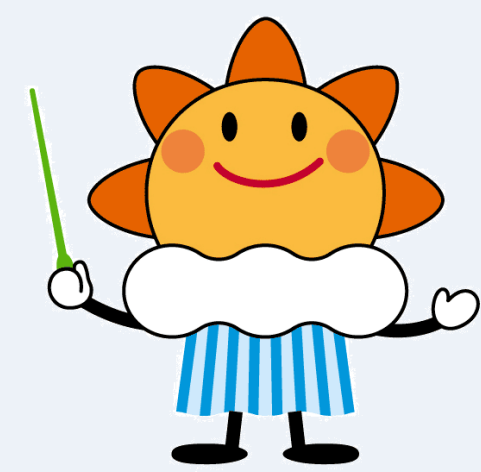




Making regional climate scenarios to assess the impact of climate change in Southeast Asian countries - Climate change projection using Non-Hydrostatic Regional Climate Model (NHRCM)

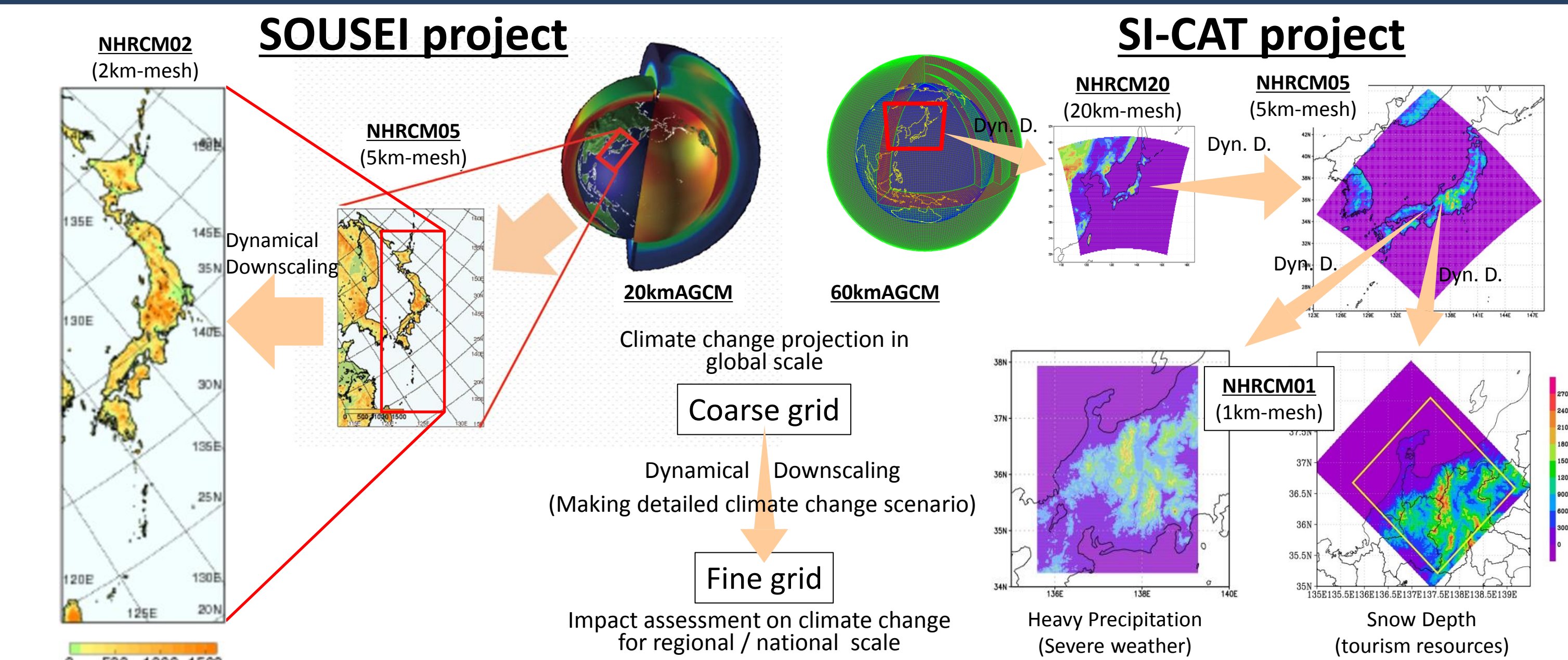


Japan Meteorological Agency / Meteorological Research Institute

Abstract

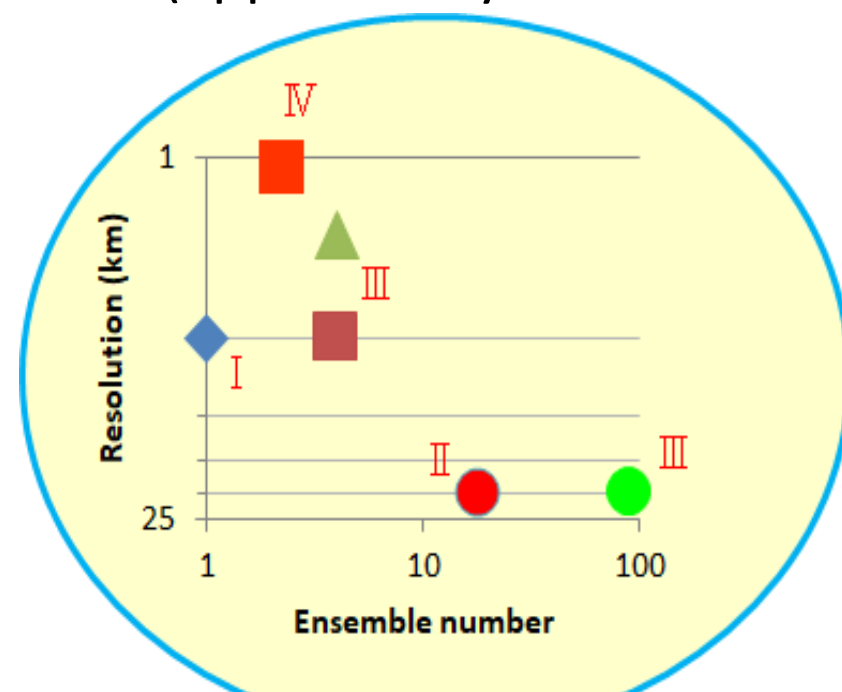
- The Meteorological Research Institute (MRI) of the Japan Meteorological Agency (JMA) has been conducting climate studies to make climate change scenarios on various spatial scales from global to regional and national scales. Dynamical downscaling method with their Non-Hydrostatic Regional Climate Model (NHRCM) has been utilized for the studies. Such downscaled (that is, finer grid) climate datasets has been used for the assessments on the impacts of global climate change on regional scale, which reaches urban scale recently. Japanese governments and universities have published official reports on climate projection and impacts of global climate change using the scenarios made by NHRCM.
- MRI/JMA has invited many researchers from Southeast Asian countries in order to conduct cooperative research programs on climate change projection around their homelands since FY2012. The Southeast Asian climate scenarios, which the invitee made, have contributed to WCRP CORDEX-SEA and other model inter-comparison projects. The scenarios have also been contributing to promote to establish fruitful cooperation between climate researchers and impact assessment researchers in each country.

