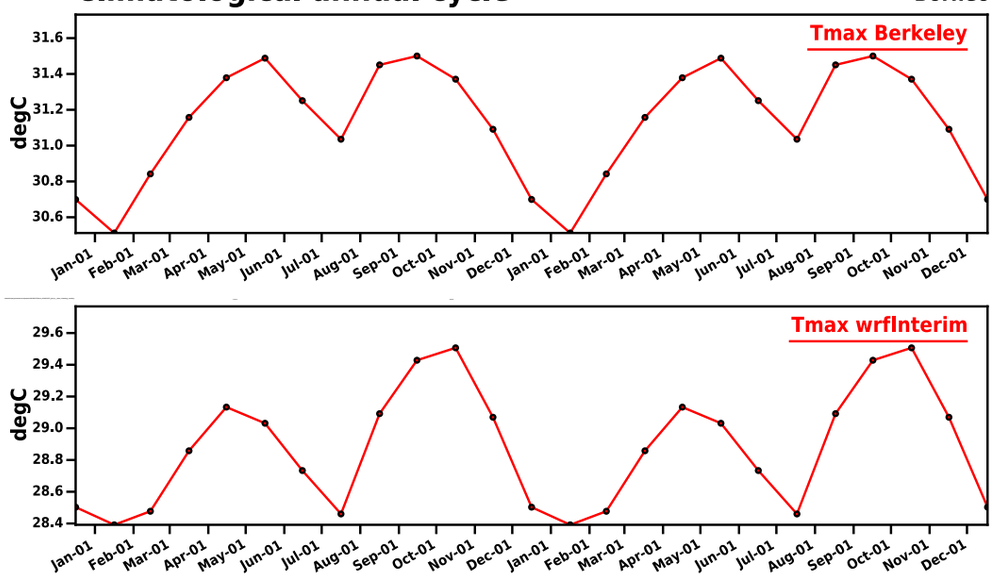
Climatological annual cycle — Philippines



