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Recent decline in global land evapotranspiration trend due to limited moisture supply

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More than half of the solar energy absorbed by land surfaces is currently used to evaporate water. Climate change is expected to intensify the hydrological cycle and to alter evapotranspiration (ET), with implications for ecosystem services and feedbacks to regional and global climate. ET changes may already be under way but direct observational constraints are lacking at the global scale. Until such evidence is available, changes in the land water cycle - a key diagnostic of the impacts of climate change and variability - remain uncertain. Using a global monitoring network, meteorological and remote sensing observations, and a machine learning algorithm we provide a data-driven estimate of global land ET from 1982 to 2008. In addition we assessed ET variations over the same time period with an ensemble of process-based land surface models. Our results suggest that global annual ET increased on average by 7.1 $\pm$ 1.0 mm per year per decade from 1982 to 1997. Then, coincident with the last major El Nino event in 1998, the global ET increase appears to have ceased until 2008. This downward trend change was driven primarily by moisture limitation in the southern hemisphere, particularly Africa and Australia. In these regions, microwave satellite observations indicate that soil moisture decreased from 1998 to 2008. Hence, increasing soil moisture limitation on ET largely explains the recent decline of the global land ET trend.