Overview of making climate change scenarios



Climate change scenario made by NHRCM around Japan

- I Projection of climate change due to global warming, Vol. 8. published by JMA* in 2013
5 km resolution NHRCM with A1B scenario
 - II Global warming projection for formulation of adaptations by MOE*, MEXT* and JMA* (approved by the Japanese cabinet in 2015)
20-km NHRCM (3 presents+18 futures)
 - III SOUSEI Program (2012-2016)
a. 5km NHRCM (1 present + 4 futures)
b. 2km NHRCM (1 present + 4 futures)
c. d4PDF 20km NHRCM
history: 1950~2010, 61 years × 50 members
future: increase 4 degrees, 61 years × 90 members
 - IV SI-CAT
1km NHRCM (only around a prefecture)
- *JMA: Japan Meteorological Agency
*MOE: Ministry of Environment
*MEXT: Ministry of Education, Culture, Sports, Science & Technology



International cooperative programs by MRI/JMA

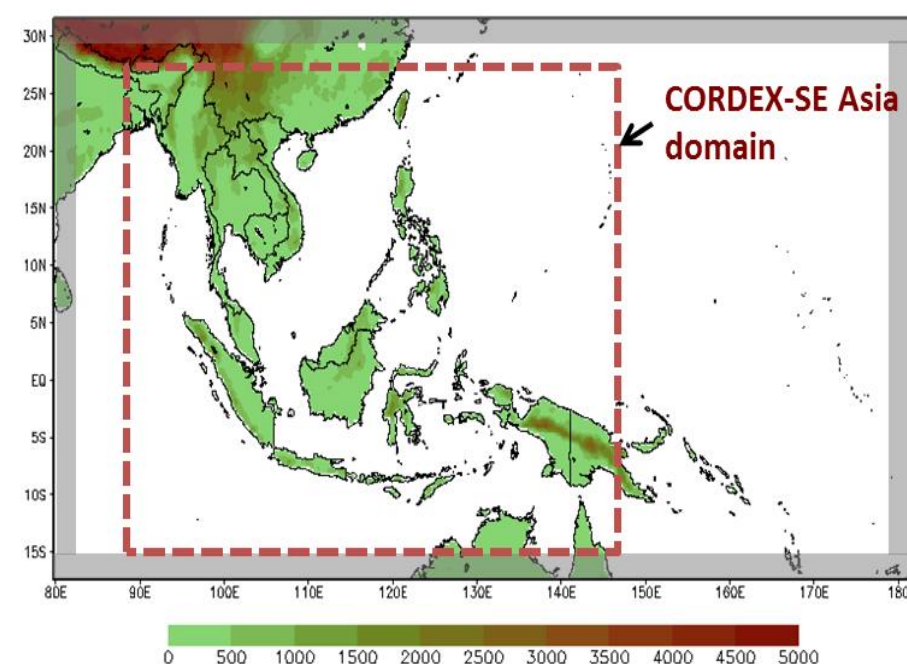
- ✓ The international cooperative research with developing countries is conducted by the MRI to produce the detail structure of the future climate change projection in tropical and sub-tropical Asian regions.
- ✓ MRI has been also providing climate models to Southeast Asian countries to support producing local climate change projection data on their own. Future plans will be shared as good practices that are broadly applicable to other countries and regions.

