Status report on the GAME Water and Energy Budget Study (GWEBS) (Session 2: GAME Water and Energy Budget studies)

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To close the energy and water budgets in each CSE is inevitable for identification of characteristics of each region in the global climate systems and investigation of heat and moisture source and sink and their seasonal and interannual variations. Each component of energy and water balance equations in atmosphere and at land surface should be estimated with high accuracy and validated independently for closing budgets. A unified method should be adopted for inter-comparison of energy and water budgets among the all CSEs.

In the GAME four regional experiments, monthly basis budget closure is proposed based on the GAME-IOP data in 1998. There are five components, precipitation, moisture convergence, evaporation, water storage variation and runoff, which should be estimated independently as follow:

1) Precipitation: A combined product by using satellite / rain gauge / ground-based radar is generated. Mutual cooperation with GPCP, NASDA and JMA is expected.

2) Moisture convergence: The GAME-IOP reanalysis is now available. The results of the reanalysis is used for estimation of moisture convergence in the GAME.

3) Evaporation: The moisture flux data at each flux measurement site of the four regional experiments is used as a point data. A land surface scheme, which is modified and evaluated by using the observed data, is used for estimation of region-wide moisture flux distribution by inputting a forcing data set generated by using the interpolated and/or extrapolated observed data. The complementary-relationship method is adopted for estimation of evaporation in region scale. Well-validated radiation budget at land surface is expected in cooperation between each CSE and ISCCP. The land surface meteorological data obtained by each CSE is used.

4) Water storage variation: It is difficult to estimate water storage variation directly. It can be calculated as residual term of the land surface water balance equation. In some region, the estimated value can be validated by using the ground based soil moisture networks. In the other region, satellite products of surface soil moisture can be used for confirmation of consistency of estimated values to the actual situation. The satellite-based snow data set can be used for quantitative validation.

5) Runoff: The observed runoff data should be collected. Seasonal and interannual anomalous states can be identified after removing the artificial effects due to river control.

The following figure shows an example of the inter-comparison of seasonal march of heat budget at the four flux sites. The convergence data obtained by the reanalysis will be overlaid.