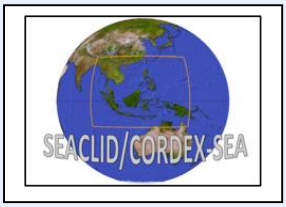
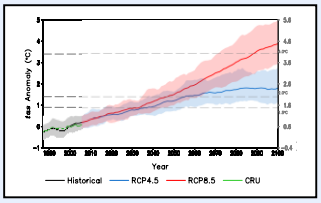
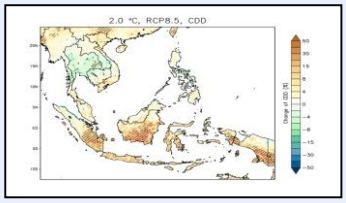
ASIA-PACIFIC NETWORK FOR GLOBAL CHANGE RESEARCH

ARCP Final Report







Project Reference Number: ARCP2015-04CMY-Tangang

The Southeast Asia Regional Climate Downscaling (SEACLID)

The following collaborators worked on this project:

1. Dr. Jerasorn Santisirisomboon, Ramkhamhaeng University, Thailand, jerasorn@ru.ac.th
2. Dr. Thanh Ngo-Duc, University of Science and Technology of Hanoi, Hanoi, Vietnam, ngoducthanh@gmail.com
3. Prof. Dr. Tan Phan Van, Hanoi University of Science Vietnam National University, Vietnam, phanvantan@hus.edu.vn
4. Dr. Faye Cruz, Manila Observatory, Manila, Philippines, faye.cruz@gmail.com
5. Dr. Gemma Narisma, Ateneo de Manila University, Manila, Philippines, gtnarisma@gmail.com
6. Prof. Dr. Edvin Aldrian, Indonesian Agency for Meteorology, Climatology and Geophysics, Indonesia, e_aldrian@yahoo.com
7. Dr. Dodo Gunawan, Indonesian Agency for Meteorology, Climatology and Geophysics, Indonesia, dodo.gunawan@bmkg.go.id
8. Dr. Patama Singhruck, Chulalongkorn University, Bangkok, Thailand, patama.s@chula.ac.th

Table of Content

Project Overview

Project Duration	**:**	3 Years + 1 year project extension
Funding Awarded	**:**	US$ 45,000 for Year 1; US$ 40,000 for Year 2; US$ 40,000 for Year 3
Key organisations involved	**:**	Universiti Kebangsaan Malaysia (Prof. Dr. Fredolin Tangang, Assoc. Prof. Dr. Liew Juneng) Ramkhamhaeng University Centre of Regional Climate Change and Renewable Energy (RU-CORE) (Asst. Prof. Dr. Jerasorn Santisirisoomboon) University of Science and Technology of Hanoi (USTH) (Assoc. Prof. Dr. Thnah Ngo-Duc) Hanoi University of Science (HUS) (Prof Dr. Phan Van Tan) Manila Observatory (Dr. Faye Cruz) Ateneo de Manila University (Assoc. Prof. Dr. Gemma Narisma) Indonesian Agency for Meteorology, Climatology and Geophysics (BMKG) (Prof. Dr. Edvin Aldrian, Dr. Dodo Gunaman, Dr. Ardhasena Sopaheluwakan) Chulalongkorn University (Dr. Patama Singhruck) Swedish Meteorological and Hydrological Institute (Dr. Grigory Nikulin) CSIRO Australia (Dr. John McGregor) APEC Climate Center Busan Korea (Dr Hongwei Yang) Germany Climate Service Center (GERICS) (Dr. Armelle Reca C. Remedio) Meteorological Research Institute (MRI) Japan (Dr. Hidetaka Sasaki)

Project Summary

The Southeast Asia Regional Climate Downscaling (SEACLID) project was established in November 2013 with objectives to downscale multiple climate change scenarios for Southeast Asia, build capacity in regional climate simulation and establish data centre for data dissemination. At its early implementation stage, the project was incorporated and streamlined into the Coordinated Regional Climate Downscaling Experiment (CORDEX) of World Climate Research Programme (WCRP) and became the 14th domain of CORDEX. Subsequently, the project was renamed as SEACLID/CORDEX Southeast Asia and joined by scientists from another 7 countries outside the regions. With the involvement of a large number of scientists, the SEACLID/CORDEX Southeast Asia has successfully carried out about 30 regional climate simulations, far more than what was proposed under SEACLID. The project has published 9 scientific papers in high-impact journals and on-track to publish

more publications in the near future. Under this project also, we have built a strong regional network of scientists within and outside the region, enhanced capacity in regional climate downscaling, produced trained young and early career scientists. More importantly, the project has established and launched the Southeast Asia Regional Climate Change Information System (SARCCIS; http://www.rucore.ru.ac.th/SARCCIS) in May 7, 2018. SARCCIS serves as a one-stop regional climate change information data centre for Southeast Asia.

Keywords:
SEACLID/CORDEX Southeast Asia, Regional Climate Downscaling, Climate Change, Climate Projection, SARCCIS

Project outputs and outcomes

Project outputs:

- Completion of about 30 regional climate simulations
- Successfully analysed the model outputs and published 9 papers and more are expected
- Organised 7 workshops and 1 Regional Climate Modelling Workshop
- Trained young and early career scientists
- Enlarged and enhanced regional network of scientists in Regional Climate Simulation
- Established the Southeast Asia Regional Climate Change Information System (SARCCIS)

Project outcomes:

- Improved access to large ensemble, robust regional climate change scenarios for Southeast Asia under SARCCIS
- Enhanced understanding of regional climate change in Southeast Asia

Key facts/figures

- Completed 30 regional climate simulations
- Trained more than 40 young and early career scientists
- Conducted 7 workshops and 1 regional climate modelling workshop
- Published 9 papers and on-track to publish more in the near future
- Established SARCCIS, the only regional climate change data portal that disseminates regional climate change projections to users freely

Potential for further work

The establishment of the Southeast Asia Regional Climate Change Information System (SARCCIS) is one of key achievement of this project (http://www.rucore.ru.ac.th/SARCCIS). While SEACLID/CORDEX Southeast Asia has ended, SARCCIS will continue to be operated to ensure the regional climate change scenarios produced under SEACLID/CORDEX Southeast Asia can be disseminated and used by users of Impact, Adaption and Vulnerability (IAV) community. While the findings of SEACLID/CORDEX Southeast Asia project provide the scientific basis of future changes of regional climate change over Southeast Asia, further works by IAV community in using data products of SEACLID/CORDEX Southeast Asia in assessing the impacts of future climate change on critical sectors over Southeast Asia is far more critical and important. Jointly launched by the Deputy Vice-Chancellor of Universiti Kebangsaan Malaysia (UKM; the National University of Malaysia) and the President of Ramkhamhaeng University, Bangkok, Thailand, on May 7, 2018 at UKM, Bangi, Selangor, Malaysia, in conjunction with the Final Workshop of SEACLID/CORDEX Southeast Asia, SARCCIS is envisioned to be a one-stop regional climate change information data centre that disseminates regional climate change projection data, bias-corrected data, observed gridded data and other data products, information on case studies using these products and to provide relevant training to users. To ensure sustainability beyond project timeline, SARCCIS is jointly operated by Universiti Kebangsaan Malaysia and Ramkhamhaeng University, and this joint operation is one of the joint activities to be implemented under the Letter of Intent (LOI) (to be developed into MoU or MoA) between Universiti Kebangsaan Malaysia and Ramkhamhaeng University, which was signed on May 7, 2018. However, to realise the long-term goals of SARCCIS, more efforts and funding are required. Further works would focus more on the climate services aspects, and this is crucial to be developed and continued to ensure knowledge gaps in how future climate change is going to be impacting critical sectors in Southeast Asia region is adequately addressed.

Publications

Tangang, F., Supari, S., Chung, J., Cruz, F., Salimun, E., Ngai, S., . . . Hein-Griggs, D. (2018). Future changes in annual precipitation extremes over Southeast Asia under global warming of 2°C. *APN Science Bulletin, 8*(1). doi:10.30852/sb.2018.436

Chung JX, Juneng L, Tangang F, Jamaluddin AF (2018). Performances of BATS and CLM land-surface schemes in RegCM4 in simulating precipitation over CORDEX Southeast Asia domain. *International Journal of Climatology,* 38: 794–810; doi: 10.1002/joc.5032

Cruz, F. T., Narisma, G. T., Dado, J. B., Singhruck, P., Tangang, F., Linarka, U. A., … Aldrian, E. (2017). Sensitivity of temperature to physical parameterization schemes of RegCM4 over the CORDEX-Southeast Asia region. *International Journal of Climatology*. https://doi.org/10.1002/joc.5151

Ngai, S. T., Tangang, F., & Juneng, L. (2017). Bias correction of global and regional simulated daily precipitation and surface mean temperature over Southeast Asia using quantile mapping method. *Global and Planetary Change*, *149*, 79–90. https://doi.org/10.1016/j.gloplacha.2016.12.009

Ngo-Duc, T., Tangang, F. T., Santisirisomboon, J., Cruz, F., Trinh-Tuan, L., Nguyen-Xuan, T., … Aldrian, E. (2017). Performance evaluation of RegCM4 in simulating extreme rainfall and temperature indices over the CORDEX-Southeast Asia region. *International Journal of Climatology*. http://doi.org/10.1002/joc.4803

Supari, Tangang, F., Juneng, L., & Aldrian, E. (2017). Observed changes in extreme temperature and precipitation over Indonesia. *International Journal of Climatology*, *37*(4), 1979–1997. https://doi.org/10.1002/joc.4829

Supari, Tangang, F., Salimun, E., Aldrian, E., Sopaheluwakan, A., & Juneng, L. (2017). ENSO modulation of seasonal rainfall and extremes in Indonesia. *Climate Dynamics*. https://doi.org/10.1007/s00382-017-4028-8

Tangang, F., Farzanmanesh, R., Mirzaei, A., Supari, Salimun, E., Jamaluddin, A. F., & Juneng, L. (2017). Characteristics of precipitation extremes in Malaysia associated with El Niño and La Niña events. *International Journal of Climatology*. https://doi.org/10.1002/joc.5032

Juneng, L., Tangang, F., Chung, J., Ngai, S., Tay, T., Narisma, G., … Aldrian, E. (2016). Sensitivity of Southeast Asia rainfall simulations to cumulus and air-sea flux parameterizations in RegCM4. *Climate Research*, 69(1), 59–77. http://doi.org/10.3354/cr01386

Awards and honours

No awards or honours have been received

Pull quote

“SEACLID/CORDEX Southeast Asia is one of WCRP's flagship activity in the region, developing cutting-edge science to explore the added value of regional downscaling in support of vulnerability, impact and adaptation strategies. The continuous collaboration with APN to deliver tangible research outcomes and strengthen capacity building in Southeast Asia and more generally the Asia Pacific region has proven to be essential and very successful, said Dr Michel Rixen, Officer in Charge of the World Climate Research Programme”

“The establishment of the Southeast Asia Regional Climate Change Information System (SARCCIS) is a true ‘SUCCESS’ of the Southeast Asia Regional Climate Downscaling (SEACLID)/CORDEX Southeast Asia Project. Ramkhamhaeng University is happy to jointly operated this data portal with Universiti Kebangsaan Malaysia”, said Professor Wutisak

Lapcharoensap, President of Ramkhamhaeng University, in his speech during the SARCCIS Launching Ceremony at Universiti Kebangsaan Malaysia, May 7, 2018.

“UKM is proud to be part of SEACLID/CORDEX Southeast Asia that led to the establishment of SARCCIS. Now it is time for me to challenge scientists from other fields, to work together, much like in SEACLID/CORDEX Southeast Asia, in translating the climate information into information on how climate change is going to affect critical sectors, people and their livelihoods” said Prof. Dato’ Dr. Ir. Marzuki Bin Mustapha, Deputy Vice-Chancellor, Universiti Kebangsaan Malaysia in his speech during the SARCCIS Launching Ceremony at Universiti Kebangsaan Malaysia, May 7, 2018.

Acknowledgements

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1.0 Introduction

Southeast Asia, which is home to more than 600,000 million people and comprises mainly least developed and developing countries, is highly exposed and vulnerable to the impacts of climate change. As highlighted in the Working Group II of the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) Asia Chapter (Hijioka et al. 2014), large knowledge gaps on how future climate change affecting critical sectors in the region existed. This was mainly due to the unavailability of high-resolution, robust and multi-model regional climate scenarios, which are needed by scientists of IAV community to assess the impacts of climate change (e.g., Valle *et al.* 2009). Such large knowledge gaps rendered countries in the region to be not in the best position to devise plans to adapt to the impacts of climate change and address issues related to the Sustainable Development Goals (SDGs) and Sendai Framework for Disaster Risk Reduction (SFDRR).

Prior to the establishment of SEACLID/CORDEX Southeast Asia, high-resolution, robust and multi-model regional climate change scenarios are non-existent in Southeast Asia. Southeast Asia was lagging behind other developed regions/countries regarding access to robust and multi-model local and regional climate change scenarios. While the requirement for these products is crucially important, generating them is a huge task due to the highly technical, resource-expensive and time-consuming exercise. For countries in the Southeast Asia region, this task is doable only through collaboration among scientists within the region. Realising this constraint, SEACLID was established to provide a platform for scientists from seven countries within the region to collaborate, share tasks in downscaling the general circulation models (GCMs) using a number of Regional Climate Models (RCMs). The streamlining of SEACLID into CORDEX and transforming it into the 14th domain of CORDEX (hence SEACLID/CORDEX Southeast Asia), is a “game changer” for this project. Not only it opened up the participation of international scientists from 7 countries outside the region that increased the number of downscaled GCMs and number of RCMs used but also the project gained international recognition and was considered one of success story among many CORDEX domains.

While the downscaling of numerous GCMs has been achieved, it is no doubt that it would not be a success without the higher degree of collaboration among scientists, the establishment of a network among scientists within and outside the region, especially young and early career scientists, that would last beyond project time. The training they have received through the opportunity to conduct research activity within each group, the training workshops organised by the project and knowledge sharing among scientists, all provided a strong foundation for this region to advance itself in research related to regional climate simulation in years to come.

More importantly, as one of its primary objective, the project has been successfully established the Southeast Asia Regional Climate Change Information System (SARCCIS;

http://www.rucore.ru.ac.th/SARCCIS). SARCCIS, being the only data portal that provides free access to the outputs of multi-model simulations of SEACLID/CORDEX Southeast Asia, would set to play a more significant role in fulfilling the requirement of IAV community in the region in conducting their assessment of future climate change impacts in Southeast Asia. This is another "game changer" in the quest to adapt and increase resilience to climate change in this region. However, SARCCIS, which is already a part of climate services, would require capacity building and training component for IAV community, which was not part of the SEACLID/CORDEX Southeast Asia objectives. This would have to be pursued perhaps in a different project.

2.0 Methodology

The future climate projections under certain prescribed concentration of greenhouse gases can be obtained by the General Circulation Model (GCM), which is a mathematical tool, embedded within it physical laws that govern how climate processes manifest itself (e.g. Collins et al. 2013). However, while GCM products have been very useful in understanding climate at the global and regional scales, their applications at the local scales for impact assessment are less appropriate and limited due to the coarse GCM resolution of 100 – 300 km (Giorgi et al. 2009). The typical approach to deal with this issue is to "refine" the information from the GCM, which is a process commonly known as regional climate downscaling (RCD). RCD can be implemented either statistically or dynamically (e.g., Hewitson and Crane 1996; Giorgi et al. 2009). Statistical downscaling requires long series of good quality observed data and hence becomes less practical in a region where data is scarce and of low quality. With dynamical downscaling, a Regional Climate Model (RCM) is nested within the GCM to produce high-resolution regional climate change scenarios that can be used for impact assessment at local scales. For this project, a domain of 91.97°E to 143.79°E; 12.39°S to 24.51°N covering entire Southeast Asia with a resolution of 25 km × 25 km has been selected (hereafter CORDEX SEA Domain; Figure 1). However, it is necessary to have output from multiple GCMs, RCMs and Greenhouse Gases (GHG) emission scenarios to estimate uncertainties (e.g. Valle et al. 2009). However, multi-model dynamical downscaling is a very resource expensive and time-consuming exercise and often out of reach by most institutions in countries of the developing world. This project, which uses the CORDEX platform, was built upon a strong collaboration among scientists involved in the project by sharing the tasks in running the simulations and analysing the outputs.

Most of the GCMs used in this project have been validated in terms of their ability in reproducing the monsoon circulations and basic climate over this region (Siew et al. 2014). However, before the application of a particular RCM to downscale the GCM, the parameterisation schemes in the RCM must be optimised for the Southeast Asia region. For the RegCM4.3, a model developed by the International Centre for Theoretical Physics (ICTP), Italy, a comprehensive experiment to determine the best physics options was carried out and details of the experiments and their key results can be found in Juneng et al. (2016), Ngo-Duc et al. (2017) and Cruz et al. (2017).

Figure 1: The SEACLID/CORDEX Southeast Asia simulation domain of 25 km x 25 km resolution.

Table 1: SEACLID/CORDEX Southeast Asia simulation matrix indicating country contribution, GCMs, RCMs and RCPs used in the simulations.

Contribution by Country	General Circulation Model (GCM)	Representative Concentration Pathway (RCP)	Regional Climate Model (RCM)
Vietnam	CNRM-CM5 (CNRM, France)	RCP8.5, 4.5	RegCM4 (ICTP, Italy)
Philippines	HadGEM2 (Hadley Centre, UK)	RCP8.5, 4.5	RegCM4 (ICTP, Italy)
Thailand	MPI-ESM-MR (MPI-M, Germany)	RCP8.5, 4.5	RegCM4 ICTP, Italy)
Thailand	EC-Earth (EC-Earth consortium)	RCP8.5, 4.5	RegCM4 (ICTP, Italy)
Indonesia	CSIRO MK3.6 (CSIRO, Australia)	RCP8.5, 4.5	RegCM4 (ICTP, Italy)
Malaysia*	CanESM2 (CCCMA, Canada)	RCP8.5, 4.5	RegCM4 (ICTP, Italy)
Malaysia	IPSL-CM5A-LR (IPSL, France)	RCP8.5, 4.5	RegCM4 (ICTP, Italy)
Malaysia	GFDL-ESM2M (GFDL, USA)	RCP8.5, 4.5	RegCM4 (ICTP, Italy)
South Korea	HadGEM2-AO (Hadley Centre, UK)	RCP8.5, 4.5	WRF (NCAR USA)
Sweden	CNRM-CM5 (CNRM, France)	RCP8.5, 4.5	RCA4 (SMHI, Sweden)
Sweden	HadGEM2-ES (Hadley Centre, UK)	RCP8.5, 4.5	RCA4 (SMHI, Sweden)
Australia**	CNRM-CM5 (CNRM, France)	RCP8.5	CCAM (CSIRO, Australia)
Australia**	CCSM4 (NCAR, USA)	RCP8.5	CCAM (CSIRO, Australia)
Australia**	ACCESS1.3 (CSIRO, Australia)	RCP8.5	CCAM (CSIRO, Australia)
Hong Kong SAR***	ESM2M (GFDL, USA)	RCP8.5, 4.5	RegCM4 (ICTP, Italy)
United Kingdom	HadGEM2-ES (Hadley Centre, UK)	RCP8.5	PRECIS (Hadley Centre, UK)
Germany***	MPI-ESM-LR (MPI-M, Germany)	RCP8.5, 4.5	ROM (MPI-M Germany)
Japan**	MRI-AGCM3.2 (MRI, Japan)	RCP8.5, 4.5	NHRCM (MRI, Japan)

[Note: * yet to be completed, ** time-slice runs, *** 50 km x 50 km and with slightly different domains to cover Western Pacific warm pool]

The streamlining of SEACLID into CORDEX made it possible to fulfil the requirement of multiple GCMs, RCMs and emissions scenarios. Table 1 shows the simulation matrix conducted under SEACLID/CORDEX Southeast Asia. Despite considered as “ensemble of opportunity”, the simulations provide a reasonable estimation of the ensemble mean and associated uncertainties in future climate projections.

The analysis of model outputs was carried out by evaluating the performance of the model ensemble means during the baseline period (1976 – 2005), and the projections were analysed based on three future periods, i.e., early century (2011 – 2040), mid-century (2041-2070) and end of 21st century (2071 – 2099). The analysis was focused on the mean of surface temperature and precipitation and extremes.

In this report, projected changes in five extremes indices have been examined, selected from the set of indices described by the Joint CCl/CLIVAR/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI) (Zhang et al. 2011) (Table 2).

Table 2: Description of ETCCDI indices used in this report.

ID	Extremes Index	Description	Units
TXmean	Mean of Tmax	Seasonal mean of daily maximum temperature	^{o}C
TNmean	Mean of Tmin	Seasonal mean of daily minimum temperature	^{o}C
RX1day	Maximum 1-day precipitation amount	Seasonal maximum 1-day precipitation	mm
R50mm	Number of extremely heavy precipitation days	Seasonal count when precipitation ≥ 50 mm	days
CDD	Consecutive dry days	Maximum number of consecutive days when precipitation < 1 mm in a season	Days

The significance of the projected changes (both in mean and extremes), indicated by the hatching in the spatial maps, reflects the significance of the climate change signal versus inter-annual variability at 95% level. This was determined by using a Monte Carlo technique (e.g. Baez and Tweed, 2013). The robustness of the projected change at 95% is indicated by the red dots if at least *n* number of models agree in the sign of change out of the total number (N) ensemble members. The number *n* was determined by using a binomial probability distribution (Vautard et al. 2014). For the spatial maps of projected temperature changes, in all grid points, the changes were significant and robust at 95%, although no hatching and red dots are shown in the maps.

In addition to the analysis of model outputs, some analyses on the observations have also been carried out to compare them with the model outputs. These analyses include observed trends and anomalous condition during the El Niño – Southern Oscillation (ENSO)

phenomenon. Detailed of these studies can be obtained in Tangang et al. (2017) and Supari et al. (2017).

In verifying the data, we have used several observation models including Tropical Rainfall Measuring Mission (TRMM) 3B42 version 7 (TRMM; Huffman *et al.* 2007), the Asian Precipitation-Highly Resolved Observational Data Integration Towards Evaluation of Water Resources (APHRODITE; Yatagai et al. 2009), the Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS) (http://chg.geog.ucsb.edu/data/chirps/), and ERA-Interim reanalysis (Simmons *et al.* 2007).

3.0 Results & Discussion

3.1 Parameterization Schemes Tuning of Regional Climate Model

The simulation matrix shown in Table 1 involves the use of 7 RCMs. However, due to the limitation of the computing resource, project members within the Southeast Asia region managed to conduct simulations using a single RCM, i.e. RegCM4.3. Others simulations were conducted by project partners outside the Southeast Asia region (Table 1). Prior to the use of RegCM4.3 for climate change scenario runs, RegCM4.3 was tuned to identify the best option of some parameterisation schemes. Due to the time constraint also, the focus of the sensitivity experiment was limited to examining the options for cumulus parameterisation and ocean-flux schemes (Table 3). The experiments have been successfully carried out, and three scientific papers have been published from the experiments of which further details can be obtained from Juneng et al. (2016), Ngo-Duc et al. (2017) and Cruz et al. (2017). Overall, as reported in Figure 2 (Figure 13 of Juneng et al. 2016), Experiment 4, which comprised of MIT/BATs1e combination of physics, was considered as the best combination cumulus and ocean-flux scheme and this combination was used for the configuration for the actual model runs for RegCM4 shown in Table 1.