Climate change projection in vulnerable areas

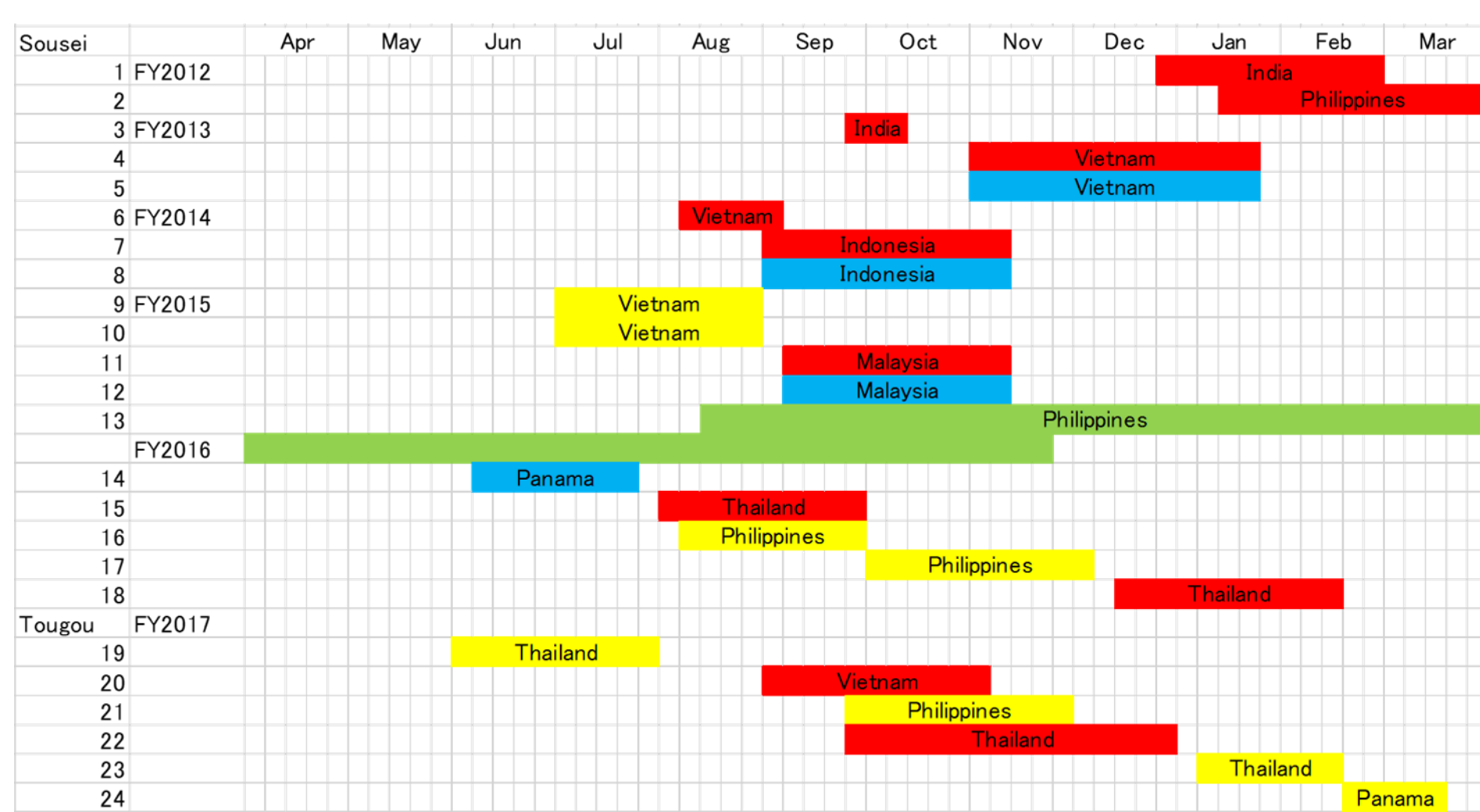
- Collaborative research with countries in Southeast Asia (CORDEX-SE Asia)
- Support to climate change projection in vulnerable areas
- Human resource development in foreign countries
- Evaluation of future water resource availability

International comparison of climate change projection

- Participation in High-Res-MIP
- Participation in CORDEX-EA
- Comparison with other countries



