I. CLIMATE CHANGE IN SOUTHEAST ASIA: AN OVERVIEW

Climate change, which is induced by global warming effect, has become a global concern as it may have many consequences on various systems and sectors that may threaten human wellbeing. Understanding climate change would be foundation for proper planning on adaptation measures to cope with future risk. However, global warming is a slow process and it would need rather long-term future climate projection to be able to clearly detect the change in future climate pattern, therefore, long-term future climate projection has been developed for assessment of climate change impact on certain sector in specific area, particularly at the local scale. Global circulation models (GCMs) were developed and have been used to simulate future climate condition, but most of the simulations, especially those GCMs that were used in the IPCC Assessment Report 4, were conducted in coarse scale due to limitation in the technology which is not quite effective for the use in climate change impact assessment at local scale and high resolution future climate data is required. The use of Regional Climate Model (RCM) help enhances the large-scale projections of a global general circulation model (GCM) into finer scale (high resolution) information for assessment of future climate change vulnerability and adaptation at the local level[1].

According to the simulation conducted by Southeast Asia START Regional Center[2], result from PRECIS regional climate model[3], which used ECHAM4[4] GCM data as initial condition, Southeast Asia tends to be warmer in the future (see Figure 1 & 2). Moreover, summertime also tends to be longer as Southeast Asia region tends to have longer hot period over the year, while wintertime or the length of "cool" period over the year tends to get shorter (see Figure 3&4). Annual precipitation may fluctuate in the early decades of the 21st century, but simulation result shows trend of higher precipitation throughout the Southeast Asia region in the future, especially toward the end of the century (See Figure 5).

[1] Jones, R.G., M. Noguer, D.C. Hassell, D. Hudson, S. Wilson, G. Jenkins and J.F.B. Mitchell. 2004. Generating high resolution climate change scenarios using PRECIS, Met Office Hadley Centre, Exeter, UK, 40pp, April 2004.

[2] The simulation of high resolution future climate projection for Southeast Asia region was conducted as part of research project under support by Asia-Pacific Network for Global Change Research and Thailand Research Fund (2007-2008). Data from the simulation is available for public use at http://cc.start.or.th/

[3] PRECIS is regional climate model developed by Hadley Center, The Met Office, UK.

[4] ECHAM4 is global circulation model which is one of the models used in IPCC Fourth Assessment Report. It was developed from ECMWF Atmospheric General Circulation Model coupled with University of Hamburg Ocean Circulation Model (http://www.ipcc-data.org/is92/echam4_info.html)

