Changes in land evaporation shape the climate

August 5 2020

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Accurate estimation of how much water is evaporated from the vegetated land surface is a challenging task. A physical-based method—such as the complementary relationship (CR) of evaporation, which explicitly accounts for the dynamic feedback mechanisms in the soil-land-atmosphere system and requires minimal data—is advantageous for tracking the ongoing changes in the global hydrological cycle and relating them to historical base values.

Unfortunately, such a method cannot be employed with recently developed remote sensing-based approaches, as they have been typically available only for the last couple of decades or so.

An international team of Hungarian, American and Chinese scientists have demonstrated that an existing calibration-free version of the CR method that inherently tracks the aridity changes of the environment in each step of the calculations can better detect long-term trends in continental-scale land evaporation rates than a recently developed and globally calibrated one without such dynamic adjustments to aridity.

With ongoing climate change, the global hydrological cycle is affected significantly. As climate research indicates, wet areas will get even wetter in general, while dry ones drier, which is not the best scenario for the vast semi-arid and arid regions of the globe. In order to produce better climatic predictions, general circulation models need to upgrade their existing evaporation estimation algorithms. A computational method that automatically adjusts its predictions to short- as well as long-term changes in aridity can improve the existing algorithms employed by these climate models.

"By repeatedly demonstrating the superb capabilities of our calibration-free evaporation method in all venues accessible to us, our ultimate goal is to have the climate modeling community take notice and give it a try," explains Dr. Jozsef Szilagyi, the lead author of the study. "As it requires only a few, surface-measured meteorological input variables, such as air temperature, humidity, wind speed and net surface radiation, without detailed information of the soil moisture status or land-surface properties, it can be readily applied with available historical records of meteorological data and see if it indeed improves past predictions of the climate or not."

"Any changes in land use and land cover is inherently accounted for by the CR method via its dynamic aridity term that does not even require precipitation measurements—one of the most variable and difficult meteorological parameter to predict," he concludes.

More information: Jozsef Szilagyi et al, Dynamic Scaling of the Generalized Complementary Relationship Improves Long-term Tendency Estimates in Land Evaporation, *Advances in Atmospheric Sciences* (2020). DOI: 10.1007/s00376-020-0079-6

Provided by Chinese Academy of Sciences