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Regional 20th Century Temperature Trends from Radiosondes and Reanalyses in the Arctic (60°N-90°N)

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We compare seasonal 20th century atmospheric temperature trends in the Arctic (60°N-90°N) from radiosonde observations (CHUAN, HadAT, IUK, RAOBCORE/RICH, RATPAC) and reanalyses (ERA-40, NCEP/NCAR (NNR), Twentieth Century reanalysis (20CR), CFSR, ERA-Interim, MERRA). Large differences are found between the magnitudes, vertical profiles of the temperature trends (even for time periods > 3 decades), and chronological sequences of bidecadal, regional warming and cooling periods in the reanalyses. Long term zonal mean vertical trend profiles from CHUAN and from the reanalyses reaching back to the time before the satellite era show an amplification of the tropospheric warming towards the surface in all seasons except in JJA for the periods 1901-99, 1948-99 and 1957-99. In 20CR, a very strong 20th century cooling trend compared to the other datasets is found between 150 and 200 hPa. The agreement of the vertical structure and temporal behaviour of regional, bidecadal trends in the long reanalyses for 11 regions in the Arctic with CHUAN is best on average for ERA-40, followed by a less good agreement with trends from NNR (especially vertical structure) and 20CR (vertical structure and temporal behaviour). ERA-40 performs best for the NE Atlantic, Karelia, the SE Canadian Arctic, Alaska, and Central Siberia, and less favourably in the NW Canadian Arctic, E Siberia, W Siberia, and Novaya Zemlya. NNR agreement with CHUAN is significantly worse than in ERA-40 for the NE Atlantic, SE Canadian Arctic, SW Central Siberia, and E Central Siberia. 20CR performance is generally worse than that of ERA-40 and NNR, particularly for Karelia, the SE Canadian Arctic, Novaya Zemlya, W Siberia, and Central Siberia. For the more recent but shorter reanalyses, the internal agreement is generally very high, and results are close to CHUAN, ERA-40 and NNR. A comparison of CHUAN with the other radiosonde datasets is only possible for Alaska, E Central Siberia, NE Atlantic and NE Central Siberia (only HadAT and IUK), E Siberia and Novaya Zemlya (only HadAT), and Karelia, SW Central Siberia and W Siberia (all except RATPAC). For the period of overlap (1951-99) the agreement is reasonable with respect to the general picture. However, some disagreement on the trend sign can be seen a) for Alaska during DJF 1961-80 with HadAT and IUK, b) for E Central Siberia during MAM 1971-90 and 1980-99 with HadAT and during DJF 1980-99, MAM 1971-99 and SON 1961-80 with IUK, c) for Karelia during MAM/JJA 1961-80 with RAOBCORE/RICH (JJA also with HadAT and IUK), d) for NE Central Siberia during DJF 1961-80 with HadAT, e) for Novaya Zemlya during DJF1961-80 with HadAT, f) for SW Central Siberia during SON 1980-99 with RAOBCORE/RICH, g) for W Siberia during DJF/MAM 1961-80 with RAOBCORE/RICH, HadAT and IUK.