The invited researchers for NHRCM



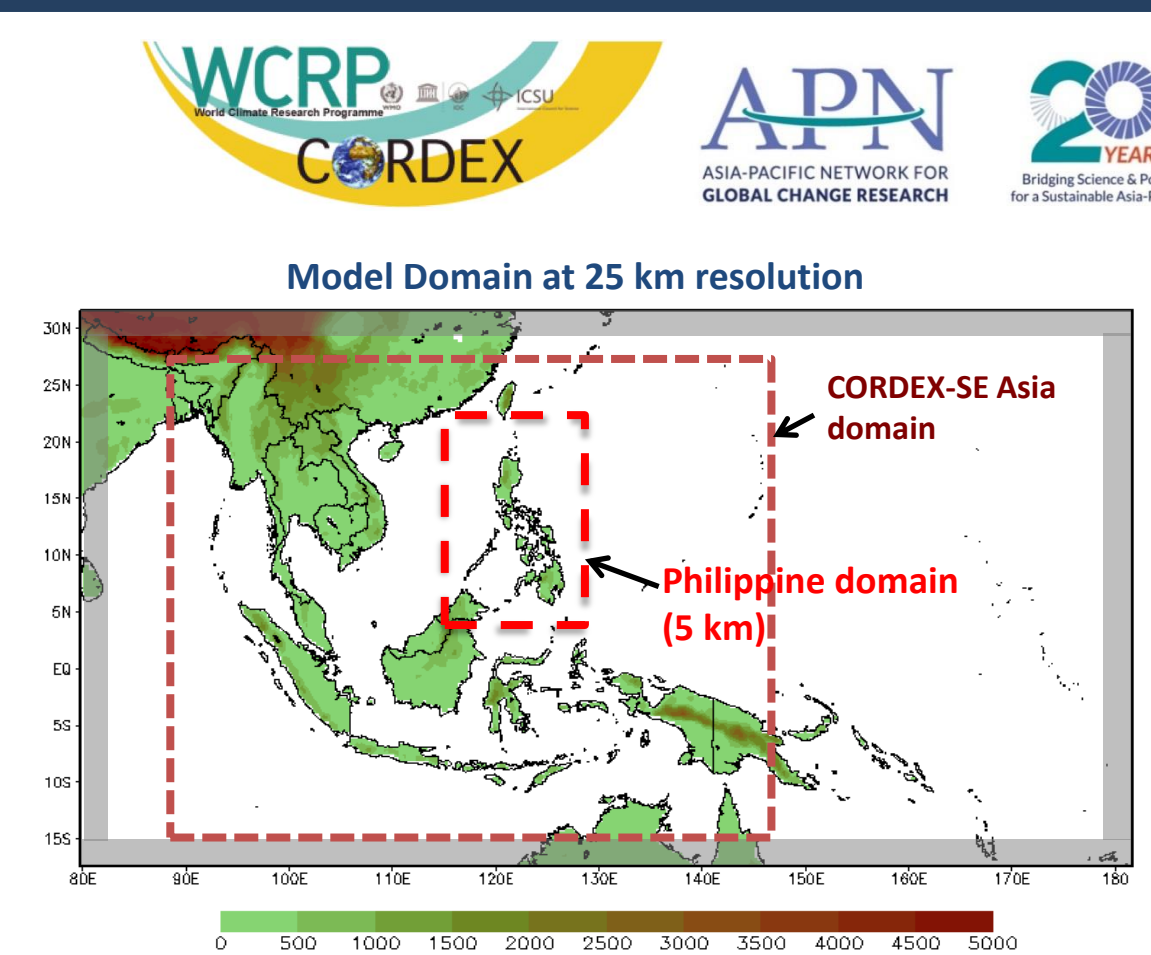
Fund: SOUSEI or TOUGOU own Ministry of Land, Infrastructure, Transport and Tourism Japan Society for the Promotion of Science

Climate change scenarios for Southeast Asian countries

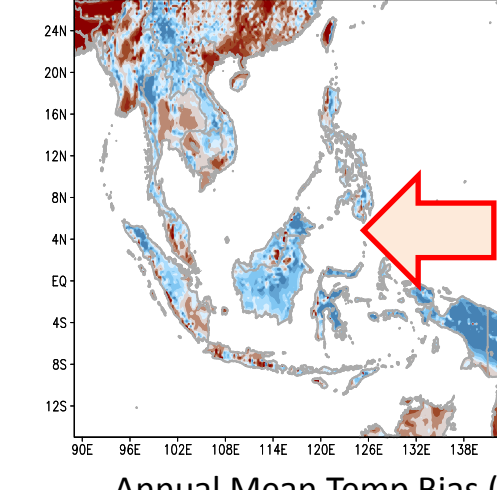
[Philippines]

©Phase I resolution: 25km

Domain	Resolution	Boundary Condition	Time Period	Scenario
SE Asia	25 km	ERA-Interim (~75 km)	1989-2008	
SE Asia	25 km	MRI-AGCM60	1981-2000	
Philippines	5 km	NHRCM (25 km)	1981-2000	
SE Asia	25 km	MRI-AGCM60	2020-2039	RCP 8.5
SE Asia	25 km	MRI-AGCM60	2080-2099	RCP 8.5
Philippines	5 km	NHRCM (25 km)	2080-2099	RCP 8.5
SE Asia	25 km	MRI-AGCM60	2080-2099	RCP 2.6
SE Asia	25 km	MRI-AGCM60	2080-2099	RCP 4.5
SE Asia	25 km	MRI-AGCM60	2080-2099	RCP 6.0