Subsequently, another experiment was conducted to determine the best option for land surface scheme, i.e. the Biosphere-Atmosphere Transfer Scheme (BATS, Dickinson et al., 1993) version 1e and the Community Land Model (CLM) version 4.5 (Oleson et al., 2013). Detailed setup and results of this experiment have been reported in Chung et al. (2018). Overall, the experiment showed that the use of CLM4.5 provided an only marginal improvement over the BATS1e at the expense of significant increase in computing time due to more computations required in CLM4.5.

Table 3: Experiment matrix for optimisation of RegCM4 performance conducted in Juneng et al. (2016).

Expt	Acronym	Cumulus parameterization schemes	Air–sea flux
01	Grell(AS)/BATS1e	Grell with Arakawa-Schubert closure	BATS1e
02	Grell (AS)/Zeng1	Grell with Arakawa-Schubert closure	Zeng 1
03	Grell(AS)/Zeng2	Grell with Arakawa-Schubert closure	Zeng 2
04	MIT/BATS1e	MIT Emanuel	BATS1e
05	MIT/Zeng1	MIT Emanuel	Zeng 1
06	MIT/Zeng2	MIT Emanuel	Zeng 2
07	MIT+Grell(FC)/BATS1e	MIT Emanuel (land) + Grell (ocean) with Fritsch-Chappell closure	BATS1e
08	MIT+Grell(FC)/Zeng1	MIT Emanuel (land) + Grell (ocean) with Fritsch-Chappell closure	Zeng 1
09	MIT+Grell(FC)/Zeng2	MIT Emanuel (land) + Grell (ocean) with Fritsch-Chappell closure	Zeng 2
10	Grell(FC)/BATS1e	Grell with Fritsch-Chappell closure	BATS1e
11	Grell(FC)/Zeng1	Grell with Fritsch-Chappell closure	Zeng 1
12	Grell(FC)/Zeng2	Grell with Fritsch-Chappell closure	Zeng 2
13	Grell(AS)+MIT/BATS1e	Grell (land) with Arakawa-Schubert closure + MIT Emanuel (ocean)	BATS1e
14	Grell(AS)+MIT/Zeng1	Grell (land) with Arakawa-Schubert closure + MIT Emanuel (ocean)	Zeng 1
15	Grell(AS)+MIT/Zeng2	Grell (land) with Arakawa-Schubert closure + MIT Emanuel (ocean)	Zeng 2
16	Kuo/BATS1e	Kuo	BATS1e
17	Kuo/Zeng1	Kuo	Zeng 1
18	Kuo/Zeng2	Kuo	Zeng 2

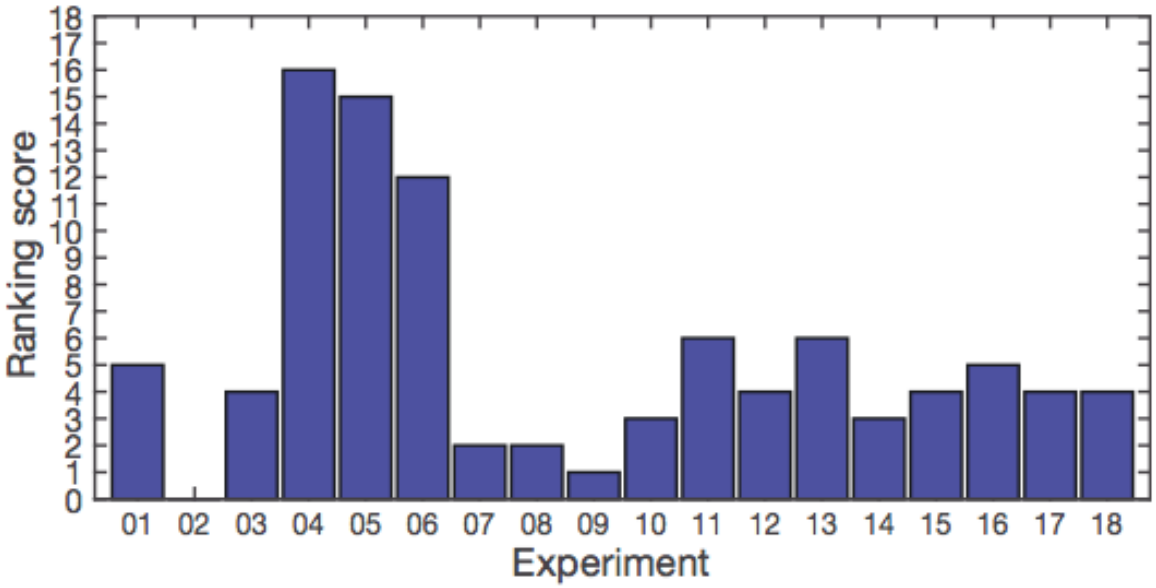

Figure 2: The ranking scores are indicating the performances of various experiments of cumulus and ocean-flux parameterisation schemes of RegCM4.3 (Juneng et al. 2016).

3.2 Model Performances During Baseline Period

In this report, we mainly describe the model performances in simulating two key parameters, i.e. surface air temperature and also precipitation for boreal winter (taken as December-January-February (DJF)) and boreal summer (June-July-August (JJA)). Figure 3 shows the simulated seasonal mean of surface air temperature for DJF (upper panel) and JJA (lower panel). However, in explaining the changes, we also used circulation related variables, e.g. winds and divergence.

Figure 3 shows the seasonal climatological means of surface air temperature of APHRODITE data and simulated values of various models. It is rather difficult to see in detailed the differences between the observed gridded data of APHRODITE and model simulated values including inter-model differences from Figure 3 due to the nature of this plot. Nevertheless, upon careful examination, we can see some notable differences, e.g. APHRODITE and HadGEM2-AO (WRF) especially over mainland Southeast Asia where much lower surface air temperatures were simulated in the model.

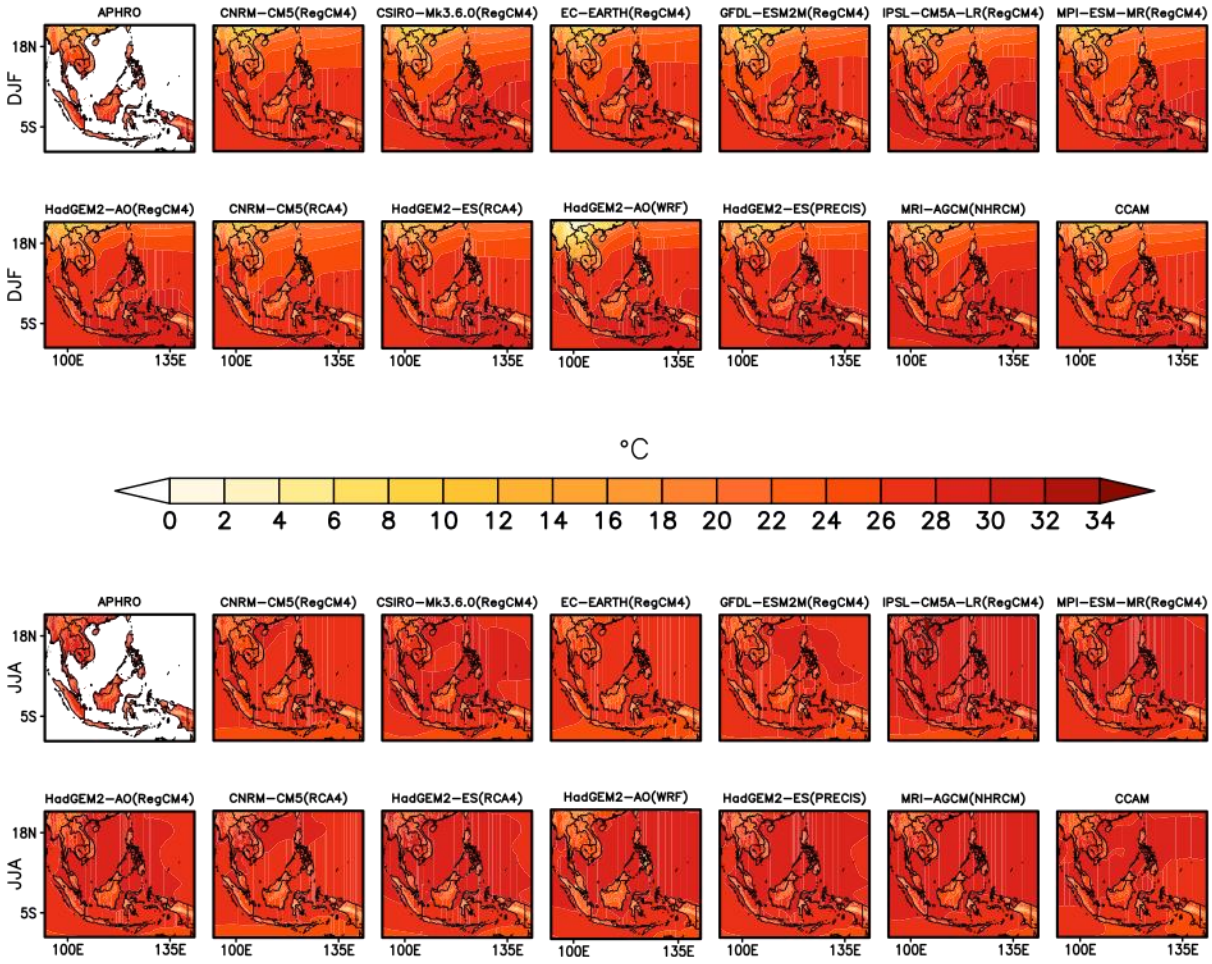

Figure 3: The observed climatological means of surface air temperature of the baseline period based on APRODITE and various models for DJF (upper panel) and JJA (lower panel).

Figure 4 shows the zonally averaged annual cycles of surface air temperature for the entire simulation domain for APHRODITE and various models. This figure shows much more apparent differences between the observations and models as well as inter-model differences. As shown some models simulated the zonally averaged annual cycle better than others. The IPSL-CM5A-LR(RegCM4) clearly overestimated the annual cycle despite to

some extent the shape was reasonably captured. Similarly, the zonally averaged annual cycle of HadGEM2-AO(WRF) also shows a distinct pattern.

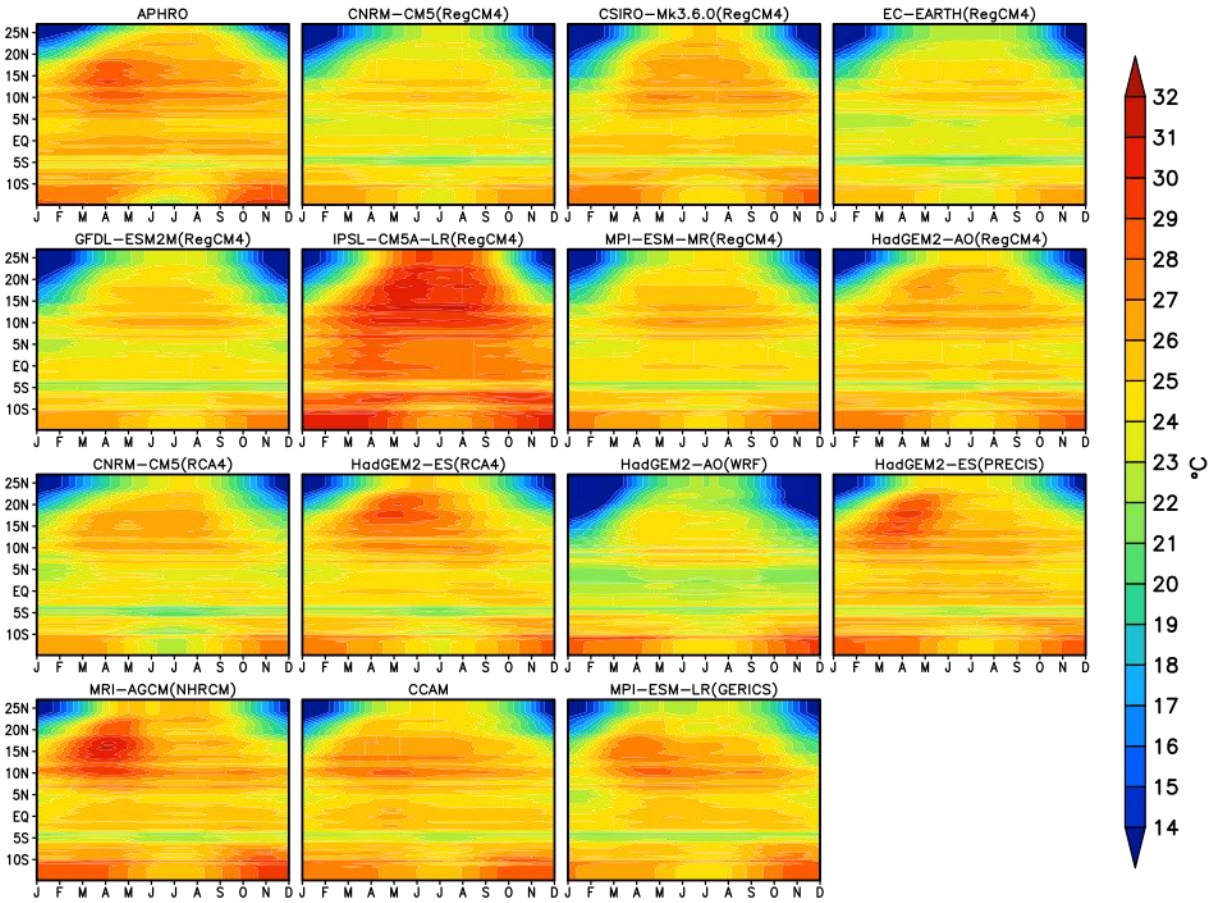

Figure 4: Zonally averaged annual cycles of surface air temperature of APHRODITE and various models.

Figure 5 shows the maps of DJF surface air temperatures biases of various models concerning APRODITE. As can be seen, there are some notable inter-model differences especially those of IPSL-CM5A-LR(RegCM4) (too warm over Malaysia and Indonesia) and HadGEM2-AO(WRF) (too cold over mainland Southeast Asia). Noticeably, the MRI-AGCM(NHRCM) also simulated warm biases. Generally, however, most models tended to be having cold biases. The warm bias of IPSL-CM5A-LR(RegCM4) became even more prominent during JJA, which covers the entire region and not only Malaysian and Indonesian region. Similarly, the cold biases of hadGEM2-AO(WRF) appeared to cover the whole region for JJA instead of just the mainland Southeast Asia (Figure 6).

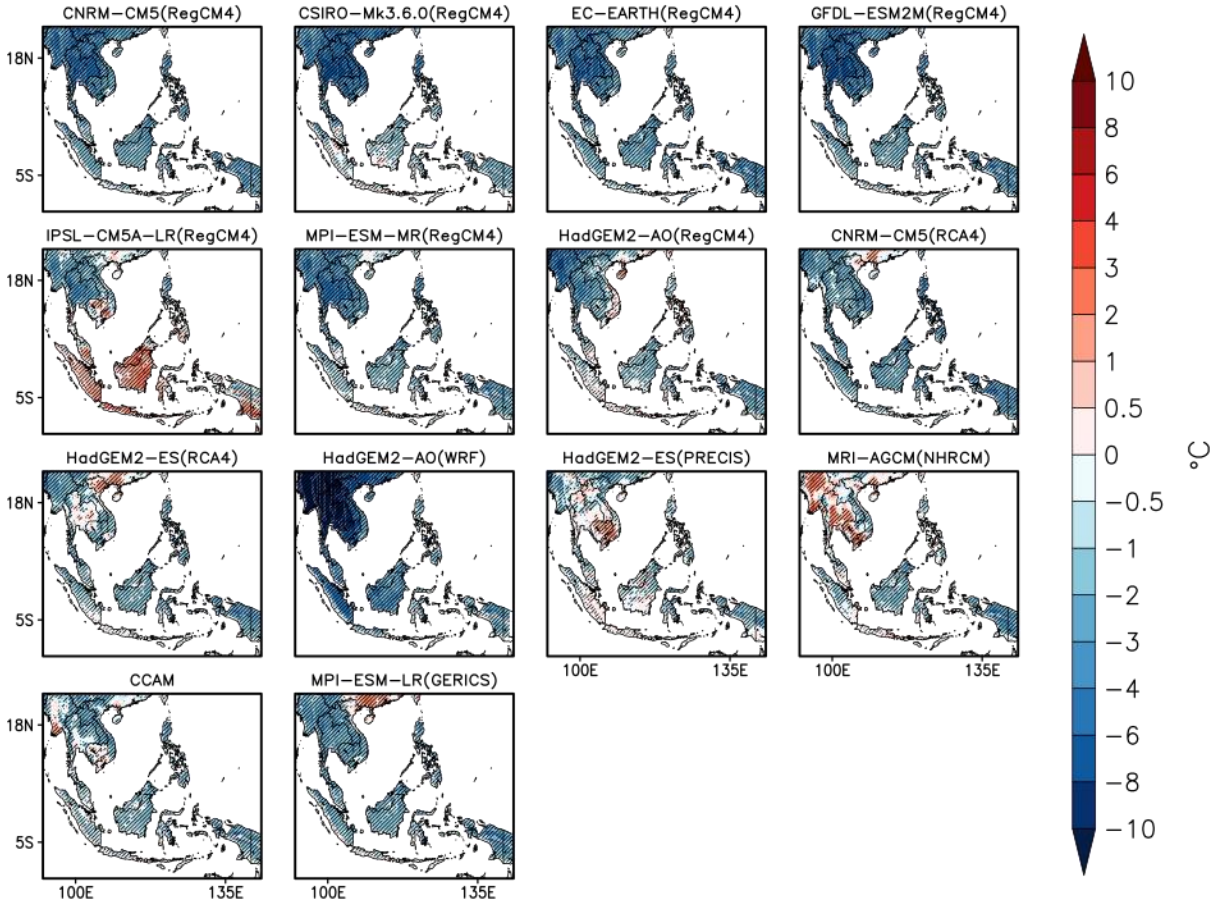

Figure 5: The seasonal temperature biases of individual models concerning APHRODITE for DJF.

Further investigation shows that the IPSL-CM5A-LR(RegCM4) also failed to simulate the monsoon circulation (not shown). This may be related to the IPSL-CM5A GCM itself, which may not have a good performance in simulating the monsoon circulation over the region. At this stage, we have not carried out any detailed analysis that can ascertain the reason for this large biases. However, based on this finding and that in Figure 6, we have decided to exclude the IPSL-CM5A(RegCM4) as one of the ensemble members. This decision is also based on its performance in simulating the rainfall, which will be discussed in this section as well.

Figure 7 indicates the performances (spatial correlation and root-mean-squared) of various models including ensemble mean in simulating the surface air temperature of APHRODITE during the baseline period. Clearly the two models mentioned above, i.e. the IPSL-CM5A-LR(RegCM4) and HadGEM2-AO(WRF) behaved differently from the rest of the models, especially during JJA. Overall the performance of ensemble mean is better than any other model.

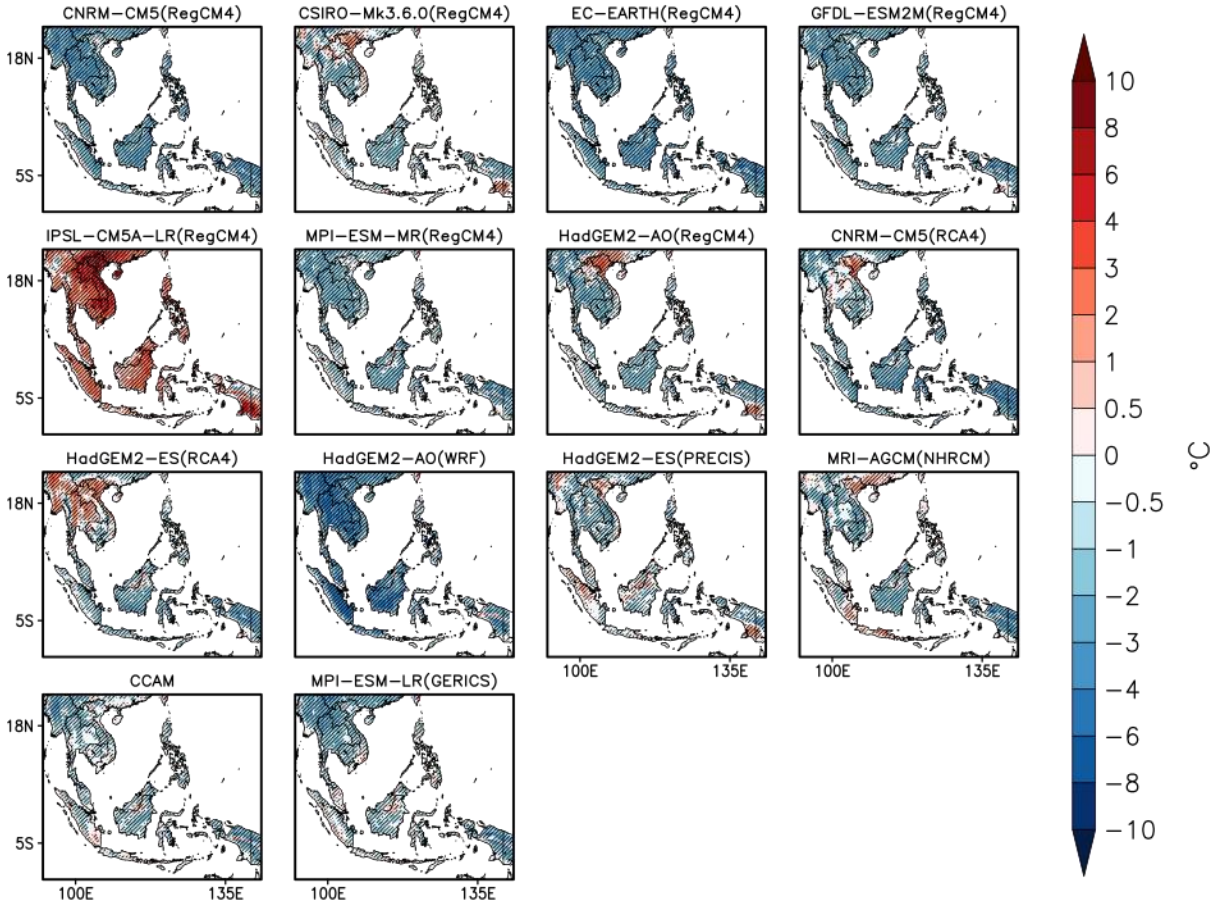

Figure 6: The seasonal temperature biases of individual models concerning APHRODITE for JJA.