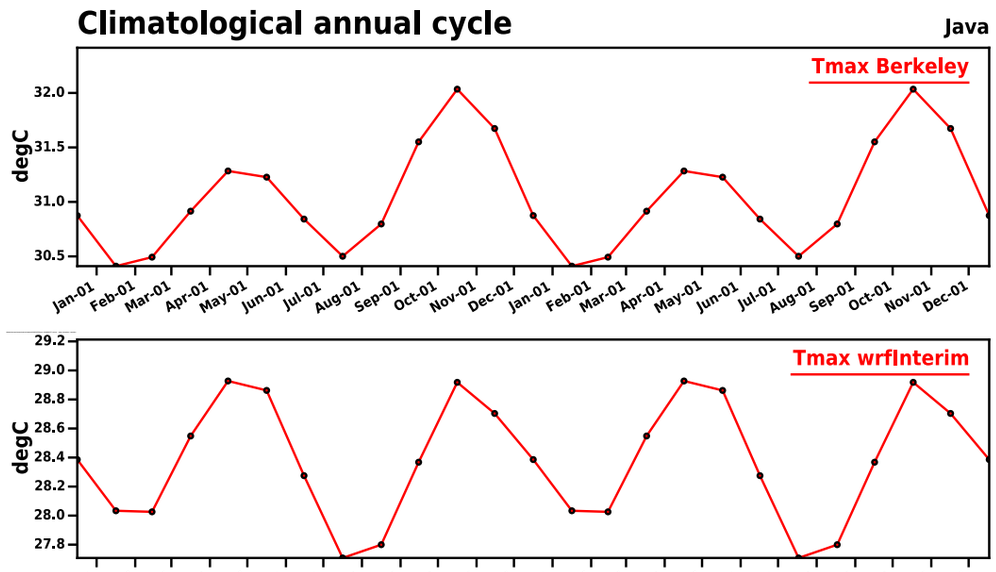
Climatological annual cycle — Sumatra



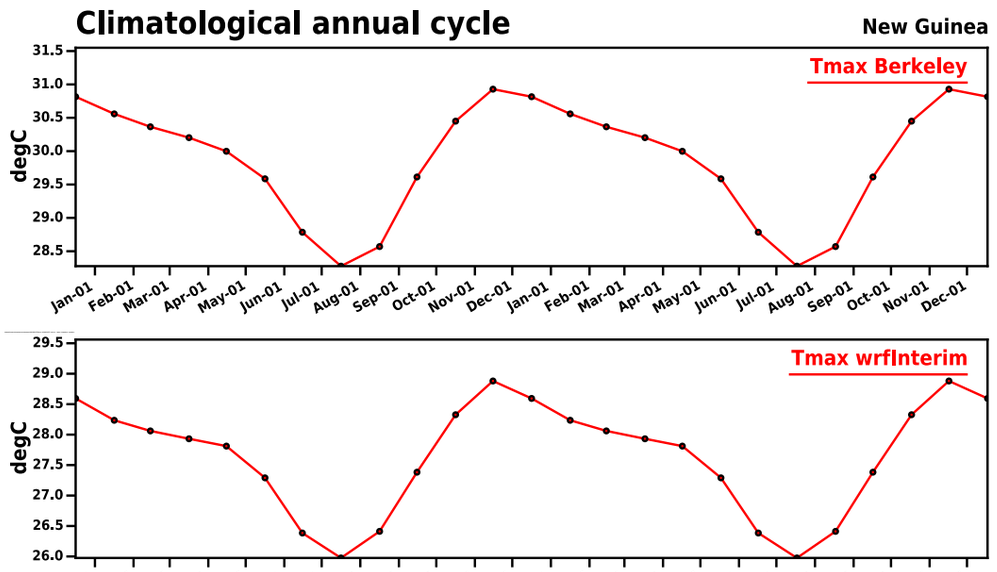
Climatological annual cycle — Borneo



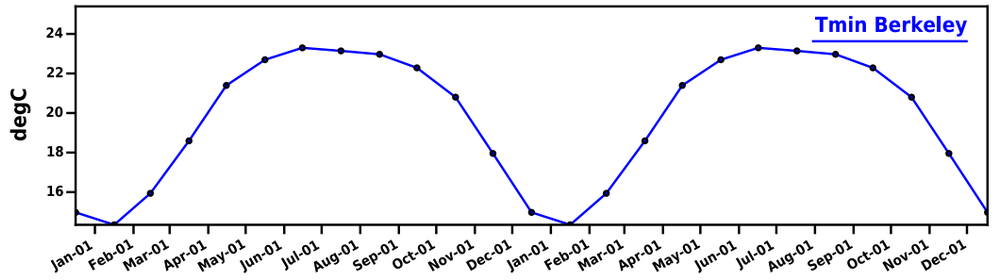
Climatological annual cycle — Java

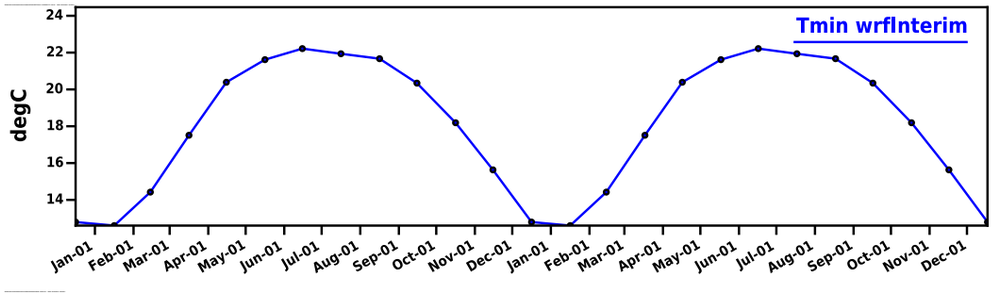


Climatological annual cycle — New Guinea

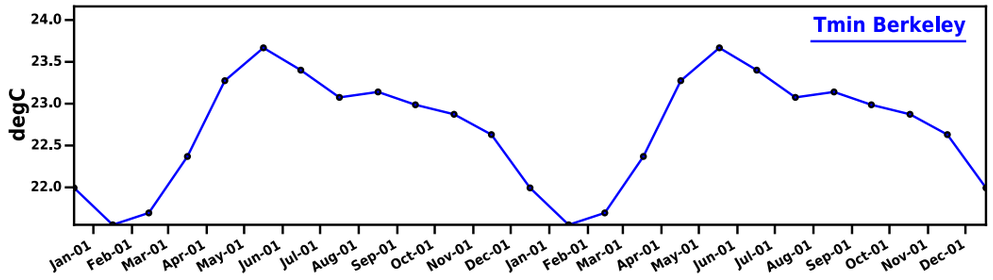


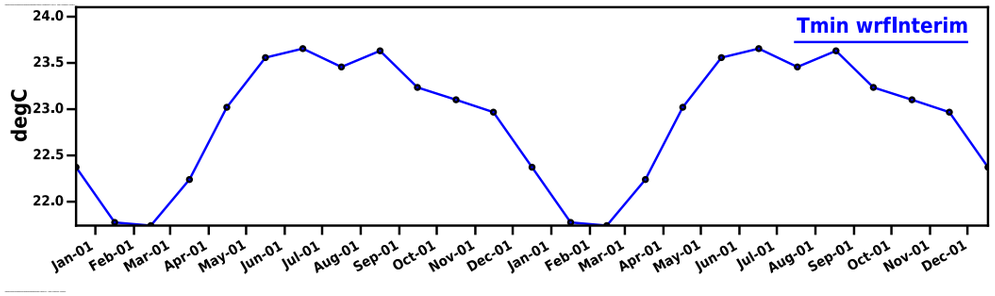
Climatological annual cycle — IC



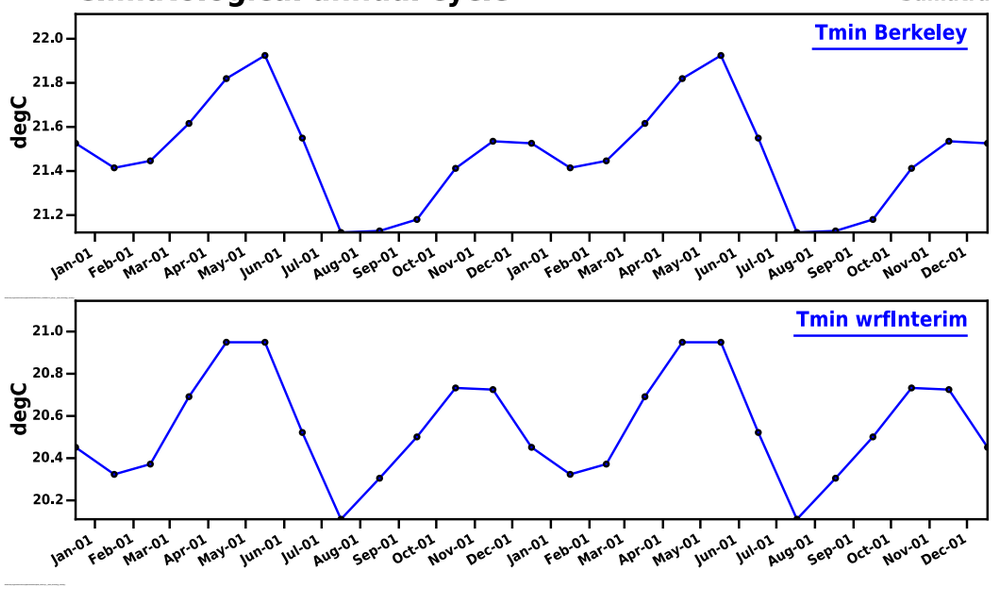


Climatological annual cycle — Philippines

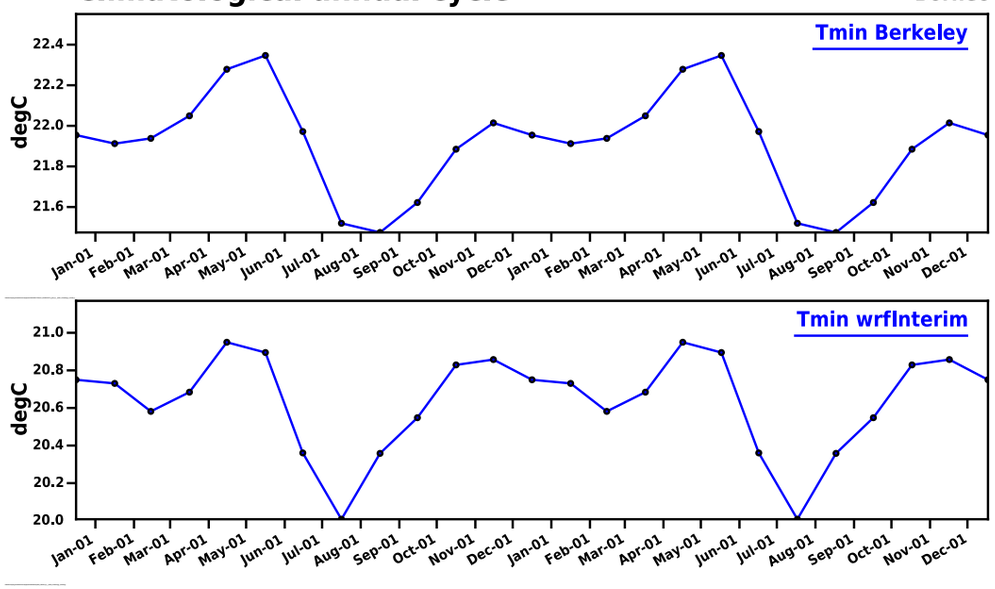




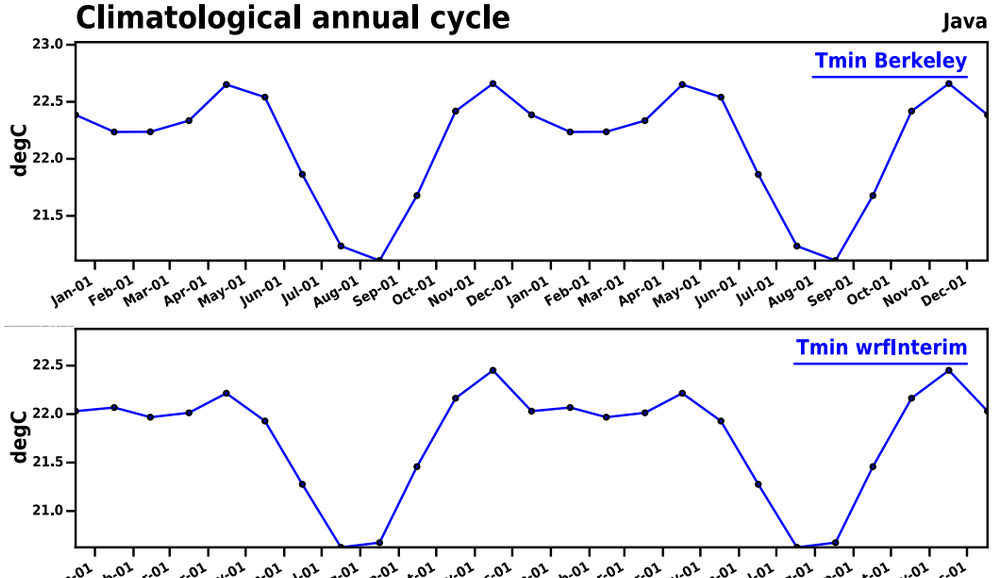
Climatological annual cycle — Sumatra



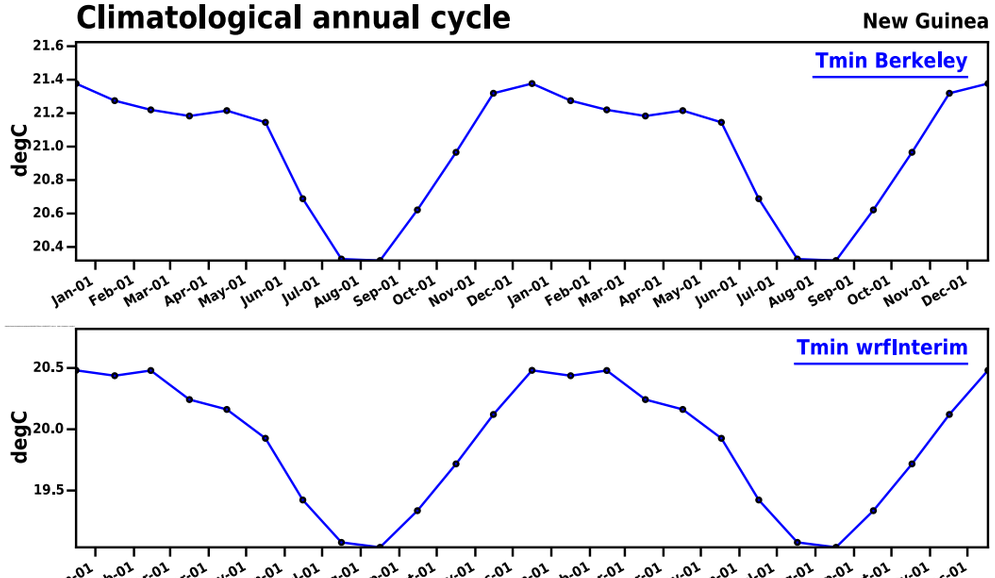
Climatological annual cycle — Borneo



Climatological annual cycle — Java



Climatological annual cycle — New Guinea



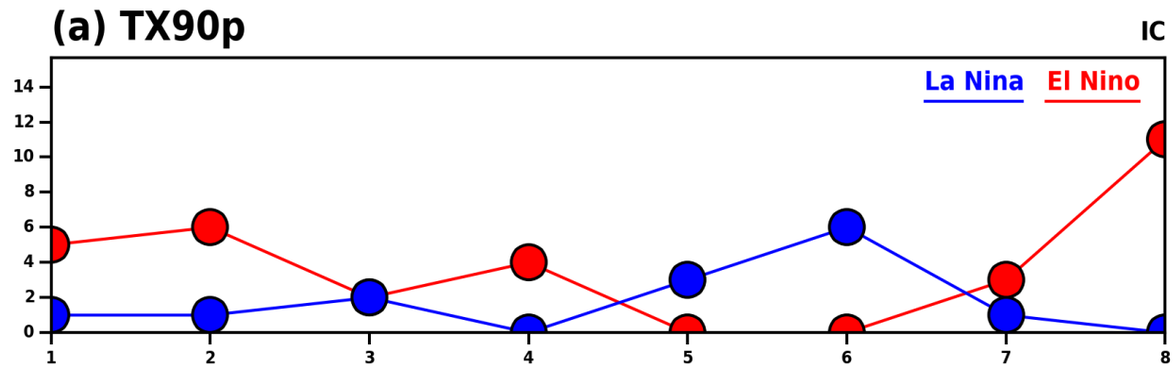
The annual cycle in the hindcast experiment generally showed the reasonable results compared with the observation

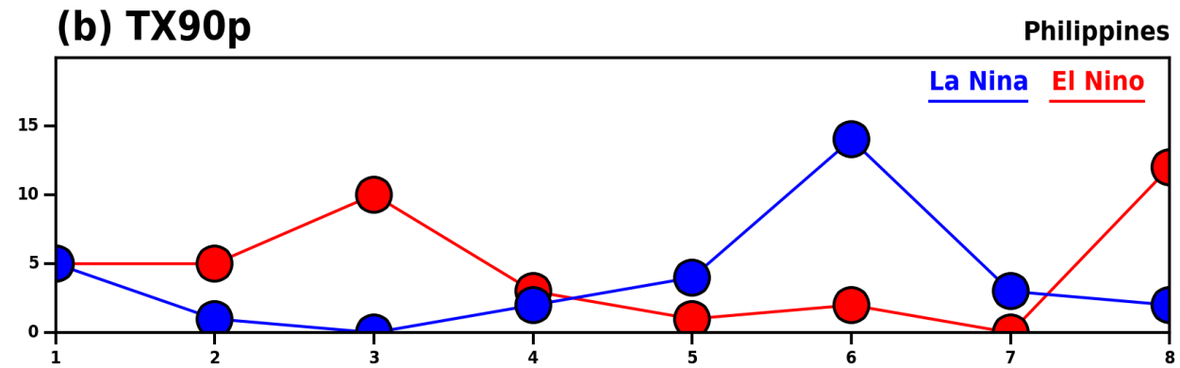
Correlation	Obs	Hindcast	Hot season
IC	0.50*	0.14	4~7
Philippines	0.53*	0.39*	4~8
Sumatra	0.64*	0.59*	2~6
Borneo	0.49	0.62*	4~6
Java	0.62*/0.08	0.71*/0.17	4~5/9~11
New Guinea	0.19	0.32	11~1

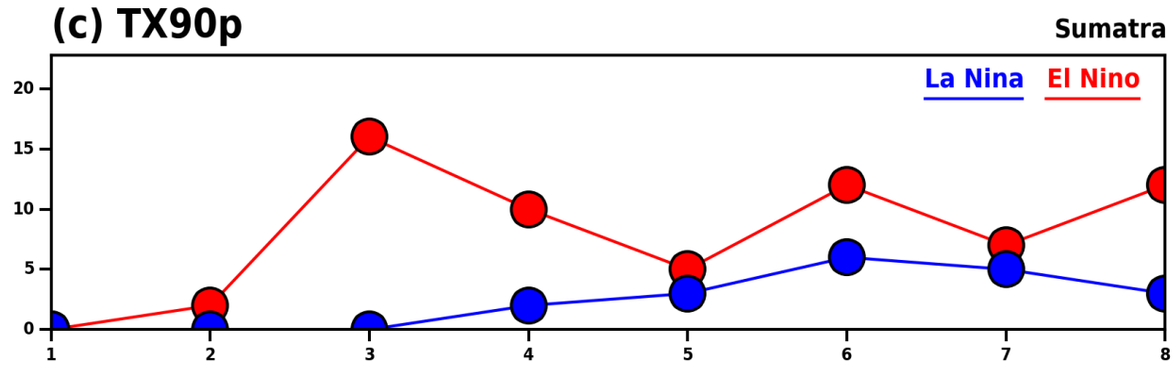
Monthly TX90p
Hot season
El nino, La Nina
lead-lag correlation

Correlation	Obs	Hindcast	Cool season
IC	-0.63*	0.14	12~2
Philippines	-0.28	-0.12	1~2
Sumatra	0.27	0.37	7~9
Borneo	0.24	-0.42	7~9
Java	-0.97/0.64	None/-0.34	7~8/1~2
New Guinea	-0.47	-0.01	7~8

Monthly -TN10p
Cool season
El nino, La Nina
lead-lag correlation


(a) TX90p
IC
La Nina
El Nino
0
2
4
6
8
10
12
14
1
2
3
4
5
6
7
8


(b) TX90p
Philippines
La Nina
El Nino
0
5
10
15
1
2
3
4
5
6
7
8


(c) TX90p
Sumatra
La Nina
El Nino
0
5
10
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20
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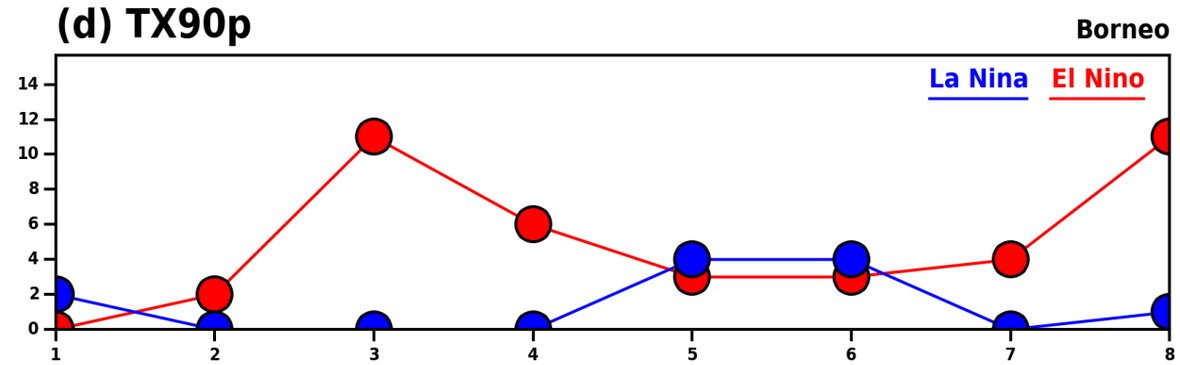
(d) TX90p
Borneo
La Nina
El Nino
0
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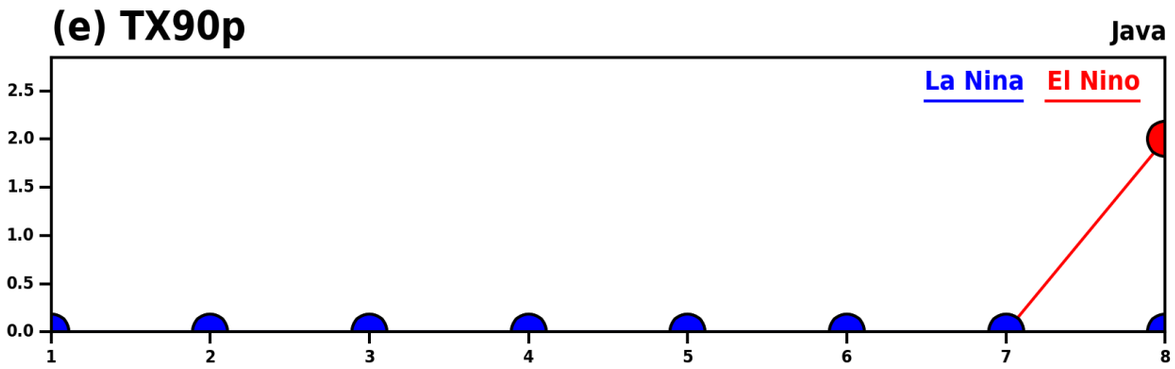
(e) TX90p
Java
La Nina
El Nino
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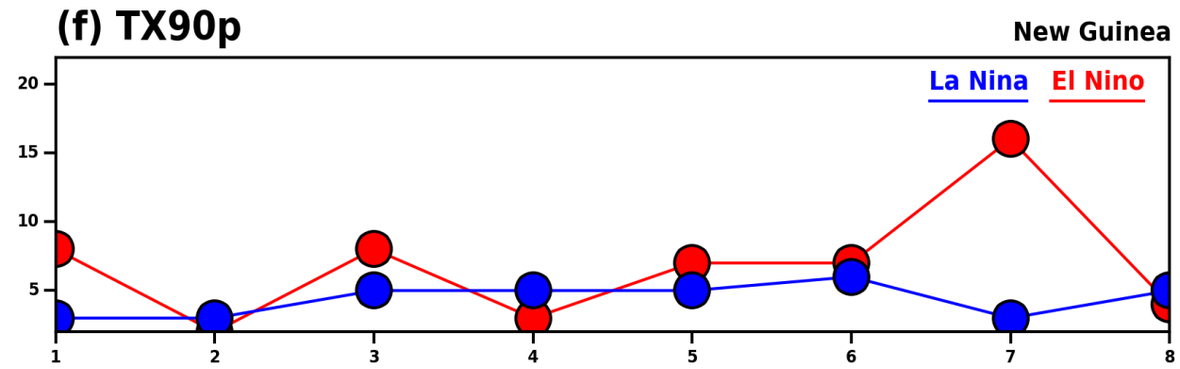
0.5
1.0
1.5
2.0
2.5
1
2
3
4
5
6
7
8


(f) TX90p
New Guinea
La Nina
El Nino
5
10
15
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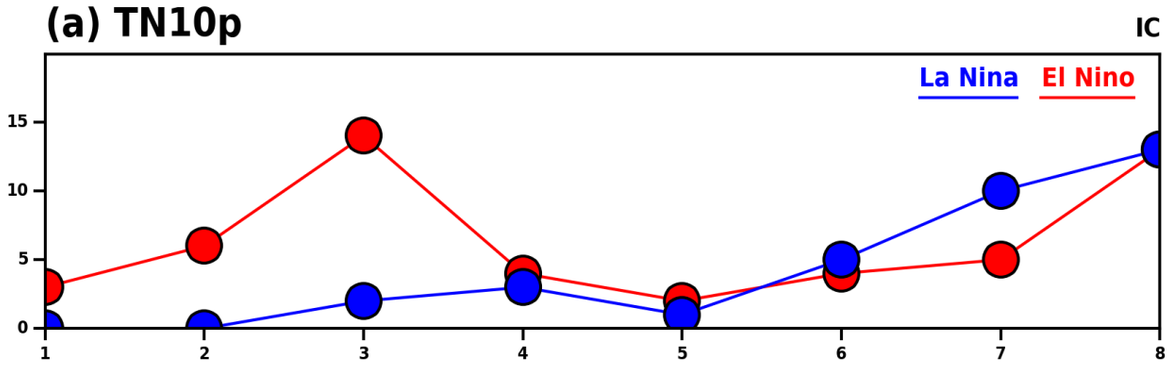
6
7
8


(a) TN10p
IC
La Nina
El Nino
15
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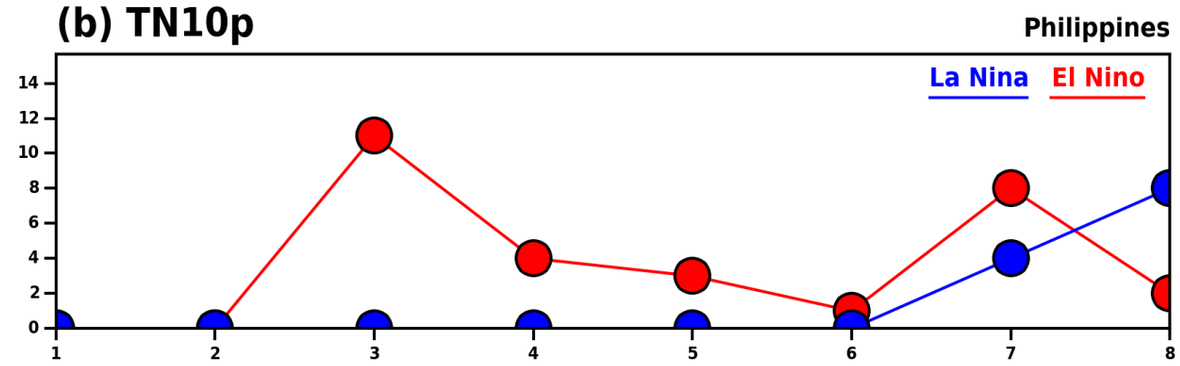
(b) TN10p
Philippines
La Nina
El Nino
14
12
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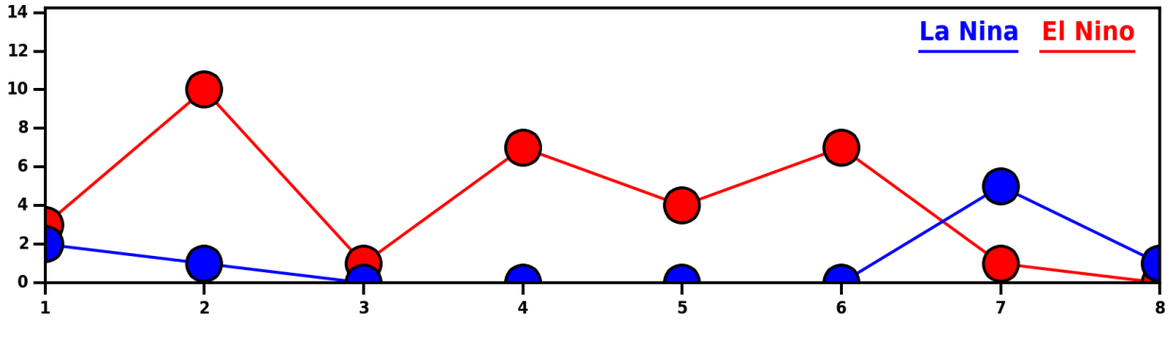
7
8


