STATEMENT OF

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ENERGY AND COMMERCE COMMITTEE

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Mr. Chairman and Members of the Subcommittee:

Several energy related interests are addressed and benefits derived from global earth observations. These interests and benefits include improving weather and climate forecasts which allow us to better project energy demand in the future and to better understand and assess the potential for consequences of future climatic changes. Such forecasts are also essential for predicting the future capacity of hydroelectric systems which depend, of course, on precipitation and runoff.

Most of the current earth observing systems have been designed primarily for the needs of weather forecasting. Weather forecasting is an "initial condition" problem. By that, we mean that the success of the forecast is heavily dependent on the quality of the specified initial state of the atmosphere. Thus, weather forecasting observing systems tend to focus on determining the three-dimensional values of the state variables of the system (the atmosphere)-- namely, air temperature, humidity, and the three components of the wind vector. While weather forecasting requires accurate observations, spatial patterns and relative accuracy across those patterns are the primary concerns.

Climate, on the other hand, is a "boundary condition" problem; that is, climate simulation depends on knowing the energy fluxes into and out of the system and the quantities of components such as carbon dioxide and water vapor which affect the flow of those energy fluxes in the system. Consequently, climate observing systems need to extend beyond measurements of state variables to measurements of fluxes of radiation, energy and water. The focus on energy and water cycles is because they are involved in the dominant forms of energy transfer in the climate system (solar energy, thermal infrared energy, evaporation and condensation). Further, because forecasting climate is a search for small system trends and imbalances in the midst of large weather variability, climate observations require a much higher degree of precision than do weather observations.

Satellite instruments are essential for both weather and climate observing systems. Satellites provide wide area coverage by their orbital characteristics and the use of cross-track scanning instruments. The past several decades have brought a dramatic increase in the number of satellites and instruments, their measurement resolution and variety, and their calibration. This trend has benefited both weather forecasting and climate. It is now possible to routinely measure temperature profiles, water vapor path amount and some profiles, cloud occurrence and other properties, wind direction and speed by tracking cloud movements, aerosol column amount, and a wide variety of other parameters.

Satellite observing systems must continue to be augmented with ground-based observing systems for climate in particular, but also for other applications such as weather forecasting, environmental prediction systems, and research. Ground based systems provide high temporal resolution measurements, usually on the order of seconds. These measurements, when acquired continuously, provide a complementary look at the atmosphere compared to the broad spatial resolution of satellite instruments. It is technically possible to acquire simultaneous measurements of many different quantities in the atmosphere and at the surface, including both state variables and energy fluxes. The combination of active and passive sensor measurements to retrieve atmospheric properties is now a well established technique that will allow scientists to investigate climate and weather processes in unprecedented detail. In addition, these ground-based measurements provide the best way to evaluate the accuracy and representative nature of satellite measurements and vice versa. The climate observing system of the future must be a combination of satellite and ground-based systems.

DOE supports some of the ground-based measurements at its three stationary Atmospheric Radiation Measurement (ARM) facilities, and at a new mobile facility that is just being deployed. These ARM facilities will be part of the GEOSS, including the U.S. Integrated Earth Observation System that is spelled out in the IEOS draft strategic plan.

As we look to the future of climate change, climate research, and climate modeling, there is no doubt that progress in this arena will be intimately connected to data availability. Climate observing systems must include a balanced approach that is based on a combination of satellite and ground-based systems; neither is adequate by itself. *In situ* observations must also be included as a critical component for evaluation and assessment of accuracy. Without an integrated observing system, it is extremely unlikely that we will be able to develop or validate the climate models that we require to understand and forecast future climate variability and change.

I would be pleased to answer your questions.