

Temperature trends – an alternative analysis that challenges the “consensus view”¹

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Abstract

The increase in global average temperature during the second half of the 20th century has widely been interpreted as a manifestation of anthropogenic global warming caused by emissions of greenhouse gasses. Various smoothing/filtering and linear regression techniques have been used to substantiate the claim of increasing and accelerating temperatures. However, the temperature record is at the same time widely accepted to be non-linear and composed of cooling and warming periods and to include abrupt changes caused by eg. extreme ENSO (El Niño/ La Niña) events. The non-linearity and the presence of abrupt changes may invalidate the use of smoothing and linear trend techniques for identifying the pattern of temperature variations in the “noisy” records.

This study explores the temperature variations in the second half of the 20th century using an alternative statistical method – step change in mean temperature - to identify the underlying pattern. The tool is available on NASA’s homepage and has been documented and published. The land-based temperature records were extracted from the Global Historical Climatology Network (GHCN, not adjusted), selecting all stations with a complete annual record for at least 1960-2010. A total of 232 stations were found in the approximate “regions” of Arctic (12), Alaska (9), Europe (89), Russia (36), Middle East (9), South Asia (30), South-East Asia (14), Africa (16), South America (10), and Antarctic (7). In addition, the average land-based temperature anomaly curves and Land/Ocean curves for Global (Crutem3gl, Hadcrut3 and GISS), US-48 states (GISS), Australia (BOM) and Denmark (DMI) were also analysed. The assumptions of constant variance and negligible influence of autocorrelation were tested and verified.

The analysis covering 1960-2010 reveals that significant step changes from one mean temperature regime to another are common in all records, typically with one or two steps only. The step changes concentrate in three periods: 1977/79, 1987/89 and 1997/99, with 72% of the GHCN stations having one or more step changes in these periods. 78% of Europe stations have a step during 1987/89. Stations with a single step change only (60%) dominate in Alaska, Europe and Russia, whereas the stations in the mostly lower latitude regions have 2 or sometimes 3 steps. The dominant single steps in

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the higher/middle latitude regions are: Alaska, 1977 (100%), Europe, 1988/89 (92%) and Russia, 1988/89 (67%). The following steps occur in the national and global records: Global, 1977, 1987 and 1998 (Crutem and GISS) and 1977, 1990 and 1997 (Hadcrut); US 48-states (excl. Alaska), 1986 and 1998; Australia, 1979 and 2002; and Denmark, 1988.

The physical reality of the steps is generally supported by the close coincidence between the occurrence of 58% of all steps in the 3 3-year periods and the documented major ENSO events and their known effects on global and regional climates: the great pacific shift of 1976/77 and the two “most intense” El Niño events of the second half of the 20th century, 1986/88 and 1997/98. This is hardly a statistical artefact.

Thus, accepting the step change model as a relevant method for identifying temperature patterns and disregarding statistically uncertain steps during 2006-2010 , the median length of the period of apparently no temperature change prior to 2010 is 18 years ($s=10$ years, $n=231$), with a “regional” distribution as (with s in parentheses): Arctic, 8 years (3), Alaska, 33 years (8), Europe, 22 years (6), Russia, 19 years (11), Middle East, 12 years (6), South Asia, 12 years (13), South-East Asia, 13 years (5), Africa, 12 years (8), South America, 22 years (15), and Antarctic, 27 years (19). Similarly, Denmark has not experienced any significant warming for 23 years.

It is concluded, that the T-increase (“global warming”) during the 2. half of the 20th century can largely be explained by a few “sudden” steps in mean temperature, occurring around 1976/77, 1988/89 and/or 1998/99 and likely related to natural events in the ocean-atmosphere system. Thus, about 50% of the stations analysed has not experienced any recent warming for +20 years. The observed warming has mainly taken place in location and region specific steps rather than as spatially and temporally uniform increases in temperature. Regional and global average T-anomaly curves are therefore like “apples and oranges”, propagating a wrong message of uniformly increasing temperature to scientists, policy makers and the public at large. It is inappropriate to analyse such curves with smoothing and linear trend techniques, as the abrupt changes are thereby eliminated.

The “consensus view” of increasing and accelerating temperatures is therefore generally not supported by the temperature observations. The findings imply that the relative importance of natural processes for the temperature variations has been underestimated by the IPCC.