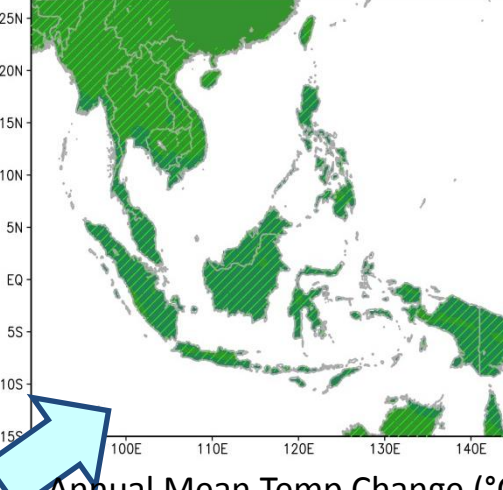
Present Climate



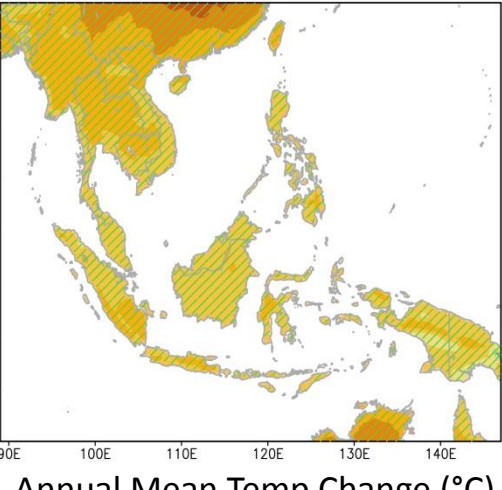
Using perfect boundary condition, most areas show **cold** and **wet** biases relative to APHRODITE with annual mean biases from -0.78 °C to -0.23 °C, and from 18.1% to 29.0% (averaged over land).

Under the RCP 8.5 scenario, the projected **warming** is up to 1.5 °C in the near-future and 4 °C in the far-future over the region. In the far future, Philippines will get more **wet** climate. Hatched areas show the significant levels are 99% or higher in temperature and 95% or higher in precipitation.