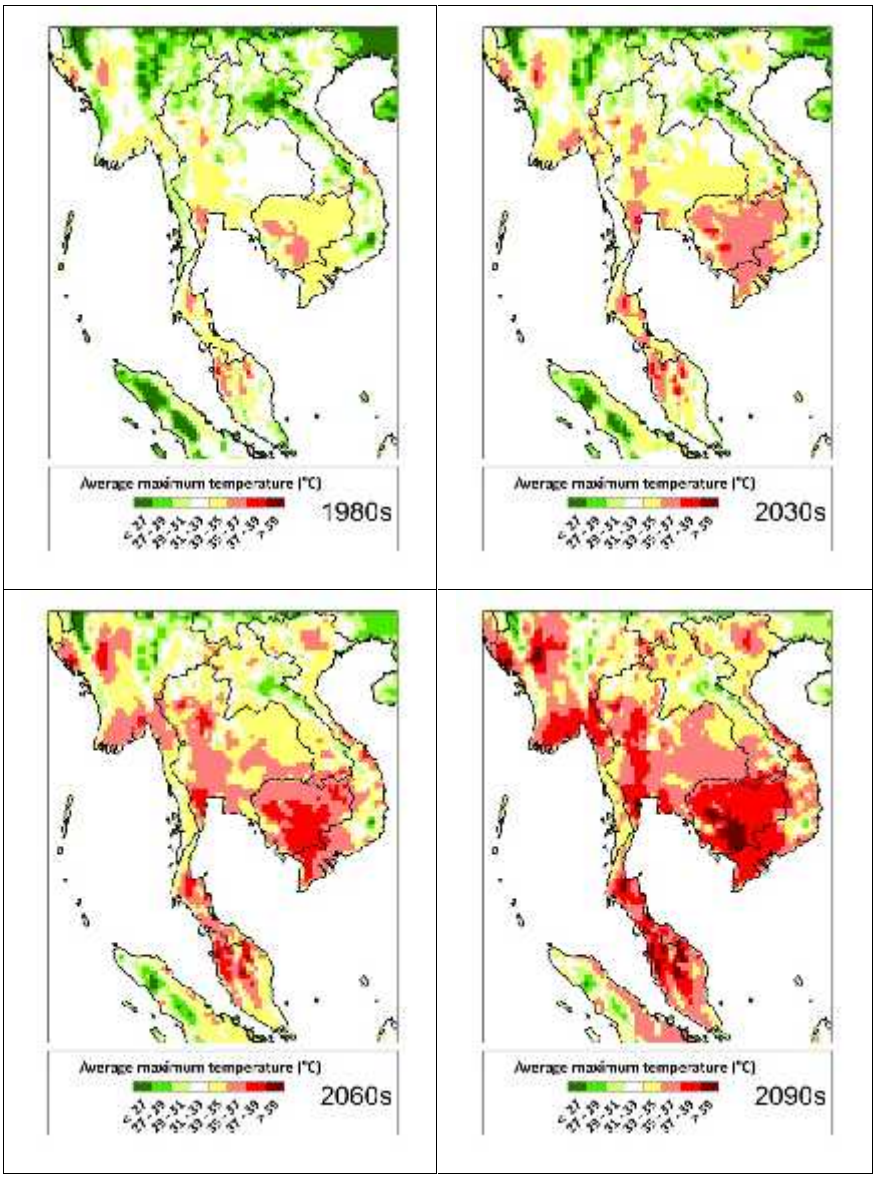

Figure 1.1: Average daily maximum temperature
(Source: SEA START RC)

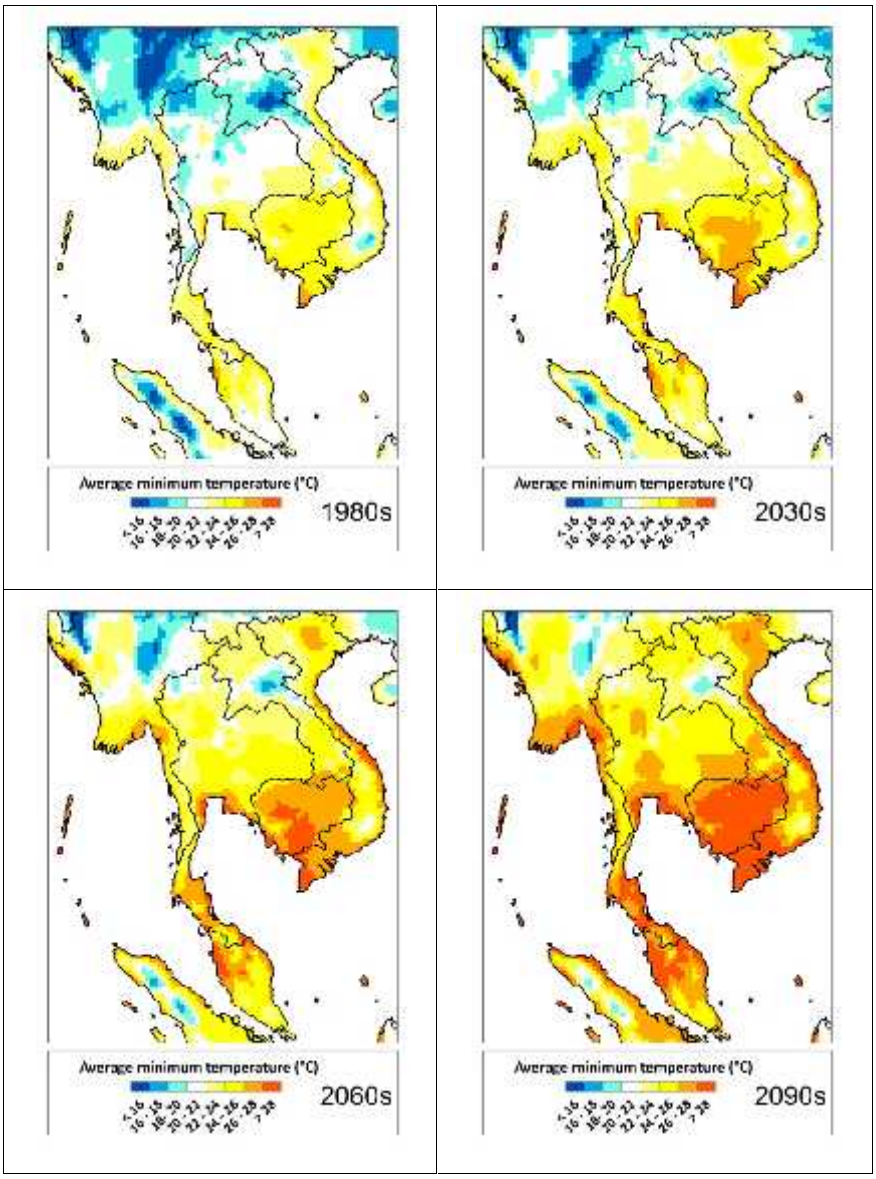

Figure 1.2: Average daily minimum temperature
(Source: SEA START RC)