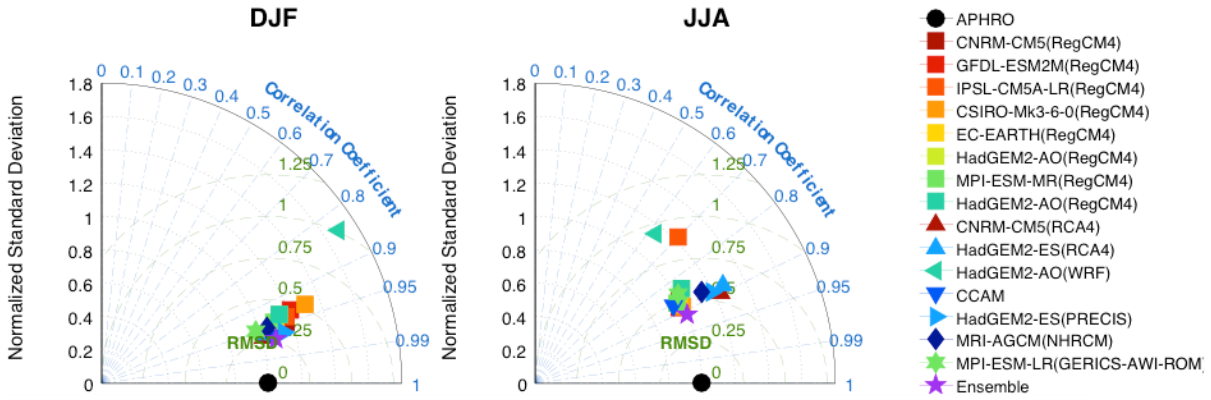

Figure 7: Taylor Diagram depicting performances of various models in simulating seasonal temperature climatology of DJF and JJA seasons

Figure 8 shows the comparison of the zonally averaged annual cycle of surface air temperature of APHRODITE data and the ensemble mean (excluding the IPSL-CM5A(RegCM4)). Generally, it can be seen that the model ensemble mean reproduced the APHRODITE surface air temperature zonally averaged annual cycle reasonably well. However, the simulated annual cycle shows lower values, indicating cold biases, which is consistent with the performances of most models in Figure 4 and 5. Indeed, Figure 9 indicated the cold biases of the ensemble mean performances in simulating the surface air temperature over the Southeast Asia domain. Generally, the magnitude of these cold biases can be around 3^{o}C.

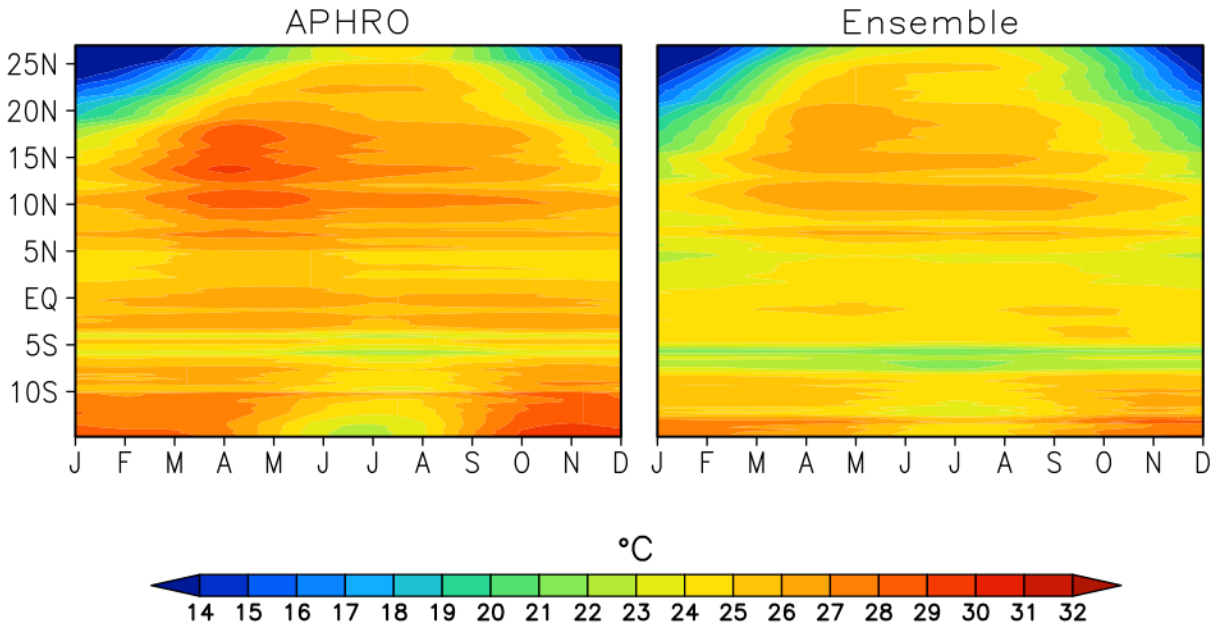

Figure 8: Zonally averaged annual cycles of APHRODITE and the ensemble mean.

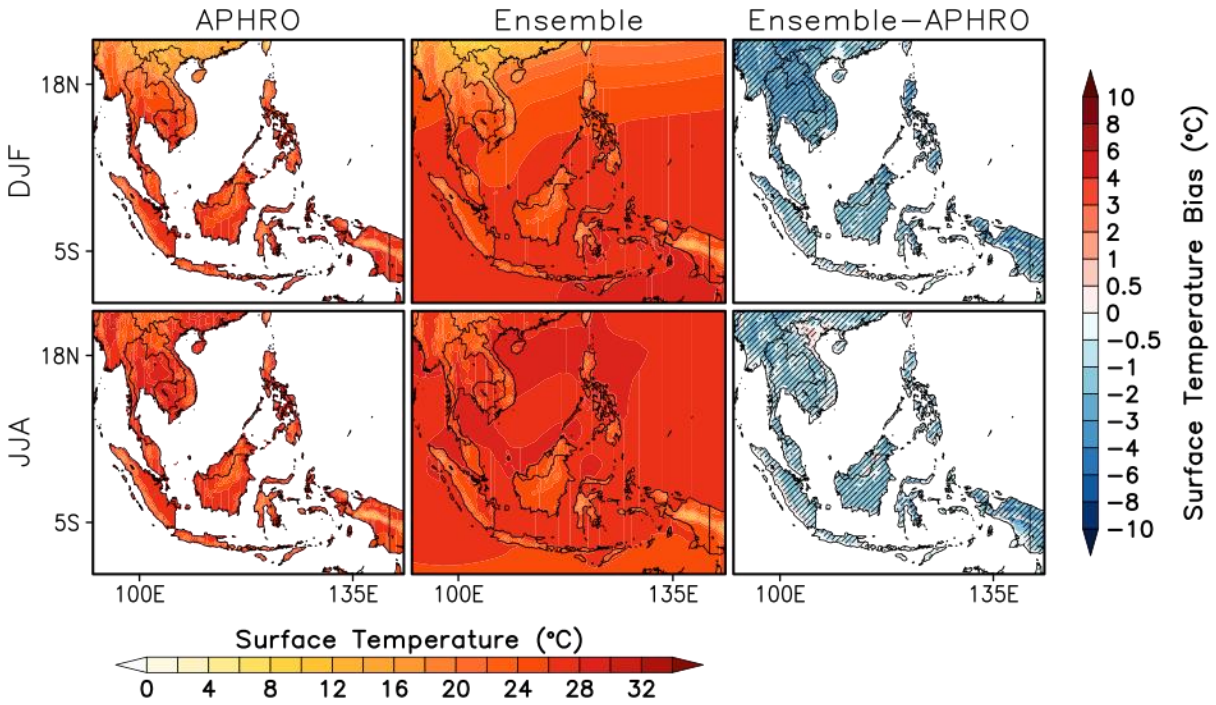

Figure 9: Seasonal-mean of APHRODITE and ensemble mean and biases for DJF (upper panel) and JJA (lower panel).

Figure 10 shows the climatological means of precipitation for boreal winter (which is taken as December-January-February (DJF)) and boreal summer (June-July-August (JJA)). As expected, it can be seen that there are some inter-model differences in term of the magnitude of rainfall being simulated. These inter-model differences provide estimates of uncertainty and spread associated with GCMs and RCMs listed in Table 1. These differences can be further elaborated based on the zonally averaged annual cycles (Figure 10) and maps of biases concerning the observed gridded TRMM data for DJF (Figure 11) and JJA (Figure 12), respectively.

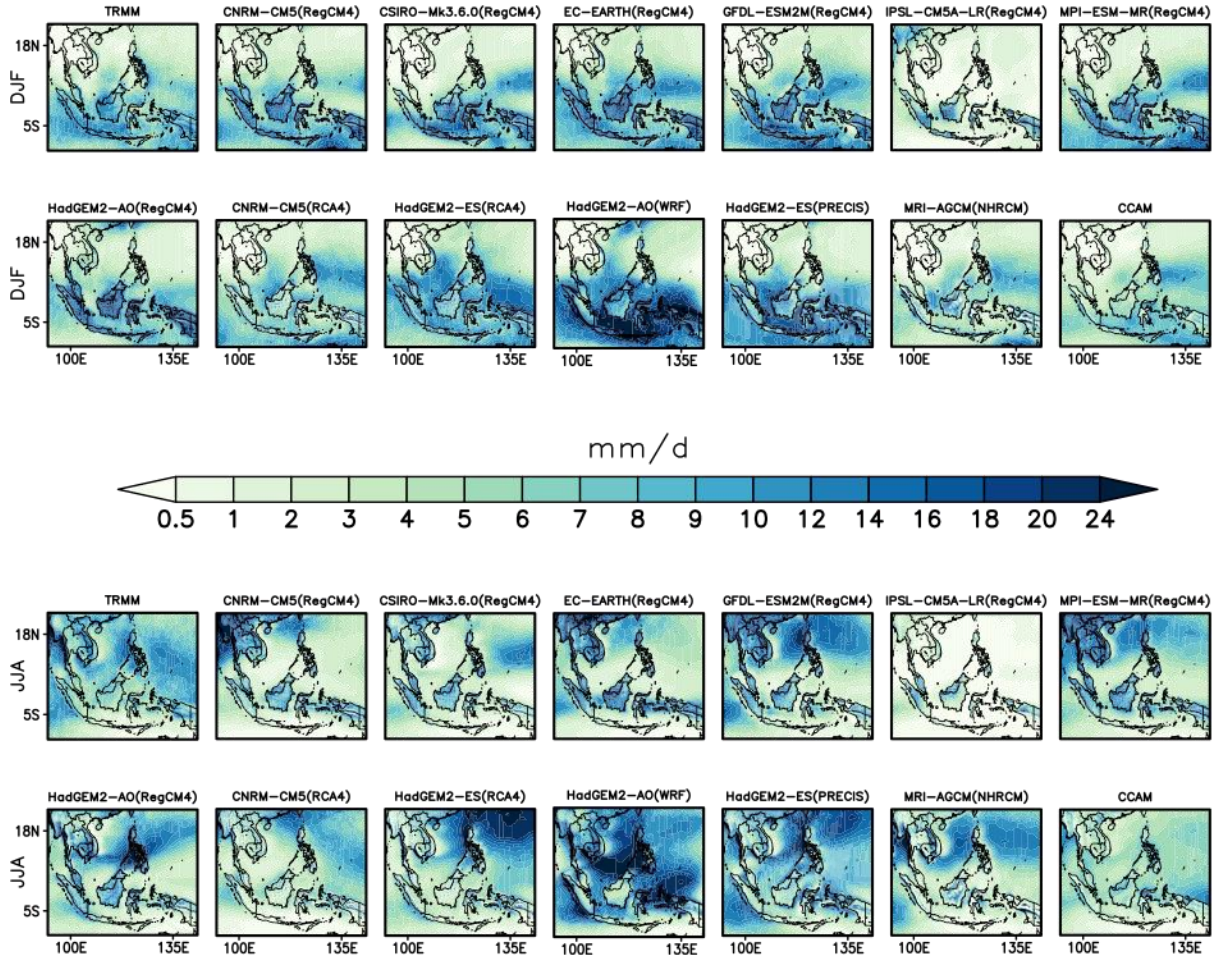

Figure 10: Climatological mean of DJF (upper panel) and JJA (lower panel) precipitation simulated by the models. Also shown in the first map of each panel is the climatological mean of TRMM data.

Figure 11 shows that most models captured the pattern of zonally averaged annual cycle although the intensity of the precipitation can be different. However, the annual cycle of precipitation simulated by IPSL-CM5A-LR(RegCM4) has a different pattern. As indicated in Figure 12 and 13, some inter-model variations are indicated in terms of the model ability to simulate the observed TRMM data. While some models showed dry biases in some areas during DJF (e.g. drier simulation over Indonesia and Borneo under ACCESS (CCAM)), wetter biases can be seen for HadGEM2-AO(RegCM4). Similarly, during JJA, a sharp contrast can be seen between IPSL-CM5A-LR(RegCM4) and MPI-ESM-MR(RegCM4) which produced dry and wet biases, respectively, over mainland Southeast Asia, despite the fact that both simulations used a common RCM, i.e. RegCM4. Hence, as expected, the biases can also be attributed to the forcing GCMs. However, at the same, the overall biases shown in Figure 12 and 13 could also be attributed to the observed gridded product itself. Over Southeast Asia, some gridded precipitation data products existed including TRMM and significant differences can exist among these products (Juneng et al. 2016).

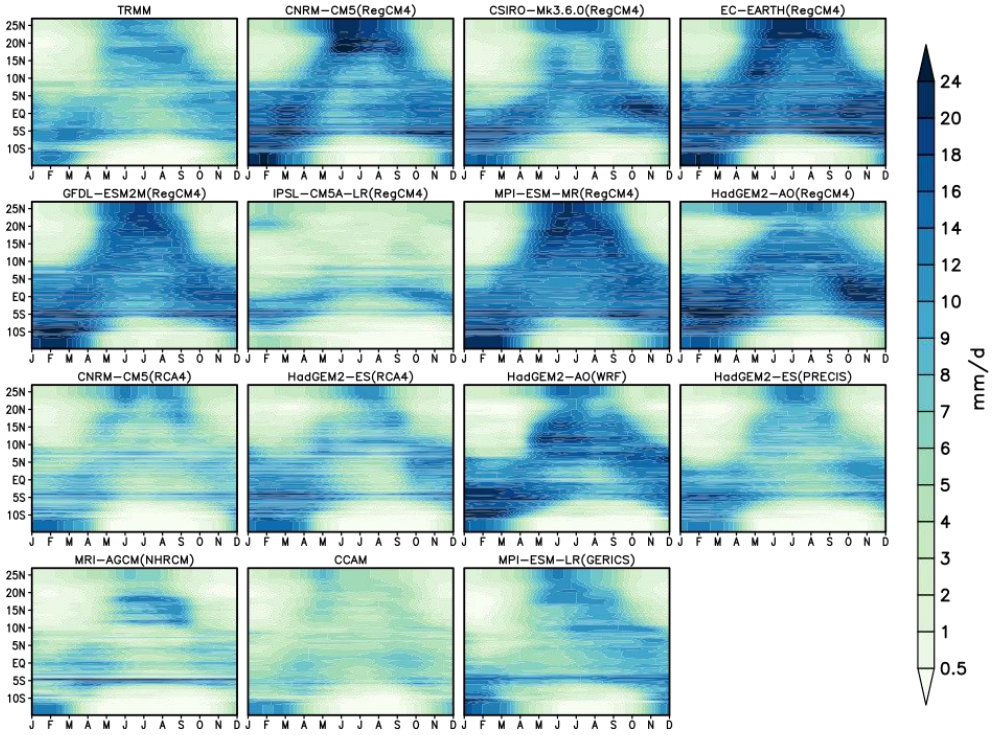

Figure 11: The zonally averaged annual cycles of precipitation for TRMM and all models.

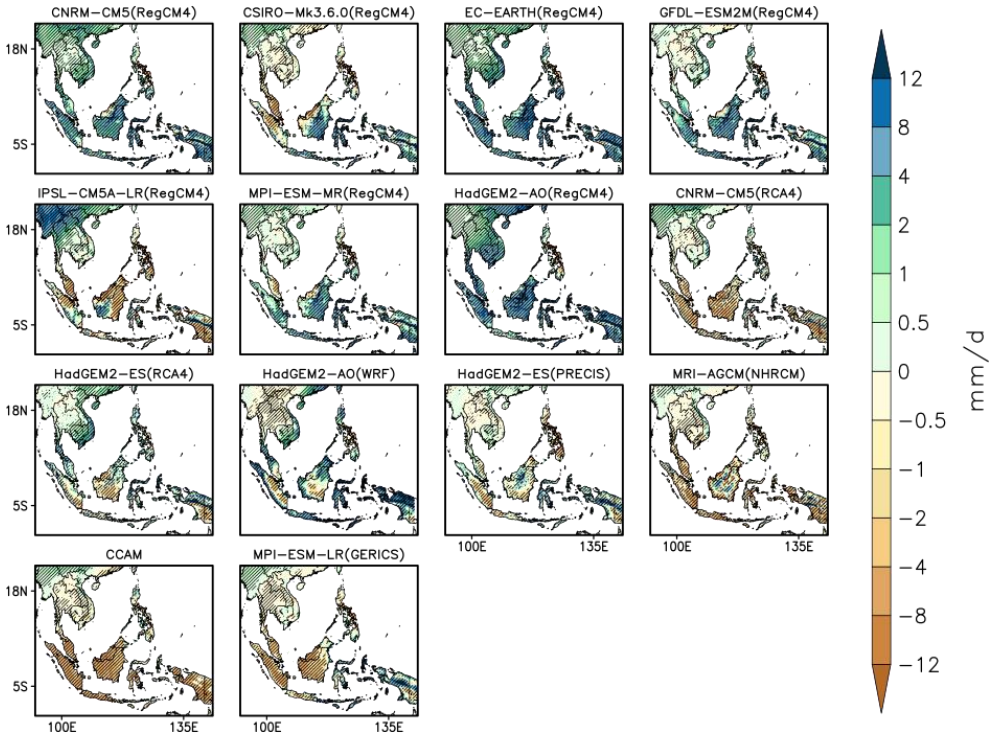

Figure 12: Maps of Precipitation biases of all models concerning TRMM data for DJF.

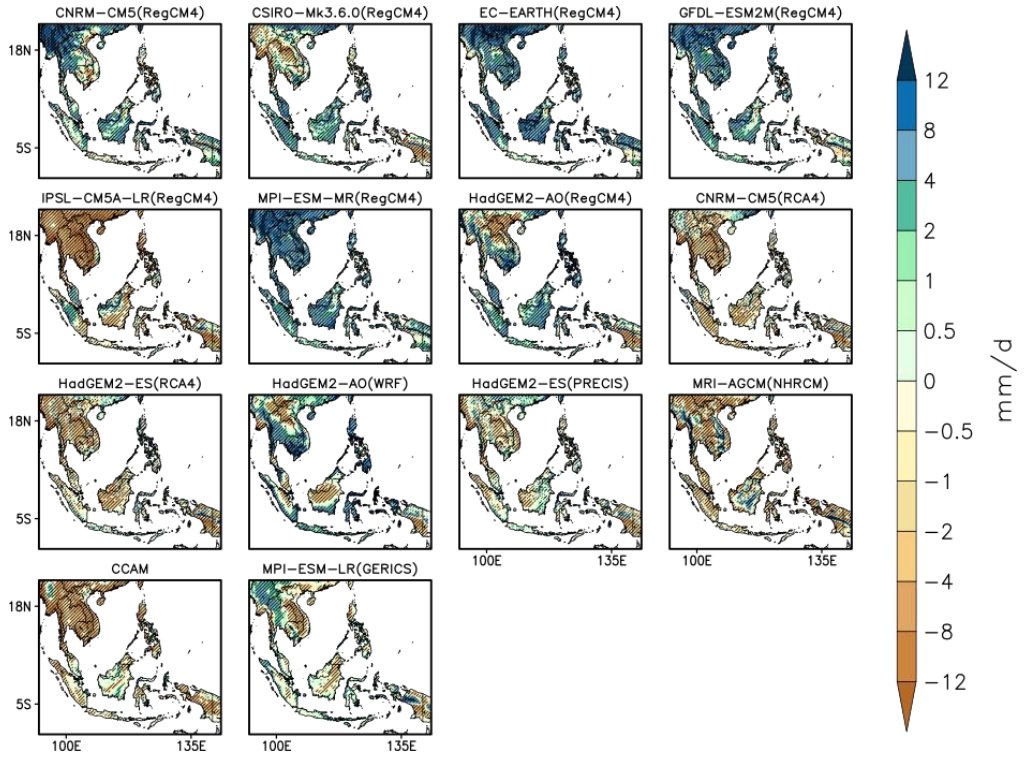

Figure 13: Maps of Precipitation biases of all models with respect to TRMM data for JJA.

To further examine the performances of these models, Figure 14 shows the Taylor Diagram that provides the spatial correlation and root-mean-square errors concerning the TRMM data. Unlike in Figure 7 of surface air temperature, the inter-model performances appear more variable. This implies that most models can simulate the surface air temperature with less variability among models. However, with precipitation, which a variable that is difficult to simulate, more variability is indicated. It can be seen that IPSL-CM5A-LR(RegCM4) performs rather poorly. Generally, however, there are inter-model variations in terms of spatial correlation and RMSD in simulating the TRMM rainfall. However, the ensemble mean, which IPSL-CM5A-LR(RegCM4) is excluded, often provides the best approximation for the observed TRMM rainfall.

Figure 15 shows zonally averaged annual cycle of the ensemble mean of precipitation, which represents the equal-weight average across all models except the IPSL-CM5A-LR(RegCM4), which was excluded. Also shown is the annual cycle of the TRMM. As can be seen, the ensemble mean approximated the shape of the observed annual cycle reasonably well. Figure 15 represents the seasonal biases of the ensemble mean with respect to the TRMM data. Generally, the ensemble mean shows slightly wet biases although in some area dry biases are indicated. The biases are generally smaller than the seasonal mean climatology. However, in some areas, they can be larger than the climatology mean, which implies large inter-model variability.