(c) TN10p
Sumatra
La Nina
El Nino
14
12
10
8
6
4
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0
1
2
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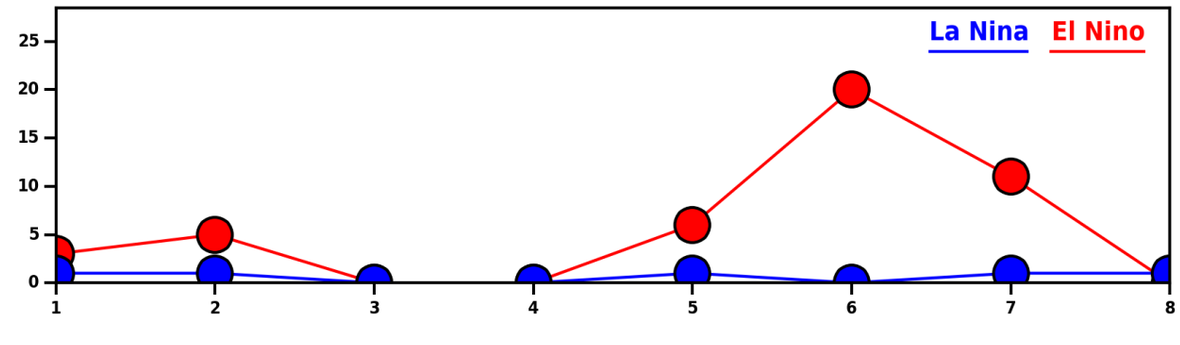
4
5
6
7
8


(d) TN10p
Borneo
La Nina
El Nino
25
20
15
10
5
0
1
2
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4
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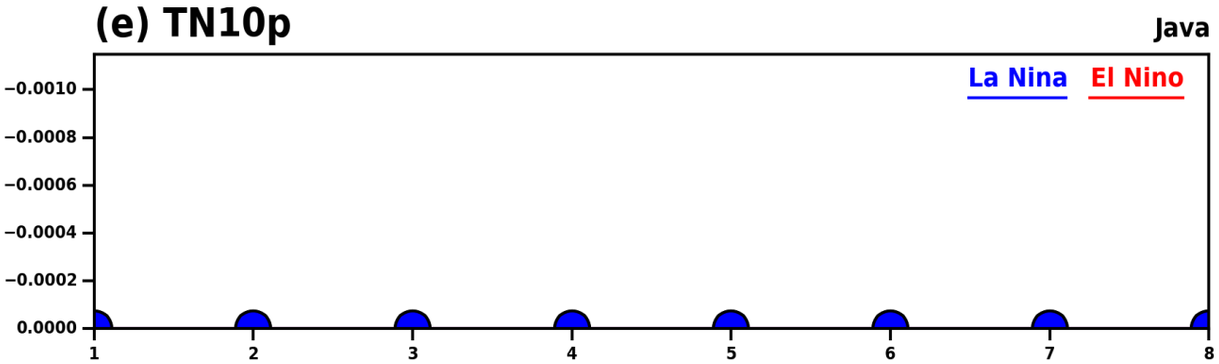
6
7
8


(e) TN10p
Java
La Nina
El Nino
−0.0010
−0.0008
−0.0006
−0.0004
−0.0002
0.0000
1
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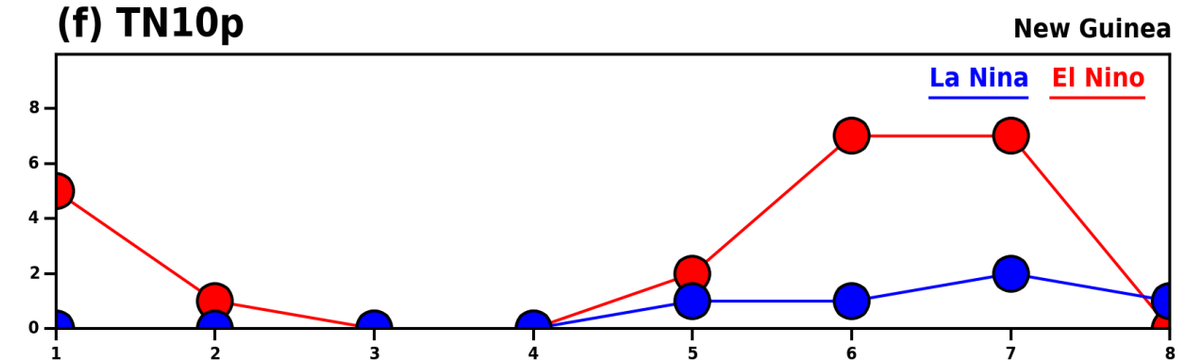
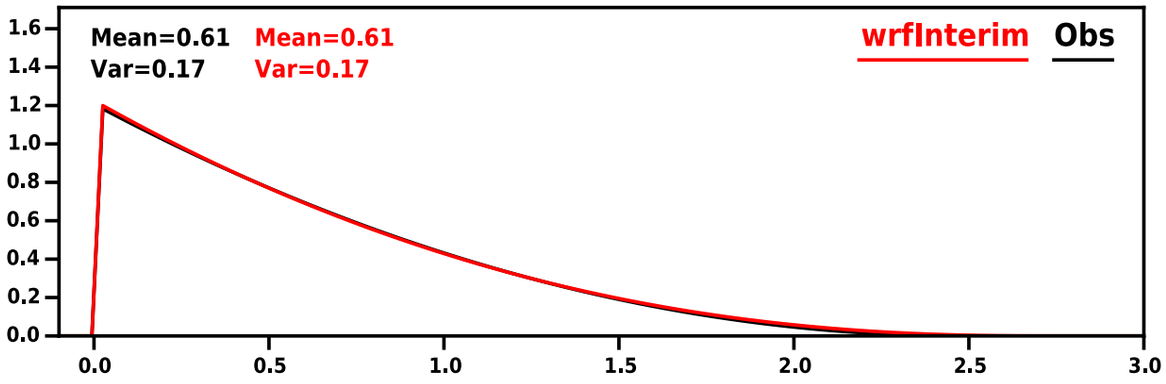

(f) TN10p
New Guinea
La Nina
El Nino
8
6
4
2
0
1
2
3
4
5
6
7
8

In the hindcast experiment:
(1) El Nino is generally favorable hot days, but depend on the MJO phases.
(2) The relationship between composited hot days and ENSO conjuction with MJO is generally correct compared with observed relationship.

Second, we analyzed the PDF of extreme. The generalized Pareto distribution (Pickands, 1975) was used to fit extreme exceedance. Robust mean and robust variation were calculated.

