

Plus 80N Temperatures - explanation.

The temperature graphs are made from numerical weather prediction (NWP) "analysis" data. Analyses are the model fields used to start NWP models. They represent the statistically most likely state of the atmosphere, given the information available to make the analysis. Since the data are gridded, it is straight forward to deduce the average temperature North of 80 degree North. However, since the model is gridded in a regular 0.5 degree grid, the mean temperature values are strongly biased towards the temperature in the most northern part of the Arctic! Therefore, do NOT use this measure as an actual physical mean temperature of the arctic. The 'plus 80 North mean temperature' graphs can be used for comparing one year to an other.

The process of making the analysis is called "data assimilation". In an NWP data assimilation system many, very different types of observations and other information are combined in a statistical manner. In practice the assimilation is done via adjusting a recent NWP forecast, a so-called first guess. Because the data assimilation system knows about interrelations of different model variables, assimilation of for example a pressure observation, will adjust not only the pressure, but also wind and temperature. Precisely how much weight to give different types of observations, and how far to distribute their effect in the first guess field, is deduced statistically. The analysis is the maximum likelihood estimate of the state of the atmosphere, provided the statistical information is correct.

An NWP analysis is based on vastly more information than available from any single observing system. Data from ground, aircraft, bouys, ship, satellites, radiosondes, etc. are all combined to adjust the first guess field. As a consequence the quality of an analysis is much better than what can be obtained from gridding, or treating in other ways, data from a single or a few observing systems.

In the plot, the red curve is based on the average 2 m temperatures north of 80 degree North, from the twice daily ECWMF analyses. These are gradually becoming better and more detailed, as the NWP model system at ECMWF is improved with time. That is why the name shift with time (e.g. from T799 to T1279 in year 2010).

The green curve is based on ERA40 data for the period 1958 to 2002. ERA40 data are in fact analyses, made in the same way as above, but done as a hind-cast, using a fixed version of the NWP model, and spending time on carefully validating and eventually correct or remove all observations found to be in error, before the data assimilation. These, so-called "re-analysis", data represent our best estimate of the properties of the atmosphere for the period they cover.