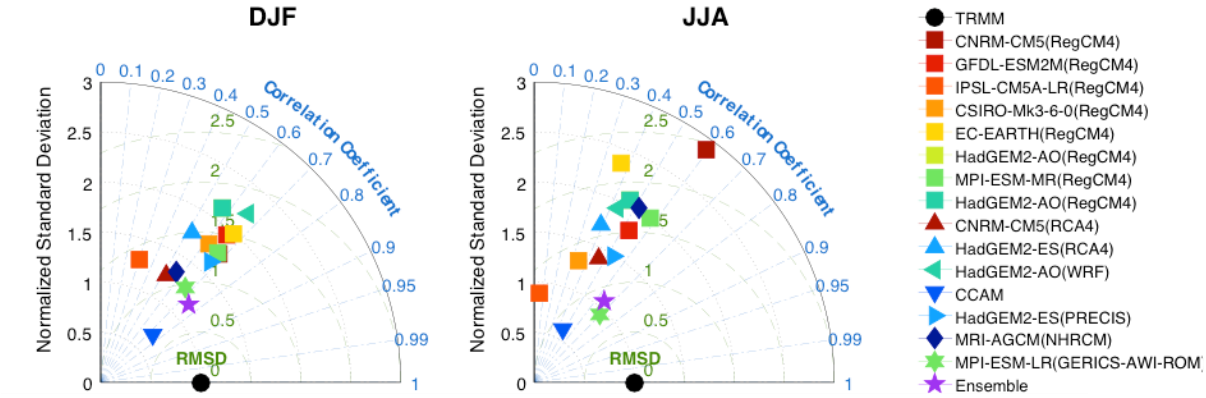

Figure 14: The Taylor Diagram depicting the performances of various models in simulating precipitation over Southeast Asia during DJF (left panel) and JJA (right panel)

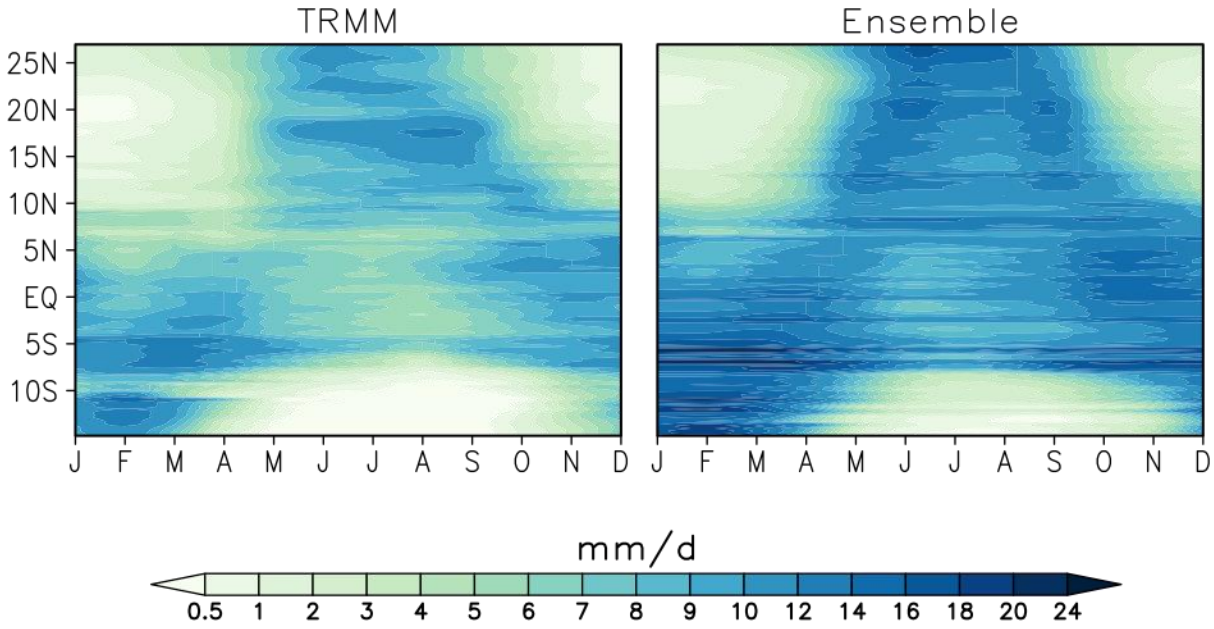

Figure 15: Zonally averaged annual cycles of precipitation for TRMM (left) and ensemble mean (right)

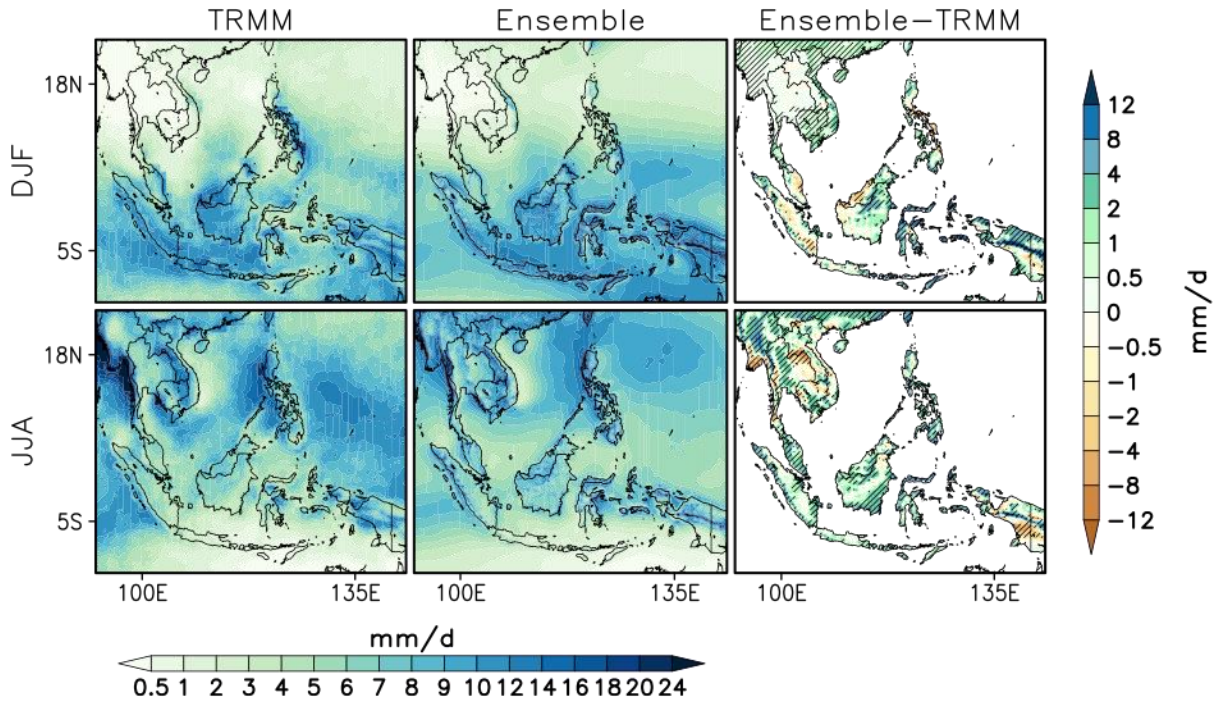

Figure 16: TRMM (left column) and ensemble climatological mean (middle column) and biases (right column) for DJF (upper panel) and JJA (lower panel).

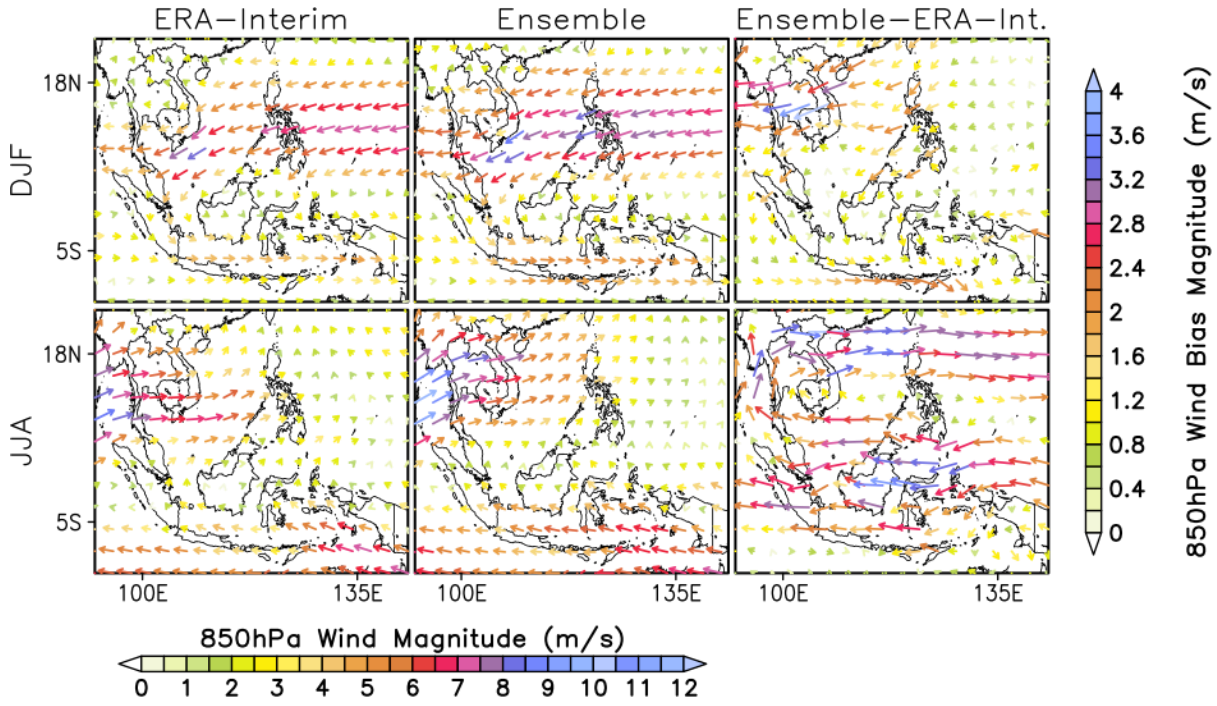

Figure 17: The ERA-Interim 850 hPa winds (left column), the model ensemble mean (middle column) and their biases (right column) for DJF (upper panel) and JJA (lower panel). The winds for DJF (JJA) signify the boreal winter (summer) monsoon circulation.

For aiding interpretation of model performances and future changes, in Figure 17 and 18, we plotted the seasonal low-level (850 hPa) winds and divergence. As shown in Figure 16, the model captured reasonably well the boreal winter and summer monsoonal circulation patterns. However, the ensemble mean generally overestimated the strength of the monsoon. As can be seen in the bias map, stronger easterlies over mainland Southeast Asia are indicated during DJF, indicating stronger winter monsoon circulation in the model. Similarly, during JJA, stronger southwesterlies prevail over the area indicating enhanced strength of summer monsoon in the model. Noticeably, the easterlies over the Maritime Continent are also indicated.

Figure 18 shows the low-level divergence at 850 hPa for ERA-Interim and model ensemble mean for baseline period. In the absence of *p*-velocity in some of the models in Table 1, the low-level divergence can provide information on subsidence and rising motion in the area. Low-level divergence (convergence) corresponds to subsidence (rising motion), which in turn corresponds to less (more) convection and rainfall. As shown in Figure 18, the low-level computed from ERA-Interim generally shows convergence (negative) south of the Maritime Continent (centred around 5^{o}S) during DJF. This corresponds to the position of the Inter-tropical convergence zone (ITCZ) during DJF where rising motion over the area is dominant. On the other hand, over latitudinal band around 15^{o}N, low-level divergence is dominant (i.e. positive) indicating subsidence over the area. However, the local system is also indicated over northern Thailand and over Lao where convergence is indicated. Over Peninsular Malaysia and northern Borneo, subsidence is indicated. During JJA, the condition is generally reversed where convergence is now located north over a latitudinal band of around 15^{o}N whereas over 5^{o}S divergence (subsidence) dominates. Over Thailand however, a dominant divergence is indicated. This alternating reversal of convergence and divergence between latitudinal bands in the north and the south corresponds to the migration of the ITCZ associated with monsoonal changes (e.g., Waliser and Gautier 1993).

Generally, the model ensemble mean simulated the ERA-Interim low-level divergence reasonably well. However, some notable biases are indicated. For example, over central-eastern Thailand during DJF, anomalous convergence is indicated whereas anomalous divergence dominates in the south. During JJA, divergence also dominates central Thailand and northern Vietnam. Similarly, anomalous divergence dominates Peninsular Malaysia and northern Borneo during JJA. During JJA, over the Philippines, the northern part is dominated by anomalous divergence whereas in the south anomalous convergence dominates. During JJA, the eastern part of the Maritime Continent is dominated by anomalous convergence.

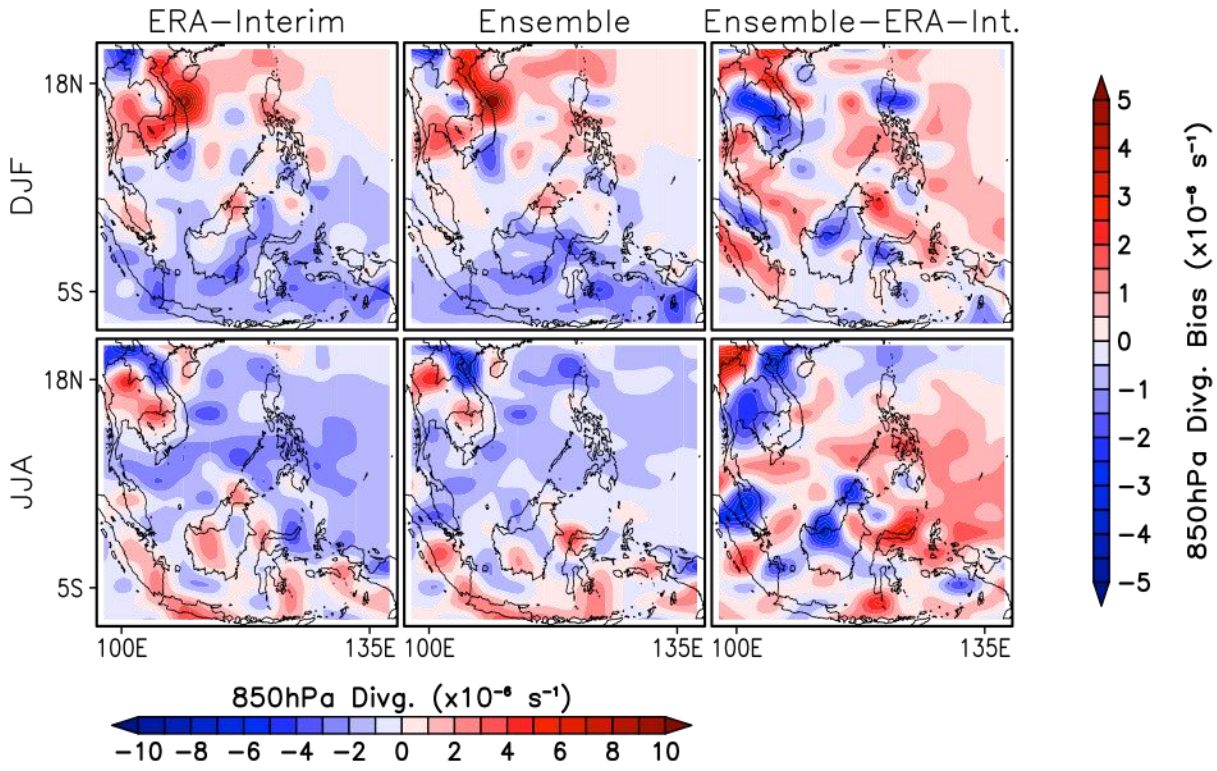

Figure 18: The ERA-Interim 850 hPa divergence (left column), the model ensemble mean (middle column) and their biases (right column) for DJF (upper panel) and JJA (lower panel). Positive values indicate divergence (subsidence) while negative values indicate convergence (rising motion).

3.3 Future Projection of Mean Surface Air Temperature and Precipitation

Generally, the multi-model simulations showed cold and wet biases as indicated by the ensemble mean shown in Figure 9 and Figure 16, for surface air temperature and precipitation, respectively. These biases may reflect the systematic errors in the models. Hence, the use of these model for estimating climate change signals in future periods should be fine. However, outputs of each of the model may need to be biased corrected before their use in impact assessment studies by IAV community.

The averaged projected surface air temperature changes averaged over the entire Southeast Asia region for the continuous period until 2100 are shown in Figure 19. As shown, a clear distinction can be seen on projected warming over the region between the higher (RCP8.5) and middle (RCP4.5) emission only after ~2035, which subsequently the two projections continue to diverge as time progresses. By 2100, business-as-usual scenario (RCP8.5) was projected to elevate the averaged surface air temperature over Southeast Asia to be about 4.5^{o}C above the pre-industrial level. However, under RCP4.5, the projected averaged temperature is about 2.3^{o}C above the pre-industrial level.

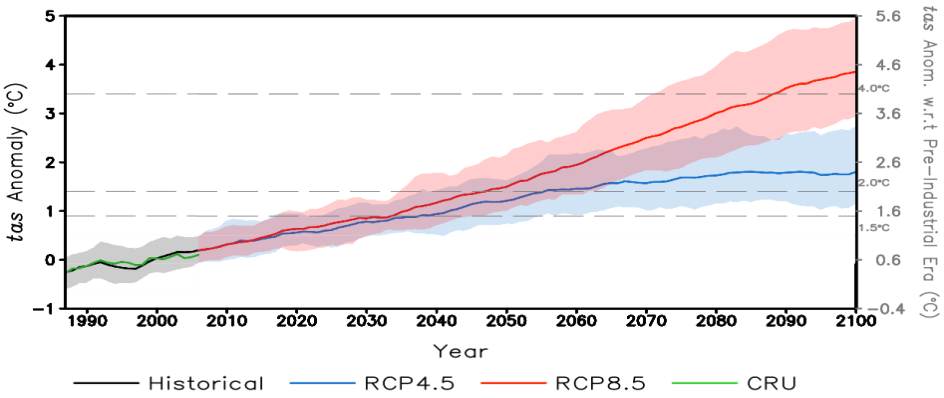

Figure 19: The ensemble mean (solid line) and ranges (shaded values) of projected annual surface air temperature according to RCPs. The left scale represents changes concerning the baseline period while the right scale is concerning pre-industrial level.

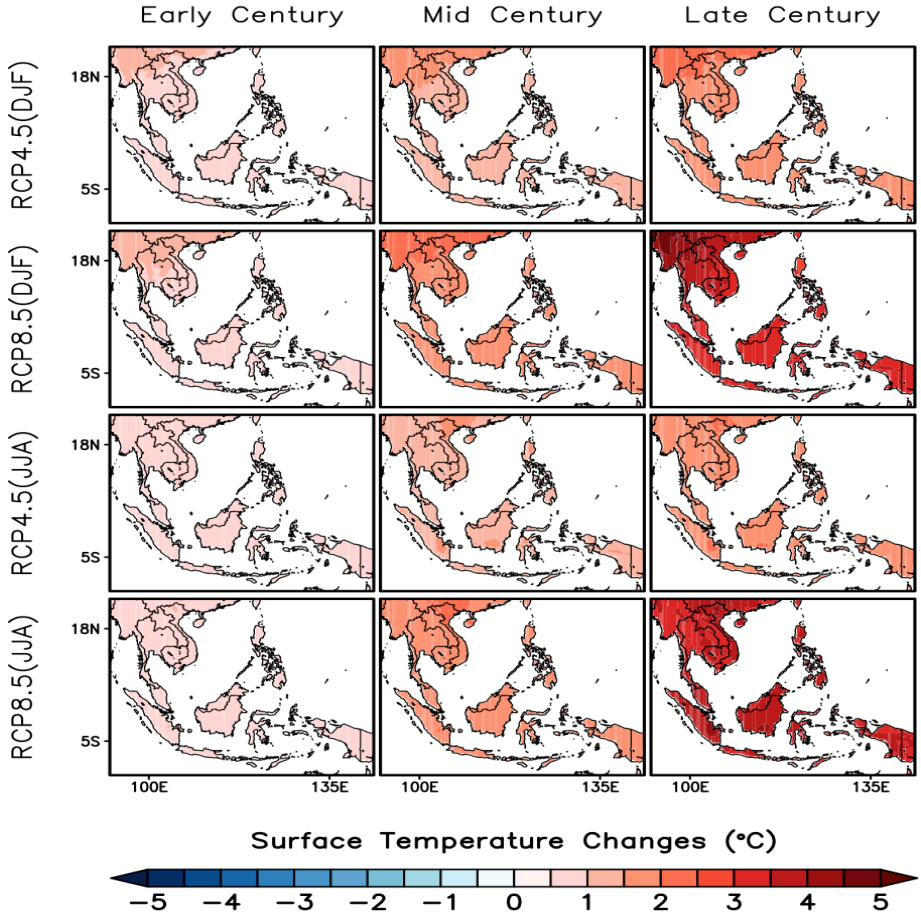

Figure 20. The projected seasonal averaged surface air temperature for DJF and JJA and the RCP8.5 and RCP4.5 scenarios for early, mid and end of 21st century.

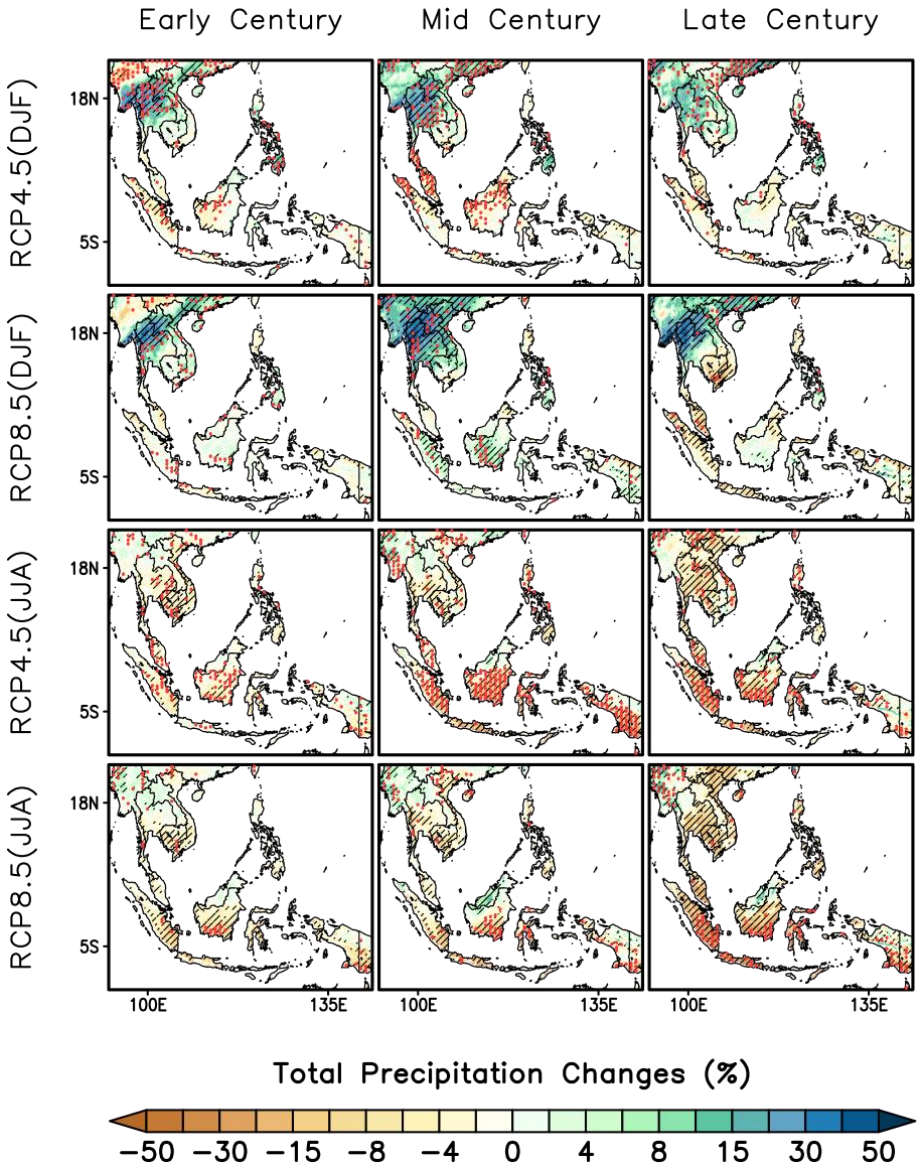

Figure 21: The ensemble mean of projected changes of precipitation (in term of percentage of baseline mean) for early (left column), mid (middle column) and late period of the 21st century (right column) for RCP8.5 and 4.5 and JJA and DJF.