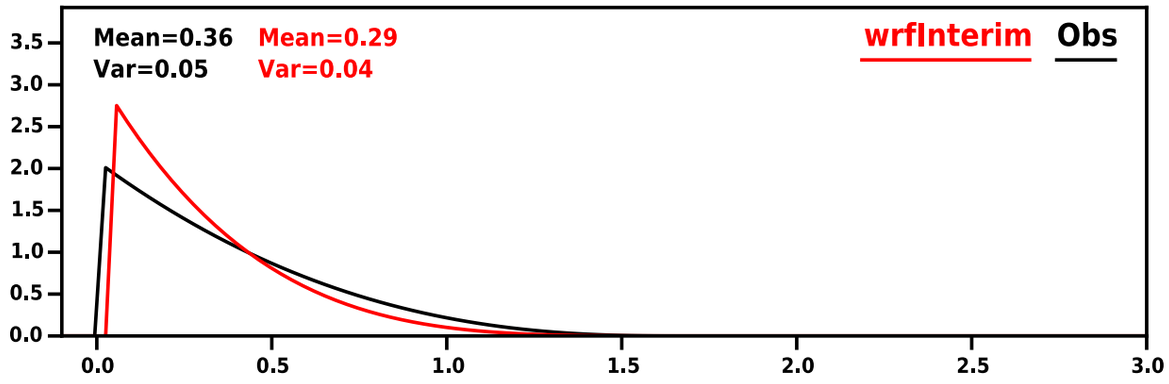
Exceedance GPD | 90p

IC



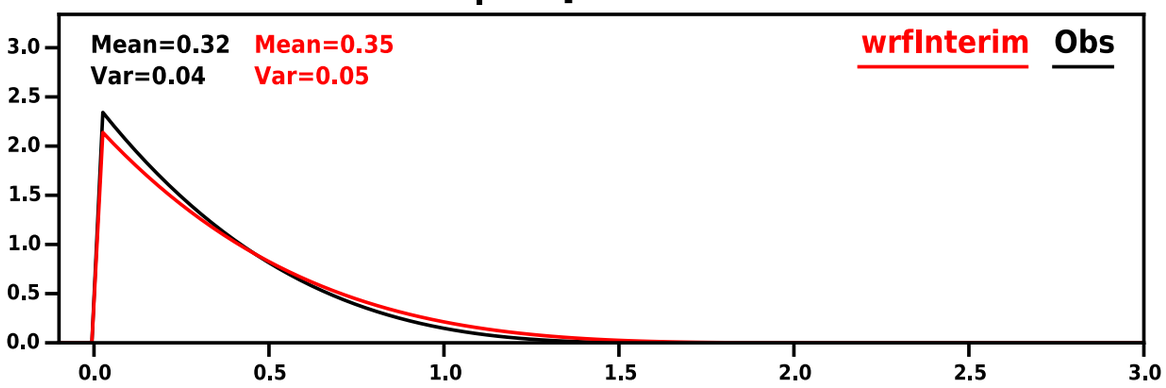
Exceedance GPD | 90p

Philippines



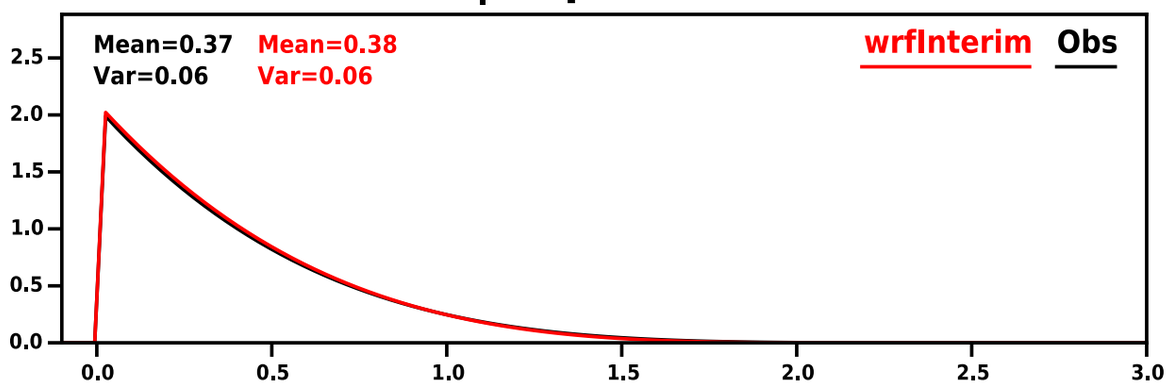
Exceedance GPD | 90p

Sumatra



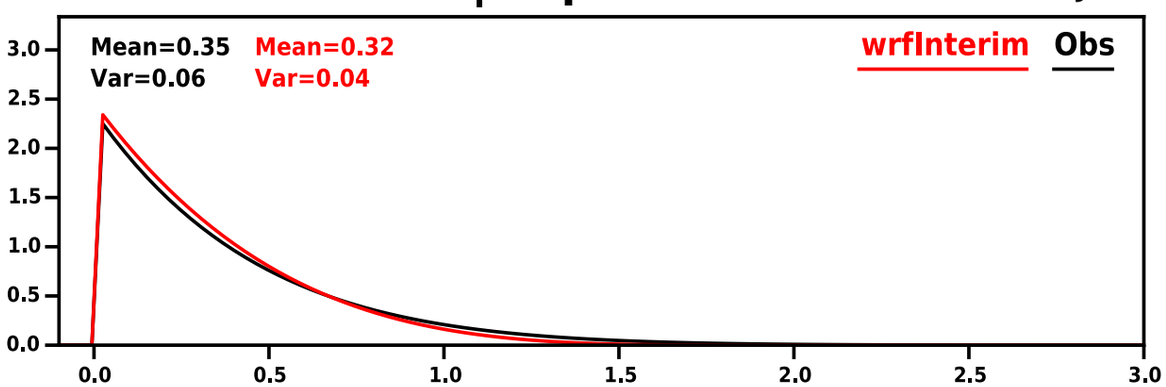
Exceedance GPD | 90p

Borneo



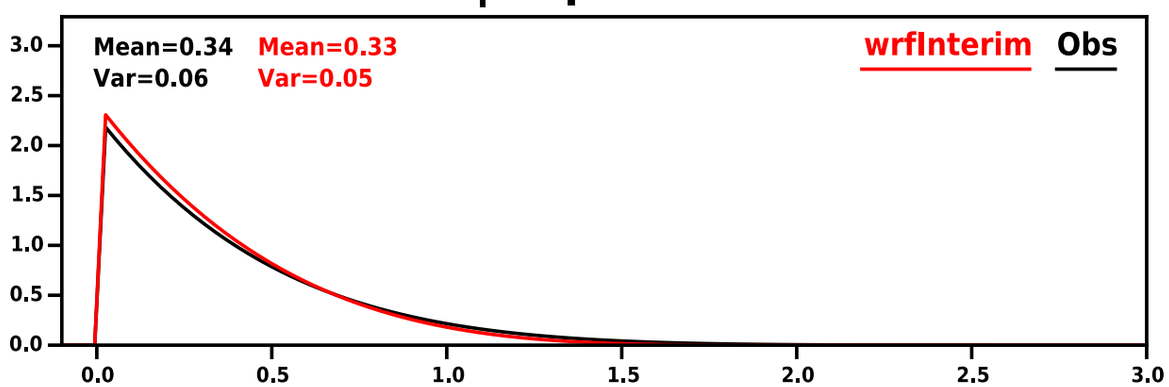
Exceedance GPD | 90p

Java

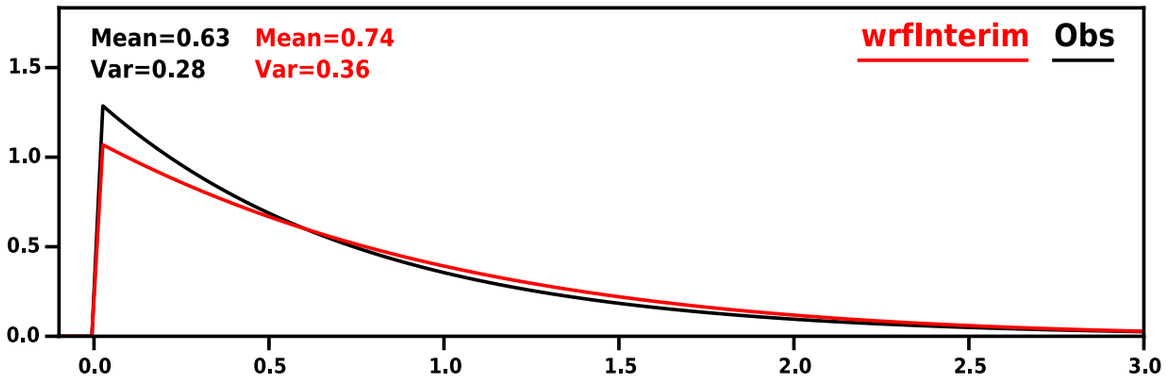


Exceedance GPD | 90p

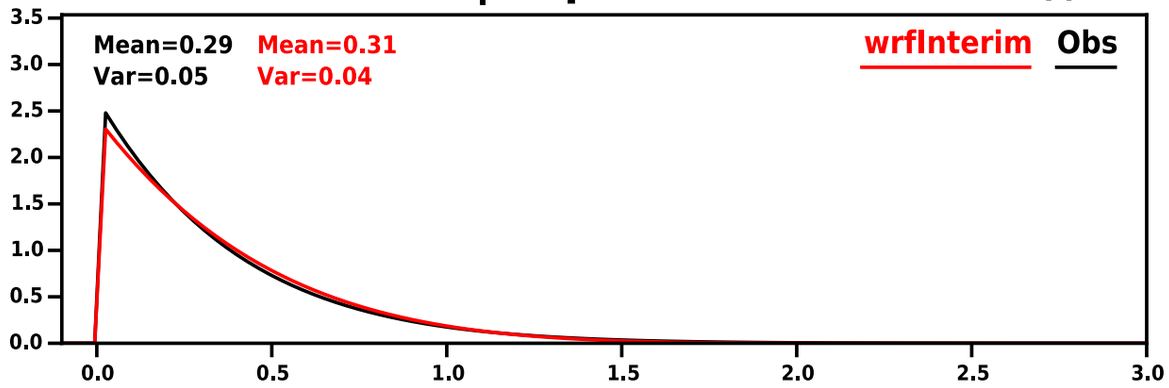
New Guinea



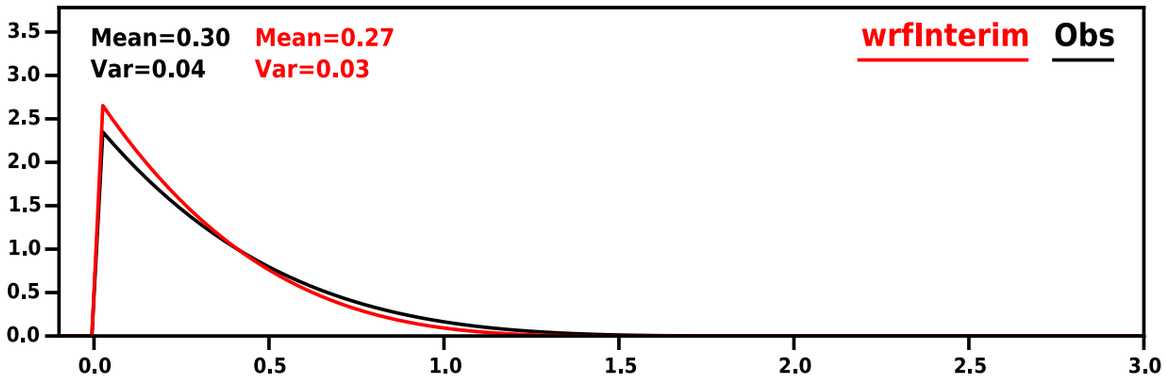
Exceedance GPD | 10p — IC



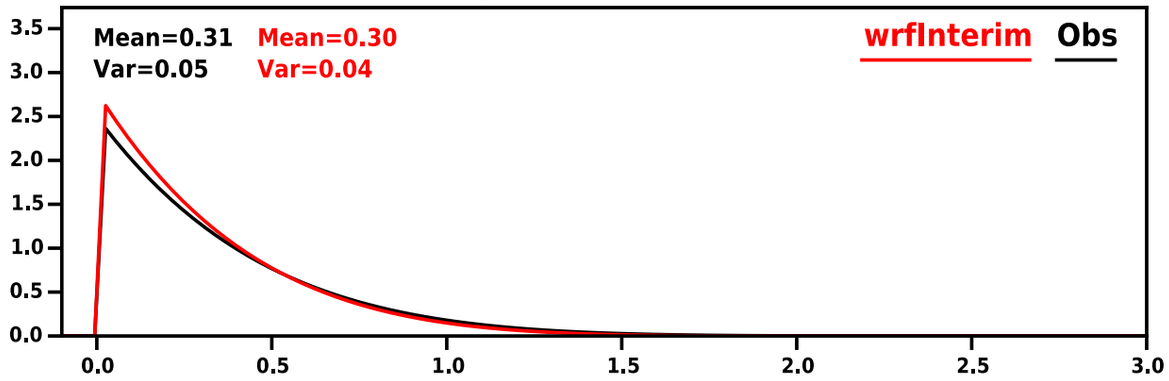
Exceedance GPD | 10p — Philippines



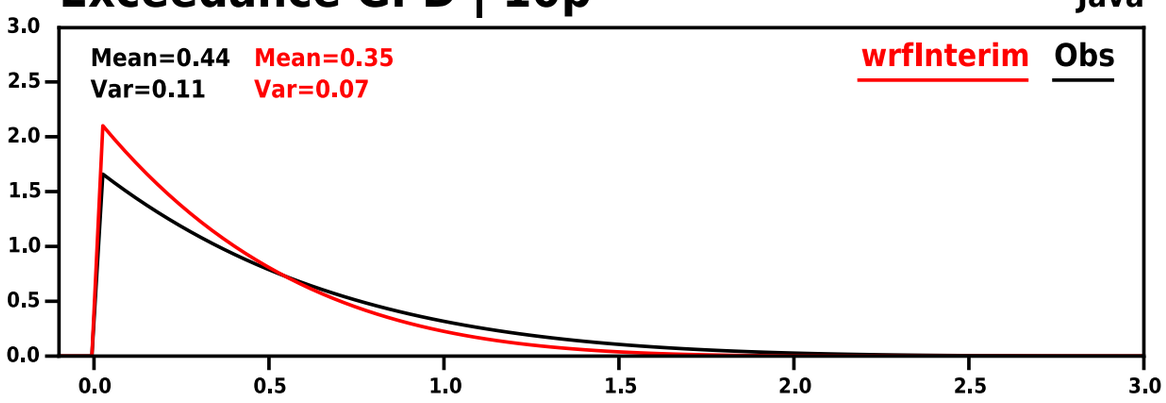
Exceedance GPD | 10p — Sumatra



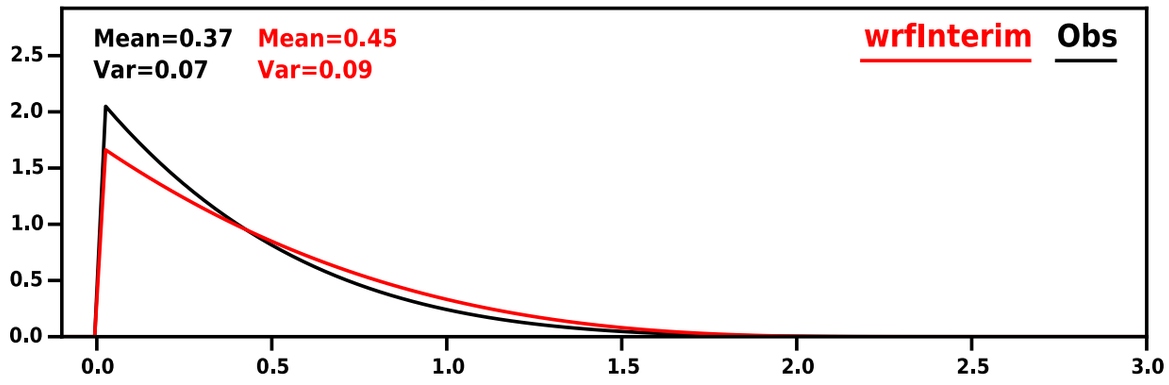
Exceedance GPD | 10p — Borneo



Exceedance GPD | 10p — Java

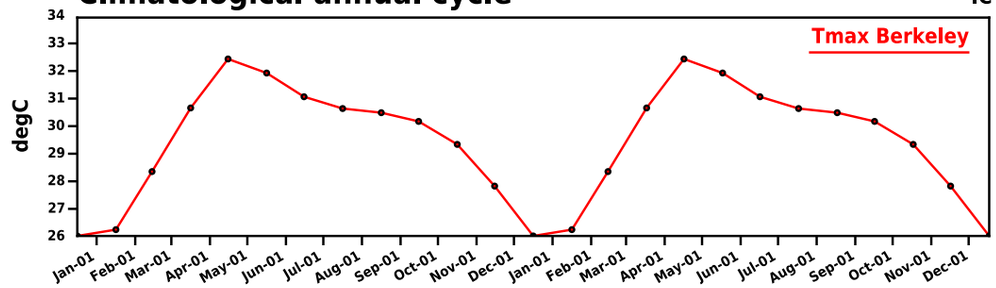


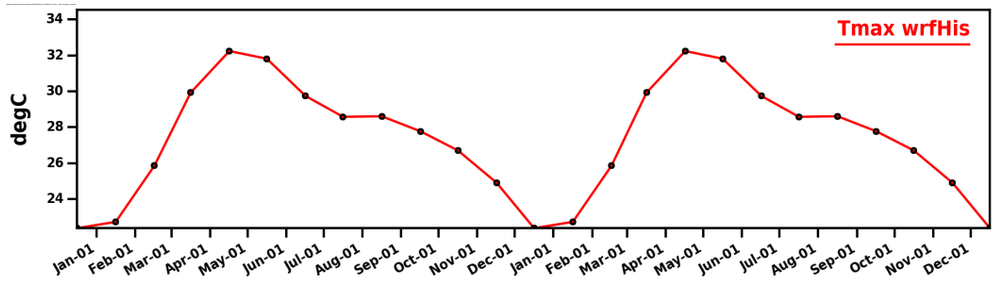
Exceedance GPD | 10p — New Guinea



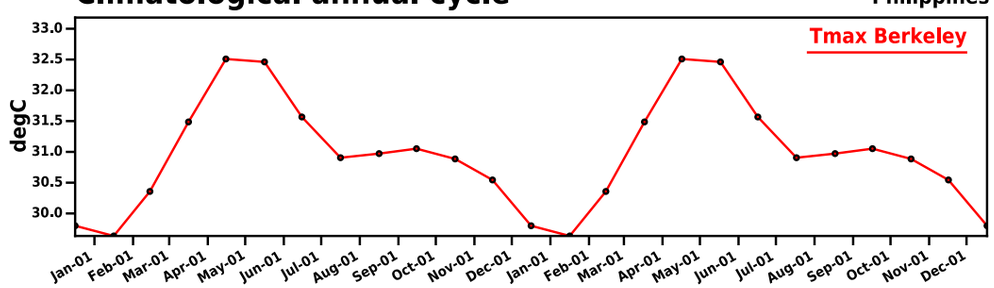
Historical experiment

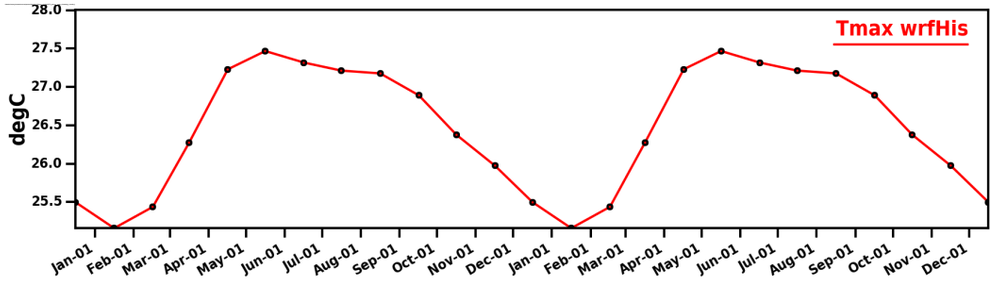
