

ACORN-SAT station adjustment summary—Orbost (as at 24 September 2014)

Orbost is one of 112 ACORN-SAT stations used by the Bureau of Meteorology to assess changes in Australia's climate. The official long-term temperature record for Orbost is defined by the Bureau as a combination of the old 'town' station (station number 84030) and the automatic weather station (AWS)—station number 84145.

Observations at Orbost began in 1938. There were several gaps in the first two years, so the ACORN-SAT record starts in 1940. Comparison of the Orbost data with surrounding stations (neighbours), 22 of which have been used at various times, combined with the use of site documentary records, reveals that there have been several significant breaks in the data. All of these coincide with documented site moves and/or changes to measurement equipment. The raw data series is a combination of several data series that must be adjusted to derive a single, consistent and accurate representation of temperature changes over time.

The ACORN-SAT record contains daily records of minimum (night-time) temperature (Min T) and maximum (daytime) temperature (Max T). The charts in this fact sheet show annual average values of Min T and Max T. The adjustment values we refer to below relate to the impact that the adjustments we make have on those annual average values.

The changes that occurred at Orbost and the resulting impacts are summarised as follows:

1. 23 November 1966—site moved within central town.
 - Night-time temperatures started to appear warmer relative to surrounding stations.
 - Min T adjusted by +0.75 °C; no detectable impact on Max T so no adjustments made.
2. 4 March 1976—site moved within central town.
 - Could not detect any impact on daytime or night-time temperatures relative to surrounding stations.
 - No adjustments made to the Max T or Min T.
3. 25 August 1980—change in instrument shelter.
 - Daytime temperatures started to appear warmer relative to surrounding stations.
 - Max T adjusted by +0.57 °C; no detectable impact on Min T so no adjustments made.
4. 8 April 1984—site moved to a paddock on northern edge of town (700 m west of current location)
 - Daytime and night-time temperatures started to appear cooler relative to surrounding stations.
 - Min T adjusted by -0.38 °C; Max T adjusted by -0.88 °C.
5. 23 November 2000—site moved from a flat paddock to a hillside and instruments automated.
 - Daytime temperatures started to appear cooler and night-time temperatures started to appear warmer relative to previous site in town. See Chart 3.
 - Min T adjusted by +1.14 °C; Max T adjusted by -0.44 °C.

Charts 1 and 2 compare raw and adjusted data for annual average Min T and Max T when all site change factors from 1940 onwards are included. Trend lines for both the raw and adjusted data indicate that Min T and Max T are increasing at this site. However, the rates of warming differ for the raw and adjusted datasets.

In Chart 1 the trend lines show that the adjusted average Min T is not increasing as quickly as the raw data would suggest. In this case, the adjustments have reduced the artificially large warming trend created by combining the raw data sets.

In Chart 2 the trend lines show that the adjusted average Max T is increasing more quickly than the raw data would suggest. In this case, the adjustments have increased the artificially small warming trend created by combining the raw data sets.]

Chart 3 shows that when comparing the manual observations and the AWS observations during the overlapping period 2001–2010 there is a consistent difference between the two sites. This provides a very clear demonstration of the need to adjust the temperature data.

Chart 1: Orbost annual average minimum temperatures (1940–2012)