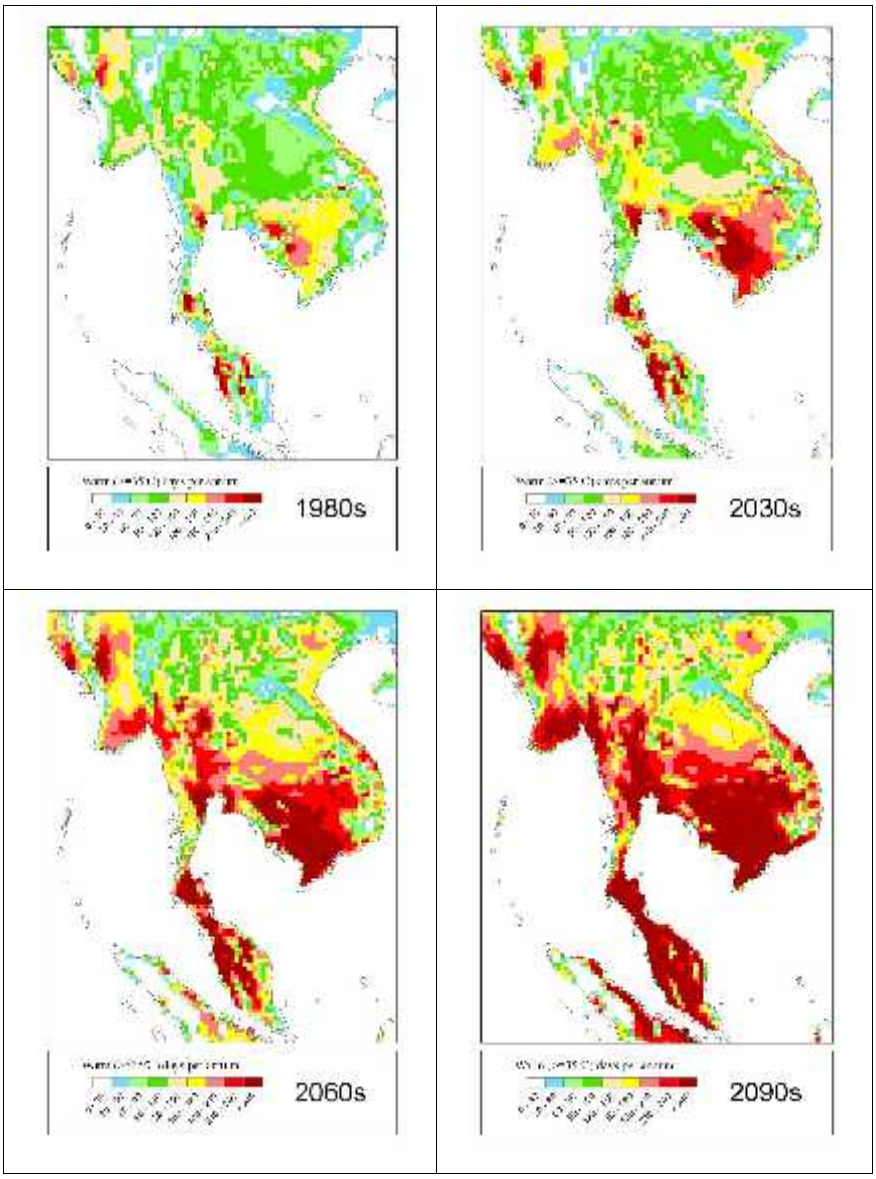

Figure 1.3: Length of hot period over the year - number of days with maximum temperature >35ºC
(Source: SEA START RC)

