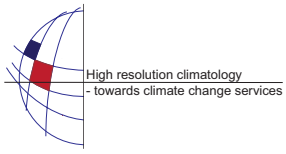
EMS Annual Meeting Abstracts
Vol. 7, EMS2010-348, 2010
10th EMS / 8th ECAC


# The vertical structure of climate variability and change over the Arctic during the past 140 years in different observation-based data sets

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The vertical thermal structure of the Arctic troposphere is an important diagnostic for understanding the processes behind climate variability and change. Because the Arctic climate undergoes strong changes on annual to multidecadal scales, long data sets of the thermal structure and atmospheric circulation over the Arctic are desirable. However, studies have shown that even recent reanalysis data sets might not always be suitable for this purpose. Here we systematically compare nine observation-based, global, vertically resolved data sets (some of them spanning more than 120 yrs) with respect to the thermal structure in the Arctic troposphere. The data sets encompass instrumental data (historical upper-air observations), two statistical reconstructions, and several reanalyses. On the interannual time scale, the correlation between data sets is generally good (i.e. between 0.7 and 0.95 depending on the level, season, and region), but the magnitude of the variability differs. Differences arise both on the short time scale (day-to-day variability) in the early period and on the long time scale (trends, biases). Despite these differences, the possibility to compare different data sets allows a better assessment of climate variability and climate change in the Arctic.

In the presentation we show examples on three time scales with a focus on the European Arctic. We analyse day-to-day variability of temperature profiles during very warm and very cold years in the historical and recent period, we analyse interannual variability in relation to atmospheric circulation, and we discuss the vertical structure of temperature trends in a 20-yr moving window over the past century.