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

Progress report: period Year-end 2003

Brief Summary:

In the year CY03, the regional study AS07 focused on the finalizing the fine resolution climate scenario for Mekong River basin which based on 1.5 and 2 times of atmospheric CO₂ level scenarios at 14 km grid.

Initiate the analysis of impact of climate change on sub-basin of Mekong River and the impact of climate change on rain-fed rice production.

Conclude the development of the Mekong River Basin rice shell for the analysis of the impact of climate change on rain-fed rice production.

Conclude the algorithm for the analysis of future land use/land cover change under different socio-economic scenarios, 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.

Identify the hot spots for the future stakeholder engagement and assessment on the impact of climate change toward the community livelihood.

More details in brief:

1. Conclusion of fine resolution climate scenario for Mekong River basin which based on scenarios of 2xCO₂ and 1.5 xCO₂ GHG atmospheric level at 14 km grid.

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 1.5 and 2 times of atmospheric CO₂ level scenarios. The output from the climate model had been analyzed and data had been adjusted using data assimilation technique with the observed climate data from 98 meteorological observation stations throughout the Southeast Asia region. For climate scenario of South-east Asia, please see Appendix 1.

Generally, the region will be wetter, even though during the dry year of the decade.

Lesson learned:

- The result from the climate model, CCAM, needs to be processed using data assimilation technique prior to further use in any other analysis with other applications.
- From the simulated result of the future climate scenarios, the hot spot – which is the area where the community may get severe impact from the future increasing of the rainfall, would be southern part of the northeastern region of Thailand, central and lower region of Lao PDR, most of Cambodia and the Mekong River delta in Viet Nam. In addition to these areas, some of the hot spots are out of the study area, e.g. the Red river basin in Viet Nam, which is currently vulnerable to the serious flood, may also have significantly increasing of rainfall in the future.
2. **Initiate analysis of impact of climate change on hydrological profile in the Mekong River region.**

Started simulation and analysis process of hydrology regime in 12 sub-basins in the central Mekong River, in Lao PDR and Thailand. The 12 sub-basins consist of:
- Nam Ou, Nam Khan, Nam Ngum, Nam Ngiap, Nam Theun/Nam Krading, Se Bang Fai, Se Bang Hieng, Se Done watersheds in Lao PDR
- Songkrarn, Chi, Mun watersheds in Thailand

(see Appendix 2)

The simulation bases on the hydrological modeling technique, using VIC model, will produce discharge of the catchments and river runoff at mouth of the tributaries on Mekong River as well as the Mekong River at those junctions themselves. This will give the picture of the impact of the future climate scenario on the water regime. The activity was conducted as part of the training workshop under CAPaBLE program, funded by APN, which also aim toward the building of scientific capacity and network of researcher in the region.

**Lesson learned:**
- The hydrological model, Variable Infiltration Capacity (VIC), cannot handle the unusual hydrology regime because the lack of hydro dynamic component, particularly the complicate system of the great lake, Tonle Sap, in the Cambodia as well as the Mekong Delta area, where tidal effect has strong influence from the tidal effect from the South China Sea.

3. **Conclude the development of Mekong River Basin Rice Shell and prepare to do analysis of climate risk on rain-fed rice cultivation.**

Finished the development of tool to analyze the climate risk on rain-fed rice cultivation, which is jointly developed with the Multiple Cropping Center of Chiengmai University. The tool will be used to simulate the yield of rain-fed rice production under different climate scenarios in various major rice growing area in the Mekong River region, which may be differ from today due to the impact of climate change. This tool will also be used as analysis tool to find the adaptation options under different crop management scheme.

The simulation of the future yield of rice in the target study area will be conducted as part of the activity under CAPaBLE program, supported by APN

**Lesson learned:**
- Direct output from the climate model cannot be used for the analysis of the impact of climate change on rain-fed rice production. Experts form the agriculture field and climate field need to have proper communication to design the appropriate format of data for further analysis task.

4. **Conclude the algorithm for the analysis of future land use/land cover change under different socio-economic scenarios.**

Joined with Unit for Social and Environmental Research (USER) of Chiengmai University, to develop socio-economic scenario and algorithm to simulate the land use land cover change (LUCC) scenarios for the Mekong River region.

Purpose of land cover scenarios is to analyse the change in future hydrological regime.

**Lesson learned:**
- Data needed for historical analysis is limited. May have to rely on interpolation technique or secondary dataset.
There is limited number of expert in Southeast Asia who is keen in the LUCC analysis application as this is not primary interest in the Southeast Asia region.

