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A global-scale comparison of modeled and observed trends in magnitude and frequency of flooding

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Simulated and observed trends in flood hazard are investigated across more than 4,000 locations globally using data from the Global Streamflow Indices and Metadata (GSIM) archive. Mann-Kendall test and Poisson regression are used respectively to evaluate the significance of changes in flood magnitude (i.e. annual maxima streamflow) and frequency (i.e. the number of streamflow events above a threshold) at each streamflow gauge. These trends were compared with trends of simulated flood hazard from six global hydrological models (GHMs; available through the Inter-Sectoral Impact Model Intercomparison Project), and the fraction of stations with significant trends are found to be similar between observed and simulated trends.
A bootstrapping procedure is adopted to assess the global spatial patterns of observed and simulated trends, considering two similarity measures (correlation and amplitude). The findings highlight statistically significant similarity in trend patterns exhibited in the GHMs and GSIM, indicating positive skill of GHMs in reproducing spatial pattern of trends at the global scale. Most GHMs, however, tend to underestimate the spread (variance) of trend magnitudes, especially over the data-covered regions in Australia and Asia. This assessment provides a first-hand comparison of flood trends at the station-level using large datasets of streamflow discharge.