Reconciling global projections of precipitation with CMIP6 and CMIP5 multi-model trends

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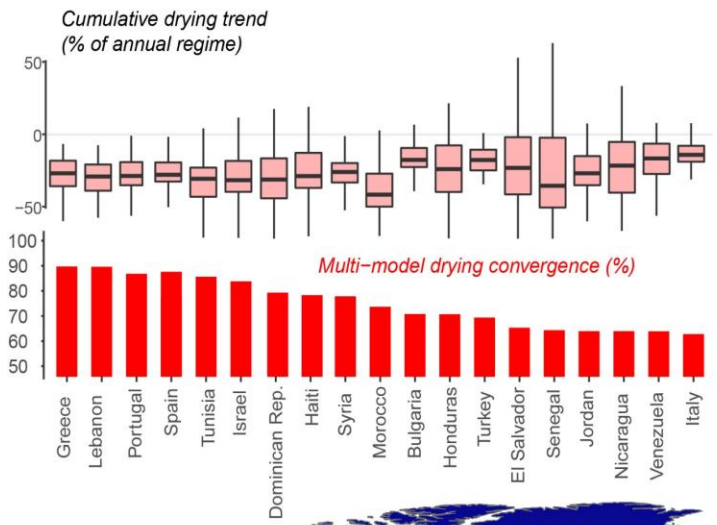
CREATE CHANGE

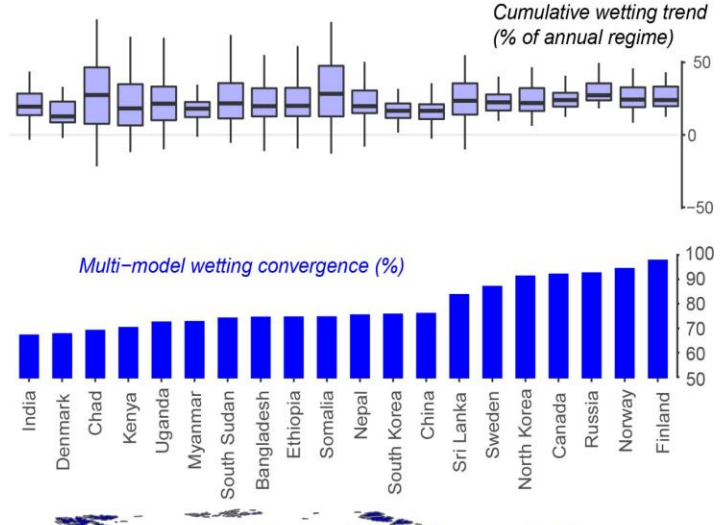
50 GCMs (RCP 8.5): 31 CMIP5 and 19 CMIP6

- *Long-term monotonic trends over 120 years to constrain natural variability;*
- Mann-Kendall and Theil-Sen slope estimator

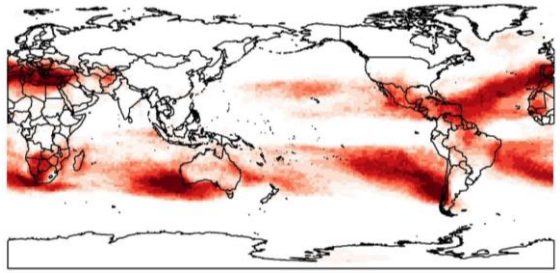
Drying / Wetting convergence (%)

- Statistically significant trends (p<0.05)
- Cumulative trend over the 120-year period (slope) > 10% of seasonal climatology

