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SST and circulation trend biases cause an underestimation of European precipitation trends

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Over the last 100 years there are have been clear precipitation trends in Europe. In winter, precipitation has increased in north-western Europe. In summer, there has been an increase along many coasts in the same area.

An investigation of precipitation trends in three multi-model ensembles including both global and regional climate models shows that these models have trouble reproducing the observed trends. In many regions the observation fall outside the bandwidth of natural variability combined with model uncertainty as parametrised by the multi-model ensemble. Conversely, the ensemble mean falls outside the error margins of the observed trends in the same regions.

In contrast, regional climate model experiments with observed boundary conditions show precipitation trends that are in good agreement with observations. We investigate the relative importance of the two prescribed factors: atmospheric circulation and sea surface temperature in setting the observed trend. The causes of the large trends in atmospheric circulation are not known, the lower SST trend in climate models is due to well-known problems in low-resolution ocean models. Improving the ocean models used for climate projections will therefore lead to more realistic precipitation trends.