Climatological annual cycle — IC



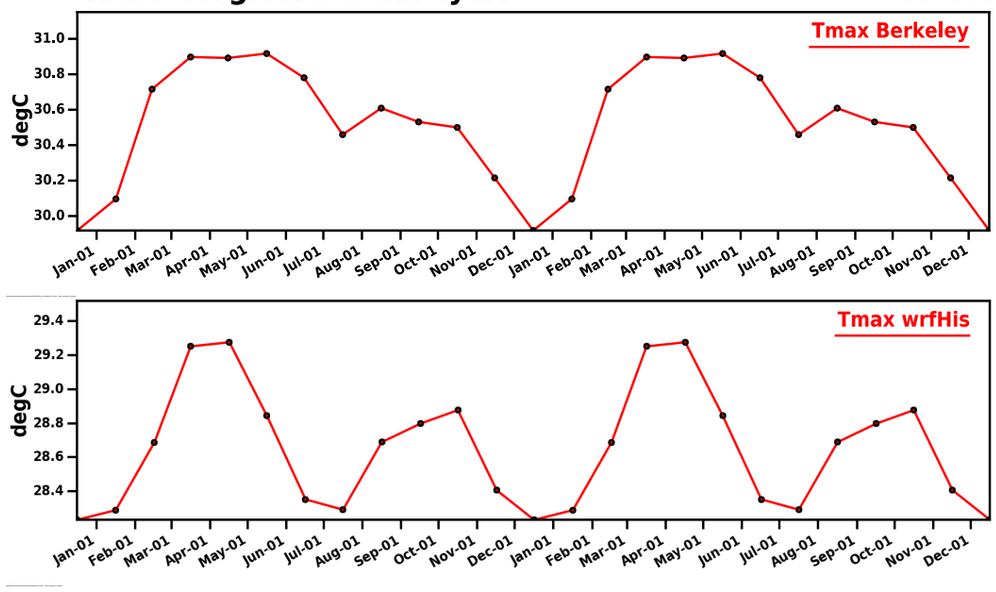


Climatological annual cycle — Philippines

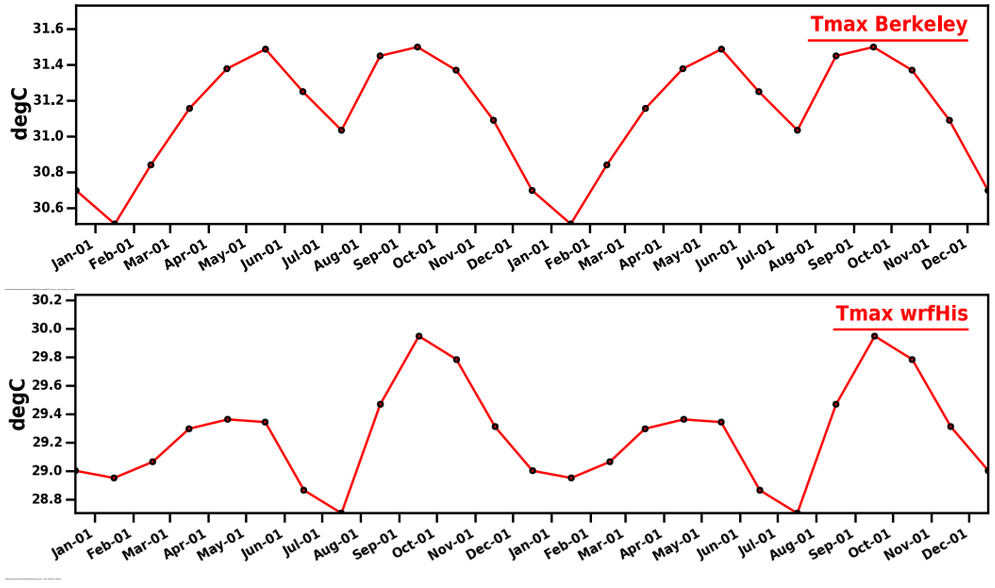




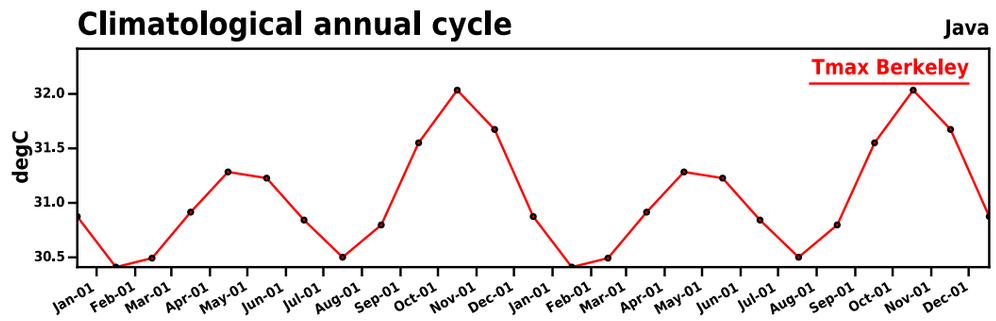
Climatological annual cycle — Sumatra

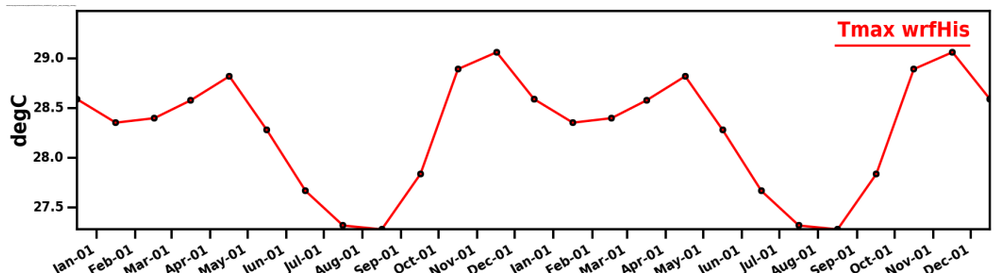


Climatological annual cycle — Borneo

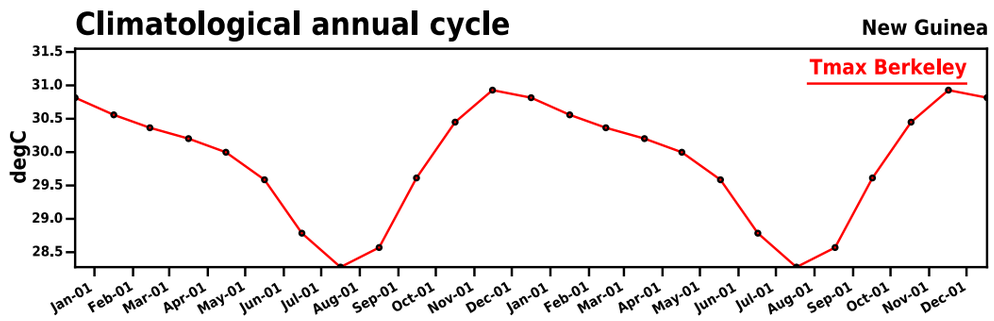


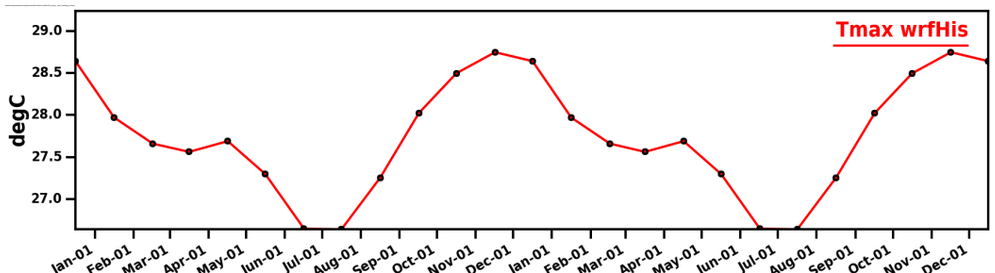
Climatological annual cycle — Java



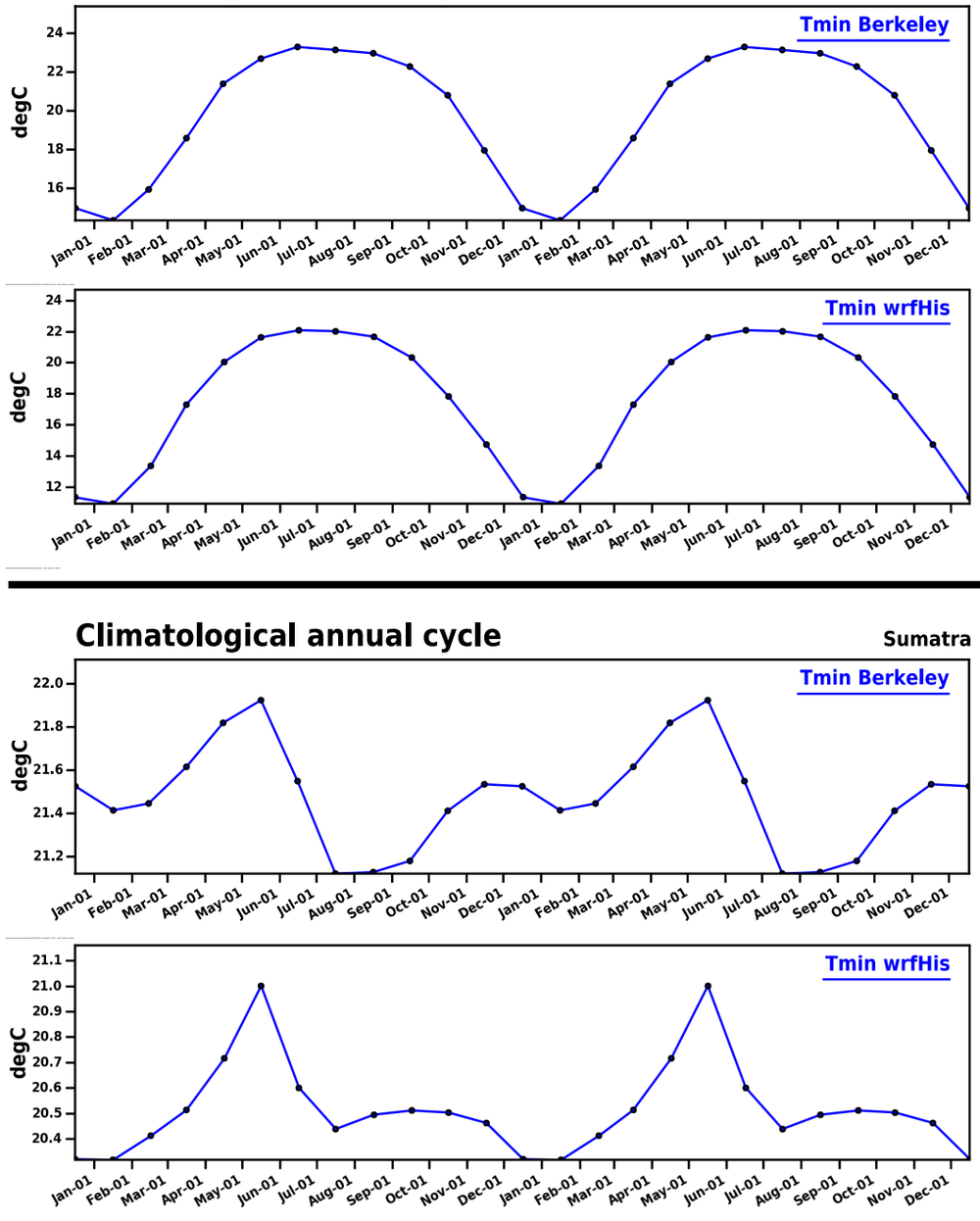


Climatological annual cycle — New Guinea

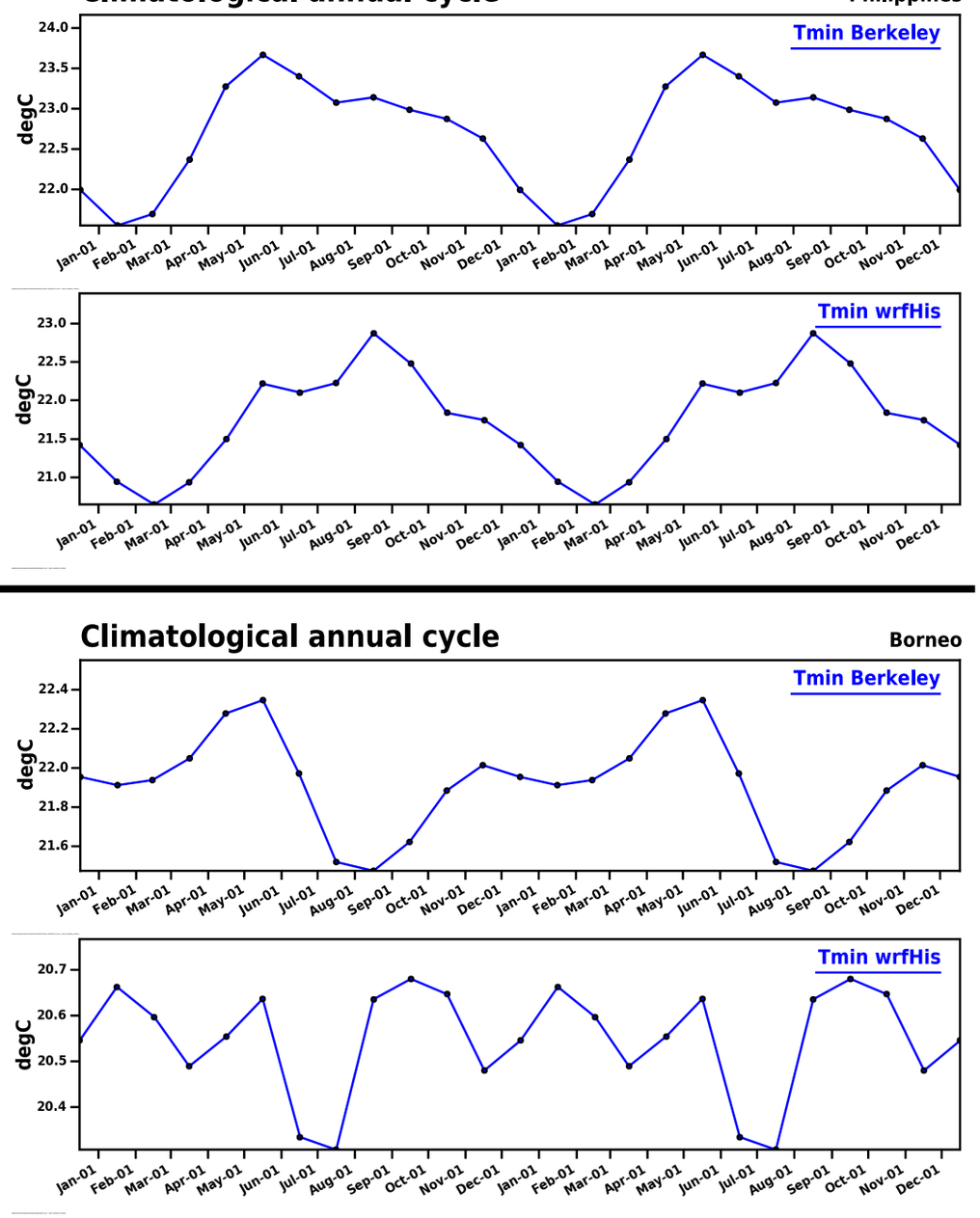




Climatological annual cycle — IC



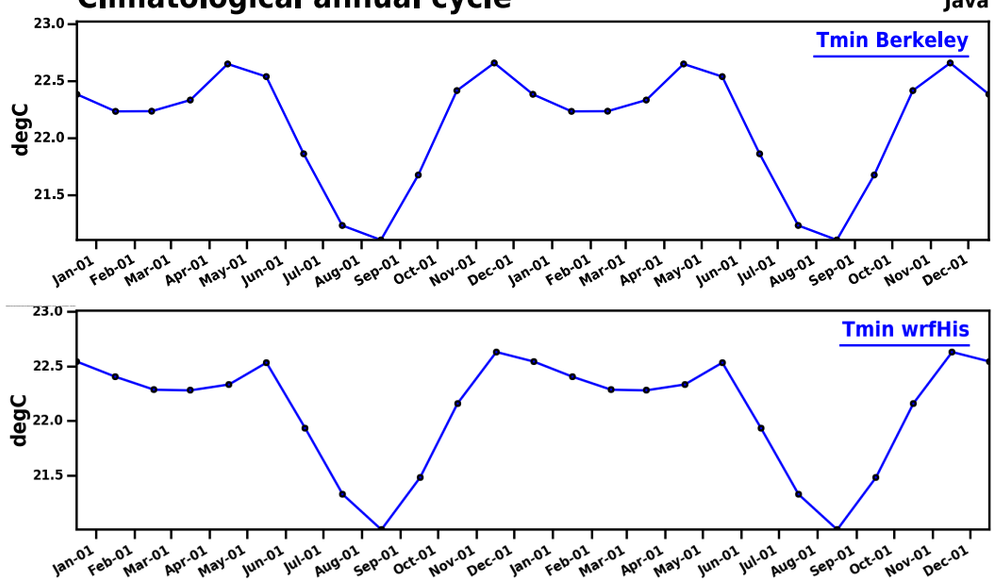
Climatological annual cycle — Philippines



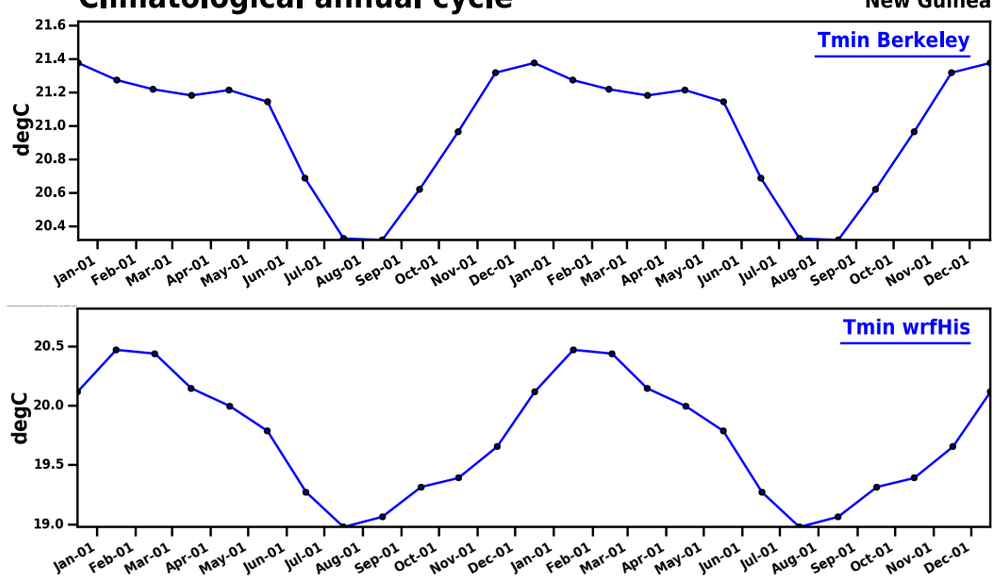
Climatological annual cycle — Sumatra

Climatological annual cycle — Borneo

Climatological annual cycle — Java



Climatological annual cycle — New Guinea

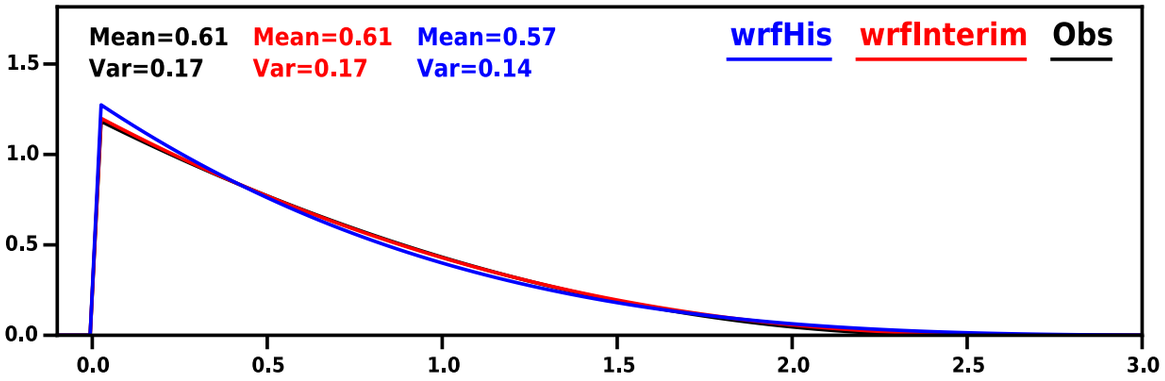


Correlation between ENSO and warms days (cool nights) do not have skill compared with the observed correlation.

