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Assessing the reliability of trends in extremes of surface temperature across Europe in the ERA-Interim reanalysis dataset

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Reanalysis data are often used in climate studies as a surrogate for observations. This is particularly the case in model comparisons, where the spatial/temporal completeness of the reanalysis data allows direct comparisons with simulated data. However, reanalysis data are susceptible to certain limitations, including changes to the observed data input over time, deficiencies in the data-assimilation scheme and uncertainties in the numerical model. Temporal inhomogeneities arising from the increasing incorporation of remotely-sensed data since the late 1970s have been a significant problem in earlier reanalysis versions, and have confounded trend evaluations in such datasets. Assessments of the reliability of reanalysis data compared to observed data is therefore vital, particularly with regard to long-term trends. Most previous comparisons have evaluated trends in mean values, and have shown that the ERA-Interim data are generally good at replicating trends in means of surface temperature in data-rich areas such as Europe. Relatively few attempts have been made to evaluate trends in extreme values derived from reanalysis data. In this paper, trends in extremes of daily maximum/minimum temperature across Europe in the ERA-Interim reanalysis dataset over the period 1980-2011 are compared with trends in both station data and the gridded E-OBS dataset. Reanalysis temperature data that have been post-processed at 3- and 12-hourly resolutions are used, and the numbers of days per season/year that daily maximum/minimum temperature exceeded the 10th and 90th base-period percentiles are employed as metrics (TX10/90 and TN10/90 respectively). The results in this paper indicate that, on the whole, the trends in temperature extremes are successfully replicated in the ERA-Interim reanalysis. The data are least successful in the spring and summer months and for the TX90 index. Significant trend differences are observed at certain high-elevation sites, where trends in extremes of maximum temperature in particular tend to be underestimated. The time-resolution of the post-processed temperature reanalysis data also appears to have an effect on the depiction of trends in temperature extremes, with the 3-hourly resolution data out-performing the 12-hourly data.