

## Water evaporated from trees cools global climate

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Scientists have long debated about the impact on global climate of water evaporated from vegetation. New research from Carnegie's Global Ecology department concludes that evaporated water helps cool the earth as a whole, not just the local area of evaporation, demonstrating that evaporation of water from trees and lakes could have a cooling effect on the entire atmosphere. These findings, published September 14 in *Environmental Research Letters*, have major implications for land-use decision making.

Evaporative cooling is the process by which a local area is cooled by the energy used in the evaporation process, energy that would have otherwise heated the area's surface. It is well known that the paving over of urban areas and the clearing of forests can contribute to local warming by decreasing local evaporative cooling, but it was not understood whether this decreased evaporation would also contribute to global warming

The Earth has been getting warmer over at least the past several decades, primarily as a result of the emissions of <u>carbon dioxide</u> from the burning of coal, oil, and gas, as well as the clearing of forests. But because water vapor plays so many roles in the <u>climate system</u>, the <u>global climate</u> effects of changes in evaporation were not well understood.

The researchers even thought it was possible that evaporation could have a warming effect on global climate, because water vapor acts as a <u>greenhouse gas</u> in the atmosphere. Also, the energy taken up in



evaporating water is released back into the environment when the <u>water</u> <u>vapor</u> condenses and returns to earth, mostly as rain. Globally, this cycle of evaporation and <u>condensation</u> moves energy around, but cannot create or destroy energy. So, evaporation cannot directly affect the global balance of energy on our planet.

The team led by George Ban-Weiss, formerly of Carnegie and currently at Lawrence Berkeley National Laboratory, included Carnegie's Long Cao, Julia Pongratz and Ken Caldeira, as well as Govindasamy Bala of the Indian Institute of Science in Bangalore. Using a climate model, they found that increased evaporation actually had an overall cooling effect on the global climate.

Increased evaporation tends to cause clouds to form low in the atmosphere, which act to reflect the sun's warming rays back out into space. This has a cooling influence.

"This shows us that the evaporation of water from trees and lakes in urban parks, like New York's Central Park, not only help keep our cities cool, but also helps keep the whole planet cool," Caldeira said. "Our research also shows that we need to improve our understanding of how our daily activities can drive changes in both local and global climate. That steam coming out of your tea-kettle may be helping to cool the Earth, but that cooling influence will be overwhelmed if that water was boiled by burning gas or coal."

## Provided by Carnegie Institution

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