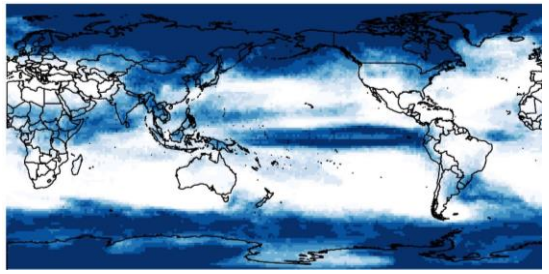




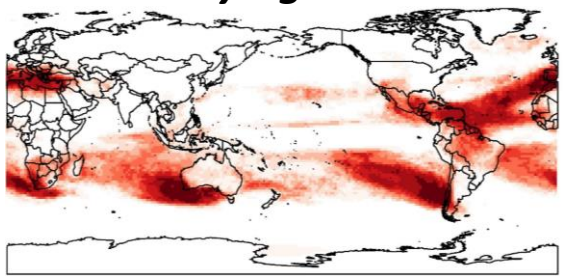
CMIP5 - Drying



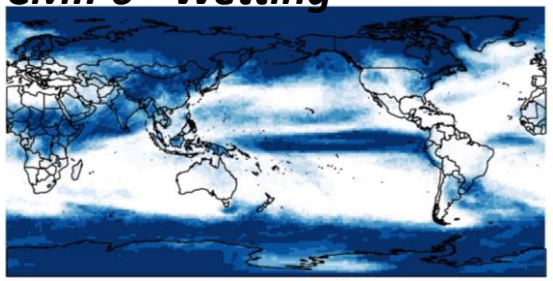
CMIP5 - Wetting

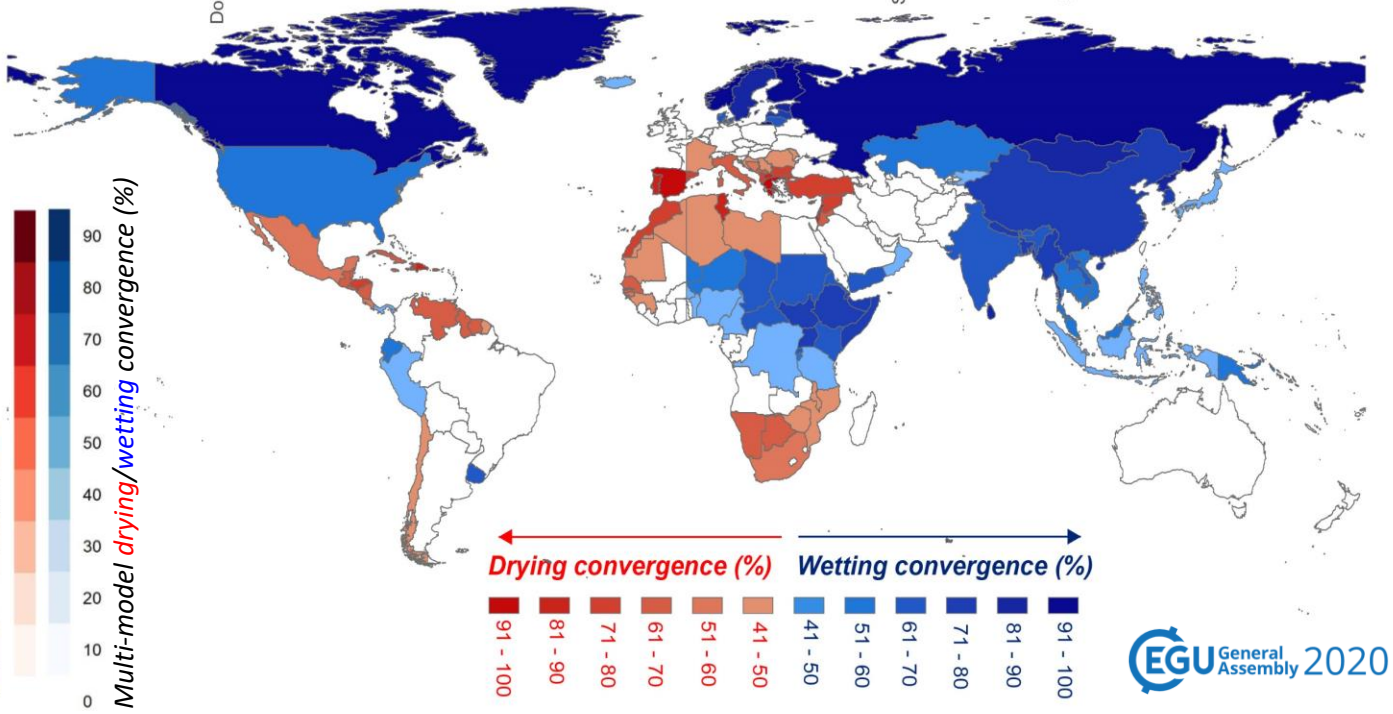


CMIP6 - Drying



CMIP6 - Wetting





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Reconciling global projections of precipitation with CMIP6 and CMIP5 multi-model trends

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Changing precipitation patterns due to climate change is a critical concern affecting society and the environment. Projected changes in global seasonal precipitation are largely heterogeneous in space, time, magnitude and direction. Therefore, reconciling projected future precipitation is pivotal for climate change science and adaptation and mitigation schemes.

This research contributes to disentangle future precipitation uncertainty globally by exploring long-term trends in projected seasonal precipitation of 33 CMIP5 and 16 CMIP6 models for the period 1980-2100. We first estimate trend slopes and significance in long-term future seasonal precipitation using the Sen-Slope and Mann-Kendall tests and constrain trends with at least 10% of cumulative changes over the 120-year period. Then, we assess convergence in the direction of trends across seasons. We highlight the world's jurisdictions with consistent drying and wetting patterns as well as the seasonal dominance of precipitation trends.

A consistent drying pattern – where at least 78% of GCMs have decreasing precipitation trends – was observed in Central America, South and North Africa, South Europe, Southern USA and Southern South America. Unlike, a strong convergence in projected long-term wetness – where at least 78% of GCMs have increasing precipitation trends – was observed across most of Asia, Central Africa, Northern Europe, Canada, Northern US and South Brazil and surrounds.

Results show convergence in direction of seasonal precipitation trends revealing the world's jurisdictions more likely to experience changes in future precipitation patterns. The approach is promisor to summarize trends in seasonal time-series from multiple GCMs and better constrain wetting and drying precipitation patterns. This study provides meaningful insights to inform water resource management and climate change adaptation globally.