Spread of monsoon circulation changes explains uncertainty in global land monsoon precipitation projection

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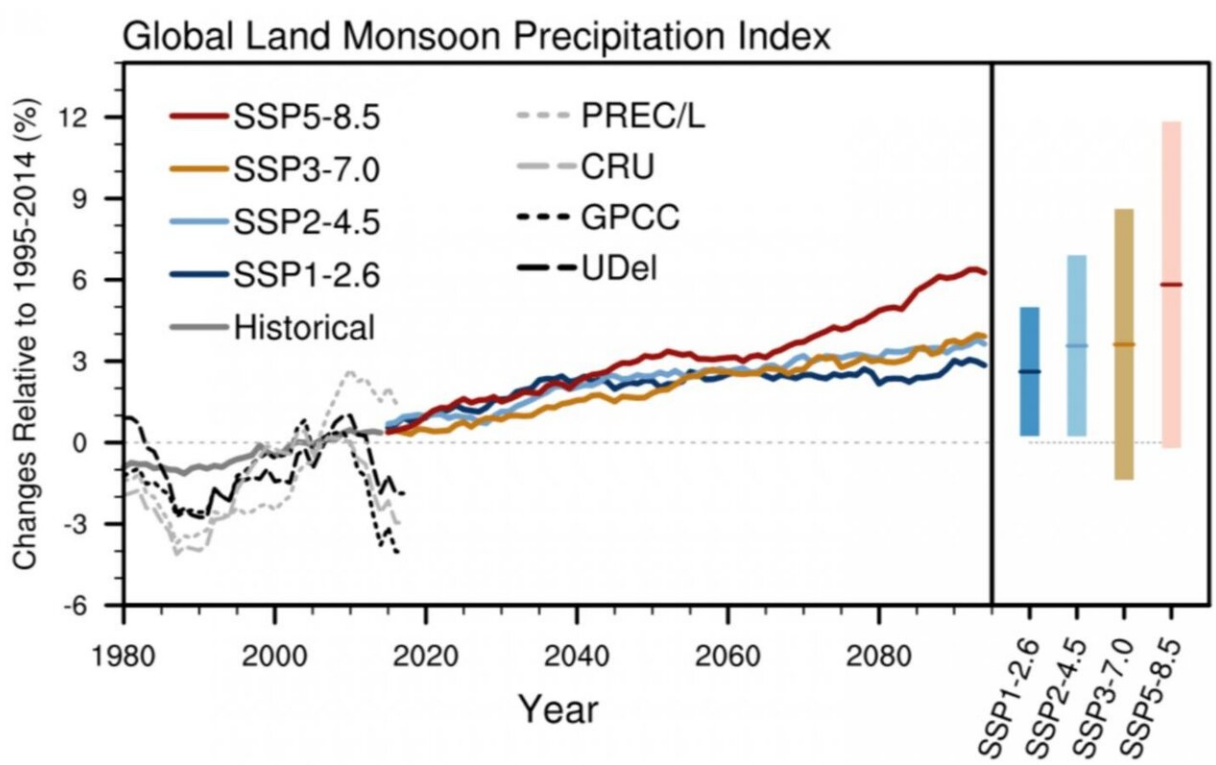

Changes of global land summer monsoon precipitation in historical climate simulation and four SSPs projections of CMIP6 multimodel ensemble (MME). Changes are relative to the 1995-2014 mean. The bars represent the MME and uncertainty in the 2080-2099. Units: %. Credit: Ziming Chen

Researchers from the Institute of Atmospheric Physics (IAP) of the Chinese Academy of Sciences found that the projected uncertainty of the precipitation increase over global land monsoon regions by the Coupled Model Intercomparison Project Phase 6 (CMIP6) models was mainly due to the spread of circulation changes across models.

Their study was published in *Geophysical Research Letters* on June 9.

Billions of people living in global land monsoon regions rely on freshwater resources from monsoon rainfall. Monsoon rainfall may cause drought and flood disasters, influencing the livelihood of populations. A reliable and accurate projection is needed.

In the CMIP6, four new projected scenarios (SSP1-2.6, SSP2-4.5, SSP3-7.0 and SSP5-8.5) reflect a set of alternative futures of social and economic development.

The researchers found that the global land monsoon summer precipitation increased under all scenarios, by about 2.54% and 5.75% in the lowest (SSP1-2.6) and highest (SSP5-8.5) emission scenarios, respectively. The enhancement was caused by thermodynamic responses due to increased moisture.

"The global land monsoon region is dominated by ascending motion in summer. The increased moisture caused by global warming can result in the increase of vertical moisture advection and contribute to the wetting trend in summer, which is also called the 'wet-get-wetter' mechanism," said Ziming Chen from IAP, the first author of the paper.

Meanwhile, the model spread in the projection was larger for higher emission scenarios. In addition, such spread was also larger than that in the previous CMIP projection. More importantly, the spread was related to the uncertainty of monsoon circulation changes.

Circulation changes should be related to the changes of sea surface temperature (SST). But in an experiment which prescribes a uniform SST warming, the spread in the monsoon circulation changes is still evident.

"This study emphasizes the importance of reliable prediction of circulation changes, to ensure that future projections of global land monsoon patterns are suitable for use by policymakers," added Chen.

More information: Ziming Chen et al, Global Land Monsoon Precipitation Changes in CMIP6 Projections, *Geophysical Research Letters* (2020). DOI: 10.1029/2019GL086902

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