In fact, Leloup et al. (2007) showed that none of the global models in the IPCC-AR4 were good at capturing all the extent, location and timing of ENSO.

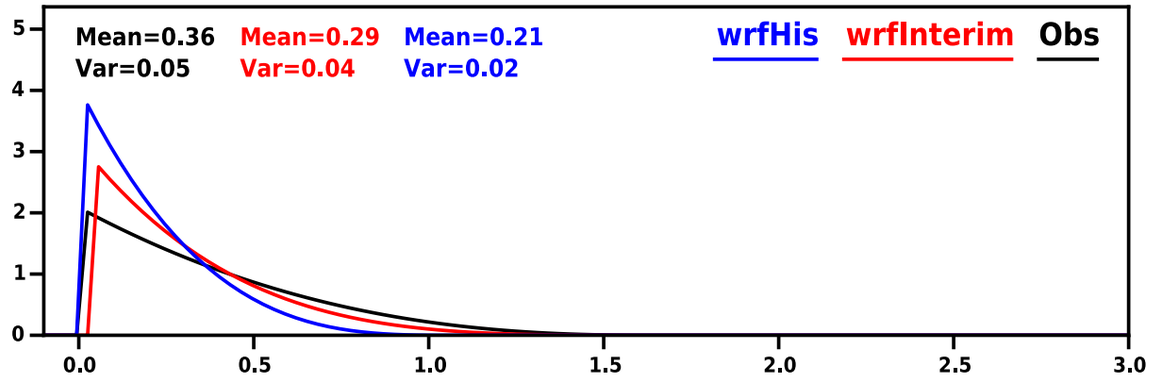
Exceedance GPD | 90p

IC



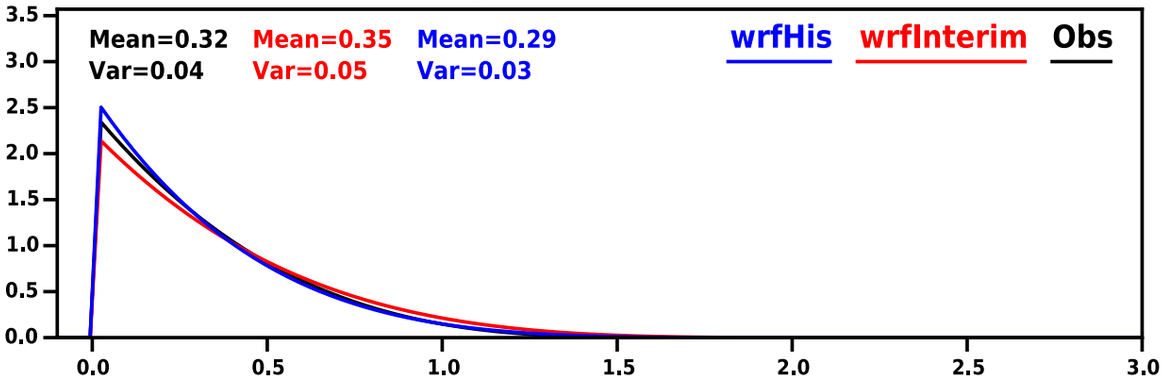
Exceedance GPD | 90p

Philippines



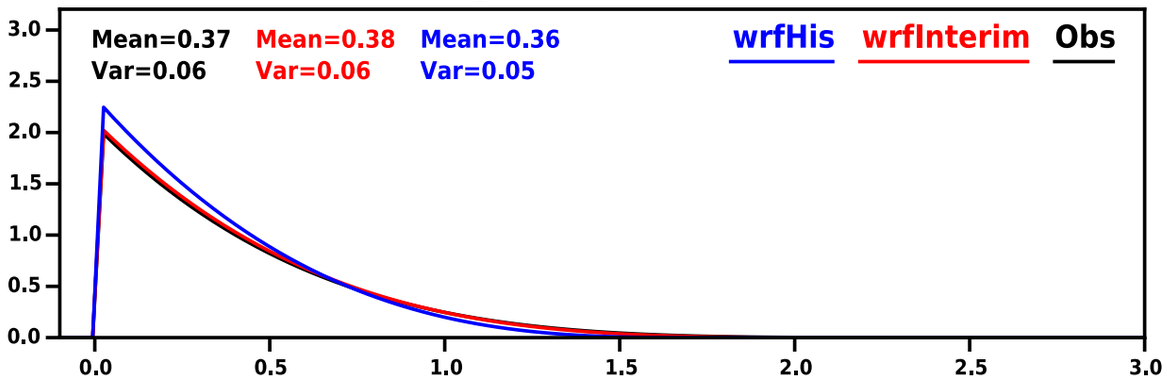
Exceedance GPD | 90p

Sumatra



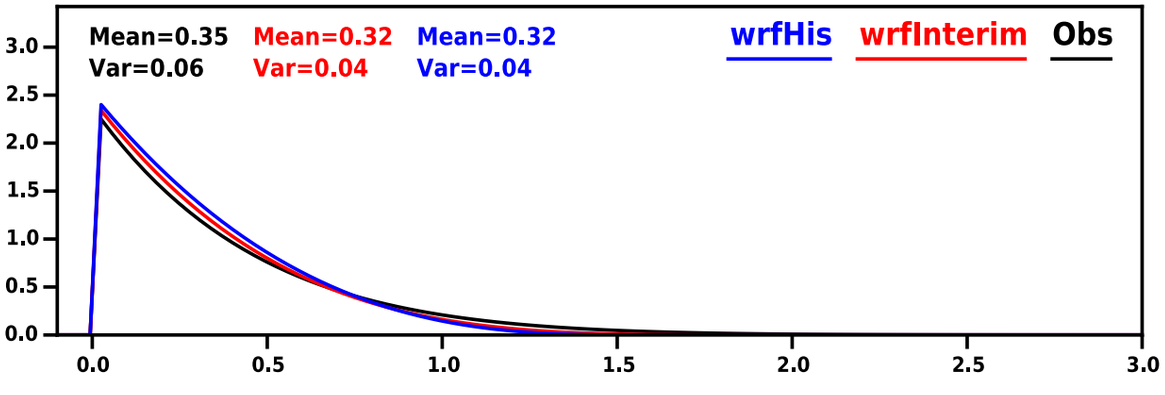
Exceedance GPD | 90p

Borneo



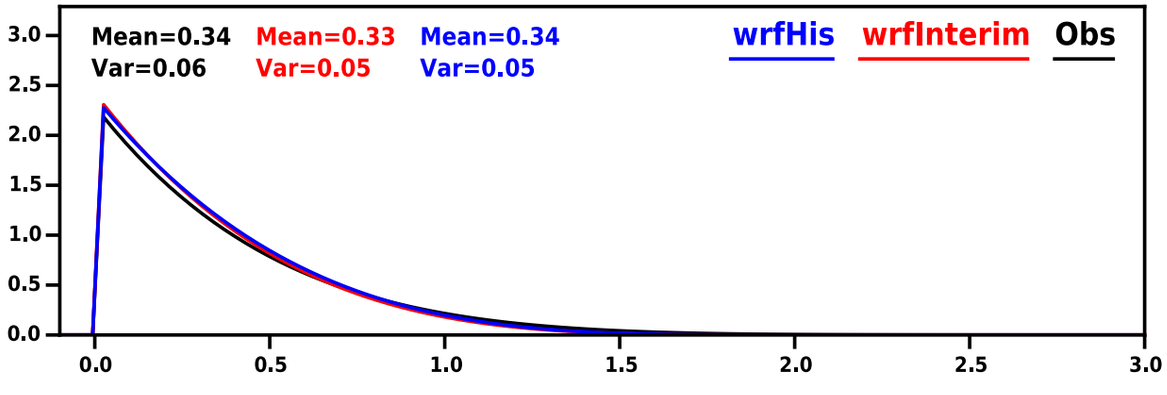
Exceedance GPD | 90p

Java

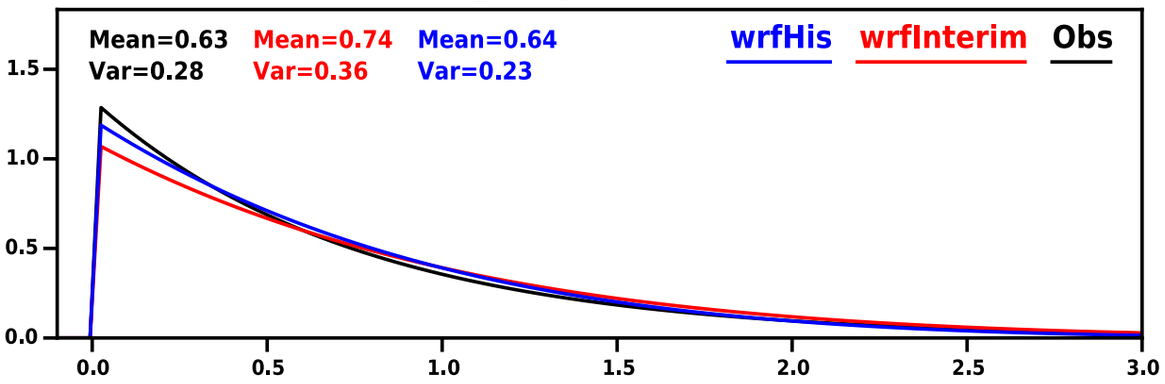


Exceedance GPD | 90p

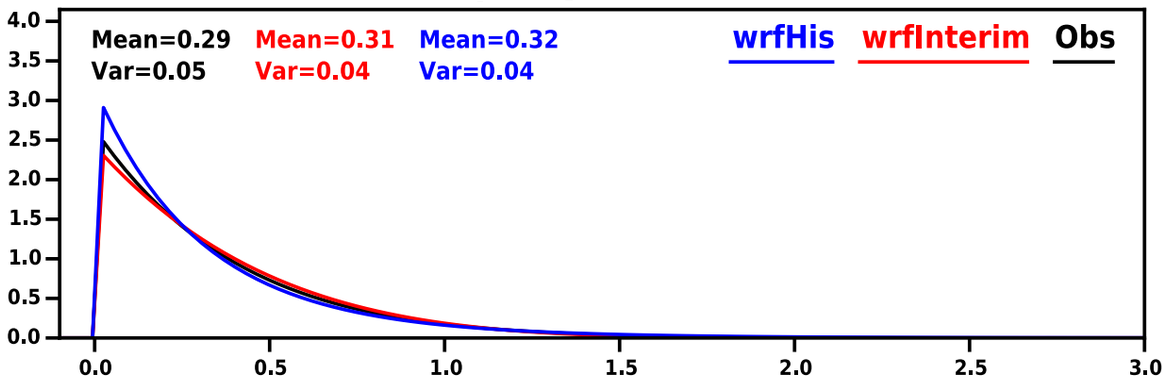
New Guinea



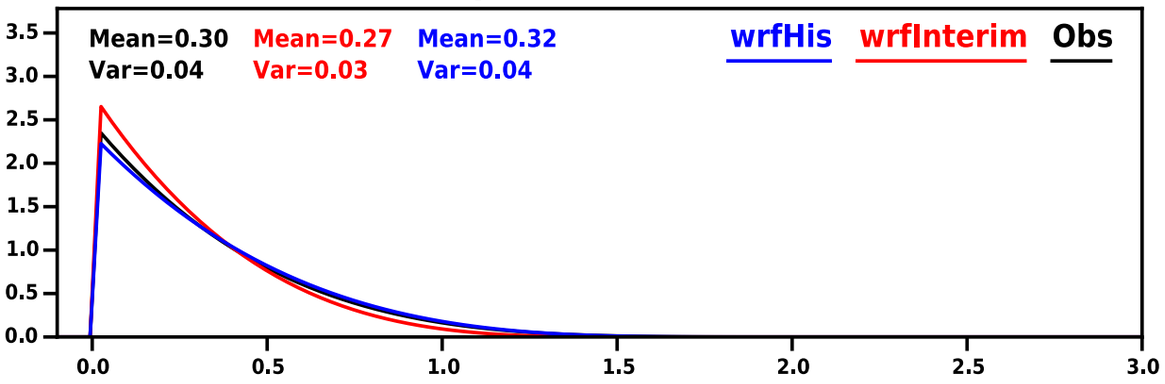
Exceedance GPD | 10p — IC



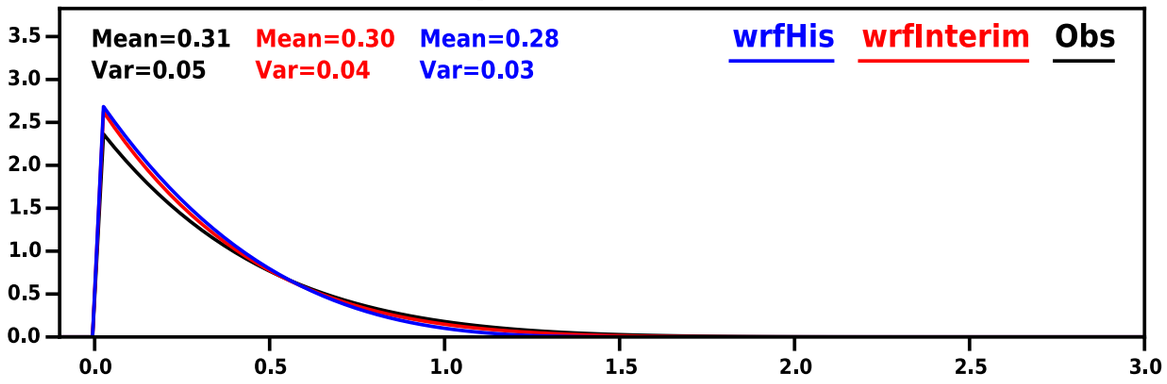
Exceedance GPD | 10p — Philippines



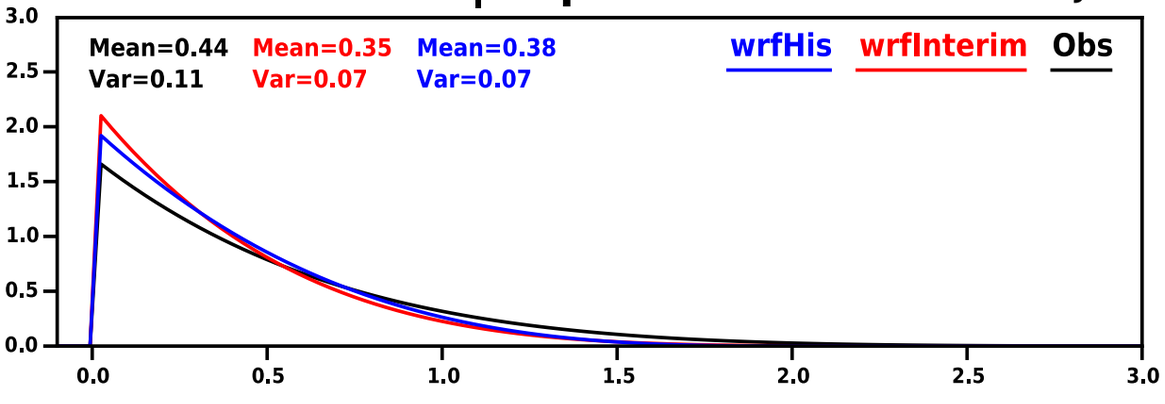
Exceedance GPD | 10p — Sumatra



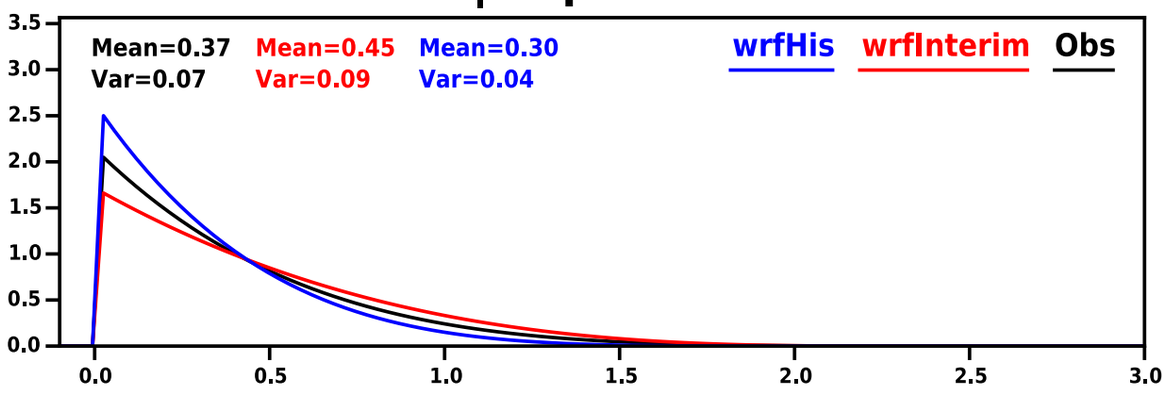
Exceedance GPD | 10p — Borneo



Exceedance GPD | 10p — Java

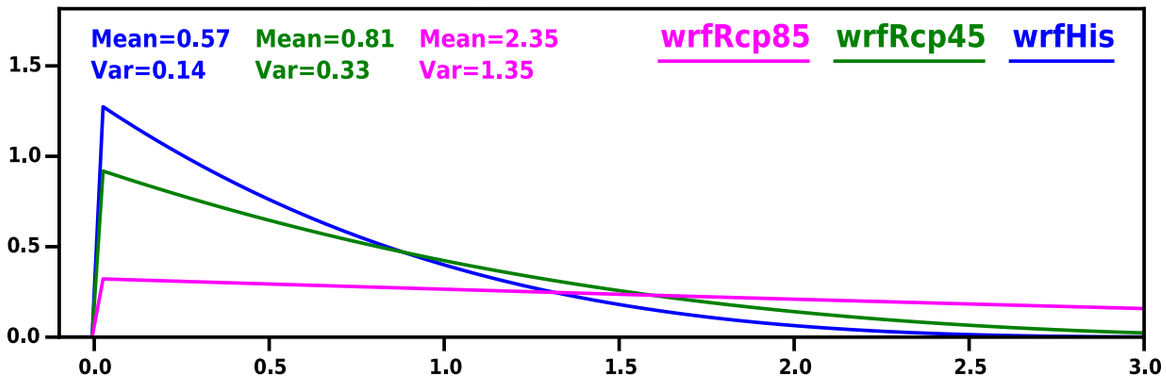