5. Identify the hot spots for the future stakeholder engagement and assessment activity.

- Identified the hot spot for the assessment of vulnerability from impact of climate change in the target study area, which base on the degree of change in the rainfall pattern. See Appendix 3.
- These potential hot spots are as follows;
  - Ubon Rachathani province in southern part of Northeastern region of Thailand.
  - 4 provinces of the Mekong River Delta of Viet Nam: Long An, Can Tho, Dong Thap and An Giang provinces. Coverage of assessment in each province will cover 2 communes per district and 4 districts per province.
- Create network of scientist who would become research counterparts to conduct future assessment activity.
  - Ubon Rachathani University for the activity in southern part of the northeastern region of Thailand.
  - Sub-Institute of Hydrometeorology of South Viet Nam (SIHYMET) for the activity in the Mekong River delta.
  - National University of Laos (NUL) and National Agriculture and Forestry Research Institute (NAFRI) for the activity in central/southern part of Lao PDR, potentially the province of Savannakhet.

Lesson learned:

- Many of the potential hot spots which were defined at the earlier stage of the project may not have serious impact from the future climate change.
- There are number of scientists in the region who could potentially be recruited to be research counterpart as part of the impact of climate change research network.

Future activities in the next 8 months:

- To disseminate adjusted Southeast Asia future climate scenarios to include future climate scenario at 1.5 and 2 xCO2 to various academic institutes and government line agencies. Primary mechanism is the training workshop under APN's CAPaBLE program, which its phase 1 is expected to complete by end-March 04.
- To complete hydrological simulation for different run-off profiles in the watersheds in the Mekong River Basin, based on the result from the climate model. This would be main activity in the part 1 of the training workshop under APN's CAPaBLE program, expected to complete by end of Jan.04.
- To complete the analysis of future land use/land cover change scenarios, which shall be based on socio-economic scenario of the region, as a joint effort with Unit for Social and Environmental Research, Chiangmai University – expect to complete by Q1 04.
- To complete the analysis of impact of climate change on rain-fed rice agriculture, using the tool which is jointly developed by Multiple Cropping Center, CHiangmai University and SEA START RC. This activity would also be part of the training workshop under APN's CAPaBLE program – expect to complete by Mar. 04.
- 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 assessment on vulnerability on the community livelihood which may cause by 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
- 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 agencies 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.

Dr. Anond Snidvongs, the Principle Investigator of AIACC AS07, had been appointed to be member of technical expert team of the National Climate Change Committee. The finding from the AIACC study will be fed to the National Climate Change Committee and could be used as guideline or part of the foundation for the next National Communication preparation.

The Ministry of Environment of Cambodia had shown their interest in working with the research team from AIACC AS07 to provide assistance and advice as well as information for the preparation of the Cambodia National Adaptation Plan for Action.

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 are under planning process with expected support from APN.
Appendix 1

Result of rainfall pattern under 540 and 720 ppm atmospheric CO$_2$ level (1.5 and 2 times CO$_2$ concentration from the baseline year of 1980s decade) simulated at the resolution of 14km. grid
Finding: The areas those appear most sensitive to climate change

- Southern part of Lao PDR, receives increases in simulated rain to around 4,500 mm/year during the wet years, compared with about 2,500 mm/year for wet years during the baseline decade.
- Most part of Cambodia will have significantly increased in rainfall to around 3,500 mm/year, compared with 2,500 mm/year during the baseline decade.
- Red River delta and coastal area - Viet Nam, increase annual rainfall of more than 5,000 mm/year, up from about 2,500 mm/year for the wet years during the baseline decade.

Comparison between assimilated CCAM climate model output and observed annual rainfall during the base years of 1980s decade. Observed rainfall data are from 98 meteorological observation stations throughout the Southeast Asia region.
Appendix 2

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

The hydrological analysis, using hydrology model – VIC, will be conducted in the 12 sub-basins in the central Mekong River, in Lao PDR and Thailand.

The 12 sub-basins consist of:
- Nam Ou, Nam Khan, Nam Ngum, Nam Ngiap, Nam Theun/Nam Krading, Se Bang Fai, Se Bang Hieng, Se Done watersheds in Lao PDR
- Songkram, Chi, Mun watersheds in Thailand
Appendix 3

Hot Spots identified for the future local stakeholders and local community assessment activity to assess their vulnerability from impact of climate change and possible adaptation options.

1. Ubon Rachathani Province, Thailand
2. Sawannaket Province, Lao PDR
3. Mekong River Delta, Long An, Can Tho, Dong Thap and An Giang Provinces, Viet Nam