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Gridded versus station temperatures: different time evolution of relationships with atmospheric circulation

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Interpolated datasets are considered to be a reliable source of information on a variety of meteorological variables, such as temperature and precipitation. These datasets are produced by interpolation of station observations on a regular grid. One expects the interpolated data to be rather similar to those directly observed at stations. This is, however, not always true; well documented are the effects of interpolation on e.g. extremes and variance. We demonstrate here another kind of differences between grid points and observations at the nearest station, which has not been documented so far: time evolution of relationships between temperature and atmospheric circulation. To this end, one of the most utilized gridded temperature datasets, CRU TS (Climatic Research Unit Timeseries; here is employed CRU TS v. 4.01) is compared with approximately 650 station time series downloaded from GHCN (Global Historical Climatology Network) distributed over the Northern Extratropics. We analyze running correlations of monthly means (calculated for 15 year windows) between modes of atmospheric circulation variability (identified in the ERA-40 reanalysis) and temperature anomalies in winter (DJF) from 1957 to 2002. The circulation modes considered include the North Atlantic Oscillation (NAO), Pacific-North American patterns, and two Eurasian modes. As may be expected given the large number of stations entering the interpolation procedure, the smallest differences in the running correlations are found in Europe and North America. However, exceptions exhibiting considerable differences in the temporal course of running correlations between station and gridpoint data can be found even there. The intriguing fact is that the differences in correlation may vary in time substantially, ranging from almost zero to over 0.3. An example of such a site, Lerwick station (Shetland Islands, the United Kingdom), is analyzed in more detail. Stations in Scandinavia, which are quite remote from Lerwick and undergo different temporal variations with the NAO and other modes, seem to influence the time course of correlations at the gridpoint nearest to Lerwick considerably, outweighing the closer stations (e.g. those located in northern Scotland). A similar issue is detected also at several stations in southeastern Asia. Thus quite surprisingly, some grid points reflect relationships of temperature with atmospheric circulation more closely at remote stations than at nearby stations.