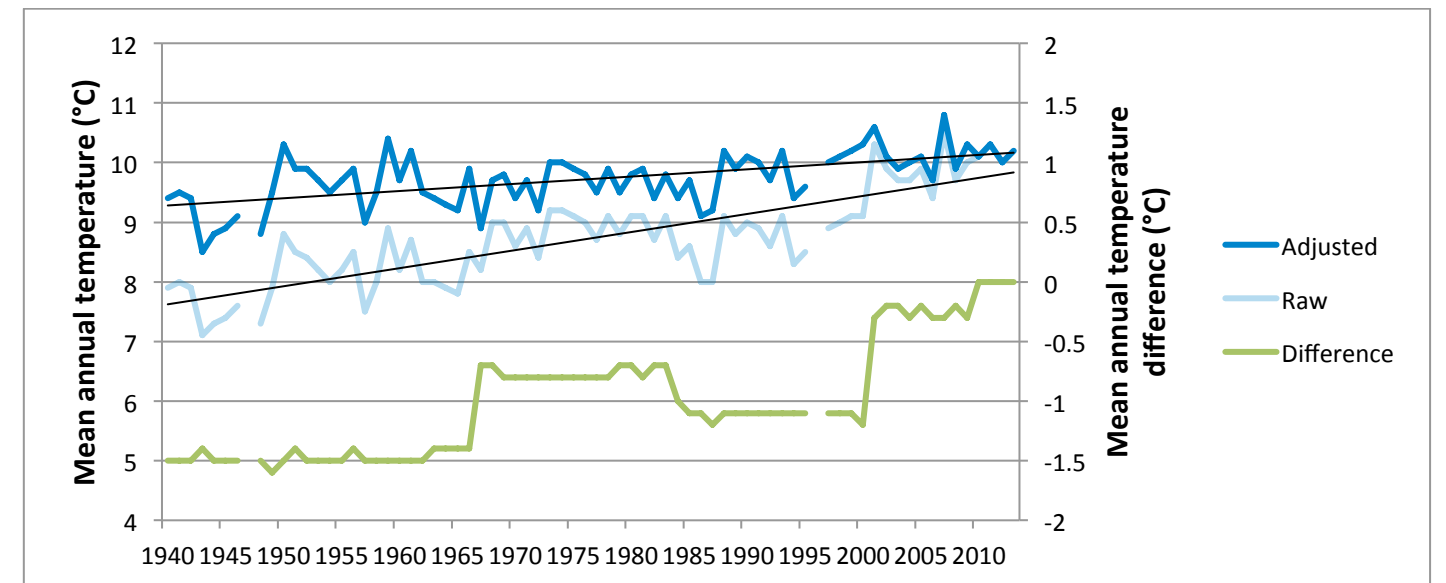


Chart 2: Orbost annual average maximum temperatures (1940–2012)

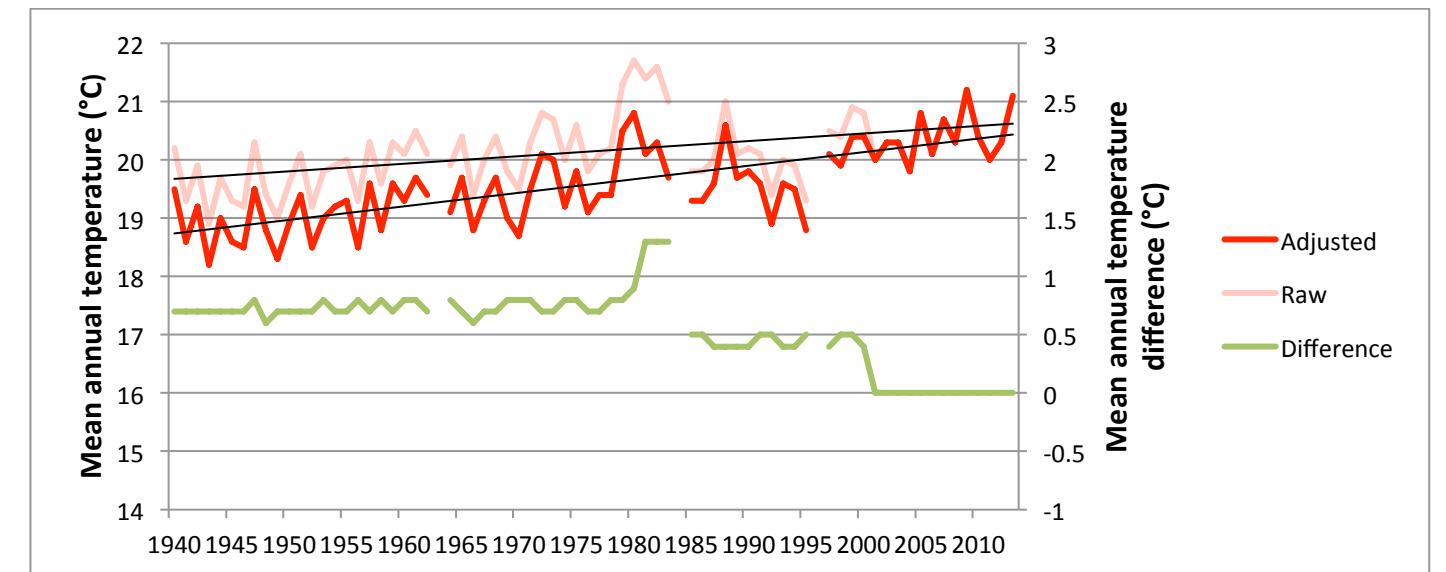
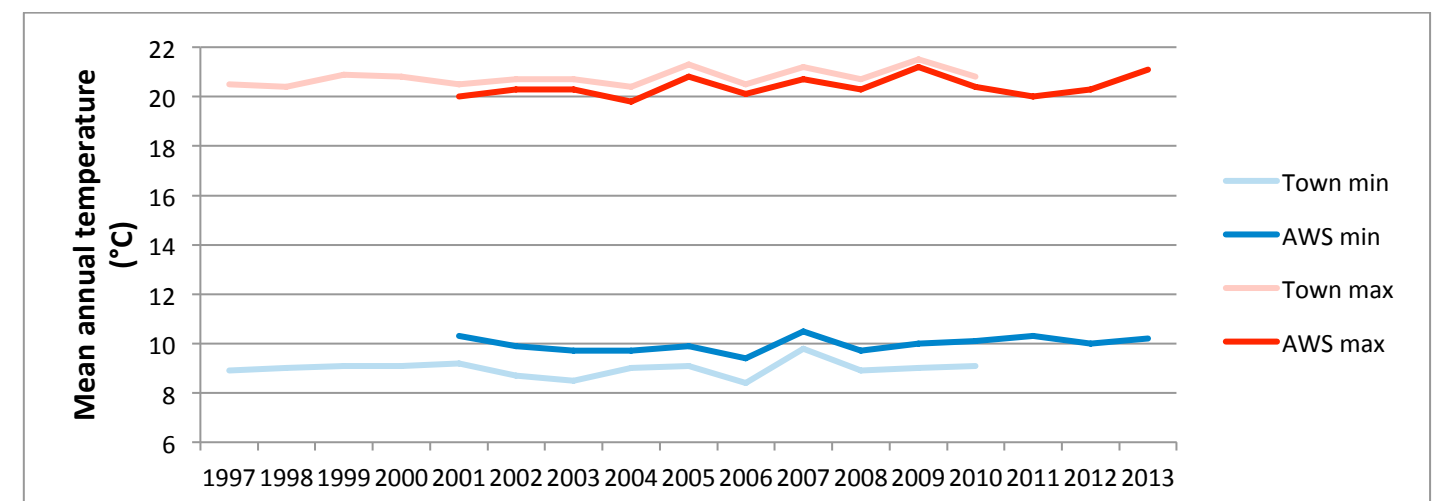


