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Changes in the variability of global precipitation

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In our warming climate there is a general expectation that the variability of precipitation (P) will increase at daily, monthly and inter-annual timescales. The increased P variability comes about from that global warming would lead to "dry becomes drier and wet becomes wetter". That expectation was recently supported by an ocean study showing "dry becomes drier" over the oceans, where the water cycle dominates the global average.

In this presentation, we will start with Budyko's perspective of surface water hydrology that evaporation is limited by available water (measured by precipitation) in a dry environment but it is limited by available energy (measured by potential evaporation) in a wet environment. That distinction constitutes fundamental difference between the ocean and land regarding the water cycle. By bringing this hydrologic perspective into both observational results and climate model outputs, we will demonstrate that the theory for the "dry becomes drier" may not apply over the land.

To evaluate that, we analysed observations (1940-2009) of monthly P over the global land surface. Interestingly, we found a reduction in global land P variance that was due to a redistribution, where, on average, the dry became wetter while wet became drier. A further decomposition of the global land P variance into spatial and temporal components shows that the global land P variability has decreased over both space and time. Those counter-intuitive results highlight recent state-of-the-art climate modelling studies pointing out that P extremes/variability tend to decrease with aerosols while tending to increase with [CO_2]. Our results lead us to speculate that aerosol loading has played a key role in changing the variability of P over land.