# Vertical structure of recent Arctic warming from observed data and reanalysis products

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## Abstract

Spatiotemporal patterns of recent (1979-2008) air temperature trends are evaluated using three reanalysis datasets and radiosonde data. Our analysis demonstrates large discrepancies between the reanalysis datasets possibly due to differences in the data assimilation procedure as well as sparseness and inhomogeneity of high-latitude observations. This casts doubts on the robustness of Arctic tropospheric warming trends recently documented by Graversen et al. (2008) based on ERA-40 (ERA=European Centre for Medium range Weather Forecasts ReAanalysis) dataset. ERA-40 Arctic atmosphere temperatures tend to be closer to the observed ones in terms of root mean square error. However, changes in the ERA-40 data assimilation procedure produce unphysical jumps in the tropospheric temperatures, which seems to be the likely reason for the reported elevated tropospheric warming trend in 1979-2002. Both NCEP/NCAR Reanalysis (NCEP=National Center for Enviromental Predictions, NCAR=National Center for Atmospheric Research) and NARR (North American Regional Reanalysis) data over the same period show that the near-surface temperature trend is greater than trend in the troposphere, which is consistent with direct radiosonde observations and contrary to ERA-40 results. A change of sign in the winter temperature trend from negative to positive in the late 1980s is documented in the upper troposphere/lower stratosphere with a maximum over the Canadian Arctic, based on radiosonde data. This change from cooling to warming tendency is associated with weakening of the stratospheric polar vortex and shift of its center toward Siberian coast. The documented temporal pattern is consistent with multidecadal variations of Arctic key climate parameters like, for example, surface air temperature and oceanic freshwater content. Elucidating the mechanisms behind these changes will be critical to our understanding of the complex nature of high-latitude variability and its impact on global climate change.