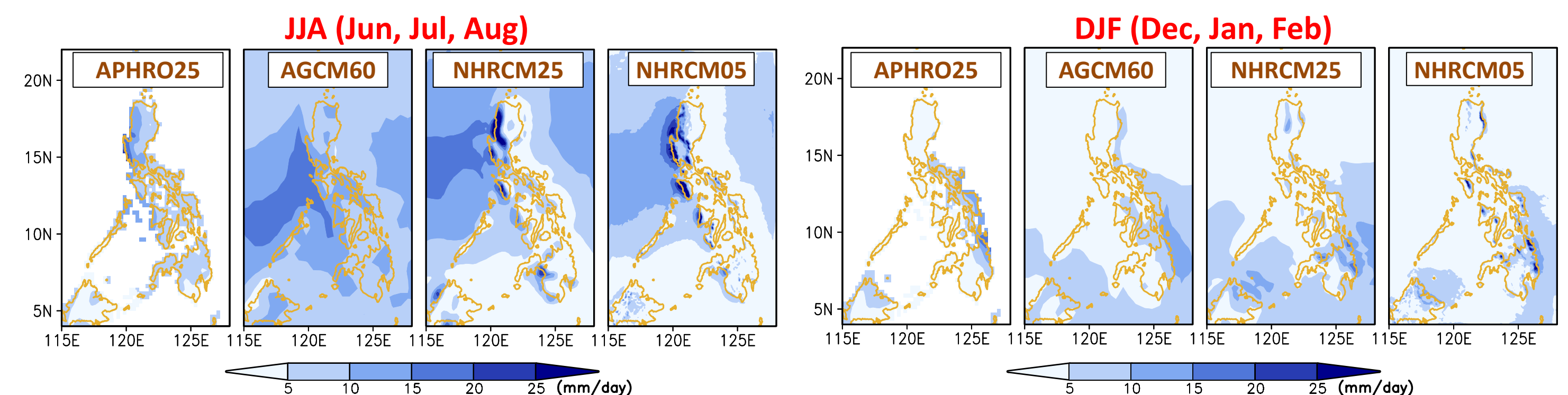
Change in near-future



Change in far-future



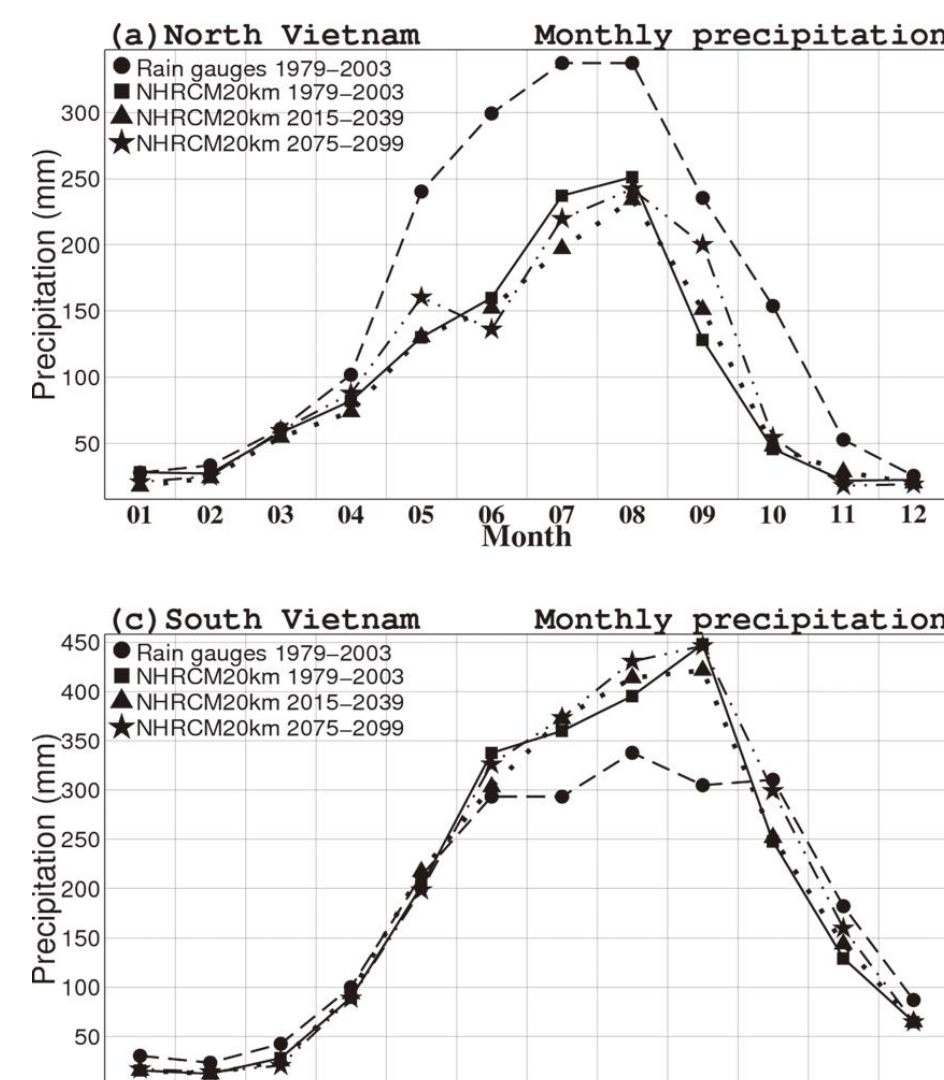
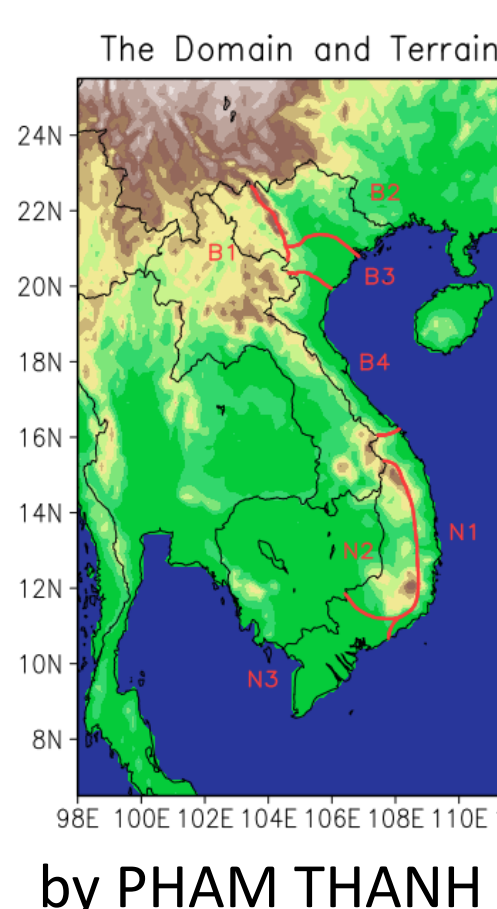
©Phase II resolution: 5km