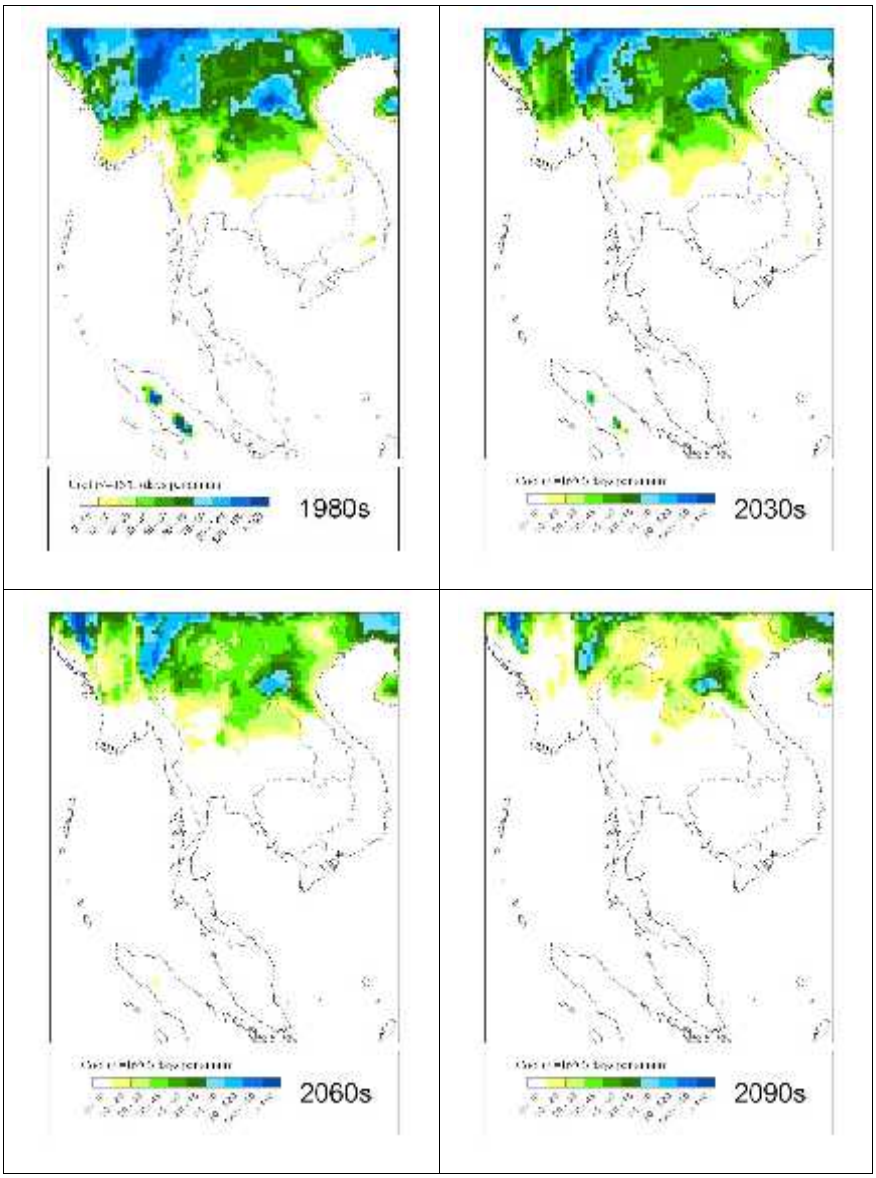

Figure 1.4: Length of cool period over the year - number of days with minimum temperature <16ºC
(Source: SEA START RC)

