White Paper on Land Surface Fluxes
for GEWEX Executive Meeting 2004
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To complete a global characterization of the energy-water cycle, measurements are required not only to determine the distribution and variation of the ?state? parameters (temperature, water vapor, clouds, winds, surface albedo, stored water on land), but also to determine the exchanges of energy-water among the main climate sub-components (atmosphere, land, ocean, ice). A few years ago, when GRP began considering how to use the many new global datasets to analyze the processes that constitute the cloud feedbacks on climate change, it was realized that these are the same processes forming the global energy-water cycle and that their operation on relatively short time scales is key to understanding both forced and unforced climate variability. Hence, attention turned to trying to complete the description of the global energy-water cycle based, in part, on GRP data projects, but necessarily requiring other datasets from outside GEWEX. For example, the atmospheric circulation is best obtained from the available reanalyses. The lack of a dataset quantifying the turbulent heat exchanges at the ocean surface at space-time scales similar to the surface radiative fluxes produced by SRB and the precipitation data produced by GPCP led to the SeaFlux project to improve analysis methods and obtain such datasets. The first phase of SeaFlux has been completed and at least one refined, global, decade-long latent and sensible heat flux dataset is now available. These data are being combined with the surface radiation and ocean heat content data for the tropical oceans in a more intensive study of the intraseasonal, seasonal and interannual variations of atmosphere-ocean energy-water exchanges.

A similar lack also exists of sensible and latent heat flux data for land surfaces to complement the surface radiation and precipitation data. The Global Soil Wetness Project (GSWP) within GMPP is conducting its second exercise to provide estimates of soil wetness by forcing land surface hydrology models with observed meteorology, including radiative fluxes and precipitation. These models determine soil wetness from energy-water conservation and so, given the atmospheric inputs, they also determine the sensible and latent heat fluxes. To date the coordination between the GRP data projects that can, and in some cases did, provide the needed atmospheric inputs for these calculations and GSWP has been through a third party, the International Satellite Land Surface Climatology Project (ISLSCP). Because of the variety of objectives and poor communications, the best of use of available satellite datasets was not achieved (mainly the usage was incomplete or inconsistent). Moreover, the primary goal was estimating soil wetness rather than the surface fluxes, so that not enough attention has been paid to the consistency of all the data products. In addition, some new and key satellite-based datasets are only now being produced. Thus, a joint activity between GSWP and GRP is proposed that, first, uses the GRP data products in a more complete and consistent fashion, with the addition of some new ones, to evaluate the current 10-yr GSWP calculations, and, second, prepares a more carefully designed, more consistent re-analysis of the soil wetness together with the land surface sensible and latent heat fluxes.

Note that a similar lack of sensible and latent heat flux data for snow and ice surfaces exists; moreover the quality of the surface radiation and precipitation datasets is poorer over such surfaces. In addition, water storage in terms of snow/ice is less well determined. These facts suggest that a more aggressive joint activity between GEWEX and CLIC is sorely needed.