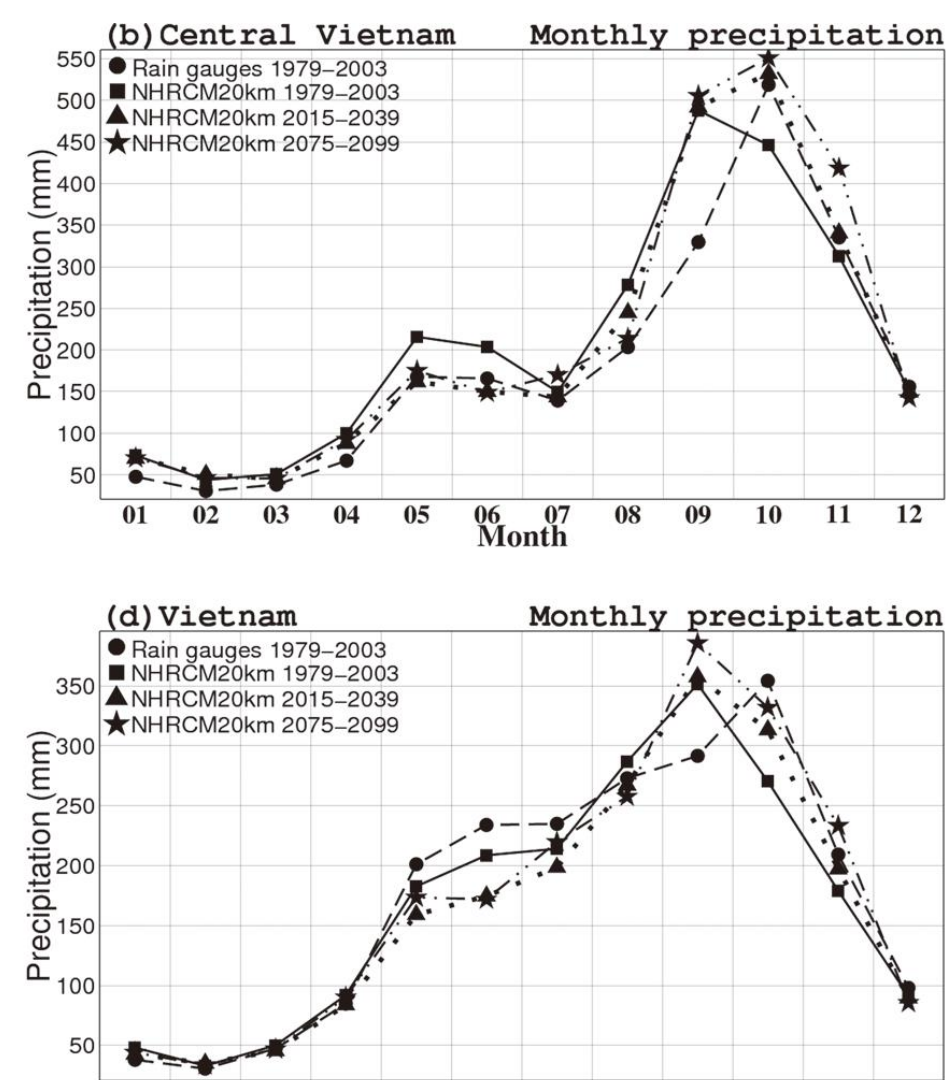
By Faye Abigail Tolentino CRUZ

[Vietnam]

NHRCM20 Resolution: 20km



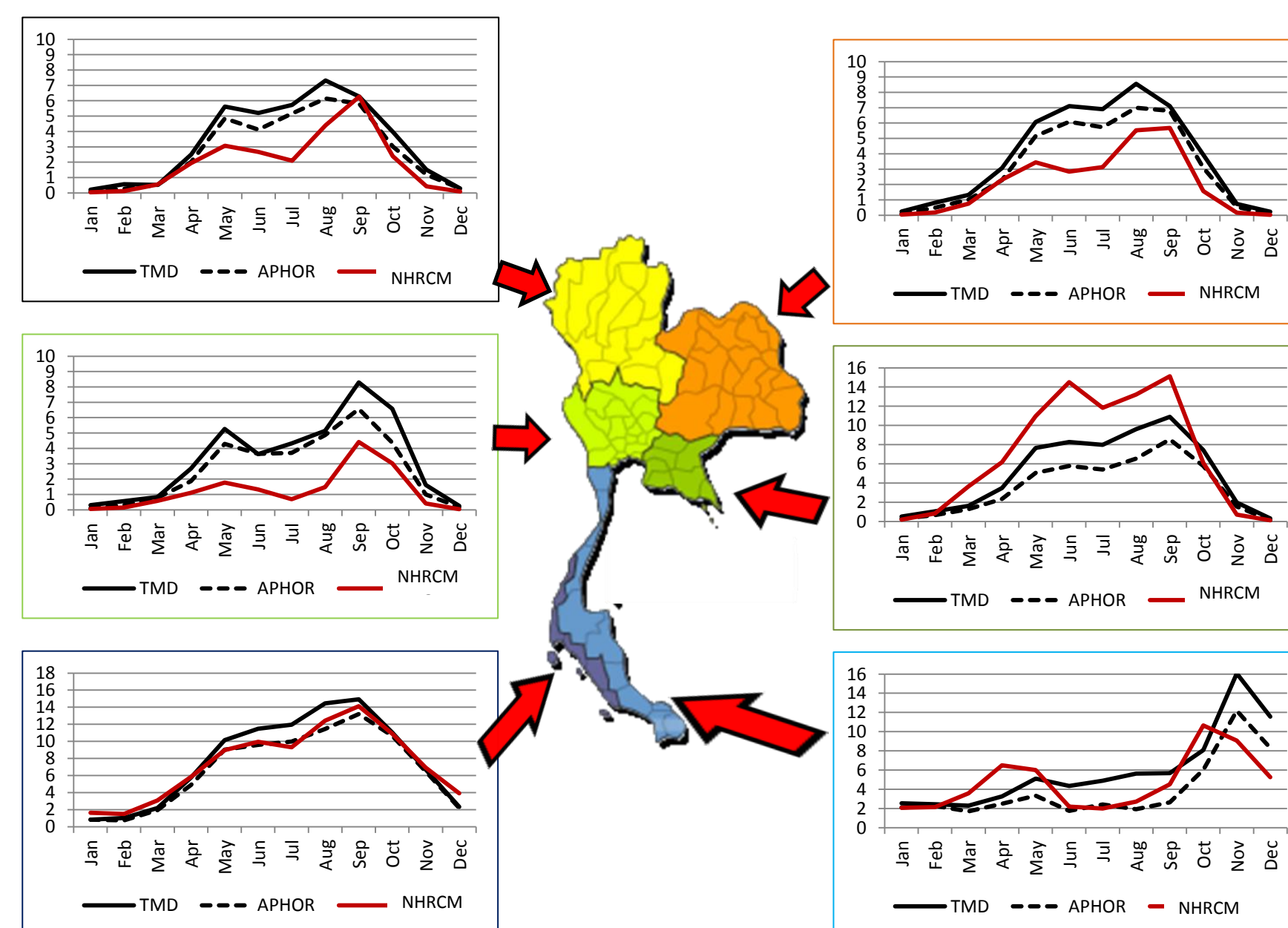
by PHAM THANH HA



Kieu-Thi et al 2016

[Thailand]

