

Historical land surface temperature reconstruction with observations over land and oceans

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We applied the reconstruction method of COBE-SST2 (Hirahara et al. 2014) to the historical land surface air temperature (LST) based on Global Historical Climatology Network (GHCN) and International Surface Temperature Initiative (ISTI) data. The reconstruction method overcame problems of uneven sampling in space and time and large observational noise in LST data. The LST analysis is given monthly on a 1-degree longitude and latitude grid as a sum of secular trend, inter-annual variations on a global grid from 1850 onward. The trend component is the leading empirical orthogonal function (EOF) of annual mean LST observations in 5-degree latitude and longitude boxes. The inter-annual variations are reconstructed using EOFs explaining 95% of the total variance of monthly mean JRA-55 LST. Two types of reconstruction analyses are performed: one with the EOFs of LST (TS_REC) only and the other with extended EOFs of SST and LST (SSTTS_REC). The trend and temporal variations of global mean TS_REC are similar to those produced by previous studies. SSTTS_REC produced more accurate LST analysis than TS_REC with respect to inter-annual variations over data-sparse regions particularly in low latitudes. In COBE-SST2, the uncertainty caused by sampling errors is investigated by a cross validation technique. With the same approach, the uncertainty in the LST analyses will be discussed.

Oral

- **Reconstructing past climates (methods)**