AIACC Regional Study AS07: Southeast Asia Regional Vulnerability to Changing Water Resource and Extreme Hydrological Events due to Climate Change

Progress report: period mid-year 2003

Brief Summary:

In the first half of CY03, the regional study AS07 was focused on the recalibration of regional climate model to generate the climate scenario for Mekong River basin which based on 2xCO2 GHG scenario at 80 km grid and also in finer resolution at 14 km grid. In addition, also extend the scope of climate scenario study to cover the 1.5xCO2 GHG scenario.

Initiate the analysis of impact of climate change on hydrological impact in the region and prepare to analyze the climate risk on agriculture (rain-fed rice cultivation).

Another activity during this period is the preparation of socio-economic scenario for land use land cover change analysis, which would be foundation for details hydrological analysis as well as to be used for vulnerability assessment and policy option analysis in the latter phase.

Also initiating the stakeholder involvement at the local community, which was first started in the northeastern part of Thailand in Songkram river basin (sub-basin of Mekong river basin) and Attapeu province in Lao PDR.

More details in brief:

The major activities in this reporting period comprise of the following activities:

- Recalibration of regional climate model for 2xCO2 climate scenario and simulation of regional climate based on 1.5xCO2.
- Initiate first trial on analysis of impact of climate change on hydrological profile in the Mekong River region.
- Preparation on the analysis of climate risk on rain-fed rice cultivation.
- Development of socio-economic scenario.
- Initiation of stakeholder involvement at local community level.

The brief details, outcome and lesson learned are as follows:

1. Recalibration of regional climate model for 2xCO2 climate scenario and simulation of regional climate based on 1.5xCO2.

The future climate scenario for the Mekong River Basin was simulated by CSIRO Division of Atmospheric Research using in-house developed regional climate model Conformal Cubic Atmospheric Model (CCAM), which based on 2xCO2 GHG scenario. The hindcast result gave the significant lower rainfall result throughout the region when compare to the actual observed rainfall data. The new result from the new simulation is the output of the model recalibration.

Further work in the climate model will be continued in the area of climate variability with the expansion in the scope of study to also cover future climate simulation under 1.5xCO2 GHG climate scenario. The conclusion is expected to be in Q3 2003.

Lesson learned:
- The preliminary result shows that there will be significant shift in season pattern in most part of the region and significantly reduced rainfall in the northern part of the region.
- Chance of extreme hydrological event in term of flooding is likely be the same as today because the total rainfall is not much differ than nowadays. However, the chance of landslide may increase as the rain in rainy season is likely be heavier.
- The regional climate modeling gave the result that the might be more meaningful when compare to the GCM downscaling technique, however the GCM downscaling technique is still required to give comparison to the regional climate modeling result.

2. Initiate first trial on analysis of impact of climate change on hydrological profile in the Mekong River region.

Start simulation of hydrology runoff at selected point on Mekong River using VIC hydrological model based on current land cover and 2xCO2 climate scenario at 80km grid size as first trial to understand the appropriate calibration approach for the details analysis in the future.

Lesson learned:
- Direction and parameters that may be required for model calibration in order to get better result of future water profile of the Mekong River region.
- May need additional software tools to incorporate with the original plan, e.g. ANUSPLINE software.


Start to develop tool to analyze the climate risk on rain-fed rice cultivation with Multi-Crop Center, Chiangmai University. The tool, once developed, will be used to forecast the yield of rain-fed rice production under different climate scenario in various major rice growing area in the Mekong River region, which may be differ from today due to the impact of climate change.

Lesson learned:
- Ability and interest of people involve in this field of study in the region to conduct further analysis do exist.
- Accessibility and availability of data for further analysis could be limited.


Join with Unit for Social and Environmental Research (USER), Chiangmai University, to develop socio-economic scenario for Mekong River region.

Purpose of Scenarios
- To provide input into hydrological models of the region to explore the range of potential interactions between land-use and climate change in water related sectors over the next several decades to a century. Ultimately, the water-related sectorial issues of primary include: provision of food, for example from rain-fed rice or irrigation systems; water supply for various uses; vulnerability of natural wetlands; and vulnerability of human settlements to floods. The scenarios thus both help guide the generation of future landscapes as well as provide context in which to interpret the implications of modeled outcomes. The main value comes in their comparison rather than the plausibility of individual scenarios.

Outputs
- A set of 4 contrasting scenarios of socio-economic development that, in turn, frame a more detailed set of assumption about changes in land-use with an emphasis on factors likely to affect hydrology. Each scenario consists of:
• Story line describing in broad terms how development proceeds at the regional scale
• A set of explicit rules (or model) for evolving landscapes under each of the scenarios
• A set of evolved land-use and land-cover maps for the Mekong Basin region under scenarios at 20 year intervals from 2000 thru to 2100

Lesson learned:
• Data needed for historical analysis may be limited. May have to rely on interpolation technique or secondary dataset.

5. Initiation of stakeholder involvement at national and local level.

• Initiated meeting with various government line agencies to introduce concept of the study of impact of climate change in Thailand and Lao PDR through workshop as well as individual meetings.

• First initial meeting with local community in target study site in Songkram river basin, which is one of the main tributary of Mekong River in northeastern part of Thailand. The objective was to introduce the concept if climate change and its possible impact on community livelihood and to build foundation for future assessment. The activity was organized with the co-operation of local education institute, Rajapat Institute – Sakon Nakorn Campus and IUCN.

