

Challenges in Developing Regional Climate Scenarios for Southeast Asia Region

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Abstract:

High resolution regional climate scenario is required for assessing climate change impact and risk from climate change at regional and local scale. However, development of regional climate scenario in Southeast Asia is still limited and facing many challenges in various aspects. Technical aspect in developing regional climate scenario is the key challenge that scientists in the region need to overcome by acquiring proper technology transfer as well as to gain access to data and secure necessary resources required for the generating of such scenario. Other challenges are disseminating of future climate data for further analysis and proper interpretation of climate data into information for communicating to stakeholders, which proper expectation need to be set and uncertainty of climate scenario need to be properly addressed in order to develop proper awareness and science-policy linkage that would lead to effective response to future climate change.

Keywords: regional climate scenario

Background: We can observe that climate change has occurred in the 20th century, but how can we know what future holds?

Climate change caused by global warming is now a highly concerned issue as it could cause many changes which may have consequences on bio-physical systems and human wellbeing. But climate change is a slow process; therefore, study of climate change normally covers long timescale, typically in range of decades or even longer, in order to be able to identify changes in climate pattern from the baseline condition out of the fluctuation of climate variability in climate system. This would need data and information on long term future climate condition to analyze change in climate pattern and also data / information to use in assessing impact and risk that may be induced by climate change in the future. However, precise prediction for such long timescale is beyond capability of any current forecasting technique to cope with. Therefore, climate scenario is developed to address the need for long term climate data. Climate model, which is computer software that composes of set of equations based on law of physic, is primarily used to simulate data on future climate under given changing conditions of atmospheric greenhouse gases that drive the global warming phenomenon. The outcomes of climate model are plausible future of future climate condition. This approach is a compromise between prediction and projection.

Regional climate scenarios for Southeast Asia: From global scale to local scale

In principle, the simulation of climate scenarios needs to be performed at global scale using global circulation model (GCM) because atmospheric system is a single system. Even though there are some efforts toward developing high resolution climate scenario at global scale, but most of today global climate models still generate future climate scenarios at large grid size of several hundred kilometers for the reason that the simulation process is highly computing intensive. Therefore, downscale process to get information regarding climate change at specific locations is required for the assessment of climate change impact. This process can be performed using statistical approach based on empirical analysis with the observe climate data or dynamic approach using regional climate model. This higher details future climate change scenario can then be used in assessing impact of climate change as well as risk, vulnerability and adaptation to future climate condition and it consequences.

Challenges in Developing Regional Climate Scenarios for Southeast Asia Region:

The concern of the regional climate change study is that the region needs future climate projection which is high resolution, regional specific and address regional concerns of climate impacts. Furthermore, multiple scenarios are required to address uncertainty of long term projection. Development of regional climate scenario in the Southeast Asia region is still considered very limited and the effort in doing so as well as the use of climate scenarios still face many major challenges.

Challenges in developing climate change scenario in Southeast Asia as addressed this paper is the summary from the observation and experience in pioneering development of regional climate scenarios as well as the use of climate scenario for climate change impact, risk, vulnerability and adaptation assessment in the region by Southeast Asia START Regional Center over the years.

Challenge 1: Overcome technical obstacles

Developing regional climate scenarios would depend on technology from advanced research institutes outside the region. For the time being, access to the technology, especially tools such as regional climate model, and data required for downscaling process to generate high resolution climate scenario is still limited. Moreover, some of the regional specific parameters and feedback of the other systems that may influence local climate are requires to incorporate into the calculation process of regional climate scenario simulation in order to get more accurate result for the region. This would require climate scenario development tools that are open for modification and know-how for such modification. Moreover, regional data such as up-to-date and with fine details land cover, etc., also needs to be integrated into the regional climate model. The issue becomes even more complicate when different climate models give different results; therefore, multiple regional climate scenarios are required for regional, national and/or local climate change impact assessment in order to address uncertainty of the future climate projections. But limited number of regional scale scenarios is available in the Southeast Asia to date due to limited access to technology, data and resources availability.

Challenges to overcome this technical issue are on the acquiring of proper technology and know-how, access to data and also the securing of resources. Scientists in the region may need to establish bi-lateral or multi-lateral collaboration with the research institutes where necessary tools and GCM data can be obtained for the development of regional climate scenario as well as collaboration among scientists in the region to gather necessary data require for the process in fine tuning regional climate scenarios. In addition, resources allocation and availability, including man machine and money, for the time consuming and computation intensive operation as well as collaboration among scientists in the region are also key success factors for the success of regional climate scenario development.

Challenge 2: Communicating climate scenario

Communicating scientific information to the public and policy community is always a challenge to scientists. Climate scenario is plausible future of how future climate might be, but it is not a long range forecast. Moreover, it should be taken in the context of "climate" and "change", where weather characteristics over rather long period of time would be compared to another period. In Southeast Asia, there still are many misconceptions and misperceptions on the climate scenario, which is another major challenge for scientists who develop climate scenario to overcome in communicating of such climate scenario to users and public by creating common understanding about climate scenario and set proper expectation among audiences.

Another major challenge in the development of regional climate change scenario is to fill the gap in science-policy linkage that would lead to the use of climate scenario in long-term policy planning process at local, national and regional level to address responses to future change with focus on minimizing risk and fully exploit benefit from positive impact from climate change. However, different users use climate scenarios differently, therefore, the outcome of climate change scenarios needs to be delivered to policy makers, stakeholders and public as information, not data, which is relevant to their concerns and context and also fit with their perception. In addition, communicating of climate scenario to policy community may need to address timescale that match the context of planning process.

Challenge 3: Disseminating climate scenarios

Scientists would use climate scenario to analyze and assess impact of climate change on various biophysical systems and would need long term climate data, which typically is large amount of data as analysis of climate change would need to conduct for rather long period of time. Disseminating large data over to network of researchers is quite a challenge for scientists who develop climate scenario in setting up proper achieve system and medium to use for the dissemination.

Challenge 4: Addressing uncertainty of the scenarios

Another frequently asked question is: “how do we know if model predictions are credible”? Climate models have sources of error: from aspects of simplification, structural design, representation of physics, to limited and inadequate science knowledge. Science today recognizes that there is no way to prove the absolute truth of any hypothesis or model, however, uncertainty does not mean nothing can be stated robustly. Climate scientist needs to be conclusive in delivering data/information on climate change, at least to a certain extent. However, as different users of climate scenario use the climate scenario differently, therefore, uncertainty in climate scenario may need to be addressed differently, e.g. scientists would need to know how uncertainty could be reduced, perhaps through the use of multiple scenarios or more refine climate model while policy makers may need to know how much the uncertainty is, so proper assumption would need to be added into policy planning process. Another challenge on developing climate scenario for policy planning support is to supply scenarios to policy maker with the establishment of common understanding that the development of climate scenario has to be on-going process; however, policy planning shall not wait for perfect scenario.

Conclusion:

These challenges are not only for the climate scientists to overcome in developing regional climate change scenario but it is the challenge that research community, policy community and society to overcome together in order to come up with proper climate change strategy for the local, national as well as regional level that would help minimize risk from climate change in the future. For the time being, there are only small groups of scientists in Southeast Asia working on the issue under limited access to technology, under funded and limited resource allocation. After all, this may be the biggest challenge of the Southeast Asia region to fill gap and make way forward in developing of regional climate change scenarios together.