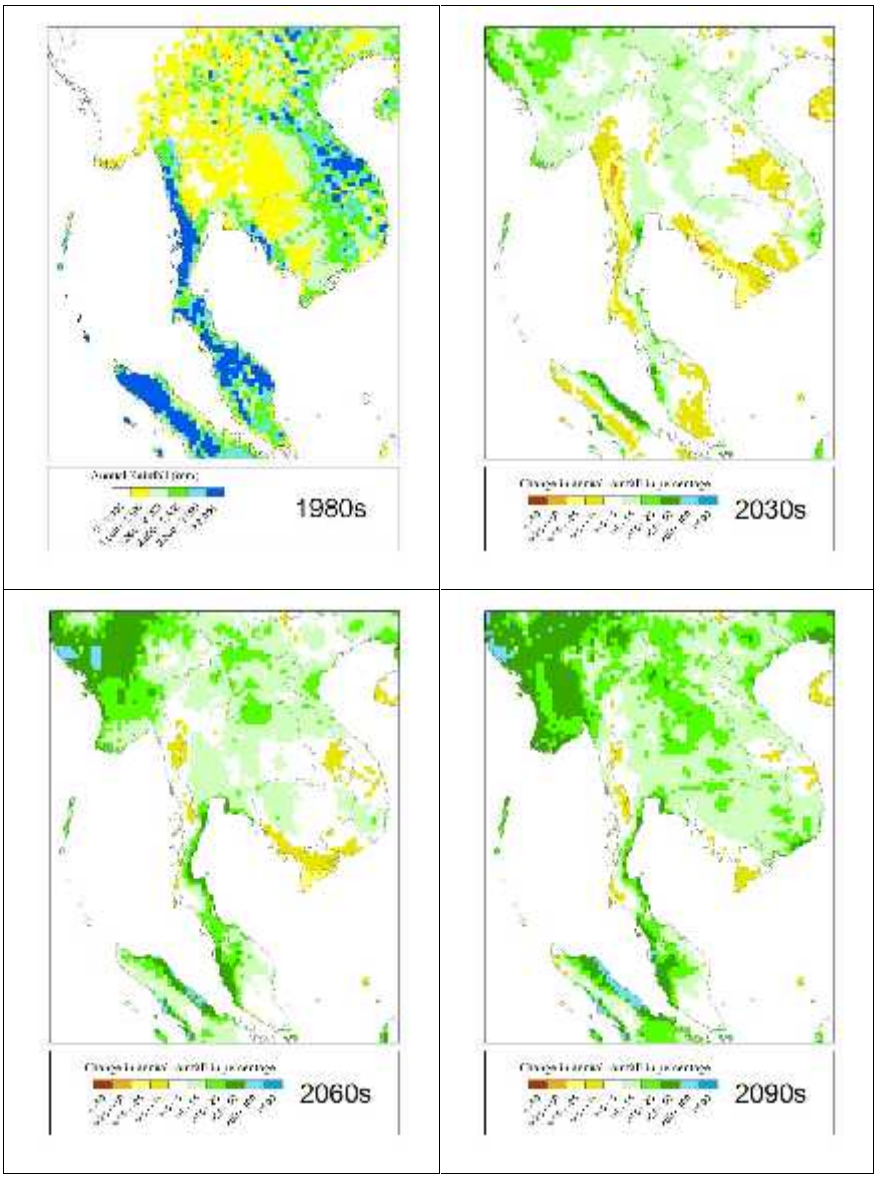

Figure 1.5: Current annual precipitation (mm.) and future change compared to 1980s (%) (Source: SEA START RC)

In summary, future climate in Southeast Asia countries tends to be warmer with longer summertime and higher rainfall, both in term of annual amount and intensity. This trend of climate change in the Southeast Asia region as projected regional climate model match with global trend as summarized in by Intergovernmental Panel on Climate Change in their Fourth Assessment Report (Figure 1.6).

Phenomenon[1] and direction of trend	Likelihood that trend occurred in late 20th century (typically post 1960)	Likelihood of a human contribution to observed trend [2]	Likelihood of future trends based on projections for 21st century using SRES scenarios
Warmer and fewer cold days and nights over most land areas	*Very likely*[3]	*Likely*[4]	*Virtually certain*[4]
Warmer and more frequent hot days and nights over most land areas	*Very likely*[3]	*Likely (nights)*[4]	*Virtually certain*[4]
Warm spells / heat waves. Frequency increases over most land areas	Likely	*More likely than not*[4]	*Very likely*
Heavy precipitation events. Frequency (or proportion of total rainfall from heavy falls) increases over most areas	Likely	*More likely than not*[4]	*Very likely*
Area affected by droughts increases	*Likely in many regions since 1970s*	*More likely than not*	*Likely*
Intense tropical cyclone activity increases	*Likely in some regions since 1970*	*More likely than not*[4]	*Likely*
Increased incidence of extreme high sea level (excludes tsunamis)[5]	Likely	*More likely than not*[6]	*Likely*[7]

Figure 1.6: Summary of global climate change trend
(Source: Intergovernmental Panel on Climate Change)

These changes are unlikely to be irreversible and would have impact on various systems and sectors. However, this future climate projection is just one plausible future which was simulated by single climate model and single initial dataset. It is important to bear in mind that such scenario cannot be taken as long-term forecast or represent truth of the future. Even though future climate projection shows precise picture of future climate pattern, however, it is consequence of a set of assumptions, i.e. the level of atmospheric greenhouse gases in the future and rate of future change. Moreover, the climate models, both global circulations model (GCM) as well as regional climate model (RCM), is yet to be further improved as knowledge on atmospheric sciences advances. In this regard, there is certain level of uncertainty in the future climate projection, of which may not be able to quantify; however, it can still be used for strategic planning purpose. Data and information from long-terms climate projection can be used to support process of risk and vulnerability assessment of community, system or sector as well as resilience of society and robustness of development plan under certain circumstance.