Exceedance GPD | 10p — New Guinea

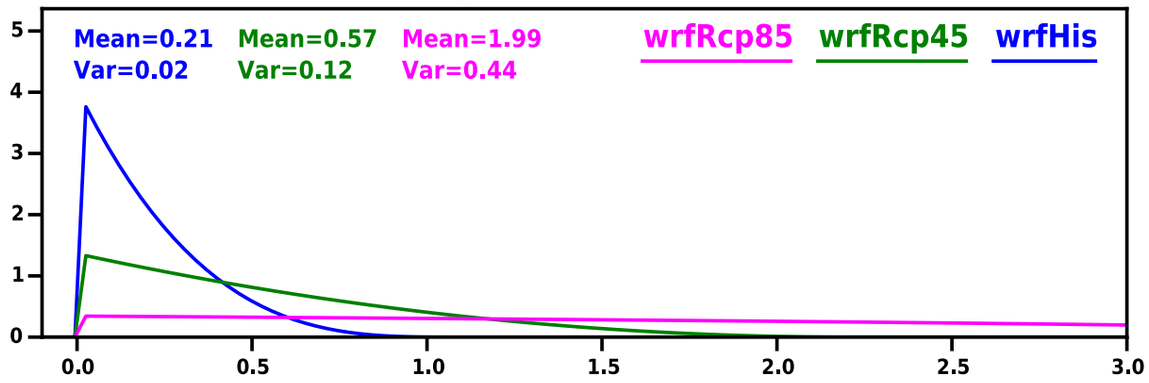


Future projection

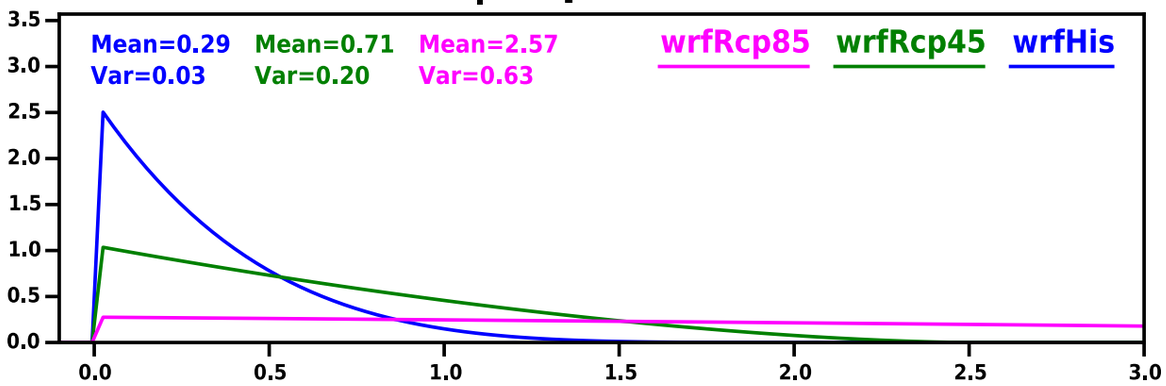
Exceedance GPD | 90p — IC



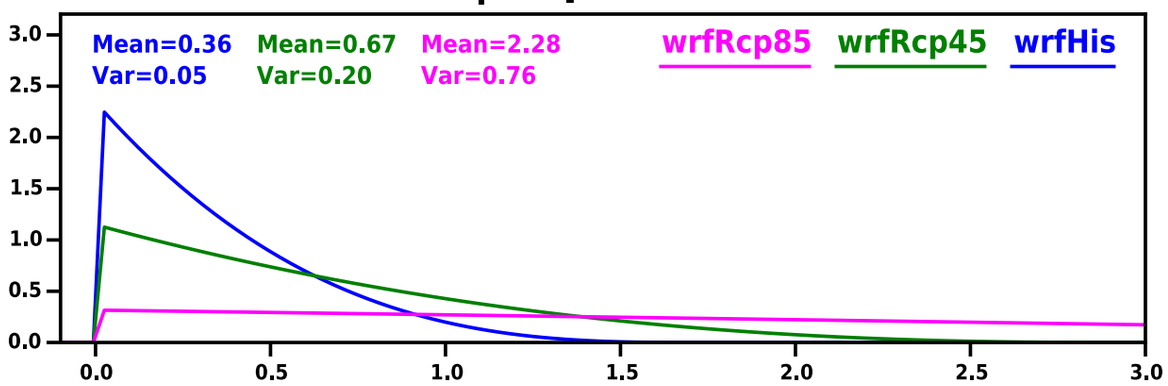
Exceedance GPD | 90p — Philippines



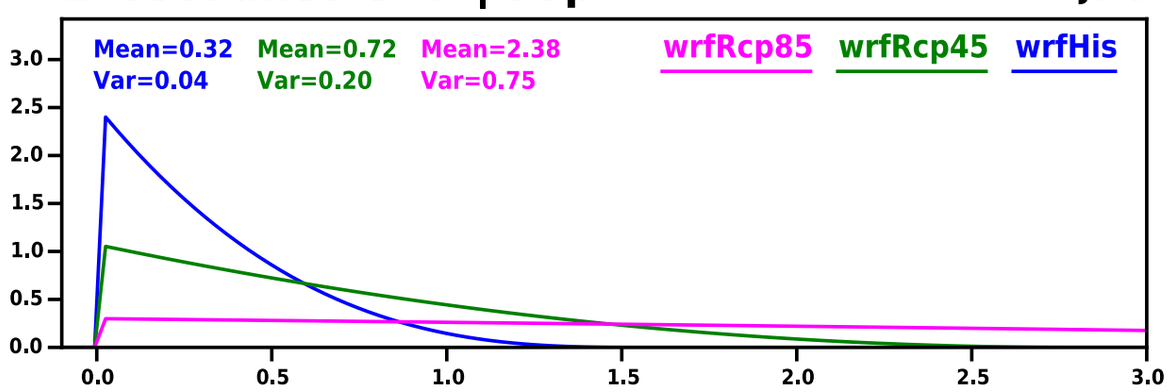
Exceedance GPD | 90p — Sumatra



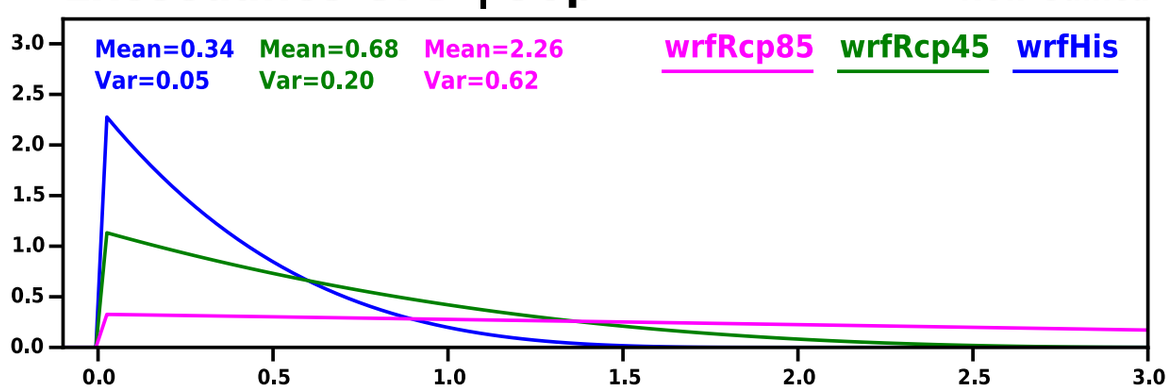
Exceedance GPD | 90p — Borneo



Exceedance GPD | 90p — Java



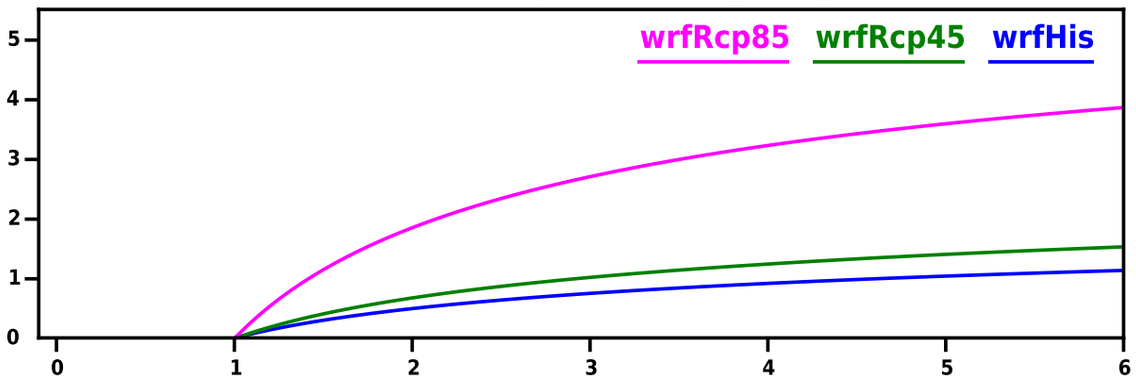
Exceedance GPD | 90p — New Guinea



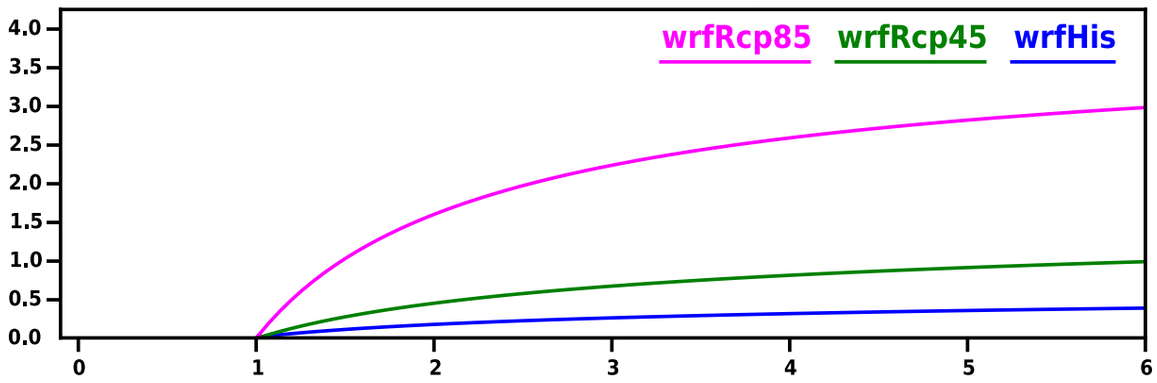
There is decreased trend for cool night in RCP downscaling experiment. Less events don't have well fitted function.

We also looked at the possible changes in the near future (RCP 4.5; 2021~2045) and far future (RCP 8.5; 2071~2095) of extremes through return value vs return period.

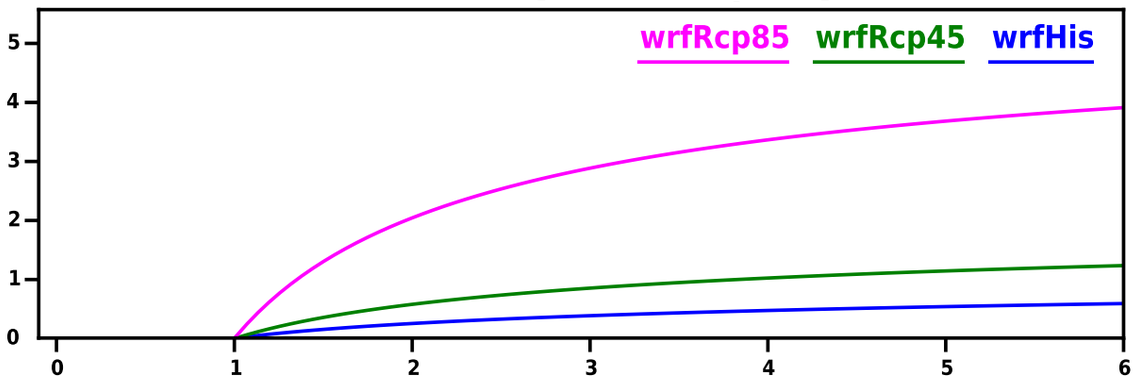
Return exceedance~periods | 90p — IC



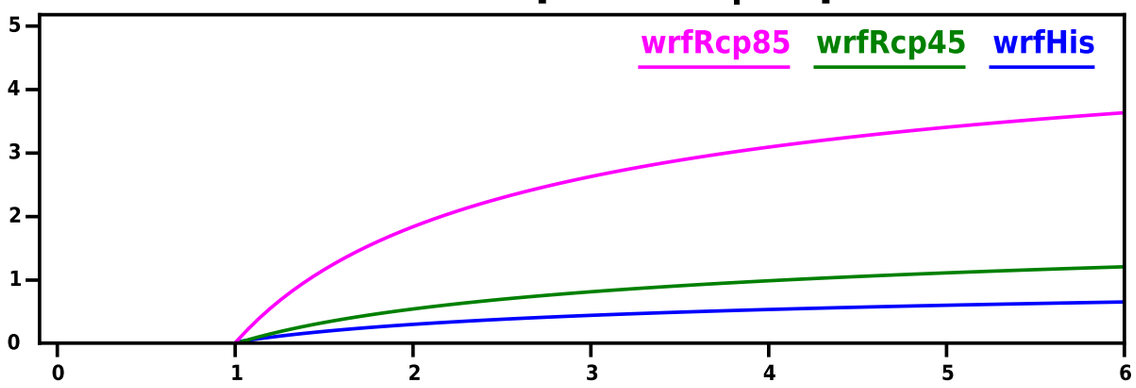
Return exceedance~periods | 90p — Philippines



