Land 'evapotranspiration' taking unexpected turn: Huge parts of world are drying up

October 10 2010

The soils in large areas of the Southern Hemisphere, including major portions of Australia, Africa and South America, have been drying up in the past decade, a group of researchers conclude in the first major study to ever examine "evapotranspiration" on a global basis.

Most climate models have suggested that evapotranspiration, which is the movement of water from the land to the atmosphere, would increase with global warming. The new research, published online this week in the journal *Nature,* found that's exactly what was happening from 1982 to the late 1990s.

But in 1998, this significant increase in evapotranspiration – which had been seven millimeters per year – slowed dramatically or stopped. In large portions of the world, soils are now becoming drier than they used to be, releasing less water and offsetting some moisture increases elsewhere.

Due to the limited number of decades for which data are available, scientists say they can't be sure whether this is a natural variability or part of a longer-lasting global change. But one possibility is that on a global level, a limit to the acceleration of the hydrological cycle on land has already been reached.

If that's the case, the consequences could be serious.

They could include reduced terrestrial vegetation growth, less carbon

absorption, a loss of the natural cooling mechanism provided by evapotranspiration, more heating of the land surface, more intense heat waves and a "feedback loop" that could intensify global warming.

"This is the first time we've ever been able to compile observations such as this for a global analysis," said Beverly Law, a professor of global change forest science at Oregon State University. Law is co-author of the study and science director of the AmeriFlux network of 100 research sites, which is one major part of the FLUXNET synthesis that incorporates data from around the world.

"We didn't expect to see this shift in evapotranspiration over such a large area of the Southern Hemisphere," Law said. "It is critical to continue such long-term observations, because until we monitor this for a longer period of time, we can't be sure why this is occurring."

Some of the areas with the most severe drying include southeast Africa, much of Australia, central India, large parts of South America, and some of Indonesia. Most of these regions are historically dry, but some are actually tropical rain forests.

The rather abrupt change from increased global evapotranspiration to a near halt in this process coincided with a major El Nino event in 1998, the researchers note in their report, but they are not suggesting that is a causative mechanism for a phenomenon that has been going on for more than a decade now.

Greater evapotranspiration was expected with global warming, because of increased evaporation of water from the ocean and more precipitation overall. And data indeed show that some areas are wetter than they used to be.

However, other huge areas are now drying out, the study showed. This

could lead to increased drought stress on vegetation and less overall productivity, Law said, and as a result less carbon absorbed, less cooling through evapotranspiration, and more frequent or extreme heat waves.

Some of the sites used in this study are operated by Law's research group in the central Oregon Cascade Range in the Metolius River watershed, and they are consistent with some of these concerns. In the last decade there have been multiple years of drought, vegetative stress, and some significant forest fires in that area.

Evapotranspiration returns about 60 percent of annual precipitation back to the atmosphere, in the process using more than half of the solar energy absorbed by land surfaces. This is a key component of the global climate system, linking the cycling of water with energy and carbon cycles.

Longer term observations will be needed to determine if these changes are part of decadal-scale variability or a longer-term shift in global climate, the researchers said.

More information: Jung, M., M. Reichstein, et al. 2010. A recent decline in the global land evapotranspiration trend due to limited moisture supply. *Nature* , DOI:10.1038/nature09396

Provided by Oregon State University

Citation: Land 'evapotranspiration' taking unexpected turn: Huge parts of world are drying up (2010, October 10) retrieved 20 September 2024 from https://phys.org/news/2010-10-evapotranspiration-unexpected-huge-world.html

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