Figure 20 shows the projected changes in seasonal mean surface air temperature with respect to baseline period during early, mid and late periods of the 21st century. Consistent with the ensemble mean in Figure 19, the projected changes increase with time as well as the level of emission. However, spatial variability can also be seen within the region albeit smaller magnitude. The projected changes of surface air temperatures in future periods are all significant and robust at 95% level although no hatching and red dots indicated.

The projected changes in seasonal mean precipitation show much more regional variation and less spatial uniform unlike surface air temperature (Figure 21). While some areas are

projected to experience decreased in mean precipitation other areas, show increases. During DJF for both RCPs, the persistent wetting trend is indicated over Thailand, Lao PDR and northern Vietnam for both RCPs and all projection periods, with 20 – 30 % higher mean rainfall compared with the baseline. In contrast, over northeast Myanmar during the early century, significant and

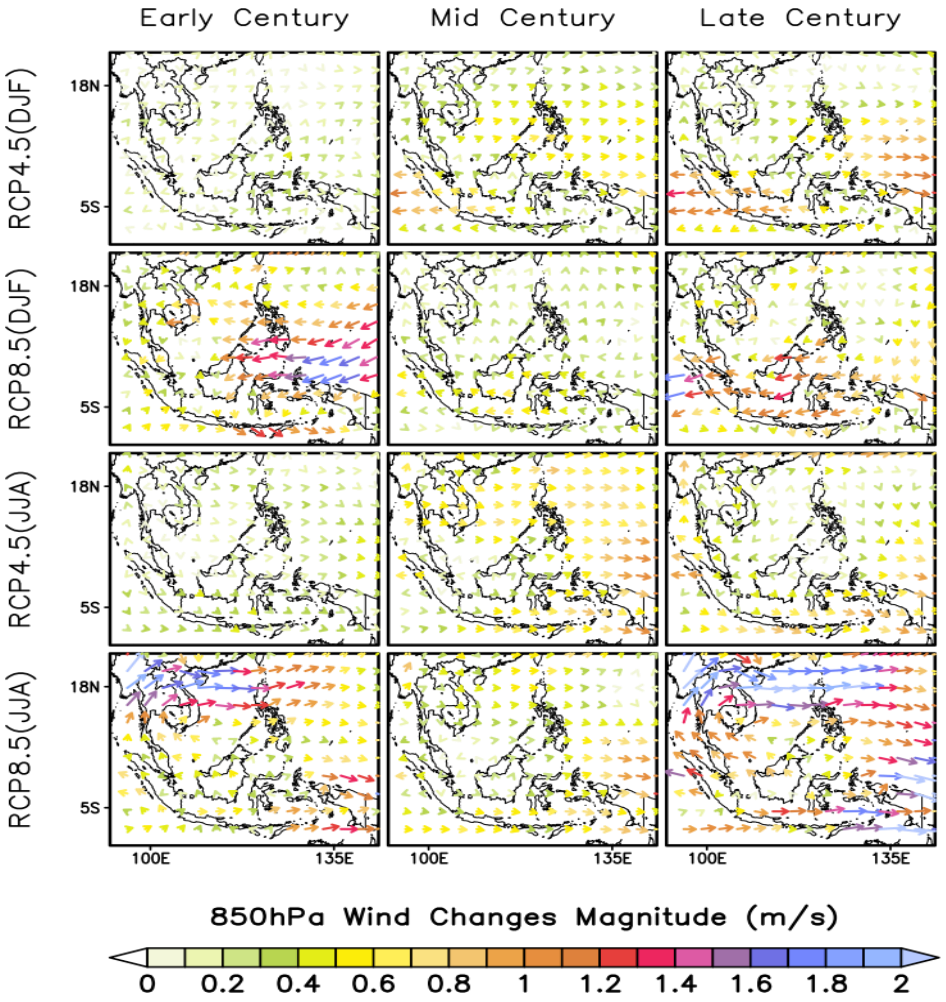

Figure 22: The ensemble mean of projected changes of 850 hPa winds for early (left column), mid (middle column) and late period of the 21st century (right column) for RCP8.5 and 4.5 and JJA and DJF.

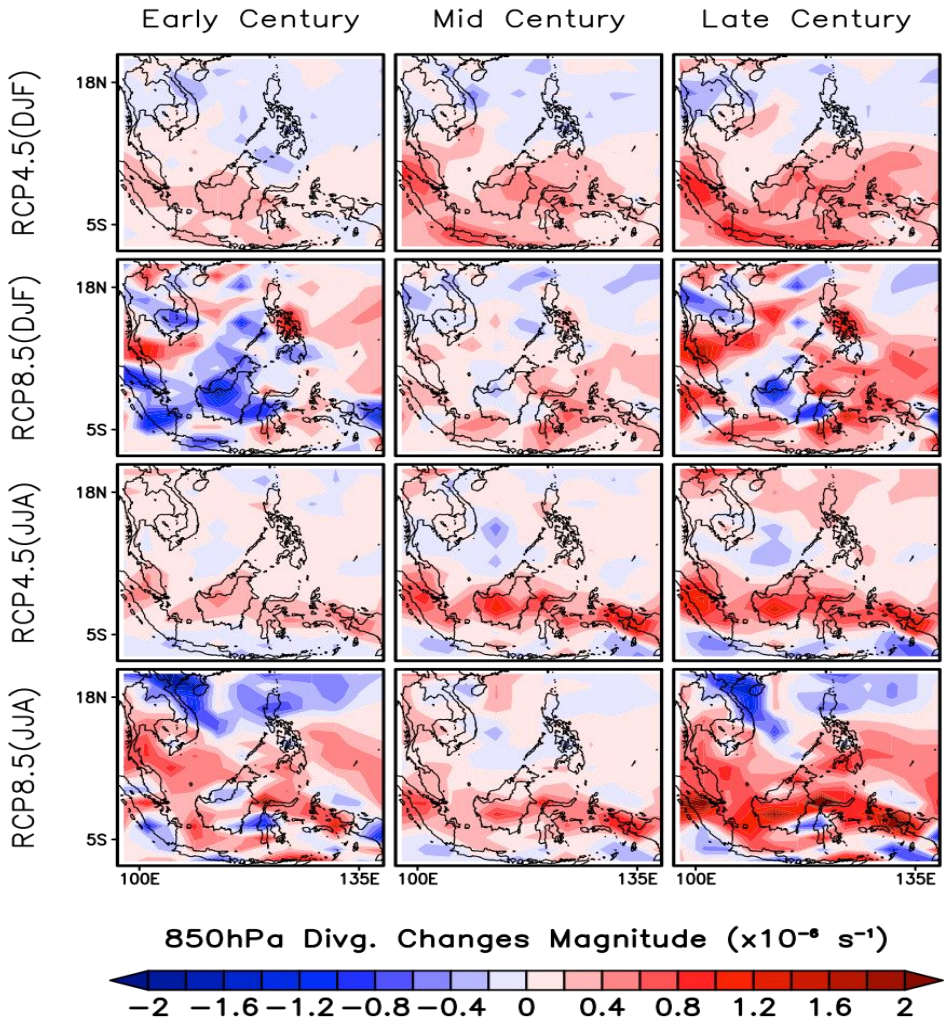

Figure 23: The ensemble mean of projected changes of 850 hPa divergence for early (left column), mid (middle column) and late period of the 21st century (right column) for RCP8.5 and 4.5 and JJA and DJF.

Robust dry condition is projected. However, by mid and late century the condition switches to wet condition, which may reflect decadal variability simulated by the model. However, this issue requires much detailed investigation, not just the ensemble mean but responses of individual models. Over the Maritime Continent, weak drying is projected during early and mid-century. However, during the mid-century, over Peninsular Malaysia, the drying signals are significant and robust. In the Philippines, enhanced precipitation is projected. The condition during JJA is projected to be different from that of the DJF. Generally, drying condition is projected over the entire region, especially over Indonesia and Malaysia where significant and robust drying conditions are indicated, and the decreasing magnitude can be 20 – 30% to that of the baseline mean. While over Thailand drying is also indicated, over Myanmar slightly wetter condition is projected.

The future projected changes on mean precipitation to some extent can be related to changes in the circulation, especially the divergence (Figure 23). There is a good

correspondence between the tendencies for drying (wetting) in Figure 20 with anomalous divergence (convergence) in Figure 23. The line of anomalous divergence that straddles from west to east around 3-5^{o}S coincided with the drying conditions over Indonesia during JJA (Figure 23). This low-level divergence implies subsidence over these latitudes and reduces convection and rainfall. This tendency for subsidence is consistent with the proposed idea of strengthening and broadening of Hadley circulation (HC) and contraction of a rising branch of HC due to intensification and broadening of the tropopause (e.g. Fu 2015). This subsidence and drying tendency over Indonesia is also highlighted in Kang et al. (2018).

The drying tendency over the Malaysian region during DJF coincides with anomalous divergence/subsidence over the area. Over the Philippines, divergence/subsidence dominates the southern part while the northern part is dominated by convergence / rising motion. Similarly, during DJF the northern-central-eastern parts of Thailand appear to be dominated by convergence / rising motion while in the southern region divergence/subsidence dominates, consistent with previous analysis by Tangang et al. (2018). During JJA however, future projection over Thailand is dominated by divergence/subsidence, which is also consistent with Tangang et al. (2018).

3.4 Future Projection of Extremes

The projected seasonal mean precipitation can be contributed by precipitation extremes. Duration, intensity and frequency of extremes all contribute to the total rainfall in different ways. From the risk and impact point of view, extreme precipitation can have even more severe impacts compared to the slow changing mean precipitation. This section provides an analysis of future projection of extremes based on the extreme indices given in Table 2. For completeness, we also considered PRCPTOT, which is the total precipitation and should be of similar characteristics of its future changes that of the mean precipitation. Figure 23 shows in the PDFs of the three indices of extreme precipitation, i.e. CDD, R50mm and RX1day, depicting the duration, frequency and intensity of extreme precipitation, in addition to PRCPTOT. The PDFs were computed based on the anomaly (due to the presence of the bias) for both the observed data (CHIRPS) and model ensemble for baseline period. The plots show that the PDFs of ensemble mean of PRCPTOT and other indices match reasonably well to those of observed. This implies reasonable behaviour of model ensemble mean in reproducing precipitation extremes.

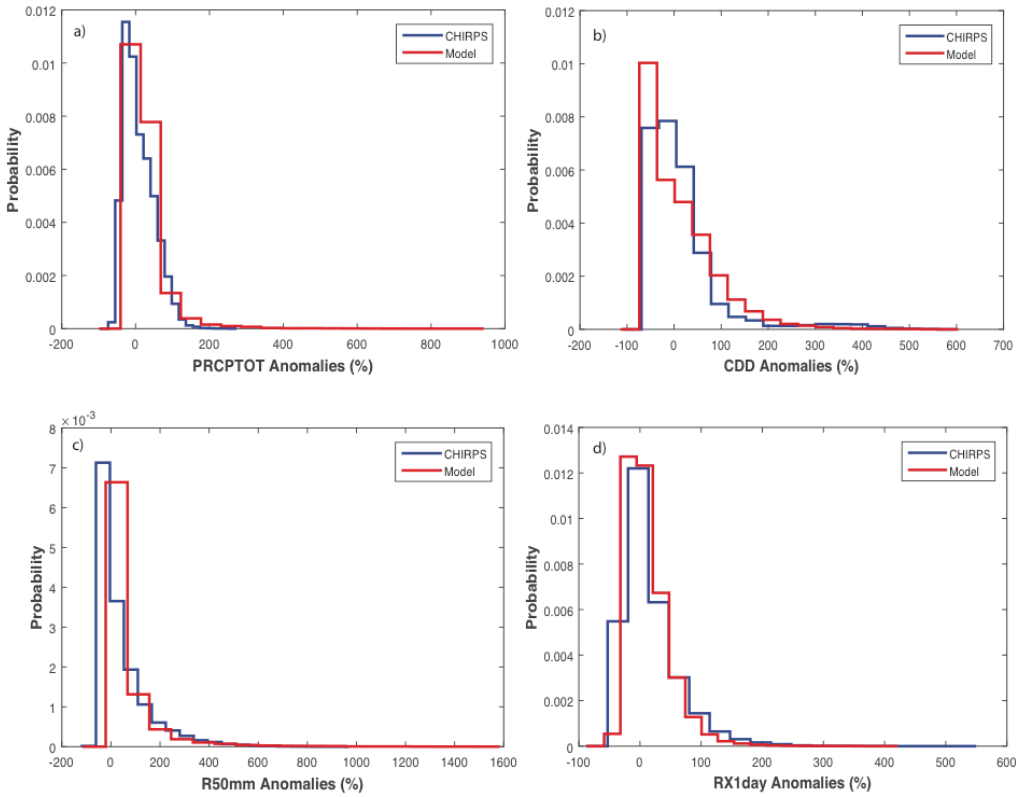

Figure 24: The PDFs of anomalous extreme indices of gridded CHIRPS dataset and model ensemble mean for Southeast Asia.

Figure 25 and 26 showed the projected changes of PRCPTOT of RCP8.5 and RCP4.5 for an early, mid and late century and DJF and JJA, respectively. As expected, the patterns of projected changes in these two plots are very consistent with the mean precipitation in Figure 20. It is more important to highlight the future changes of extremes, which are depicted in the next subsequent figures. The future changes of R50mm, which is the frequency of heavy rainfall event with rainfall intensity of 50 mm / day or more, are projected to increase over mainland Southeast Asia during DJF for both scenarios and all projection periods, although the changes are largely not significant and robust. Over Thailand, this increase in R50mm may contribute to an increase in total precipitation (Figure 25). However, over the northeast of Myanmar, despite a projected decrease in total rainfall, R50mm is also projected to increase. Over the Maritime Continent, generally, R50mm is projected to increase although the percentage of increase is lower than over the mainland Southeast Asia. Over the Philippines, generally, it is also projected to have enhanced R50mm although there is also a tendency for reduced R50mm over northern Philippines (Luzon).

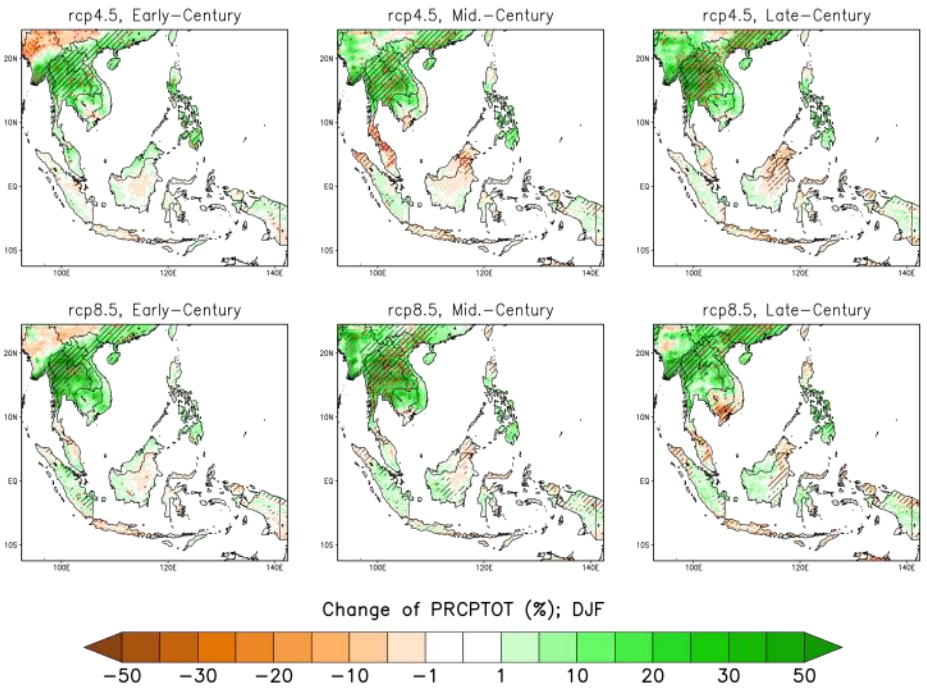

Figure 25: Projected changes in PRCPTOT (in %) during DJF for early, mid and late periods of the 21st for RCP 4.5 and 8.5.

The projected changes of R50mm during JJA provide interesting findings. While the projected mean rainfall (Figure 21) and total rainfall (Figure 26) during JJA indicated a tendency for drying especially over the Indonesian region, this region is also projected to have increased R50mm. On the other hand, over Myanmar, R50mm is projected to increase in agreement with the projected increase of total rainfall. Interestingly, over northern Vietnam, R50mm is projected to decrease in agreement with the projected total precipitation during JJA (Figure 26). Over Thailand, an increase of R50 mm is projected in most of the area although most of the signals are not significant and not robust. This is also the case over the Philippines, although there is also a tendency for differences between north and south of the country.

The RX1day provides information on the intensity of extreme precipitation. During DJF, significant changes are projected over mainland Southeast Asia including Thailand, Lao and Vietnam (Figure 27). However, over Myanmar RX1day is projected to decrease. Generally, small and insignificant changes are projected over the Maritime Continent during DJF. During JJA, RX1day is projected over Myanmar especially during the end of century and RCP8.5, where the projected signals become significant and robust. This is also the case over northern and central Thailand. Over Indonesia, other the other hand, RX1day is projected to decrease especially south of Sumatra, Java and south of Sulawesi during the end of century and RCP8.5.

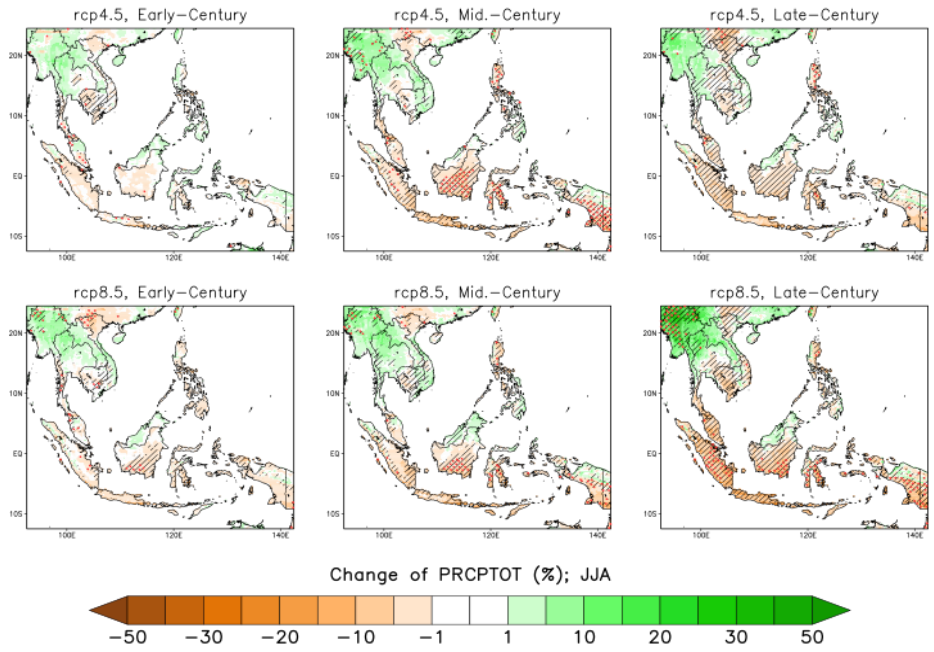

Figure 26: Projected changes in PRCPTOT (in %) during JJA for early, mid and late periods of the 21st for RCP 4.5 and 8.5.

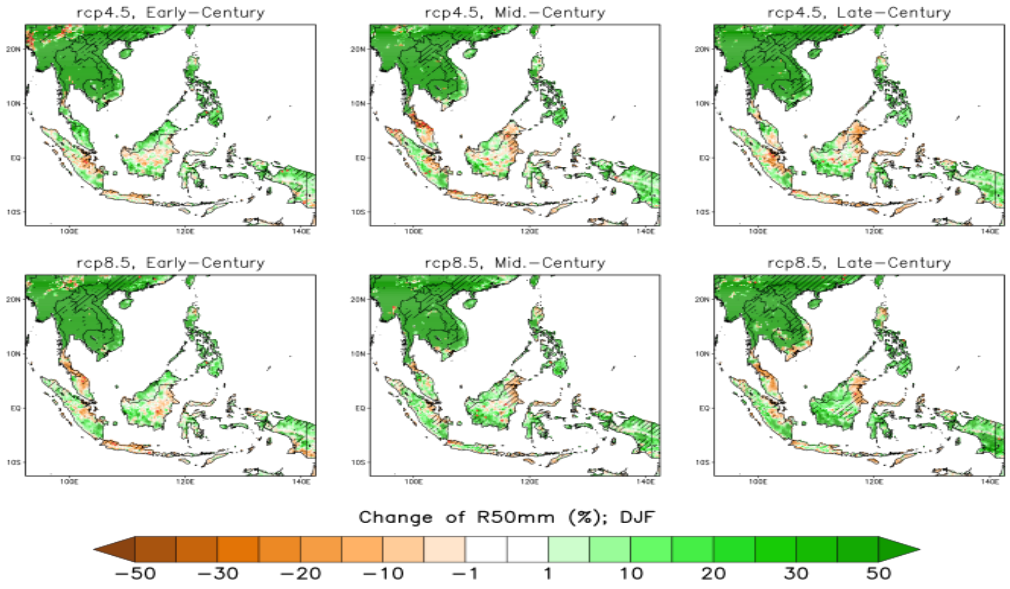

Figure 27: Projected changes in R50mm (in %) during DJF for early, mid and late periods of the 21st for RCP 4.5 and 8.5.

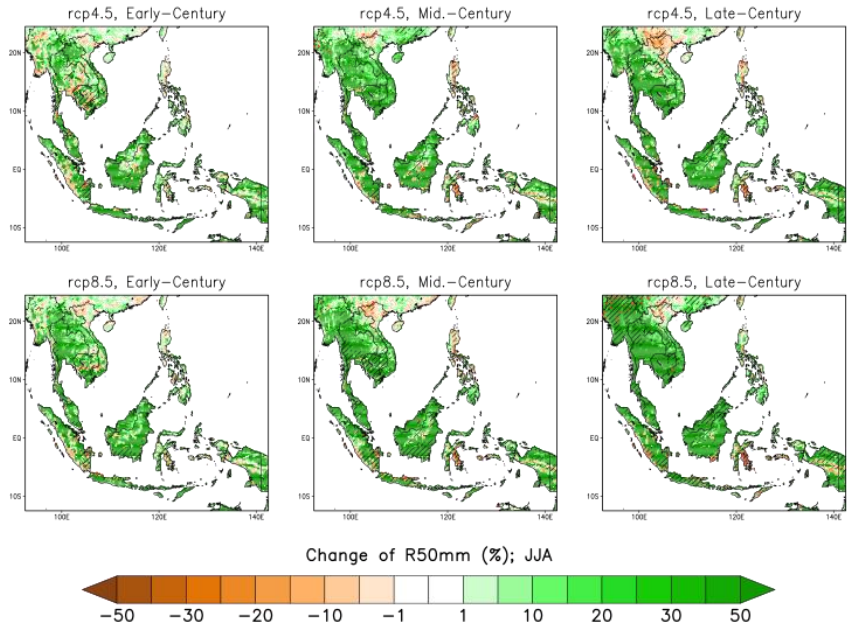

Figure 28: Projected changes in R50mm (in %) during JJA for early, mid and late periods of the 21st for RCP 4.5 and 8.5.

