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An estimate of the reliability of climate model trends

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In weather and seasonal forecasting, a reliable probability forecast is defined as one in which the forecast probability is equal to the observed probability, verified over a large number of cases. An ensemble forecast can only be interpreted as a probability density function (PDF) if the ensemble is reliable. Here we apply this concept to the CMIP3 multi-model ensemble of climate model simulations that is widely used for the construction of climate scenarios. We verify hindcasts of the temperature trend over 1950-2010 against observed trends. As there is only a single verification time, the spatial dimension is used to collect the data for the verification. For each grid point the percentile of the observed trend in the PDF of the ensemble is computed. If the trend hindcasts would reliable, the resulting reliability histogram would be flat. However, like many weather and seasonal forecast ensembles, the climate change ensemble is seen to be overconfident: the observed trend is outside the range of modelled trends in many more grid points than would be expected by chance. To obtain calibrated forecasts from the ensemble the ensemble spread will have to be increased to obtain a reliable PDF.