NHRCM05 Resolution: 5 km

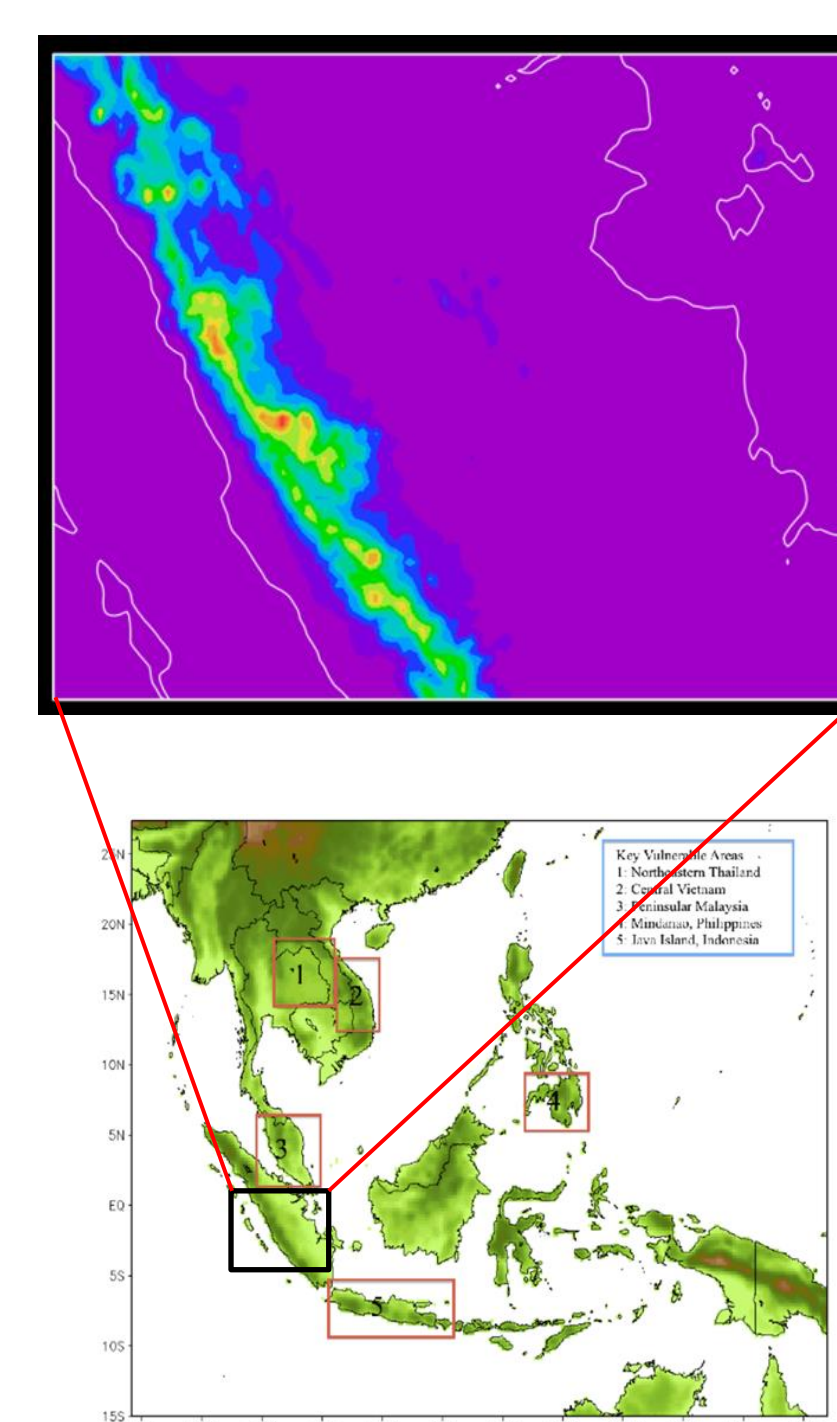


TMD: Observation by Thai Meteorological Department
APHOR: Analysis by APHRODITE (Asian Precipitation—Highly Resolved Observational Data Integration Towards Evaluation of Water Resources)
NHRCM: Reproduction by NHRCM05
By Sujittra Ratjiranukool

[Indonesia]

NHRCM05 Resolution: 5 km

Target: Batang Hari River basin



Acknowledgement: This work was partially conducted under the framework of "the Integrated Research Program for Advanced Climate Modeling" supported by the TOUGOU Program of MEXT of Japan.