



Surface air temperature and circulation changes during the Early Twentieth Century Warming in 20th century reanalyses and empirical data

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Since the beginning of the 20th century, the rise of global surface temperature according to instrumental observations was characterized by two global warming periods – warming of the mid-20th century and modern warming, separated by a period of global temperatures decline.

Different reanalysis datasets – global gridded data on atmospheric characteristics obtained with the atmospheric models with assimilation of various empirical data - are increasingly used for the analysis of the climate change.

Due to significantly lower quantity and quality of observational data in the first half of the 20th century, the ability of reanalyses covering the entire 20th century to reproduce the mid-century warming requires quantitative assessment. Here we analyze evolution of the surface air temperature, sea level pressure and geopotential height in the Northern Hemisphere (with a focus on the northern Extratropics) according to three reanalyses covering the 20th century: NOAA-CIRES 20th Century Reanalysis, ECMWF ERA20C and CERA20C compared to empirical gridded datasets. Spatial trend structures, area averages and indices of leading atmosphere circulation modes are inter-compared focusing on the Early Twentieth Century Warming period. Relation between temperature and circulation changes is analyzed. It is found that for the first half of the 20th century, reanalyses data differ significantly between each other and observations most strongly in high latitudes. The performance of the reanalyses depends on a season. An overall assessment points to CERA20C as to relatively more realistic product.