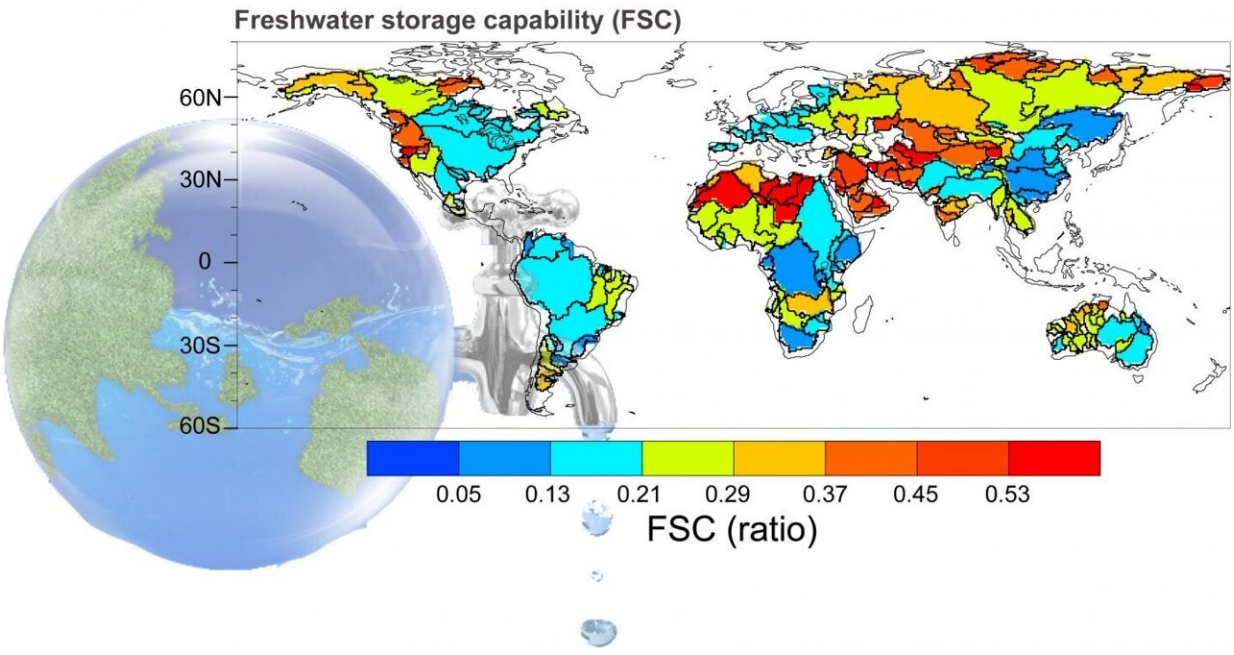
Land can retain about a quarter of monthly precipitation

May 18 2021



Global distribution of total land water-based freshwater storage capability. Credit: Enda Zhu

To support growing human and animal life, freshwater sources must continuously supply water. Freshwater from lakes, rivers, and underground is mainly recharged by rainfall. Ground reservoirs can store rainwater over time, depending on that location's storage capability. However, estimating freshwater storage capability (FSC) is still a

challenge due to few observation opportunities and methods to measure and quantify FSC.

Prof. Xing Yuan and his Ph.D. student Enda Zhu, from the Institute of Atmospheric Physics at the Chinese Academy of Sciences, developed and applied a new metric that characterizes the 'inertia' of water after rainfall. This method allows better FSC analysis based on satellite data from the Gravity Recovery and Climate Experiment (GRACE). Researchers simulated their new algorithm using the Community Land Model version 5 (CLM5) for 194 major river basins around the world. *Advances in Atmospheric Sciences* has accepted the study, its results, and supporting data.

"The FSC of river basins which displays the proportion of precipitation that can be retained in land is closely related with the hydrological memory." said Prof. Yuan. "Larger FSC means longer hydrological memory, which will have an impact on local and regional weather and climate through the land-atmosphere couple."

Results show that, on average, global land surfaces can retain over one quarter of monthly precipitation based on GRACE observation. The CLM5 simulation represents a similar global distribution. Using this new metric, Small FSC areas have wetter conditions and a higher vegetation density, whereas large FSC areas have drier climates.

This metric observes evaporation using satellite observations. Compared with the monthly FSC, the amount of water retained within land is higher at a shorter time scale due to less evaporation in low FSC areas. Across multiple time scales, the root zone contributes to about 40% of the global land FSC.

While this study, published in *Advances in Atmospheric Sciences*, primarily focuses on rainfall, precipitation that falls as snow is

important, despite most frozen water content sitting above the ground surface. Snow contributes to more than 20% of land FSC, especially in high latitudes.

"This work is worthy of further attentions for water resources management and hydrological prediction," explained Prof. Yuan.

More information: Enda Zhu et al, Global Freshwater Storage Capability across Time Scales in the GRACE Satellite Era, *Advances in Atmospheric Sciences* (2021). DOI: 10.1007/s00376-021-0222-z

Provided by Chinese Academy of Sciences