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ENSO and multi-decadal ’trends’ in continental evaporation

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While the hydrological cycle is expected to intensify in response to global warming, little unequivocal evidence of such an acceleration has yet been found on a global scale. This holds in particular for terrestrial evaporation, the crucial return flow of water from continents to atmosphere. Counterintuitively, the few studies that have applied satellite and *in situ* observations to evaluate multi-decadal trends have uncovered prolonged declines in global average continental evaporation. A priori, these reductions contradict the expectations of an intensifying water cycle. Up to date, the question of whether these declines in evaporation reflect a more permanent feature of global warming or they result from internal climate variability, has been left unanswered.

Here, we attempt to answer that question by analyzing global satellite-based datasets of evaporative fluxes, soil moisture and NDVI. Our findings reveal that the reported recent declines in global continental evaporation are not a consequence of a persistent reorganization of the water cycle, but a consequence of internal climate variability. During El Niño, limitations in the supply of moisture in central Australia, southern Africa and eastern South America cause vegetation water-stress and reduced terrestrial evaporation. These regional terrestrial evaporation declines are so pronounced that that determine the total annual volumes of water vapour from continental land surfaces into the atmosphere. Meanwhile, in northern latitudes (where the effects of ENSO are weaker) continental evaporation has raised since the ’80s at rates that are consistent with the expectations calculated from air temperature trends. Future changes in continental evaporation will be determined by the response of ENSO to changes in global radiative forcing, which still remains highly uncertain. Opportunely, the increasing timespan of satellite observation records will enable a more significant assessment of the trends in global evaporation in coming years.