E07

Hydrological Simulations in Red River Basin Using Super High Resolution GCM Outputs with Geostatistical Processes

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South-east Asia is one of the most frequently affected regions by flood. Many of the cities in these regions are vulnerable to floods due to their geographic locations in floodplains of large rivers. Hanoi, situated in Red river delta, is one of them. Red river delta is the most densely populated area where floods occur annually. This risk has been enhanced by global climate change and sedimentation problem. In order to address these problems, there is need for studying the hydrological system and simulating different extreme events to visualize the probable floods that would exceed the flood control design standards.

A physically-based distributed model, Hydro-BEAM (Hydrological River Basin Environment Assessment Model), has been used for this study. In the context of developing countries, there is always limited data. To overcome the data limitation, the super high resolution (20km spatial and hourly temporal) GCM (Global Climate Models) outputs based on A1B scenario of IPCC SRES AR4 has been used. AGCM20 has been chosen here to bridge the temporal and spatial resolution gap between the GCMs and hydrologic use. Moreover, these have advantages in simulating orographic rainfall and frontal rain bands. GCM data used here are precipitation and temperature. However GCMs are often characterized by biases that limit their direct application for basin level hydrological modeling. Bias correction method, based on Pearson Type III distribution, is applied to improve the raw GCM output. Basic concept behind the data correction is the existence of correlation between GCM outputs, observed and estimated value. The statistical bias correction method used here is based on the initial assumption that both simulated and observed values are well approximated by same probability function as shown in figure 1. Conversion function $f(P_{GCM})$ is determined based on the assumption that the non-exceedance probability of the GCM output is same as that of observed. Then adjustment factors at each grid point are estimated from the scale factors found out at observed points. For this Kriging interpolation method is used. This is then applied to get the corrected GCM precipitation and temperature at each grid. Ratio-based and difference-based corrections are applied to precipitation and temperature respectively. Finally the hydrologic model, Hydro-BEAM, is applied to simulate the observed runoff for the Red River Basin based on the modified GCM precipitation and temperature. Precipitation and temperature scenarios developed with bias-correction provide an improved reproduction of basin level runoff observations.

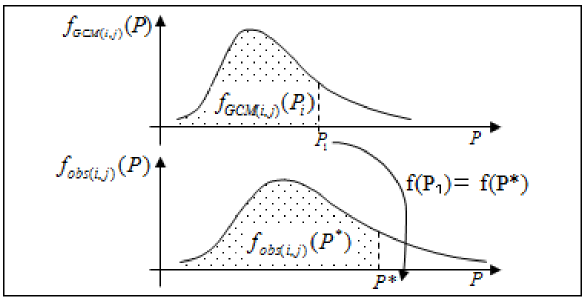

Figure1. Basic concept of data correction (ex. monthly precipitation)

$f_{GCM(i,j)}(P)$*:probability distribution function of monthly precipitation of GCM output (grid:i, month:j)*

$f_{obs(i,j)}(P)$ *: probability distribution function of monthly precipitation of obs. output (grid:i, month:j)*