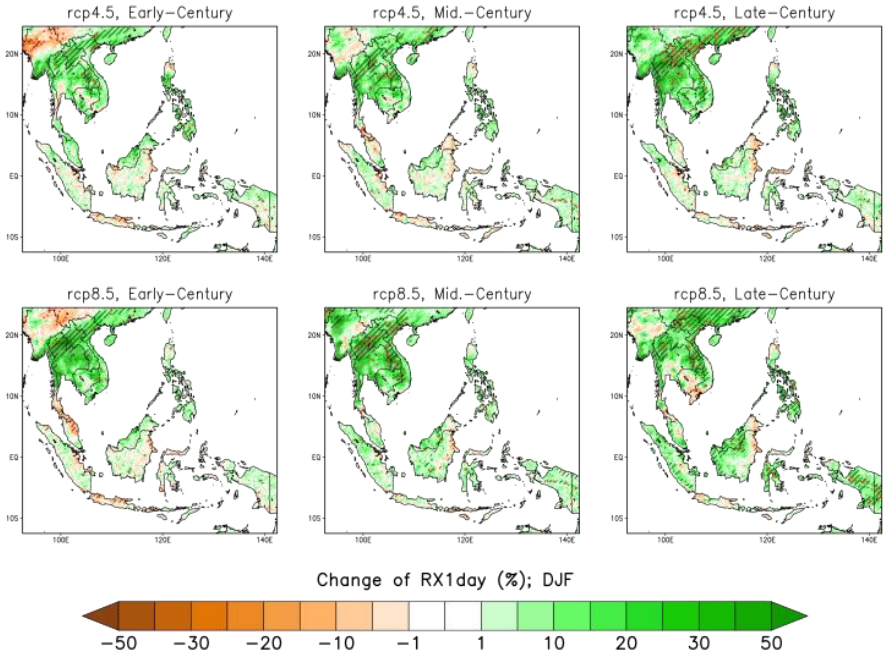

Figure 29: Projected changes in RX1day (in %) during DJF for early, mid and late periods of the 21st for RCP 4.5 and 8.5.

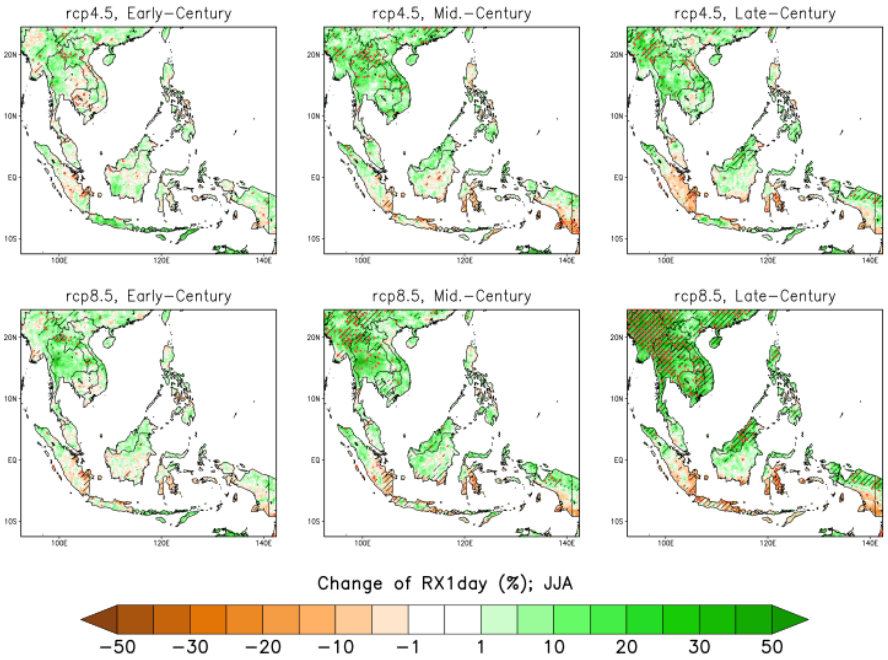

Figure 30: Projected changes in RX1day (in %) during JJA for early, mid and late periods of the 21st for RCP 4.5 and 8.5.

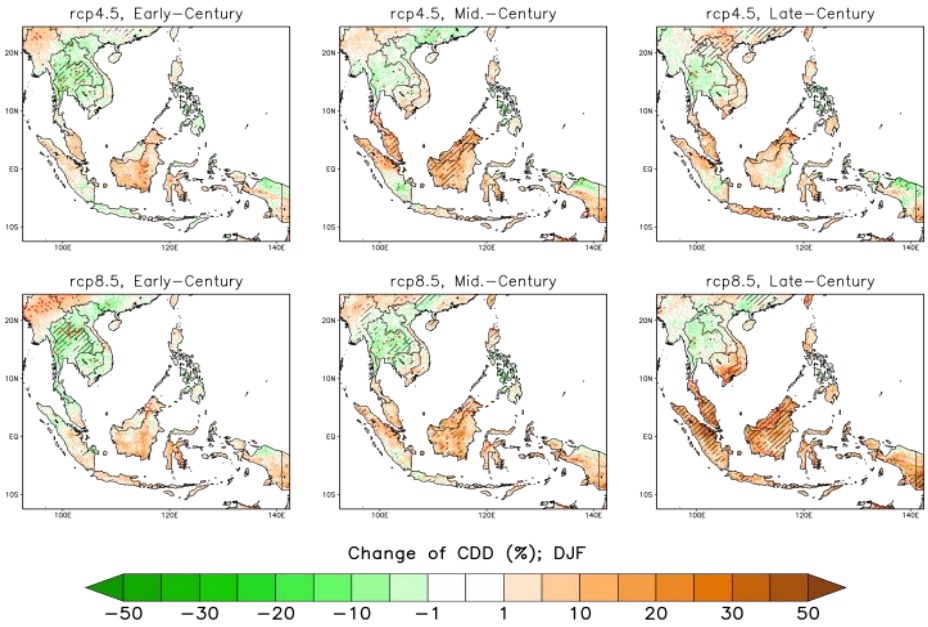

Figure 31: Projected changes in CDD (in %) during DJF for early, mid and late periods of the 21st for RCP 4.5 and 8.5.

The projected changes of CDD are highlighted in Figure 31 (DJF) and Figure 32 (JJA). Generally, Southeast Asia is projected to have increased CDD in future periods. However,

over Thailand, the decreasing trend of CDD is projected during DJF. However, during JJA, the increasing trend of CDD dominates. This is especially true for the Indonesian region. Hence, the projected drying trend in mean and total precipitation over this region is primarily contributed by increased in CDD. This implies that more drought events and longer duration of drought are projected for Indonesia during JJA. The same condition is projected for the whole of Vietnam, Cambodia and Lao.

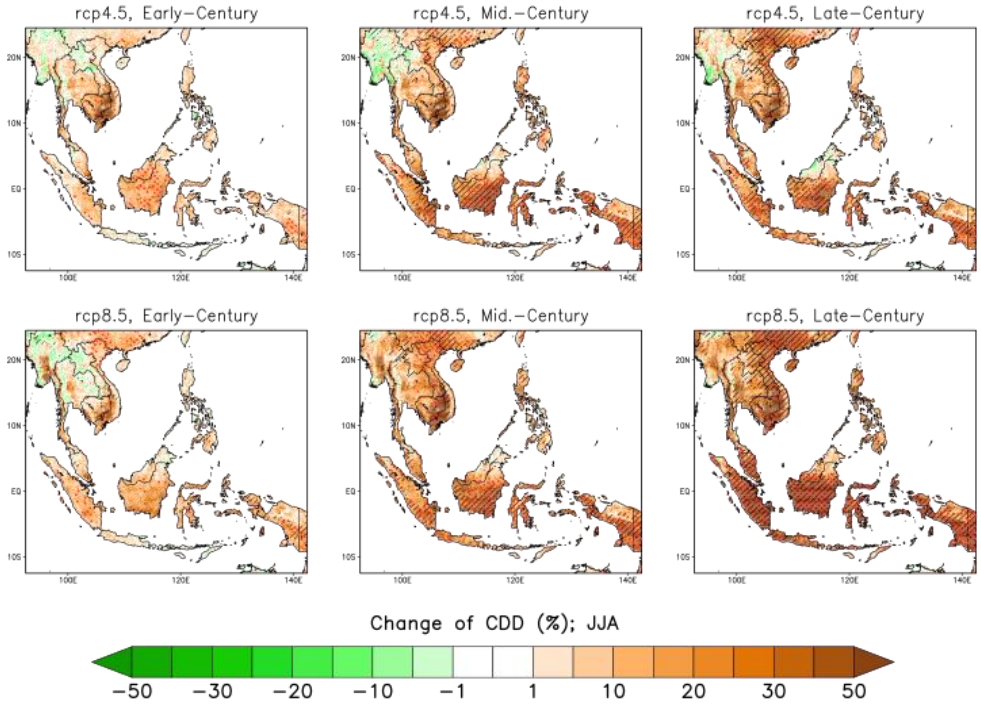

Figure 32: Projected changes in CDD (in %) during JJA for early, mid and late periods of the 21st for RCP 4.5 and 8.5.

3.5 The Southeast Asia Regional Climate Change Information System (SARCCIS)

The analysis of SEACLID/CORDEX Southeast Asia multi-model simulations presented in previous sections indicated that Southeast Asia is projected to experience significant climatic changes if the world fails to mitigate climate change and global warming continues beyond 2°C above the pre-industrial level. The analysis also shows that the conditions could be much worse in future if a combined effect of climate variability and climate change is considered. While the multi-model simulations provide a solid physical understanding of how changes are likely to occur, it is more important to understand how these changes would eventually affect critical sectors in Southeast Asia. Hijioka et al. (2014) identified large knowledge gaps in how climate change is affecting critical sectors in Southeast Asia especially on food production and food security issues. Hence, scientists from IAV community would have to increase research activities, and outputs of multi-model

SEACLID/CORDEX Southeast Asia simulations could be used as inputs to their respective impact models. Hence, access and understanding of how to use these model outputs by IAV scientists. As part of an effort to ensure efficient data dissemination of SEACLID/CORDEX Southeast Asia, the Southeast Asia Regional Climate Change Information System (SARCCIS) was established and launched on May 7, 2018 (Figure 33). SARCCIS, which will function beyond the project timeline, is operated jointly by the Universiti Kebangsaan Malaysia and Ramkhamhaeng University, Bangkok, Thailand.

Figure 33: Pamphlet of SARRCIS

More importantly, SARCCIS will be an essential component of climate services in Southeast Asia. It is envisioned not just a portal to disseminated model outputs of SEACLID/CORDEX Southeast Asia, but also there will be several components required including the inclusion of bias-corrected data, observed products and information on case studies (Figure 34). Hence, SARCCIS can be viewed as a one-stop regional climate change information portal that can serve users community in the region. In addition to these, however, training and capacity building on how to access, analyse and interpret the data are crucial, and these will be part of SARCCIS, which can be implemented through a different project.

SARCCIS is hosted by the Ramkhamhaeng University Centre for Regional Climate Change and Renewable Energy (RU-CORE) (Figure 51), and it represents a significant advancement of how countries in the region to deal with issues related to Climate Change, especially SGD # 13.

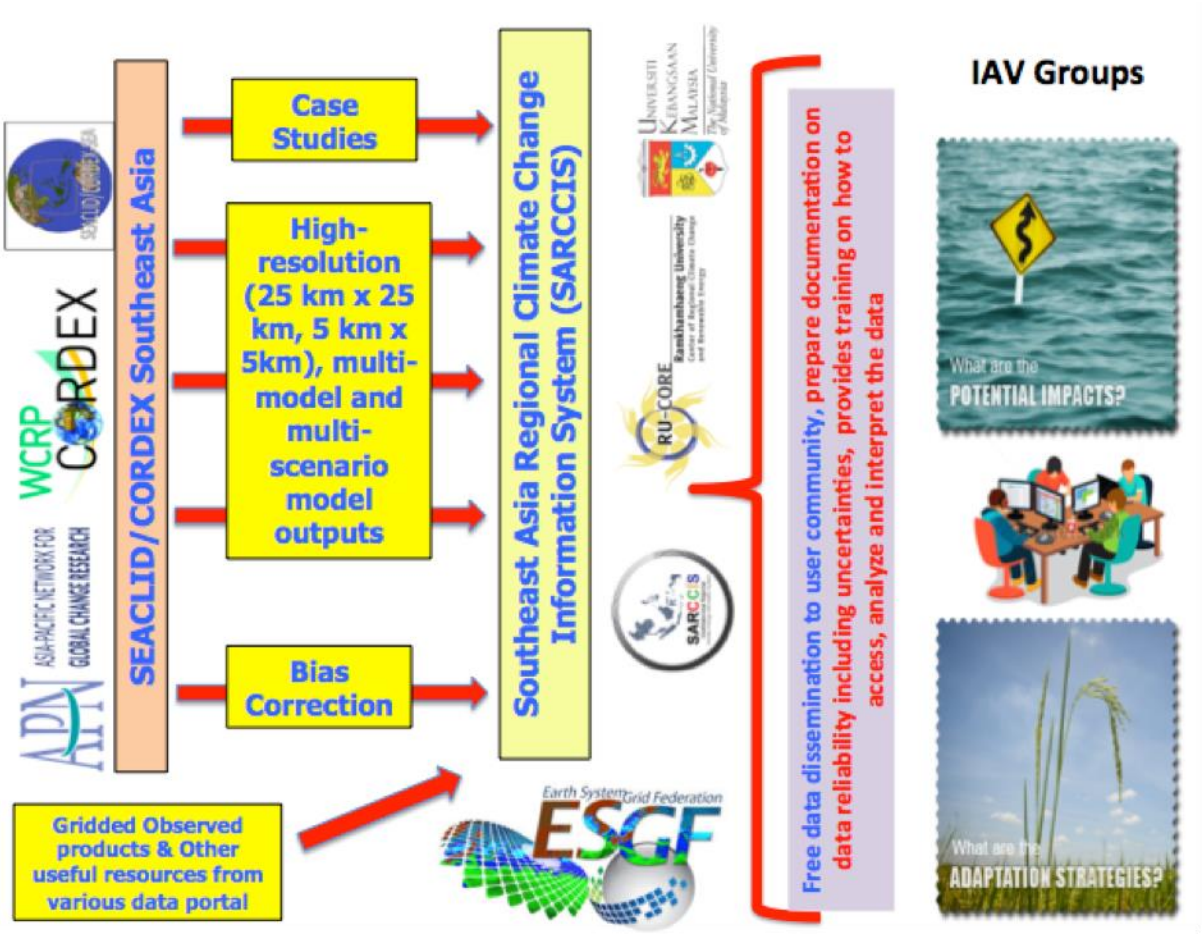

Figure 34: Illustration depicting the full components of SARCCIS

Figure 35: The current landing page of SARRCIS, which is hosted by the Ramkhamhaeng University Centre of Regional Climate Change and Renewable Energy (RU-CORE), Bangkok, Thailand

4. Conclusions

This project has been successfully implemented and has achieved its objectives. Among its successes include:

- Increased visibility in regional climate modelling under CORDEX, enhanced networking and collaboration among scientists, especially young and early career scientists from within and outside Southeast Asia
- Sensitivity experiments conducted in tuning optimal configurations of RegCM4.3 over Southeast Asia contributed to the advancement of scientific knowledge in regional climate simulation with the publications of 4 related scientific papers.
- Through SEACLID/CORDEX Southeast Asia, a large ensemble of multi-model and high-resolution simulations have been successfully out carried; a significant project from earlier works of limited 1 GCM and 1 RCM simulation in the region.
- A significant advancement of physical understanding of future climate changes over the region. While changes in surface temperature are more uniform and monotonic over the region, it is not the case for rainfall where spatial variation is evident.

- While changes in mean precipitation can be significant in most areas, changes in extremes are more evident and striking. In some areas like over northeast of Myanmar, as warming continues beyond 2^{o}C, more heavy and intense precipitation, longer and severe drought are projected.
- Indonesian region is projected to be significantly drier in future periods, in which more longer and severe drought are projected.
- A combined effect of El Niño and climate change could provide much worse drought condition over Indonesia in future periods and would have many severe repercussions on various key important sectors especially environmental issues such as forest fires and trans-boundary haze.
- The establishment of SARCCIS opens up a new opportunity to increase the number of studies by IAV community in assessing climate change impacts in Southeast Asia.

5. Future Directions

The climate information "downscaling" is continuing under the second phase of SEACLID/CORDEX Southeast Asia (CRRP2016-2MY-Santisirisoomboon) which further downscaling will be carried out into 5 km x 5 km resolution on a number of sub-domains to cater data needs for certain application or research, e.g. basin-scale study, mega-cities etc. The output of this project extension will also be uploaded to SARCCIS for dissemination to users.

However, several components of SARCCIS (bias-correction of SEACLID/CORDEX Southeast Asia model outputs, uploading of observed products, documentation of case studies, capacity building and training for IAV community) are not part of both phases of SEACLID/CORDEX Southeast Asia. These would need to be carried out in a different initiative, in which new funding is required.

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7. Appendix

Appendix 7.1: Conferences/Symposia/Workshops

Appendix 7.1A: The Inception Workshop of SEACLID/CORDEX Southeast Asia, Jakarta, Indonesia
Appendix 7.1B: The Second Workshop of SEACLID/CORDEX Southeast Asia, Bangkok, Thailand
Appendix 7.1C: The Third Workshop of SEACLID/CORDEX Southeast Asia, Manila, Philippines
Appendix 7.1D: The Fourth Workshop of SEACLID/CORDEX Southeast Asia, Hanoi, Vietnam
Appendix 7.1E: The Fifth Workshop of SEACLID/CORDEX Southeast Asia, Bangi, Malaysia
Appendix 7.1F: The First Manuscript Writing Workshop of SEACLID/CORDEX Southeast Asia, Bangi, Malaysia

Appendix 7.1G: The Second Manuscript Writing Workshop of SEACLID/CORDEX Southeast Asia, Bangkok, Thailand
Appendix 7.1H: The RegCM Regional Climate Modelling Workshop of SEACLID/CORDEX Southeast Asia, Manila, Philippines

Funding sources outside the APN

Appendix 7.2: List of Funding Sources Outside APN

List of Young Scientists

Appendix 7.3: List of Young Scientists

Glossary of Terms

Appendix 7.4: List of Acronyms and Abbreviations.

Program Schedule

The 1st Southeast Asia Regional Climate Downscaling (SEACLID)/ CORDEX Southeast Asia Workshop

Venue: BMKG Headquarter Office, Jakarta – Indonesia, 18 – 19 November 2013

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18 Nov (Monday)	OPENING SESSION	
09.00 – 10.00	Registration	
10.00 – 10.10	Opening Remarks	**Dr. Andi Eka Sakya, M.Eng** Director General of Agency for Meteorology Climatology and Geophysics (BMKG)
10.10 – 10.30	Keynote Address	**Dr. Michel Rixen** CORDEX, WCRP (via Skype)
10.30 – 10.45	Introduction to SEACLID/CORDEX-SEA	**Prof. Dr. Fredolin Tangang** SEACLID/CORDEX-SEA Coordinator The National University of Malaysia
10.45 – 10.50	Group Photo	
10.50 – 11.00	Coffee Break	
18 Nov (Monday)	SESSION I Existing Initiatives and Coordination, Chair: 1A: Fredolin Tangang, Rapporteur: Faye Cruz, 1B: Edvin Aldrian, Rapporteur: Ngo Duc Thanh	
11.00 – 11.30	Downscaling for practical purposes	**Prof. Dr. Michael Manton** Chair Scientific Steering Committee for Monsoon Asia Integrated Regional Study (MAIRS)
11.30 – 12.00	SEACAM Project and Coordination of the SEACAM & SEACLID/CORDEX-SEA projects towards more useful scientific outputs	**David Hein** Met Office UK **Raizan Rahmat** Meteorological Service Singapore

12.00 – 12.30	Dynamic downscaling of climate projection over Maritime Continent	**Dr. Hongwei Yang** APCC, Busan, South Korea
12.30 – 13.30	Lunch	
13.30 – 14.00	A proposal for Global CORDEX Data Center- Projection of the Climate Change for South Asia region with the high-resolution AGCM based on the RCP Scenarios	**Prof. Jaiho Oh** Dept. of Environmental & Atmospheric Sciences Director of PKNU Supercomputer Center Pukyong National University, Busan, South Korea (via Skype)
14.00 – 14.30	Regional climate modelling for CORDEX and southeast Asia using a variable-resolution model	**Dr John McGregor** (& Jack Katzfey, Kim Nguyen, Peter Hoffmann and Marcus Thatcher) CSIRO, Australia
14.30 – 15.00	Regional Climate Model Simulations of Diurnal Rainfall Variations and Extreme Events in Asia	**Dr. Francis Chi Yung Tam** City University of Hongkong
15.00 – 15.15	Coffee Break	
18 Nov (Monday)	SESSION II Regional Climate Modeling by SEACLID Member Countries; Chair Mcheal Manton, Rappotuer: Francis Tam	
15.15 – 15.35	Regional Climate Modeling & Needs in Malaysia	**Prof. Dr. Fredolin Tangang / Dr. Liew Juneng / Mr. Ling Leong Kwok**
15.35 – 15.55	Regional Climate Modeling & Needs in Indonesia	**Dr. Dodo Gunawan / Dr. Edvin Aldrian**
15.55 – 16.15	Regional Climate Modeling & Needs in the Philippines	**Dr. Gemma Narisma / Dr. Faye Cruz**
16.15 – 16.35	Regional Climate Modeling & Needs in Vietnam	**Dr. Ngo Duc Thanh**
16.35 – 16.55	Regional Climate Modeling & Needs in Thailand	**Dr. Jerasorn Santisirisomboon / Dr Patama Singhruck**
16.55 – 18.00	Open Discussion	
18.00 – 20.00	Dinner hosted by BMKG	

