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Assessment of the performance of a multi-model ensemble of inter-decadal climate change simulations

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A comparison of climate modelling results with historical observations is important for further development of climate models and for understanding the capabilities and limitations of climate change projections. Here we present results from a comparison of coupled atmosphere-ocean IPCC AR4 models run with historical anthropogenic forcings and for their joint multi-model ensemble (MME).

The comparison was carried out in terms of annual extremes indices derived from daily maximum and minimum temperature and daily precipitation series. A new observational dataset of gridded extremes indices (HadEX) was used to form a benchmark for the assessment of the general performance of these climate models.

The comparison is focused on temporal trends in the indices during the second half of the 20th century. A bootstrapping technique is used to assess the uncertainty in the observed and model trend estimates. We used bootstrapped observed and modelled temporal trend patterns to estimate probability density functions (PDFs) for measures of their similarity. We then compare these PDFs of trend pattern similarity of individual models/members with corresponding PDFs of their MME means.

All the models demonstrate reasonable skill at simulating the observed trend patterns in temperature indices especially when the global mean is included in the analysis. None of the models are particularly successful at reproducing the trend patterns for precipitation indices.