

CASE STUDY: Global Warming - the forest from the trees

APPENDIX 6: Calculation of anomalies

For the purpose of monitoring regional variability and change in climate, temperature anomalies are preferable to actual temperature values. By international convention, at present, temperature and rainfall anomalies are calculated relative to the well-studied base period of 1961 to 1990.

The reason why anomalies are preferable to the absolute values for monitoring long-term change in climate is that they reduce *“the impact of temperature differences between stations arising from variations in topography and exposure, as much of this structure is accounted for in the mean. Hence there is a reduced need to sample across a range of altitudes”* (Jones and Trewin (2000), p. 263). Thus, if one station is impacted by urbanisation and another by forests and mountains, when you subtract from each station's yearly values the constant amount of its 1961-90 mean you remove most of the effect of the peculiarities of the station's exposure leaving behind the year-to-year variation and change. This assists when combining the results from different stations for regional analyses of change.

We describe here in more detail the calculation of temperature anomalies using, as an example, the Newcastle High Quality dataset.

1. Calculate the Station Normals:

For each time-series (i.e. Maximum and Minimum, separately) calculate the average temperature for the 30 year period from 1961 to 1990 – i.e. $T_{61-90} = (T_{1961} + T_{1962} + T_{1963} \dots + T_{1989} + T_{1990})/30$

2. Calculate the Anomalies:

Subtract this 30-year “station normal” from each of the individual values in the time-series in order to obtain a new time-series such that each element in the time-series is now expressed as a departure (i.e. an anomaly) from the 1961-1990 mean - e.g. T_{1910} subtract T_{61-90} ; T_{1911} subtract T_{61-90} ; T_{1912} subtract T_{61-90} ; ... T_{2008} subtract T_{61-90}

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These calculations are illustrated in the table below:

Year	Annual mean maximums (°C)	(Maximums - Station Normal Max) (°C)	Anomalies of the annual maximums (°C)	Annual mean minimums (°C)	(Minimum - Station Normal Min) (°C)	Anomalies of the annual minimums (°C)
1910	22.6	(22.6 – 21.9)	0.7	14.5	(14.5 – 14.6)	-0.1
1911	22.7	(22.7 – 21.9)	0.8	14.2	(14.2 – 14.6)	-0.4
1912	22.8	(22.8 – 21.9)	0.9	14.5	(14.5 – 14.6)	-0.1
etc. ...	etc. ...	etc. ...	etc. ...	etc. ...	etc. ...	etc. ...
1961	21.3	(21.3 – 21.9)	-0.6	14.2	(14.2 – 14.6)	-0.4
1962	21.6	(21.6 – 21.9)	-0.3	14.2	(14.2 – 14.6)	-0.4
1963	21.4	(21.4 – 21.9)	-0.5	15.0	(15.0 – 14.6)	0.4
1964	21.8	(21.8 – 21.9)	-0.1	13.6	(13.6 – 14.6)	-1.0
1965	22.1	(22.1 – 21.9)	0.2	14.1	(14.1 – 14.6)	-0.5
1966	21.7	(21.7 – 21.9)	-0.2	13.9	(13.9 – 14.6)	-0.7
1967	21.2	(21.2 – 21.9)	-0.7	14.5	(14.5 – 14.6)	-0.1
1968	21.8	(21.8 – 21.9)	-0.1	14.2	(14.2 – 14.6)	-0.4
1969	21.3	(21.3 – 21.9)	-0.6	14.7	(14.7 – 14.6)	0.1
1970	21.6	(21.6 – 21.9)	-0.3	14.2	(14.2 – 14.6)	-0.4
1971	21.6	(21.6 – 21.9)	-0.3	14.0	(14.0 – 14.6)	-0.6
1972	21.7	(21.7 – 21.9)	-0.2	14.3	(14.3 – 14.6)	-0.3
1973	22.4	(22.4 – 21.9)	0.5	15.1	(15.1 – 14.6)	0.5
1974	21.1	(21.1 – 21.9)	-0.8	14.5	(14.5 – 14.6)	-0.1
1975	21.7	(21.7 – 21.9)	-0.2	14.7	(14.7 – 14.6)	0.1
1976	21.5	(21.5 – 21.9)	-0.4	14.5	(14.5 – 14.6)	-0.1
1977	21.8	(21.8 – 21.9)	-0.1	14.4	(14.4 – 14.6)	-0.2
1978	21.4	(21.4 – 21.9)	-0.5	14.5	(14.5 – 14.6)	-0.1
1979	22.8	(22.8 – 21.9)	0.9	14.8	(14.8 – 14.6)	0.2
1980	23.4	(23.4 – 21.9)	1.5	15.3	(15.3 – 14.6)	0.7
1981	22.5	(22.5 – 21.9)	0.6	15.0	(15.0 – 14.6)	0.4
1982	22.5	(22.5 – 21.9)	0.6	14.4	(14.4 – 14.6)	-0.2
1983	22.0	(22.0 – 21.9)	0.1	15.0	(15.0 – 14.6)	0.4
1984	21.6	(21.6 – 21.9)	-0.3	14.2	(14.2 – 14.6)	-0.4
1985	21.6	(21.6 – 21.9)	-0.3	14.8	(14.8 – 14.6)	0.2
1986	21.9	(21.6 – 21.9)	0.0	14.6	(14.6 – 14.6)	0.0
1987	22.0	(22.9 – 21.9)	0.1	14.9	(14.9 – 14.6)	0.3
1988	22.6	(22.6 – 21.9)	0.7	15.4	(15.4 – 14.6)	0.8
1989	21.8	(21.8 – 21.9)	-0.1	15.0	(15.0 – 14.6)	0.4
1990	22.2	(22.2 – 21.9)	0.3	15.1	(15.1 – 14.6)	0.5
etc. ...	etc. ...	etc. ...	etc. ...	etc. ...	etc. ...	etc. ...
2007	21.9	(21.9 – 21.9)	0.0	15.2	(15.2 – 14.6)	0.6
2008	21.4	(21.4 – 21.9)	-0.5	14.6	(14.6 – 14.6)	0.0
1961-90 mean (station normal)	21.9	-	-	14.6	-	-

