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Scientists Call For Research Aimed At Better Understanding Earth's Energy 'Balance' Projects such as Deep Space Climate Observatory would retrieve vital information

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In an article in this week's issue of *Science*, three leading climate and atmospheric scientists argue that scientific research is lacking in several core areas concerning Earth's climate and its fundamental energy system.

In a "Perspectives" article in the journal, the scientists say that a significant gap exists in accounting for the amount of the sun's energy that is absorbed by Earth's atmosphere and surface and the amount reflected back into space.

Such information about this "energy balance" is vital, the authors say, for accurately determining how Earth's climate and temperature is changing, factors that can influence a host of important processes and patterns such as weather, sea level and precipitation, and for gaining a clear understanding of how human-produced changes are impacting climate. The authors are Robert J. Charlson of the University of Washington, Francisco P. J. Valero of Scripps Institution of Oceanography at the University of California, San Diego, and John H. Seinfeld at the California Institute of Technology's Division of Chemistry and Chemical Engineering.

The authors call for more and better research observations and models that describe the overall energy balance of Earth's system.

"If we want to contribute to the well being of humanity and to enhance its ability to live in harmony with the environment, it is essential that we gain the needed observational and theoretical knowledge that will permit the accurate description of the Earth system and its evolution," said Valero, a research scientist at Scripps Institution.

Valero is the lead scientist of the Deep Space Climate Observatory, designed to place a satellite into orbit around the sun approximately one million miles from Earth. At this point, the sun and Earth's gravitational pull on the satellite combine in a way that allows the satellite to orbit the sun in the same time as Earth does, and thus have its advanced albedo (reflectivity) sensors aimed at Earth's sunlit side all the time. The satellite was to have been launched aboard the space shuttle by December 2000, but remains on hold while waiting for a new launch date.

Life and most natural processes on our planet are driven almost entirely by energy arriving at Earth from space, essentially in the form of radiation from the sun. This energy is partly reflected back to space and partly absorbed by Earth's atmosphere and surface. The absorbed portion is utilized to drive the atmosphere, the oceans, climate and life itself and is finally re-radiated back to space in the form of infrared (heat) radiation.

If the solar energy absorbed by the Earth system equals the infrared energy radiated back to space, the system is in "balance" and there is no "heating" or "cooling" of Earth.

But to better understand and characterize the complex interactions of Earth's systems-and to be able to forecast its future evolution-it is imperative to find accurate answers to the fundamental scientific questions that involve the balance between the absorbed solar radiation and the radiated infrared radiation, says Valero. Such balance is affected by natural and human-made changes that affect the interactions of radiation (solar and infrared) with greenhouse gases, aerosols and clouds, including the effects of greenhouse gases and aerosols on clouds and the atmosphere.

In the Perspectives article, the authors point out the importance of accurate observations of Earth albedo as well as the need for the development of a strategy that facilitates research involving the interaction of radiation (both solar and infrared) with gases, aerosols and clouds.

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