

## GLOBAL ENERGY AND WATER CYCLE EXPERIMENT (GEWEX)

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The need for better quantitative understanding of energy fluxes and water exchanges is basic to all climate studies. Water in its various phases plays a dominant role in nearly all aspects of the Earth's system. As an example, much of the heat that drives the atmospheric circulation involves phase changes of water. As vapor, water is the Earth's most powerful greenhouse gas. Clouds, ice and snow have strong influences on the Earth's radiation budget.

The global hydrological cycle is poorly understood, due, in part, to the lack of reliable global data on such important quantities as precipitation, evaporation and atmospheric transport. There is also a need for further study of important physical processes in the water cycle, such as the exchanges of energy between the land surface and the atmosphere. Both improved global observations and improved understanding of the physical processes are prerequisites for developing better short and long-range models to the level needed to determine global water and energy fluxes.

The Global Energy and Water Cycle Experiment (GEWEX) is a program initiated by the World Climate Research Programme (WCRP) to observe, understand and model the hydrological cycle and energy fluxes in the atmosphere, at the land surface, and in the upper oceans. The overall objectives of GEWEX are fourfold: to determine global water and energy fluxes, to model the global hydrological cycle, to predict variations in global and regional water processes and resources and their response to global climate change, and to foster the development of observational systems suitable for making long-range weather forecasts and climate predictions. The scientific programs of GEWEX are focused on three important areas: clouds and precipitation processes, radiation and hydrometeorology (Table 1). Two of these programs are further discussed below.

Although GEWEX aims at an understanding of the global hydrological cycle, current global data bases are inadequate to meaningfully test detailed model formulations of surface and mesoscale atmospheric processes. There is a need to develop new surface hydrological models on a scale appropriate for coupling them with atmospheric general circulation models. Several U.S. and international agencies are actively engaged in planning for the GEWEX Continental-

Scale International Project (GCIP) . GCIP will support the development of hydrological models of continental-scale river catchments, encompassing a diversity of terrain and climate conditions, coupled with atmospheric models. The objective is to conduct systematic testing of these models on a long-term basis (5 years, minimum) . The first such project will be conducted in the Mississippi River Basin (GCIP-Mississippi) . GCIP-Mississippi will provide the opportunity to compare the performances of the various models under realistic time-dependent conditions, to ascertain their sensitivity to various estimates of forcing fluxes, and to determine the degree of similarity of model predictions with observed hydrological quantities (e.g., river runoff data) .

Another GEWEX program, the GEWEX Water Vapor Project (GVaP), is an effort to improve the global measurement of water vapor and the accuracy and availability of its global data sets. The three key elements of this program are: (1) the compilation of an experimental global water vapor database based upon retrievals from existing satellite observations; (2) the establishment of one or two ground-based water vapor reference stations (e.g. Raman lidar) for extended observation of temporal variations, and (3) the inter-comparison of water vapor measurements from balloons and active and passive remote sensing techniques.

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**TABLE 1. GEWEX PROJECTS**

	<u>NAME</u>	<u>GOAL</u>
HYDRO/TELEOLOGY	GEWEX CONTINENTAL-SCALE INT'L PROJECT (GCIP)	INTENSIVE STUDY OF MISSISSIPPI RIVER BASIN HYDROLOGICAL AND ENERGY BUDGETS
	GLOBAL RUNOFF DATA CENTER (GRDC)	GATHER GLOBAL RIVER DISCHARGE DATA
	INT'L SATELLITE LAND SURFACE CLIMATOLOGY PROJECT (ISLSCP)	PROVIDE GLOBAL DATA, EXPERIMENTS, AND MODELLING ON LAND-SURFACE INTERACTIONS, EMPHASIZING SATELLITE REMOTE SENSING
RADIATION	GEWEX WATER VAPOR PROJECT (GVAP)	IMPROVE MEASUREMENT OF WATER VAPOR AND ACCURACY AND AVAILABILITY OF GLOBAL DATA
	INT'L SATELLITE CLOUD CLIMATOLOGY PROJECT (ISCCP)	PRODUCE A GLOBAL DATA SET ON THE EARTH'S RADIANCE
	SURFACE RADIATION BUDGET (SRB)	PROVIDE GLOBAL DATA ON THE RADIATION BUDGET OF EARTH'S SURFACE
	BASELINE SURFACE RADIATION NETWORK (BSRN)	PROVIDE MEASUREMENTS AND VALIDATION DATA WORLDWIDE
CLOUD/PRECP	GLOBAL PRECIPITATION CLIMATOLOGY PROJECT (GPCP)	PROVIDE MONTHLY GLOBAL ESTIMATES OF AREA-AVERAGED PRECIPITATION
	GEWEX CLOUD SYSTEM STUDY (GCSS)	DEVELOP PROTOTYPE MODELS OF CLOUD SYSTEMS THAT CAN BE INCORPORATED INTO LARGE CLIMATE MODELS