• Another initial meeting with local community was conducted at Attapeu Province in southern Lao PDR, where people in the area is expected to have low coping capacity to cope with the impact of climate change, particularly the coping with the impact of extreme hydrological event which occur in the area regularly.

Lesson learned:
• Stakeholders at national and local community level, which consist of both line agencies and community leaders, still lack of proper awareness about impact of climate change.
• Most stakeholders, particularly in Thailand and Lao PDR still lack of resource, capacity and clear direction toward the study the impact of climate change.
• Most member of the local community had observed the impact of climate variability over the years and able to provide information, which could be used to assist the future climate change impact analysis.
• Common and simple communication approach in the future assessment need to be developed in order to create same understanding on climate change issues and to get correct input in the future assessment activity.

Future activities in the next 8 months:

• To complete the extended simulation of the future climate scenario to include future climate scenario at 1.5xCO2 by CSIRO in Australia – expect to complete by end-July 03.
• To complete the future land use/land cover change scenarios, which shall be based on socio-economic scenario of the region – expect to complete by Sept. 03.
• To complete hydrological simulation of different run-off profiles in the Mekong River watershed, which will base on the result from the climate model on current land use/land cover – expect to complete by Sept. 03.
• To complete hydrological simulation of different run-off profiles in the Mekong River watershed, which will base on the result from the climate model and different land use/land cover scenarios – expect to complete by Dec.03.
• To complete analysis of impact of climate change on water resource in the Mekong River region – expect to complete by Q1, 04.
• To complete the development of tools to analyze impact of climate change on rain-fed rice agriculture – expect to complete by Dec.03.
• Finalize the scope of the assessment and the study area; the selection will be jointly made with the participating countries and/or the international organizations that this study may collaborate with – expect to complete by Q1, 04.
• Initiate analysis of impact from climate change on rice production – expect to start in Q1, 04.

Anticipated difficulties in the next 8-month period:

• Availability and accessibility of data for conducting historical data analysis for land use land cover change analysis as well as data for the calibration of hydrology model and other analysis on impact of climate change on other biophysical systems.
• To create appropriate awareness among stakeholders at various levels regarding impact of climate change on local community livelihood.

Describe any connections or interaction between your AIACC project and the preparation of national communications under the UNFCCC for countries relevant to your project:

To provide information from the AIACC research study to the government agency who responsible for the preparation of the next National Communication. At this stage, the future climate scenario data set from the regional climate model based on 1.5xCO2 and 2xCO2 will be distributed to National Climate Change Committee of the 4 lower Mekong River countries, namely Cambodia, Lao PDR, Thailand and Viet Nam.

Initiate capacity building activity for group of people, who might involve in the next National Communication preparation, to understand the approach and method as well as conducting trial pilot study in national and local scales by using result from AIACC research study as input to such process. The activities is under planning process with expected support from APN.
Appendix 1

Result of recalibrated climate simulation under 2xCO2 scenario:
80 sq. km. grid
Figure 1: Change in maximum temperature

Country boundary
Mekong basin boundary

Different maximum temperature (°C)
-3 - 1
-1 - 1
1 - 3
3 - 10
Figure 2: change in minimum temperature

<table>
<thead>
<tr>
<th>Country boundary</th>
<th>Mekong basin boundary</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3 - 1</td>
<td>1 - 1</td>
</tr>
<tr>
<td>1 - 3</td>
<td>3 - 10</td>
</tr>
</tbody>
</table>

AIACC AS07: Southeast Asia Regional Vulnerability to Changing Water Resource and Extreme Hydrological Events due to Climate Change
Figure 3: Change in daily precipitation

Country Boundary
Mekong Basin Boundary
Different rainfall value
(mm/month : 2CO2 - CO2)

-70 - 20
-20 - 20
20 - 70
>70
No Data
Appendix 2

Impact of climate change on hydrology – trial run at Mukdaharn locations on Mekong River Basin

The first trial run of hydrology model used data derived from climate model simulation based on the level of CO2 at present and 2xCO2 GHG scenario. The river discharge was calculated at Mukdaharn which is on the main stream of Mekong River and located in the center of the watershed.
The result of first trial run will be used to determine the hydrology model calibration in the next step.
Appendix 3

Planned frame of socio-economic scenario for land-use/land-cover change analysis and further vulnerability assessment

Initial Scenario Set

Figure 1. Initial thoughts on a framework for development of socio-economic and embedded landscape evolution scenarios. Inner boxes represent the landscape scenarios and outer boxes the social development contexts. These are arranged along axes of overall tree abundance and spatial distribution. “More patchy” implies that forest patches are more contiguous and distinct from other land-uses, whereas “Less patchy” implies smaller or less distinct patches with trees. A second pair of axes describing variation in social economic development can be overlaid on this framework to emphasize how the 4 scenarios differ with respect to social organization (Figure 2).
Figure 2. Key axes variation in landscape and social organization in the proposed scenario set. Levels of trade and the spatial extent of institutional arrangements are examples of social connectivity.
Appendix 4

Approaching local stakeholders and local community to create awareness on climate change and its possible impact on community livelihood.

Initial meeting with stakeholders in Songkram River area in Thailand to introduce the concept of impact of climate change. The participants are local community leaders, local government agency and local educational institutes. The meeting was conducted at Rajapat Institute in Sakon Nakorn province, Thailand.
Initial meeting with stakeholders in Attapeu Province, Lao PDR to introduce the concept of impact of climate change. The participants are local government agencies. The meeting was conducted at the Provincial Planning Office at Attapeu Province, Lao PDR.