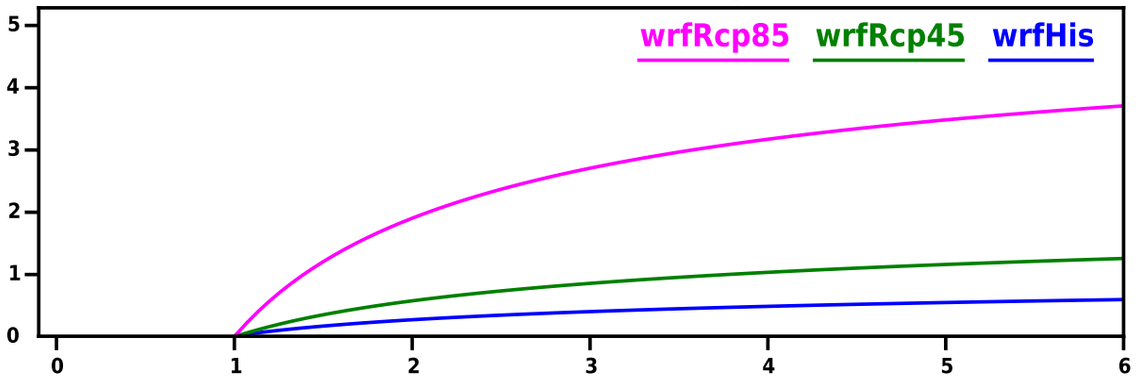
Return exceedance~periods | 90p — Sumatra



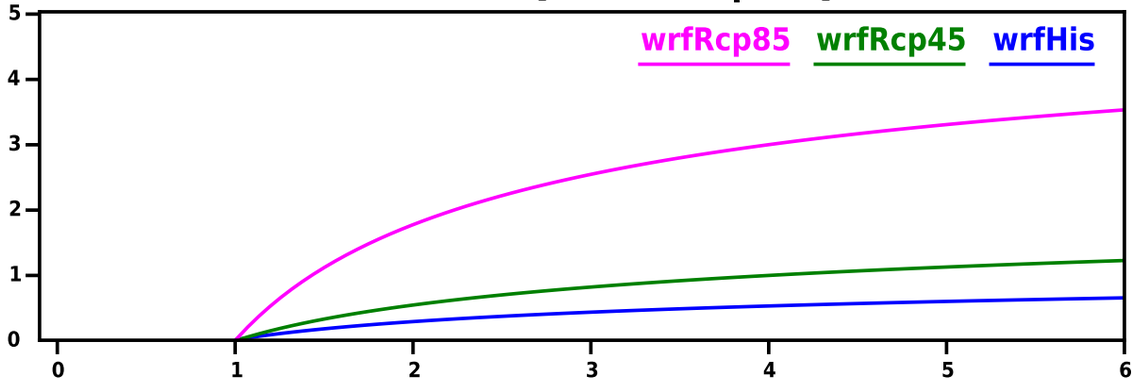
Return exceedance~periods | 90p — Borneo



Return exceedance~periods | 90p — Java



Return exceedance~periods | 90p — New Guinea



Conclusion

Generally, TX90p has strong relationship with ENSO. TN10p has weak relationship with ENSO.

Thus, El Nino events are generally favorable extreme tempetures over the Maritime Continent, but modulated by MJO.

The annual cycle of tmax and tmin in the hindcast experiment generally showed the reasonable results compared with the observation.

Except over IC, correlation between ENSO and simulated hot days in the hindcast experiment is reasonable.

Correlation between ENSO and simulated cool nights in the hindcast experiment is low and has bias compared with the observed relationship.

The relationship between ENSO and composited extremes is generally correct compared with observed relationship.

Except Philippines, the mean and spread of the distribution of exceedance of hot days in the hindcast experiment is reasonable compared with the observed distribution.

For the distribution of exceedance of cool nights in the hindcast experiment, except over IC, Java, and New Guinea, the simulation is reasonable over other lands.

The hot season and cool season are reasonable in the historical experiment. The maganitude of the annual cycle of tmax and tmin has certain bias.

Correlation between TX90p and TN10p and ONI do not have skill compared with the observed correlation.

Except Philippines, the mean and spread of the distribution of exceedance of hot days in the historical experiment is reasonable compared with the observed distribution.

For the distribution of exceedance of cool nights in the hindcast experiment, except over New Guinea, the simulation is reasonable over other lands.

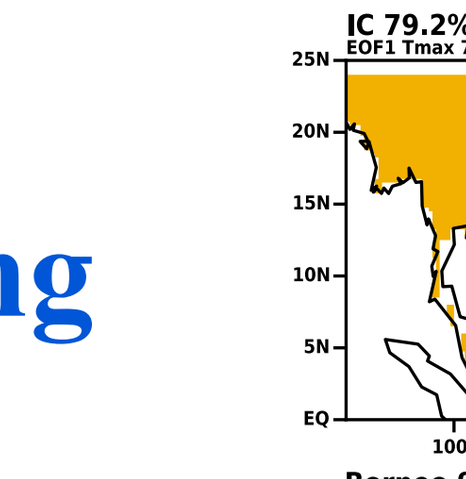
There is decreased trend for small exceedance of hot days in RCP downscaling. There is increased trend for large exceedance of hot days in RCP downscaling.

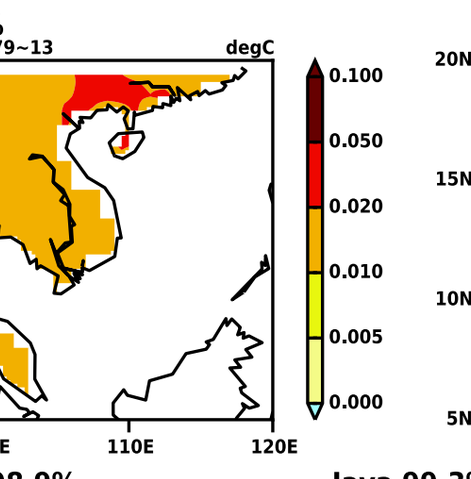
There is decreased trend in cool night in RCP downscaling experiment. Less events don't have well fitted function.

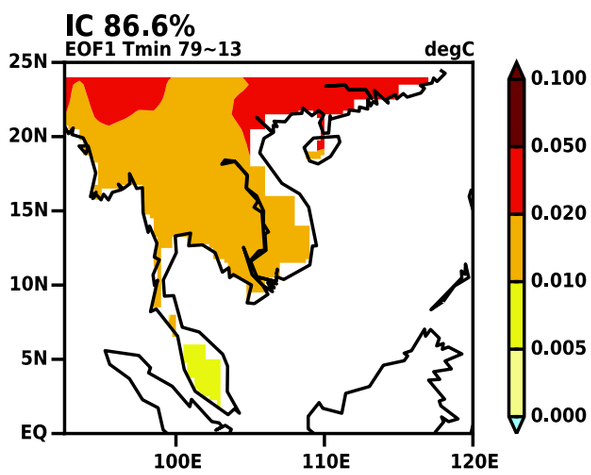
In RCP downscaling experiments, the return of the hot days became more often.

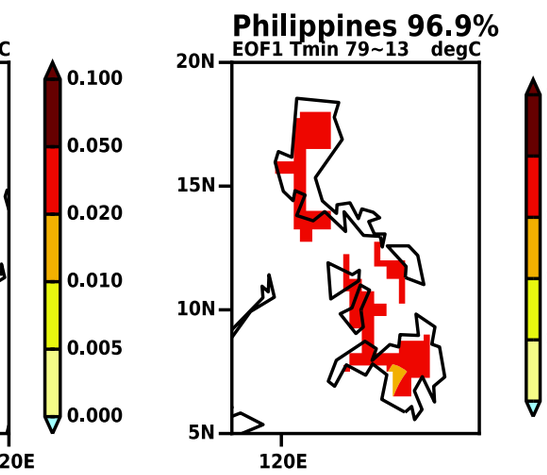
Thanks !

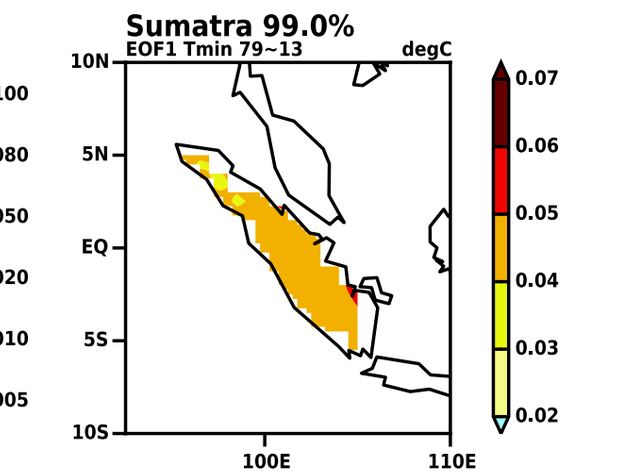
EOF leading mode

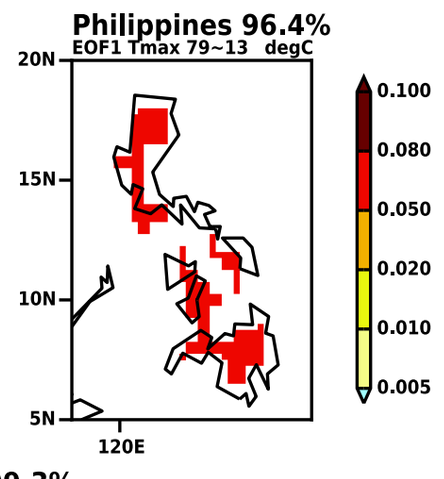


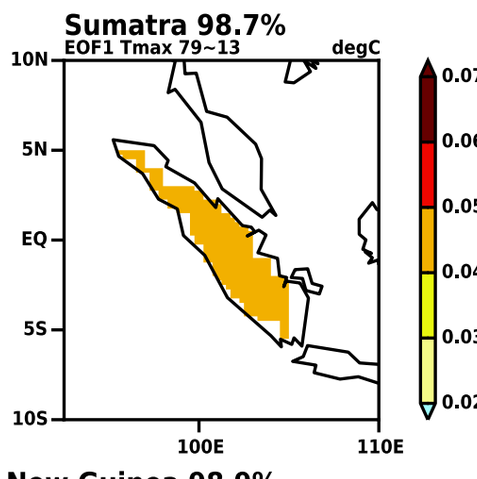


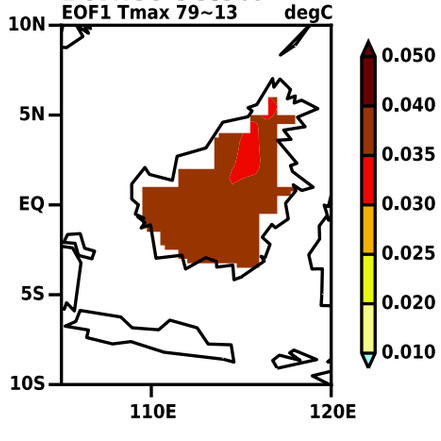


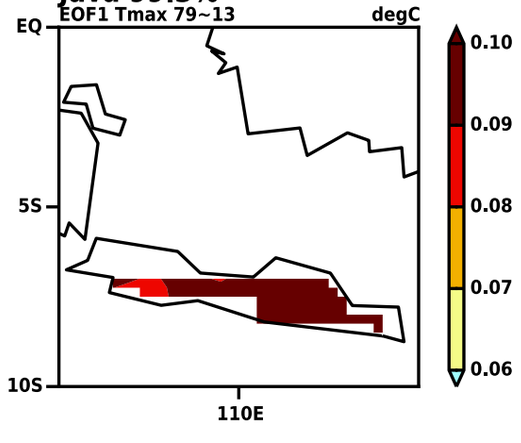


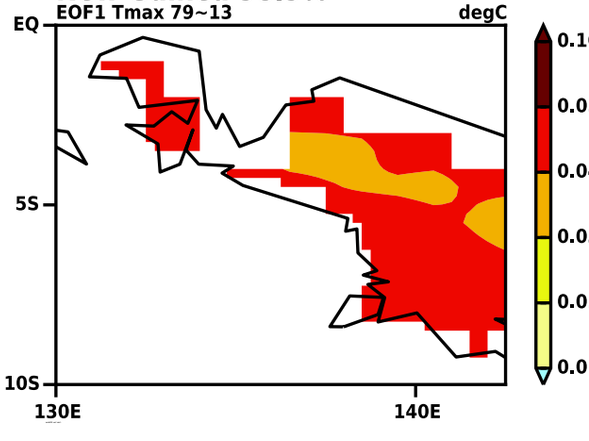






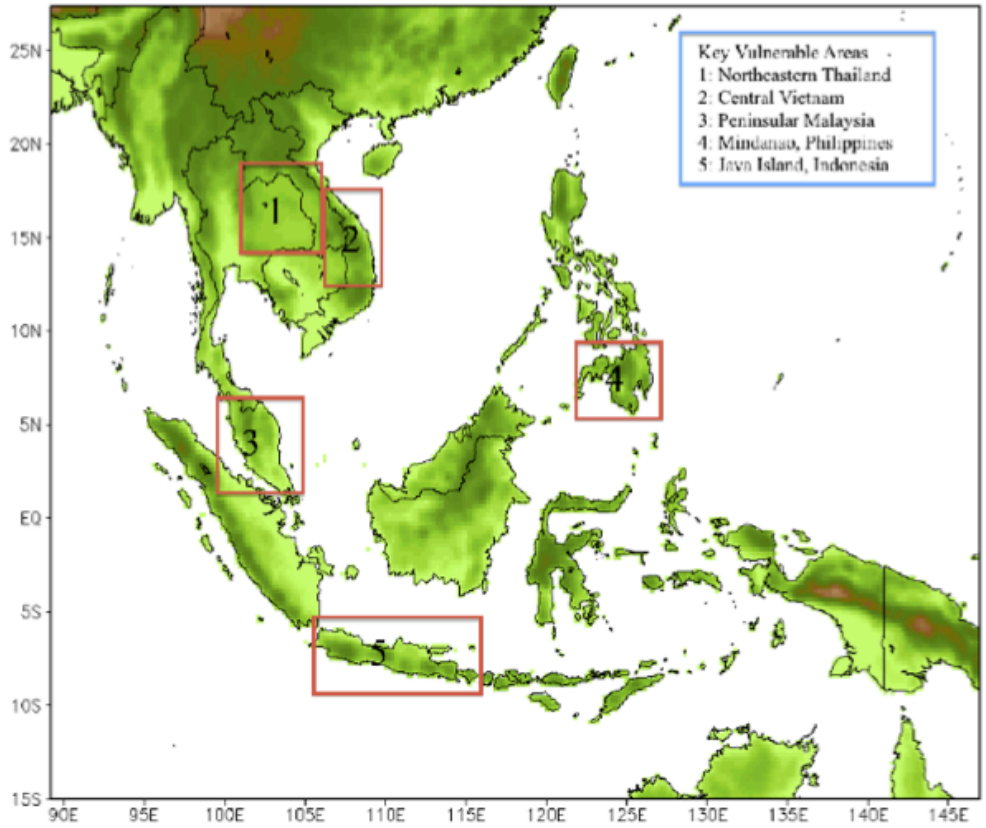






Second Phase of CORDEX Southeast Asia – submitted to APN for funding consideration

Further downscaling to 3 km x 3 km resolution over key vulnerable areas to address IAV community needs for basin-scale assessment of climate change impacts



Countries: Thailand, Malaysia, Vietnam, Indonesia and Philippines

3 GCMs, 2 RCMs, 2 RCPs, Slice-runs

RCMs will be forced using outputs from current phase of CORDEX Southeast Asia