Predicting the Intensification of Global Precipitation under Climate Change

Scientific Challenge

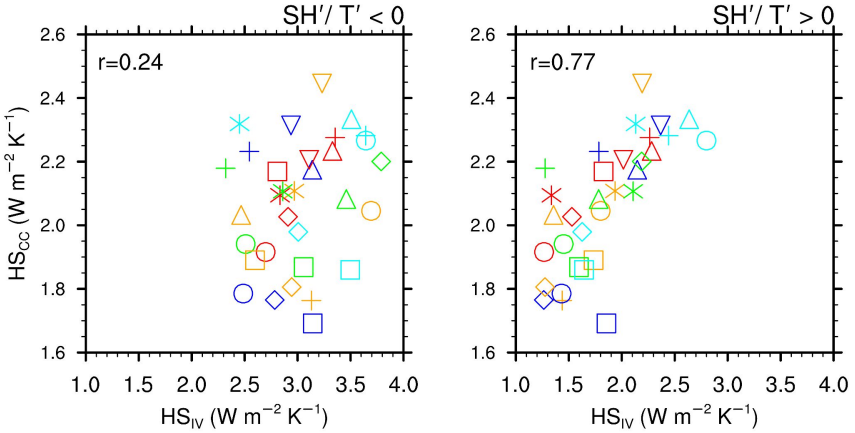
Global precipitation is expected to intensify under climate change, but the amount of intensification per degree of warming remains highly uncertain across climate models. Here, we evaluate this so-called hydrologic sensitivity in climate models by decomposing the global energy budget.

Approach and Findings

We decompose hydrologic sensitivity (HS) under both climate change (CC) and internal climate variability (IV), based on the global energy budget, We find that sensible heat exchange between the atmosphere and ocean is not accounted for in the atmospheric energy budget under IV, masking the connection between HS under IV and CC. Removing this term, a closer relationship emerges. We use observations in conjunction with this relationship to suggest an upward shift in the likely range of future HS.

Significance and Impact

This research suggests that global climate models are almost all underestimating the rate at which global precipitation will intensify under climate change. This means that wet regions will likely become even wetter than previously expected, and dry regions will become even drier.



Hydrologic sensitivity under internal climate variability (x-axis) versus climate change (y-axis) across CMIP6. Under internal variability, the contribution of surface sensible heat (SH′/T′) is conditioned as negative (left) and positive (right), revealing a strong connection between the two forms of HS only when this term is positive.

Norris, J., Thackeray, C. W., Hall, A., and Madakumbura, G. D. (2024). Historical sensible-heat-flux variations key to predicting future hydrologic sensitivity. npj Clim. Atmos. Sci.. https://doi.org/10.1038/s41612-024-00676-4