19 Nov (Tuesday)	Session III Results of Sensitivity Experiments over SEACLID/CORDEX-SEA Domain; Chair: John McGregor, Rapporteur: Raizan Rahmat	
09.00 – 09.30	Performance evaluation of RegCM4 in simulating rainfall over SEACLID / CORDEX-SEA Domain	**Malaysia (Dr. Liew Juneng / Prof. Fredolin)**
09.30 – 10.00	Performance evaluation of RegCM4 in simulating temperature over SEACLID/ CORDEX-SEA Domain	**The Philippines (Dr. Faye Cruz / Dr. Gemma Narisma)**
10.00 – 10.15	Coffee Break	
10.15 – 10.45	Performance evaluation of RegCM4 in simulating Tmax, TMin over SEACLID/ CORDEX-SEA Domain	**Indonesia (Dr. Dodo Gunawan)**
10.45 – 11.15	Performance evaluation of RegCM4 in simulating Circulation Fields over SEACLID/ CORDEX-SEA Domain	**Thailand (Dr. Jerasorn / Dr. Patama)**
11.15 – 11.45	Performance evaluation of RegCM4 in simulating Extremes over SEACLID/CORDEX-SEA Domain	**Vietnam (Dr. Thanh Ngo-Duc)**
11.45 – 12.30	Open Discussion on Model Performance	
12.30 – 13.30	Lunch	
19 Nov (Tuesday)	Session IV Open Discussion on SEACLID/CORDEX-SEA Follow-Up Actions and Coordination with Potential Collaborators; Co-Chairs: Faye Cruz, David Hein, Rapporteurs: Patama, Juneng	
13.30 – 15.00	Open Discussion on Follow-up Actions and Coordination	
15.00 – 15.30	Coffee Break	
15.30 – 16.00	Proposal on Follow-up Actions and Coordination	
16.00 – 17.00	Further discussion on the proposal on Follow-up Actions & Coordination	
17.00 – 17.30	Closing	

Program Schedule

The 2nd Southeast Asia Regional Climate Downscaling (SEACLID)/ CORDEX Southeast Asia Workshop

Venue: Ramkhamhaeng University, Bangkok, 9 – 10 June 2014

9 June (Monday)	**OPENING SESSION**	
09.00 – 09.30	Registration	
09.30 – 09.35	Welcoming remarks	**Prof. Dr. Fredolin Tangang,** Coordinator, SEACLID / CORDEX Southeast Asia
09.35 – 09.45	Welcoming remarks	**Prof. Suthipun Jitphimolmard,** Director, Thailand Research Fund
09.45 – 09.55	Opening and Welcoming Address	**Asst. Prof. Wutisak Lapcharoensap** President, Ramkhamhaeng University
09.55 – 10.25	Keynote Address: Opportunities across CORDEX initiatives in Asia	**Dr. Michel Rixen** (via remote video presentation) World Climate Research Programme (WCRP), World Meteorological Organization
10.25 – 10.40	Group Photo	
10.40 – 11.00	Coffee Break	
9 June (Monday)	**SESSION I** **IPCC AR5 Report: Relevance to Southeast Asia & CORDEX Activities, Chair: TBD, Rapporteur: TBD**	
11.00 – 11.30	IPCC AR5 WGI Report and its relevance to Southeast Asia	**Prof. Fredolin Tangang**, IPCC WG1 Vice Chair
11.30 – 12.00	IPCC AR5 WGII Report and its implications for Southeast Asia	**Dr Poh Poh Wong** IPCC WGII Coordinating Lead Author (CLA)
12.00 – 13.30	Lunch	

9 June (Monday)	SESSION II CORDEX activities, Other Existing Regional Climate Initiatives, and Coordination, Chair: TBD, Rapporteur: TBD	
13.30 – 13.55	MAIRS and its roles in Regional Climate Change Initiatives	**Prof. Dr. Michael Manton** Chair Scientific Steering Committee for Monsoon Asia Integrated Regional Study (MAIRS)
13.55 – 14.20	CORDEX South Asia & its activities	**Dr Krishnan** (via remote video presentation)**,** CORDEX South Asia
14.20 – 14.45	CORDEX East Asia & its activities	**Dr Ailikun,** CORDEX East Asia
14.45 – 15.10	The Southeast Asia Regional Climate Downscaling (SEACLID)/CORDEX Southeast Asia	**Prof. Dr. Fredolin Tangang** SEACLID / CORDEX Southeast Asia
15.10 – 15.20	Coffee Break	
15.20 – 15.45	Summary of CORDEX Australasia Activities and CSIRO's involvement in CORDEX-SEA	**Dr. Jack Katzfey**, CORDEX Australasia
15.45 – 16.10	Simulating the East Asian and western north Pacific summer monsoon with RegCM4- sensitivity to model physics & involvement in CORDEX SEA	**Dr. Francis Chi Yung Tam**, City University of Hong Kong
16.10 – 16.35	Regional Climate Downscaling at APCC & Involvement in CORDEX SEA	**Dr. Hongwei Yang**, APCC, Busan, South Korea
16.35 – 17.00	Regional Southeast Asia Climate Analysis and Modelling (SEACAM) Project	**Dr. Liew Juneng,** The National University of Malaysia
17.00 – 17.25	Evaluation of simulated Asia summer monsoon in AMIP experiment with high resolution climate model & Possible involvement in CORDEX Southeast Asia	**Prof. Jaiho OH,** Pukyong National University, South Korea
18.00 – 20.00	Dinner hosted by Thailand Research Fund	

10 June (Tuesday)	Session III Priorities and Data Requirement for Impact Assessment Studies; Chair: TBD, Rapporteur: TBD	
08.30 – 08.55	MWCropDSS as a tool for Impact Assessment Studies & Regional Climate Change Scenarios Data Requirements in Thailand	**Asst. Prof. Dr.Attachai Jintrawet,** Chiang Mai University, Thailand
08.55 – 09.20	Impact Assessment Studies & Regional Climate Change Scenarios Data Requirements in Vietnam	**Prof. Dr. Phan Van Tan,** VNU, HUS, Vietnam
09.20 – 09.45	Impact Assessment Studies & Regional Climate Change Scenarios Data Requirements in Malaysia	**Mr. Mohd Syazwan Faisal Mohd,** National Hyraulic Research Institute of Malaysia (NAHRIM), Ministry of Natural Resources and Environment, Malaysia
09.45 – 10.10	Impact Assessment Studies & Regional Climate Change Scenarios Data Requirements in Indonesia	**Dara Kasihairani & Dr. Dodo Gunawan,** BMKG, Indonesia
10.10 – 10.20	Coffee Break	
10.20 – 10.45	Cambodia First National Communication Report	**Mr. Sem Sopheak,** Ministry of Environment, Cambodia
10.45 – 11.10	Impact Assessment Studies & Regional Climate Change Scenarios Data Requirements in Lao PDR	**Mrs. BouaNgeun Oudomchit,** Department of Water Resources MoNRE, Lao PDR
11.10 – 11.35	Impact Assessment Studies and Regional CC Scenarios and other data requirements (Philippines and other regions in Asia)	**Ms. Jessica Asne Dator-Bercilla,** Christian Aid, Ateneo de Manila University
11.35 – 12.00	Assisting Adaptation to Climate Change: Preparing regional scenario data and using it to model impacts in New Zealand	**Dr David Wratt,** NIWA, New Zealand
12.00 – 12.30	Open Discussion on Data Needs and How CORDEX initiatives may fill the gaps	
12.30 – 14:00	Lunch	

10 June (Tuesday)	Session IV Presentation of SEACLID/CORDEX SEA Sensitivity Experiments; Chairs: TBD, Rapporteurs: TBD	
14.00 – 14.30	Performance evaluation of RegCM4 in simulating rainfall over SEACLID / CORDEX-SEA Domain	**Malaysia** (Dr Juneng/ Ms. Ngai Sheau Tieh /Mr Chung Jing Xiang/Prof Fredolin)
14.30 – 15.00	Performance evaluation of RegCM4 in simulating temperature over SEACLID/ CORDEX-SEA Domain	**The Philippines** (Ms. Julie Mae B. Dado / Dr Gemma Narisma / Dr Faye Cruz**)**
15.00 – 15.30	Performance evaluation of RegCM4 in simulating Tmax, TMin over SEACLID/ CORDEX-SEA Domain	**Indonesia** (Dr Dodo Gunawan / Dr Elvin Aldrian)
15.30 – 16.00	Performance evaluation of RegCM4 in simulating Circulation Fields over SEACLID/ CORDEX-SEA Domain	**Thailand** (Dr Jerasorn Santisirisomboon / Dr Patama Singhruck)
16.00 – 16.30	Performance evaluation of RegCM4 in simulating Extremes over SEACLID/CORDEX-SEA Domain	**Vietnam** (Dr Thanh Ngo-Duc / Prof. Phan Van Tan)
16.30 – 16.45	Coffee Break	
16.45 – 17.15	Open Discussion on the Analysis Results of Sensitivity Experiments, Decision on Domain, Resolution & Physics Option	
17.15 – 17.45	Open Discussion on CORDEX SEA outstanding issues & moving forward	
17.45 – 18.00	Closing	**Ramkhamhaeng University / TRF**
18.00 – 19.30	Dinner hosted by Ramkhamhaeng University (Venue: Ramkhamhaeng University)	
20.00 – 22.00	CORDEX SEA Side Meeting (Venue: Ramkhamhaeng University, by invitation)	

The 3rd Workshop of the Southeast Asia Regional Climate Downscaling (SEACLID)/ CORDEX Southeast Asia Project

Manila, Philippines
1-2 June 2015

PROGRAMME

June 1 (Monday)	Opening Session	
08.30 – 09.00	Registration	
09.00 – 09.20	Welcome Remarks	**Fr. Jose Ramon T. Villarin, S.J.** President Ateneo de Manila University **Ms. Ma. Antonia Yulo Loyzaga** Executive Director Manila Observatory
09.20 – 09.40	Opening Remarks	**Prof. Dr. Fredolin Tangang** Coordinator, SEACLID/CORDEX Southeast Asia The National University of Malaysia **Dr. Eleanor O'Rourke** Director, International Project Office for CORDEX (IPOC) SMHI
09.40 – 10.00	Keynote Address: Celebrating 20 years of APN in global/climate change research	**Dr. Linda Anne Stevenson** Asia-Pacific Network for Global Change Research (APN)
10.00 – 10.15	Group Photo	
10.15 – 10.30	Coffee Break	
June 1 (Monday)	Session 1 Activities of CORDEX and SEACLID/CORDEX South East Asia Chair: Dr. Gemma Narisma Rapporteur: Angela Magnaye, Jose Rizal	
10.30 – 11.00	The IPOC's role in supporting CORDEX South East Asia	**Dr. Eleanor O'Rourke** Director, International Project Office for CORDEX (IPOC) SMHI
11.00 – 11.30	SEACLID/CORDEX South East Asia: Progress and challenges	**Prof. Dr. Fredolin Tangang** Coordinator, SEACLID/CORDEX Southeast Asia The National University of Malaysia
11.30 – 11.55	Progress report (Malaysia)	**Dr. Liew Ju Neng / Mr. Chung Jing Xiang** The National University of Malaysia
11.55 – 13.00	Lunch	
13.00 – 13.25	Progress report (Philippines)	**Dr. Faye Cruz / Mr. Arnold Discar** Manila Observatory / Ateneo de Manila University
13.25 – 13.50	Progress report (Thailand)	**Dr. Jerasorn Santisirisomboon /**

		Dr. Patama Singhruck Ramkhamhaeng University / Chulalongkorn University
13.50 – 14.15	Progress report (Vietnam)	**Assoc. Prof. Thanh Ngo-Duc / Thanh Nguyen-Xuan** Hanoi University of Science, Vietnam National University
14.15 – 14.40	Progress report (Indonesia)	**Dr. Erwin Makmur / Mr. Budi Suhardi** BMKG
14.40 – 15.05	Progress Report (Australia): Variable-resolution CCAM simulations for SEACLID	**Dr. John McGregor** CSIRO Oceans and Atmosphere Flagship
15.05 – 15.30	Progress Report (APEC, South Korea) (Skype call)	**Dr. Hongwen Yang** APEC Climate Center, South Korea
15.30 – 15.55	Update from UKMO on CORDEX South East Asia (Skype call)	**David Hein** Hadley Centre, UKMO
15.55 – 16.15	Coffee break	
16.15 – 17.30	Discussion 1: Model performance and related issues	

June 2 (Tuesday)	Session 2 Activities of CORDEX and other regional climate initiatives Chair: Assoc. Prof. Thanh Ngo-Duc Rapporteur: Richie Antonio, Thanh Nguyen-Xuan	
09.00 – 09.25	Evaluating the impacts of cumulus, land surface and ocean surface schemes on summertime rainfall simulations over East Asia and the Western North Pacific by RegCM4	**Dr. Francis Tam** Chinese University of Hong Kong
09.25 – 09.50	Simulating tropical cyclones in a regionally coupled AOGCM covering CORDEX Southeast Asia domain	**Dr. Armelle Reca Remedio** Climate Service Center 2.0 – Helmholtz Zentrum Geesthacht
09.50 – 10.20	Coffee break	
10.20 – 10.45	TBD	**Mr. Ling Leong Kwok** Malaysian Meteorological Department
10.45 – 11.05	TBD	**Ms. BouaNgeun Oudomchit** Department of Water Resources, MONRE, Lao PDR
11.05 – 12.00	Discussion 2: Model performance and related issues	
12.00 – 13.00	Lunch	
June 2 (Tuesday)	Session 3 Discussion on issues concerning SEACLID/CORDEX-SEA project Chair: Dr. Faye Cruz and Prof. Fredolin Tangang Rapporteur: Jenn Tibay, Chung Jiang Xing	
13.00 – 15.00	Open Discussion 1 Topic: Data Sharing & Analysis, Data Dissemination through ESGF & Scientific & policy relevant publications Issues: • How and what is the best way for us to carry out the analysis on the simulation output (baseline and projection)? • Do we need to perform bias correction (methods, advantages, disadvantages)?	

	• ESGF (countries to volunteer to become ESGF nodes & related issues – training & conversion of data to ESGF compliant format) • Scientific & Policy-relevant publication (Regional Climate Atlas for South East Asia) • Engaging end users of SEACLID/CORDEX South East Asia	
15.00 – 15.30	Coffee Break	
June 2 (Tuesday)	Session 4 Moving forward with SEACLID/CORDEX South East Asia Chair: Dr. Gemma Narisma and Prof. Fredolin Tangang Rapporteur: JL Algo, Pipattra Saesin	
15.30 – 17.30	Open Discussion 2 Topic: SEACLID/CORDEX South East Asia in the next 1 ½ years and beyond Issues: • What are the scientific issues relevant to this region (e.g. YMC, land cover change and aerosols, regional atmosphere-ocean coupling) & can we investigate these issues in the next 1 ½ years • CORDEX vision/plan on Flagship Pilot Studies • CORDEX plan on ESD and issue related to data scarcity • Phase 2 of CORDEX Southeast Asia?	
17.30 – 17.45	Closing Remarks	**Assoc. Prof. Dr. Gemma Narisma** Manila Observatory and Ateneo de Manila University
17.45	Culminating Dinner	

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

(For latest update please visit the project website http://www.ukm.edu.my/seaclid-cordex/)

November 23 (Wednesday)	Formation of Empirical-Statistical Downscaling (ESD) Group in CORDEX Asia
13.00 – 13.30	Registration
	Presentation Session (13.30 – 15.30) Chair: Prof. Dr. Ailikun
13:30-13:45	Dr. Koji Dairaku (CORDEX Asia ESD Leader): Opening and Brief Introduction of CORDEX Asia ESD
14:00-14:15	Dr. Nishimori (Japan): Bias Correction, Weather Generator and Empirical Statistical Downscale for Impact Studies on Agriculture -Previous and Ongoing Activities of NIAES-
14:15-14:30	Dr. Lianhua ZHU (China): Downscaling daily precipitation over the Yangtze-Huaihe River Basin in China using multiple statistical Methods
14:30-14:45	Dr. Liew Juneng (Malaysia): Downscaling and Bias Correction of Precipitation and Surface Air Temperature over the Southeast Asia Regions

14:45-15:00	Dr. Jerasorn Santisirisomboon (Thailand): Statistical Downscaling Activities of RU-CORE	
15:00-15:15	Dr. Yatagai (Japan): APHRODITE-2: Asian Precipitation -- Highly Resolved Observational Data Integration Towards Evaluation of Extreme Events	
15:15-15:35	Coffee break	
16.00 – 17.30	**Discussion Session** Chair: Dr Koji Dairaku Rapporteur: Juneng, Ailikun Topics: 1. The main objectives of ESD group 2. What kinds of ESD datasets, methodologies or software can be shared in Asian group? 3. What kinds of products can be provided by ESD group? 4. Task allowance of ESD Asian team and coordination mechanism 5. Plan of Joint activity and funding opportunities	
17.30 – 18.30	**SEACLID Project Meeting** **(By invitation only)**	
November 24 (Thursday)	**The 4th Workshop of SEACLID/CORDEX Southeast Asia** **Opening Session** **(Chair: Prof. Dr. Phan Van Tan, HUS)**	
08.30 – 09.00	Registration	
09.00 – 09.20	Welcome Remarks	**Professor Dr. Phan Tuan Nghia, Vice-Rector,** VNU Hanoi University of Science **Professor Dr. Patrick Boiron, 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	**Prof. Dr.Ailikun**

	CORDEX-Asia project	SPG Member, Asia-Pacific Network for Global Change Research (APN) / Director of TPE IPO, 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	**Dr Faye Cruz / Dr Rochelle Coronel**, 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 (Nhà hàng Tu Do, 42 Tang Bat Ho)**	

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	Future changes in Asian summer monsoon precipitation extremes as inferred from 20-km AGCM simulations	**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 Faye Cruz** **Rapporteur: Dr Ardhasena Sopaheluwakan / 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)** ▪ **Ms Nuzba Shaheen to share her vision of her project: Exploring new approaches and devising strategies for climate change adaptation in South Asia (~ 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**) • PARIS AGREEMENT & COP22 (**Invite Ms Jessica Dator Bercilla, Christian Aid/Wanun Permpibul of the Asia Climate Change Consortium and Climate Watch Thailand, to give a brief presentation: Paris Agreement and COP22 and How science can inform climate action**) • 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 Projection Baseline in Indonesia: A Sensitivity Study	**Ratna Satyaningsih/Jose Rizal/Adi Mulsandi**, BMKG, Indonesia
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	**Nguyen Thi Tuyet**, VNU, Vietnam

	simulations	
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

Launching of the Southeast Asia Regional Climate Change Information System (SARCCIS)
&
The Final Workshop of the First Phase and the Second Technical Workshop of the Second Phase of the Southeast Asia Regional Climate Downscaling (SEACLID)/ CORDEX Southeast Asia Project

May 7 – 9, 2018

Workshop venue: Conference Hall, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, MALAYSIA

WORKSHOP PROGRAM

(For latest update please visit the project website http://www.ukm.edu.my/seaclid-cordex/)

May 7 (Monday): 0830 – 1130	Launching of The Southeast Asia Regional Climate Change Information System (SARCCIS) & Opening of the SEACLID/CORDEX SEA Workshop
08:30-09:00	Registration of Workshop Participants
09:00-09:05	Welcoming speech by Prof. Dr. Fredolin Tangang, Project Leader of SEACLID/CORDEX Southeast Asia
09:05-09:10	Video Recorded Speech by Dr Michel Rixen, World Climate Research Programme (WCRP), World Meteorological Organization, Geneva, Switzerland (TBC)
09:10-09:15	Speech by Mr. Alui Bin Bahari, National Focal Point of the Asia-Pacific Network for Global Change Research (APN) and Director-General, Malaysian Meteorological Department
09:15-09:25	Speech by Professor Wutisak Lapcharoensap, President of Ramkhamhaeng University, Bangkok, Thailand

09:25-09:40	Officiating Speech by Professor Tan Sri Datuk Dr. Noor Azlan Ghazali, Vice-Chancellor of Universiti Kebangsaan	
9:40-09:50	Launching of the Southeast Asia Regional Climate Information System (SARCCIS) jointly by Professor Tan Sri Datuk Dr. Noor Azlan Ghazali, Vice-Chancellor UKM and Professor Wutisak Lapcharoensap, President Ramkhamhaeng University	
09:50-10:30	Group Photo, Coffee break & Media Briefing	
May 7 (Monday): 10:30 – 11:30	**Plenary Session (Chair: Assoc. Prof. Dr. Gemma Narisma)**	
10.30 – 11.00	From SEACLID/CORDEX Southeast Asia to SARCCIS: Empowering Southeast Asia region with Robust Climate Change Information	Professor Fredolin Tangang, Universiti Kebangsaan Malaysia
11.00 – 11.30	Projections of future climate over the western Maritime Continent	Professor Eun-Soon Im, The Hong Kong University of Science and Technology, Hong Kong
11.30 – 12.00	Comparison of the Past and Future Urban Impact on the Regional Climate of Southeast Asian Capital Cities	Professor Hiroyuki Kusaka, University of Tsukuba, Japan
12.00 – 12.30	IPCC AR6 Regional Chapters and Potential Contributions from CORDEX Southeast Asia	Professor Edvin Aldrian, IPCC WG1 Vice-Chair & BBPT Indonesia
12.30 – 14.00	Lunch	
May 7 (Monday): 14:00 – 15:40	**Session 1 SEACLID/CORDEX SEA Outcomes Chair: Asst. Prof. Dr. Jerasorn Santisirisomboon**	
14.00 – 14.20	CORDEX-SEA multi-model simulations of current and future rainfall changes over Southeast Asia	Mr. Chung Jing Xiang, National University of Malaysia
14.20 – 14.40	Projected changes of precipitation extremes over SEA region based on SEACLID/CORDEX-SEA multi models simulations.	Mr. Supari, National University of Malaysia / BMKG Indonesia
14.40 – 15.00	CORDEX-SEA activities in Vietnam and scientific achievements	Assoc. Prof. Dr. Thanh Ngo-Duc, Vice-Rector, University of Science and Technology Hanoi, Vietnam
15.00 – 15.20	Drought characterization of future projections from	Dr. Ardhasena Sopaheluwakan, BMKG, Indonesia

	CORDEX-Southeast Asia (CORDEX-SEA)	
15.20 – 15.40	Detection of tropical cyclones in regional climate model simulations over CORDEX-SEA domain	Ms. Jennifer B. Tibay, Manila Observatory, Philippines
15.40 – 16.00	Coffee Break	
May 7 (Monday): 16:00 – 17:30	**Session 2** **SEACLID/CORDEX SEA & Regional Climate Downscaling in Southeast Asia** **Chair: Prof. Dr. Phan van Tan**	
16.00 – 16.20	High Resolution Downscaling over Southeast Asia – What is the added value?	Dr. Srivatsan V Raghavan, NUS, Singapore
16.20 – 16.40	Role of Cumulus Parameterization on the Seasonal and Diurnal Precipitation over Southeast Asia in RegCM4	Professor Francis Chi Yung Tam, The Chinese University of Hong Kong
16.40 – 17.00	Rainfall Diurnal Cycle over the Maritime Continent in the SEACLID/CORDEX-SEA Multi model simulations	Mr. Fairudz Amahd Jamaluddin, National University of Malaysia / Malaysian Meteorological Department
17.00 – 17.20	The role of local sea surface temperature on the Southwest Monsoon rainfall over western Philippines	Dr. Julie Mae B. Dado, Manila Observatory Philippines
17.20 – 17.40	The CCAM downscaling approach and some results for SEACLID / CORDEX SEA	Dr John McGregor, CSIRO, Australia
17.40 – 18:30	**Trip Back to Hotel**	
19.30 – 21.00	Reception Dinner at The Everly Hotel, Putrajaya	
May 8 (Tuesday): 08:30 – 10:30	**Session 3** **SEACLID/CORDEX SEA / Regional Climate Downscaling in Southeast Asia / National Climate Projection** **Chair: Assoc. Prof. Dr. Thanh Ngo-Duc**	
08.30 – 08.50	Providing rainfall and temperature projections in the Philippines based on multiple dynamical downscaling models	Dr. Marcelino Q. Villafuerte II, PAGASA, Philippines
08.50 – 09.10	Climate Change Projection over Malaysia based on SEACLID/CORDEX Southeast Asia simulations	Dr. Ester Salimun, National University of Malaysia, Malaysia
09.10 – 09.30	Climate Change Projection over Thailand based on SEACLID/CORDEX Southeast	Dr. Jerasorn Santisirisomboon, RU-CORE, Thailand

	Asia simulations	
09.30 – 09.50	Climate Change projections for Singapore	Dr. Bertand Timbal, CCRC, MSS, Singapore
09.50 – 10.10	Climate Change Projection in Vietnam (Tentative)	Dr. Mai Văn Khiêm, IMHEN, Vietnam
10.10 – 10.30	Climate Change Projection in Myanmar	Ms. Khaing Soe Oo, DMH, Myanmar
10.30 – 10.50	Coffee Break	
May 8 (Tuesday): 10:50 – 13:00	**Session 4 SEACLID/CORDEX SEA Outcomes Chair: Prof. Dr. Eun-Soon Im**	
10.50 – 11.10	Multi-model projected changes in climate hotspots in the Philippines	Dr. Faye Cruz, Manila Observatory, Philippines
11.10 – 11.30	Drought Characteristics over Vietnam: Projected Changes and Uncertainty	Prof Phan Van Tan, HUS, Vietnam
11.30 – 11.50	Projected changes in temperature over southeast asia in the CORDEX-SEA simulations	Assoc. Prof. Dr. Gemma Narisma, Manila Observatory, Philippines
11.50 – 12.10	Projection of Extreme Maximum- and Minimum-Temperature in Southeast Asia from CORDEX-Southeast Asia	Ms. Ratna Satyaningsi, BMKG, Indonesia
12.10 – 12.30	Sea surface temperature influence in regional climate downscaling: Analysis of SST representation using SEACLID/CORDEX-SEA simulations.	Ms. Angela Monina T. Magnaye, Manila Observatory, Philippines
12.30 – 12.50	Time of Emergence of Climate Signals over Vietnam detected from the CORDEX-SEA experiments	Ms. Nguyen Thuy Huong, USTH, Vietnam
12.50 – 14.00	Lunch	
May 8 (Tuesday): 14:00 – 15:40	**Session 5 SEACLID/CORDEX SEA Outcomes / ESD Chair: Assoc. Prof. Dr. Liew Juneng**	
14.00 – 14.20	Bias Correction on Future Precipitation and Extreme Indices from CORDEX-SEA Regional Climate Model over	Ms. Ngai Sheau Tieh, Universiti Kebangsaan Malaysia, Malaysia

	Southeast Asia	
14.20 – 14.40	Indonesian Statistical Downscaling	Ms. Apriliana Rizqi Fauziya, BMKG
14.40 – 15.00	Climate Analog Analysis in SEA Based on Multi-Model SEACLID/CORDEX Southeast Asia simulations	Ms Nguyen Thi Tuyet, VIDS, Vietnam
15.00 – 15.20	Bias correcting MPI-ESM-MR data for CORDEX SEA Domain	Dr. Jerasorn Santisirisomboon, RU-CORE, Thailand
15.20 – 15.40	Comparison of decadal variation between GCMs and RCMs over CORDEX Southeast Asia domain	Dr Patama Singhruck, Chulalongkorn University, Bangkok, Thailand
15.40 – 16.00	**Coffee break**	
May 8 (Tuesday): 16:00 – 17:40	**Session 6 Regional Climate Downscaling in Southeast Asia / Applications Chair: Prof. Dr. Edvin Aldrian**	
16.00– 16.20	Utilization of climate projected model data for sectoral policy and decision	Dr. Dodo Gunawan, BMKG, Indonesia
16.20 – 16.40	Future hydro-meteorological drought projection of the Johor River Basin	Dr. Tan Mou Leong, School of Humanities, Universiti Sains Malaysia
16.40 – 17.00	Climate change, biomass emission, and biogenic emission impact on surface ozone and particulate in Southeast Asia	Assoc. Prof. Dr. Justin Sentian, Universiti Malaysia Sabah, Sabah, Malaysia
17.00 – 17.20	Analysis of Extreme Weather/Climate in Kelantan Basin based on SEACLID/CORDEX SEA data	Ms. Anisa Mohamad Azahari, School of Mathematical Sciences, UKM
17.20 – 17.40	Estimates of The Impacts of Climate Change Scenario on River Discharges in The West Region of Java Island	Mrs. Levina / Prof. Waluyo Hatmoko, Research Center for Water Resources Indonesia, Indonesia
17.40 – 18.00	High Performance Computing-Advanced Scientific Research on a Massive Scale	Choong Ming Tze, Hewlett Packard Enterprise Malaysia
18.00 – 18:30	Trip Back to Hotel	
May 9 (Wednesday): 08:30 – 09:50	**Session 7 SEACLID/CORDEX SEA / Applications Chair: Dr. Bertand Timbal**	

08.30 – 08.50	Climate-smart DSS for Big Data Applications in Agriculture	Dr. Md Rowshon Kamal, UPM, Malaysia
08.50 – 09.10	Links between climate change and air pollution in Southeast Asia	Dr. Matthew Ashfold, Nothingham University Malaysia Campus
09.10 – 09.30	Climate extreme indices over 5 big cities in Thailand using SEACLID/CORDEX Southeast Asia products	Dr. Kamphol Promjiraprawat, RU-CORE, Thailand
09.30 – 09.50	Precipitation indices over Thailand using SEACLID/CORDEX Southeast Asia products	Dr. Damrongrit, Setsirichok, RU-CORE, Thailand
09.50 – 10.10	Analyses of Standardized Precipitation Index over Thailand using SEACLID/CORDEX Southeast Asia products	Dr. Waranyu Wongseree, RU-CORE, Thailand
10.10 – 10.30	Impact Assessment of Climate Change on Rice Productivity in Java Island using CORDEX-SEA Climate Model outputs	Dr. Elza Surmaini, Indonesian Agro-climate and Hydrology Research Institute, Indonesia
10.30 – 10.50	On application of dynamic downscaling for hydrometeorological hazards of Central Himalayas	Mr. Tanmay Dhar, UDRP-World Bank and Uttaranchal University, India
10.50 – 11.10	Coffee Break	
May 9 (Wednesday): 11:10 – 13:00	**Session 8 Presentations, Discussion and Coordination on Very High Resolution Simulation of SEACLID/CORDEX SEA Phase 2 & Follow-up Activities related to Phase I & SARCCIS Chairs: Assoc. Prof. Dr. Gemma Narisma, Prof Fredolin Tangang**	
11.10– 11.30	Brief Presentation of SEACLID/CORDEX Southeast Asia Phase 2	Dr. Jerasorn Santisirisomboon, RU-CORE, Bangkok, Thailand
11.30– 11.50	Preliminary works on very high resolution (5km) simulation (TBD)	Assoc. Prof. Dr. Liew Juneng
11.50– 12.10	Challenges and Prospects under very high resolution modelling using the WRF model	Dr. Srivatsan V Raghavan, NUS, Singapore
12.10– 13.00	Open Discussion & Coordination: Part I	
13.00 – 14.00	**Lunch**	
14.00 – 15.30	Open Discussion & Coordination: Part II	
15.30 – 15.45	Closing Remarks	**Prof. Fredolin Tangang, UKM, Malaysia**

		& Dr. Jerasorn Santisirisomboon, RU-CORE, Bangkok, Thailand
15.45 – 16.00	Coffee Break	
16.00 –	**Free Activity (TBD)**	

The First Manuscript Writing Workshop of SEACLID/CORDEX Southeast Asia
August 25 – 29, 2014, The National University of Malaysia,
Bangi, Selangor, MALAYSIA

1.0 Justification

The SEACLID/CORDEX Southeast Asia project will complete its first year period at the end of September 2014. As publications (peer-review and policy relevant) are key outputs of the project, there is a need for concerted and well-organized effort among members to achieve this. During the second workshop of SEACLID / CORDEX Southeast Asia June 9-10 in Bangkok, a decision was made on the needs to have a dedicated workshop for manuscript writing session of completed tasks particularly the ERAint sensitivity runs. For this purpose, the workshop is proposed to be organized from August 25-29, 2014 and to be hosted by the National University of Malaysia. In addition to manuscript writing, this workshop is also needed for the group to make a final decision regarding RegCM4 physics option of the actual simulation.

2.0 Objectives

- To come up with 3 draft manuscripts of ERAint Sensitivity Experiments for the entire Southeast Asia region
- To come up with structures and bullet points for 1 o 2 country level publications
- To discuss and come up with structure on a book on Regional Climate Change in the Southeast Asia region
- To discuss and make final decision on the RegCM4 physics options other pending issues on actual simulation

3.0 Targeted output

- Three manuscripts of ERAint Sensitivity Runs
- Structures and agreement on country-level publications
- Structures on a book on Regional Climate Change in the Southeast Asia region
- Decision on RegCM4 physics options

4.0 Participants

Two members of the five core-country members are invited:

Vietnam: Prof. Phan Van Tan, Dr. Thanh Ngo-Duc
Thailand: Asst Prof. Dr. Jerasorn Santisirisomboon, Dr. Patama Singhruck

Indonesia: Dr Edvin Aldrian (replaced by Mr Utoyo Ajie Linarka), Dr. Dodo Gunawan (replaced by Ms. Trinah Wati)
The Philippines: Assoc. Prof. Dr. Gemma Narisma, Dr Faye Cruz, Ms Julie Dado
Malaysia: Prof. Dr. Fredolin Tangang, Dr. Liew Juneng (and Local participants)

5.0 Coordinator Assignments

Item	Task / Manuscript	Coordinator
1	Manuscript on Rainfall [Overall Southeast Asia region]	Dr Liew Juneng
2	Manuscript on Temperature [Overall Southeast Asia region]	Dr Faye Cruz
3	Manuscript on extremes [Overall Southeast Asia region]	Dr Thanh Ngo-duc
4	Manuscripts on country level	Assoc Prof. Dr Gemma Narisma
5	Book on Regional Climate Change in the Southeast Asia region	Prof. Fredolin Tangang

6.0 Workshop Venue and Accommodation

The workshop will be held at the Faculty of Science and Technology, the National University of Malaysia.

Participants will be staying at the UKM Puri Pujangga (http://www.puripujangga.com.my/)

7.0 Schedule

Date / Time	Activity	Remarks
August 24, 2014	Arrival	
August 25, Morning Session (9.00 – 12.30)	Discussion on Item 1	Coordinator: Dr Liew Juneng
August 25, Afternoon Session (2.00 – 5.00)	Discussion on Item 2	Coordinator: Dr Faye Cruz
August 26, Morning Session (9.00 – 12.30)	Discussion on Item 3	Coordinator: Dr Thanh Ngo-Duc
August 26, Afternoon Session (2.00 – 5.00)	Discussion on Item 1	Coordinator: Dr Liew Juneng
August 27 Morning Session (9.00 – 12.30)	Discussion on Item 2	Coordinator: Dr Faye Cruz
August 27 Afternoon Session (2.00 – 5.00)	Discussion on Item 3	Coordinator: Dr Thanh Ngo-Duc
August 28 Morning	Discussion on Item 1/2	Coordinator: Dr Liew

Session (9.00 – 12.30)		Juneng / Dr Thanh Ngo-Duc
August 28 Afternoon Session (2.00 – 5.00)	Discussion on Item 2/3	Coordinator: Dr Thanh Ngo-Duc / Dr Thanh Ngo-Duc
August 29 Morning Session (9.00 – 12.30)	Discussion on Item 4 & Item 5 & Discussion on Final Decision of Best Physics Options & Commencement of Actual RegCM4 Simulation	Coordinator: Dr Gemma / Prof. Fredolin
August 29 Afternoon Session (2.00 – 5.00)	Final discussion and other issues	Coordinator: Dr Gemma / Prof. Fredolin

7.0 Funding

All Participants (except from Malaysia) will be fully funded using SEACLID/CORDEX Southeast Asia APN funding

The Second Manuscript Writing Workshop of SEACLID/CORDEX Southeast Asia
July 3 – 10, 2017, Ramkhamhaeng University Center of Regional Climate Change and Renewable Energy (RU-CORE), Bangkok, Thailand

Introduction

Since early 2017 the SEACLID/CORDEX Southeast Asia project has been in model output analysis and manuscript writing phase. This stage is crucial as the success of the project is measured by how successful we process, analyze, transform and distill the huge amount of model output into meaningful "regional climate information" and publishing them into scientific publications. SEACLID/CORDEX Southeast Asia is now a well-known "brand" and comes with this "status" is a high expectation to deliver. In terms of dissemination of downscaled multi-model products, effort is currently being made by Dr. Jerasorn's group to establish the SEACLID/CORDEX SEA EGSF Data Node and hopefully by before end of 2017 we would be able to archive most of the data. In terms of scientific publications, SEACLID/CORDEX Southeast Asia has high expectation to deliver and provide meaningful and robust scientific regional climate change information to user community in the region. In addition, scientific publications from this project would likely be useful inputs to the IPCC Sixth Assessment Report and other related IPCC Special Reports. Following the success of the first manuscript writing workshop we had in UKM in August 2014, where as a result of the workshop we successfully published 3 papers (1 in CR, 2 in IJOC), a Second Manuscript Writing Workshop of SEACLID/CORDEX Southeast Asia will be held from July 3 – 10, 2017 and will be hosted by the Ramkhamhaeng University Center of Regional Climate Change (RU-CORE) in Bangkok, Thailand.

This workshop will provide a platform for groups to coordinate and synergize their effort in completing the manuscripts they are currently writing and working on. Due to the time constraint, participants are expected to join the workshop with their completed analysis of model outputs, completed figures and have written draft of their manuscripts. In this workshop, participants will synergize their manuscripts and reduce overlapping. To achieve this the workshop will be structured so that each group would have the opportunity to present the progress of their manuscripts (presenting the questions they want to answer, the analysis, the figures, etc). Subsequently each group would proceed to modify, plot new figures and improve their manuscripts. Before the workshop ends, each group would finalize and come up with an almost final draft of their manuscript.

Objectives

- To provide a platform for groups to coordinate and synergize efforts in writing manuscripts and minimize overlapping
- To complete the manuscripts which have been assigned to each group by the Project Leader.
- To discuss other topics not covered and potentially can be written into scientific papers.

- To discuss outstanding issues related to the project

Targeted outputs

- Completion of manuscripts assigned by Project Leader to each group.

Participants

No	Country	Name
1.	Vietnam	Prof. Dr. Phan Van Tan
2.		Assoc. Prof. Dr. Thanh Ngo-Duc
3.		Nguyen Tuyet
4.	Philippines	Assoc. Prof. Dr. Gemma Narisma
5.		Dr. Faye Cruz
6.		Ms. Angela Monina Magnaye
7.	Malaysia	Prof. Dr. Fredolin Tangang (*)
8.		Dr. Ester Salimun
9.		Mr. Supari
10.		Mr. Chung Jing Xiang
		Ms. Ngai Sheau Tieh
11.	Indonesia	Prof. Dr. Edvin Aldrian
12.		Dr. Ardhasena Sopaheluwakan
13.		Ratna (TBC)
14.	Thailand	Asst. Prof. Dr. Jerasorn Santisirisomboon
15.		Dr. Patama Singhruck
16.		Dr. Kamphol

Tentative Schedule

Day	Time	Country
1 (July 3)	08.30 – 09.00	Brief opening (Asst. Prof Dr Jerasorn Santisirisomboon and Prof. Dr. Fredolin Tangang)
	09.00 – 09.30	Vietnam: Paper # 1
	09.30 – 10.00	Vietnam: Paper # 2
	10.00 – 10.30	Q & A / Discussion
	10.30 – 11.00	Philippines: Paper # 3
	11.00 – 11.30	Philippines: Paper # 4
	11.30 – 12.00	Q & A / Discussion
	12.00 – 13.30	Lunch
	13.30 – 14.00	Malaysia: Paper # 5
	14.00 – 14.30	Malaysia: Paper # 6
	14.30 – 15.00	Q & A / Discussion

	15.00 – 16.00	Coffee break
	16.00 – 16.30	Malaysia: Paper # 7
	16.30 – 17.00	Malaysia: Paper # 8
	17.00 – 17.30	Q & A / Discussion
2 (July 4)	09.00 – 09.30	Malaysia: Paper # 9
	09.30 – 10.00	Thailand: Paper # 10
	10.00 – 10.30	Q & A / Discussion
	10.30 – 11.00	Thailand: Paper # 11
	11.00 – 11.30	Indonesia: Paper # 12
	11.30 – 12.30	Q & A / Discussion
	12.30 – 13.30	Lunch
	13.30 – 17.50	Writing
3 (July 5)	09.00 – 10.00	Discussion, coordination
	10.00 – 12.00	Writing
	12.00 – 13.30	Lunch
	13.30 – 17.50	Writing
4 (July 6)	09.00 – 10.00	Discussion, coordination
	10.00 – 12.00	Writing
	12.00 – 13.30	Lunch
	13.30 – 17.30	Writing
5 (July 7)	09.00 – 10.00	Discussion, coordination
	10.00 – 12.00	Writing
	12.00 – 13.30	Lunch
	13.30 – 17.30	Writing
6 (July 8)	09.00 – 10.12	Travel to Smpran Riverside Nakorn Pathom, Thailand due to closure of Ramkhamhaeng University (Thailand Public Holiday July 8 – 11, 2017)
	12.00 – 13.30	Lunch
	13.30 – 17.30	Discussion & Coordination; Writing
7 (July 9)	09.00 – 09.30	Vietnam: Paper # 1 (Final presentation)
	09.30 – 10.00	Vietnam: Paper # 2 (Final presentation)
	10.00 – 10.30	Q & A / Discussion
	10.30 – 11.00	Philippines: Paper # 3 (Final presentation)
	11.00 – 11.30	Philippines: Paper # 4 (Final presentation)
	11.30 – 12.00	Q & A / Discussion
	12.00 – 13.30	Lunch
	13.30 – 14.00	Malaysia: Paper # 5 (Final presentation)
	14.00 – 14.30	Malaysia: Paper # 6 (Final presentation)
	14.30 – 15.00	Q & A / Discussion
	15.00 – 16.00	Coffee break
	16.00 – 16.30	Malaysia: Paper # 7 (Final presentation)
	16.30 – 17.00	Malaysia: Paper # 8 (Final presentation)
	17.00 – 17.30	Q & A / Discussion
8	09.00 – 09.30	Malaysia: Paper # 9 (Final presentation)

(July 10)	09.30 – 10.00	Thailand: Paper # 10 (Final presentation)
	10.00 – 10.30	Q & A / Discussion
	10.30 – 11.00	Thailand: Paper # 11 (Final presentation)
	11.00 – 11.30	Indonesia: Paper # 12 (Final presentation)
	11.30 – 12.30	Q & A / Discussion
	12.30 – 13.30	Lunch
	13.30 – 17.50	1. Discussion on outstanding issues on SEACLID/CORDEX Southeast Asia 2. Discussion on how to prepare the SEACLID/CORDEX Southeast Asia Report for Policy Makers
	17.30 – 18.00	Closing by Dr Jerasorn & Prof Fredolin
9 (July 11)	09.00	Travel back to 941 Hotel near Ramkhamhaeng University and prepare for Inception Workshop of 2nd Phase SEACLID/CORDEX Southeast Asia Project (12 – 13 July 2017)

Funding

All participants except Prof. Fredolin and Thailand participants will be funded through the first and second phase of the SEACLID/CORDEX project. Prof. Fredolin will be partially funded via allocation of RU-CORE Adjunct Professor program and other funding. Per diem and hotel accommodation of participants will be covered by funding from the first phase of the project. The airfare of two main participants will be covered by funding from the second phase of the project while the airfare of the third participant will be covered by funding from the first phase.

Workshop Venue and Accommodation

The workshop will be held at the Ramkhamhaeng University Center of Regional Climate Change and Renewable Energy (RU-CORE), Bangkok, Thailand from July 3 – 7, 2017. Participants will be staying at the 941 Hotel.

However, form July 8 – 10, 2017, the workshop will be held at the Sampran Riverside hotel as July 8 – 11, 2017 is a public holiday in Thailand and University is closed and is not accessible.

Participants arrive on 2 July and leave on July 11 for those who will not be involved in the Inception Workshop of the Second Phase of SEACLID/CORDEX Southeast Asia.

Organizing Committee Members

Asst. Prof. Dr. Jerasorn Santisirisomboon
Prof. Dr. Fredolin Tangang
Staffs of RU-CORE

RegCM Training Workshop for Southeast Asia
May 25-29, 2015, Manila, Philippines

DRAFT PROGRAMME

Time	25-May MONDAY	26-May TUESDAY	27-May WEDNESDAY	28-May THURSDAY	29-May FRIDAY
9:00-9:30	Registration	On regional climate modeling: progress and challenges (ICTP)	SEACLID/CORDEX-SEA: Progress and Challenges (Fredolin Tangang)	Coupled atmosphere-ocean model for tropical climate studies (Armelle Remedio)	Regional Climate Projection of the Maritime Continent (Im Eun Soon)
9:30-10:00	Welcome remarks				
10:00-10:30	Introduction to regional climate modeling (ICTP)	Very high resolution climate modeling (Izuru Takayabu)	RegCM4 over CORDEX-SEA (Xuejie Gao)	Regional climate research in monsoon Asia with a focus on Southeast Asia (Thanh Ngo-Duc)	Presentation from participants
10:30-11:00					
11:00-11:30	Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
11:30-12:00	RegCM regional modeling system (ICTP)	RCM in Southeast Asia: Modeling evaluation and addressing uncertainties (Liew Juneng)	RCM simulations of tropical cyclones (Izuru Takayabu)	The impact of two land-surface schemes on the characteristics of summer precipitation over East Asia from the RegCM4 simulations (Im Eun Soon)	Presentation from participants
12:00-12:30					
12:30-1:00	Lunch	Lunch	Lunch	Lunch	Lunch
1:00-1:30					
1:30-2:00					
2:00-2:30	Lab Session	Lab Session	Lab Session	Lab Session	Presentation from participants
2:30-3:00					
3:00-3:30					
3:30-4:00					
4:00-4:30	Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
4:30-5:00	Lab Session	Lab Session	Lab Session	Lab Session	Closing Remarks
5:00-5:30					MO Exhibit tour
5:30-6:00					
6:00-6:30	Welcome Dinner	Dinner	Dinner	Dinner	Dinner
6:30-7:00					
7:00-7:30					

Contact Information:
ICTP Phone: +39 040 2240 374
Email: smr2719@ictp.it
Website: http://indico.ictp.it/event/a14269/