Chart 3: Comparison between town site and AWS site



Orbost station temperature adjustments

| Station name | Station number | Temperatures adjusted | Date (adjustment applied to all data prior to this date) | Cause | Impact of adjustment (°C) | Seasonal (if applicable) | Comparative stations | | | | | | | | | | Merged stations | Notes | |
|--------------|----------------|-----------------------|---|---------------------|---------------------------|--------------------------|----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----------------|-------|--|
| Orbost | 84145 | Max | 23/11/2000 | Move (with overlap) | -0.44 | | | | | | | | | | | | | 84030 | Overlap between 84030 and 84145 used over period 2000–2011 |
| Orbost | 84145 | Min | 23/11/2000 | Move (with overlap) | 1.14 | | | | | | | | | | | | | 84030 | Overlap between 84030 and 84145 used over period 2000–2011 |
| Orbost | 84145 | Max | 18/04/1984 | Move | -0.88 | | 84083 | 85072 | 84070 | 85199 | 85277 | 99005 | 85096 | 85106 | 86077 | 87031 | | | |
| Orbost | 84145 | Min | 18/04/1984 | Move | -0.38 | | 84083 | 85072 | 84070 | 85277 | 83025 | 85199 | 82042 | 70005 | 85106 | 86050 | | | |
| Orbost | 84145 | Max | 25/08/1980 | Screen | 0.57 | | 84108 | 84083 | 85072 | 84070 | 85199 | 85103 | 85227 | 99005 | 85096 | 85106 | | | |
| Orbost | 84145 | Min | 23/11/1966 | Move | 0.75 | | 84080 | 85072 | 83025 | 85103 | 83033 | 85106 | 84016 | 88109 | 70094 | 82053 | | | |

Comparative and Merged stations

| Station number | Station Name |
|----------------|---------------------------------------|
| 70005 | Bombala (Therry Street) |
| 70094 | Cooma North SMHEC |
| 82042 | Strathbogie |
| 82053 | Wangaratta |
| 83025 | Omeo Comparison |
| 83033 | Woods Point |
| 84016 | Gabo Island Lighthouse |
| 84070 | Point Hicks (Lighthouse) |
| 84080 | Bairnsdale Post Office |
| 84083 | Lakes Entrance |
| 84108 | Bairnsdale |
| 85072 | East Sale Airport |
| 85096 | Wilson's Promontory Lighthouse |
| 85103 | Yallourn SEC |
| 85106 | Olsens Bridge (Morwell River Prison) |
| 85199 | Moondarra Reservoir |
| 85227 | East Tarwin (Mirboo Pastoral Company) |
| 86050 | Healesville (Badger Creek Sanctuary) |
| 86077 | Moorabbin Airport |
| 87031 | Laverton RAAF |
| 88109 | Mangalore Airport |
| 99005 | Flinders Island Airport |

Station temperature adjustment table legend

- Station name: name used in the national climate record
- Station number: the active ACORN-SAT station number as at 31 December 2011.
- Temperatures adjusted: this describes which aspect of the temperature record was adjusted—Max for daily maximum temperature; Min for daily minimum temperature.
- Date: all data prior to this date was adjusted for the reason (cause) cited.
- Cause: this describes why an adjustment was required.
 - Merge: data from two different station numbers are being merged, with overlap.
 - Move: a documented site move.
 - Move (n): a documented site move, together with a change of station number.
 - Screen: indicates a change or repair to the Stevenson screen.
 - Obs time: indicates a change in observation time (most often the 1964 change at some stations from a midnight to 9 am observation time).
 - Site env: a change has occurred in the local site environment (e.g. addition/removal of building nearby, change in vegetation).
 - Statistical: a change found by statistical methods without specific documentary support.
 - Statistical*: indicates some kind of documentary support which may be imprecise or subject to interpretation. This is further explained in the notes field.
 - AWS: installation of an automatic weather station; if there was an associated site move this is shown as 'move'
- Impact of adjustment: the overall impact of the daily adjustments made for the particular reason (cause) cited.
- Seasonal (if applicable): this applies where the adjustment was made on the basis of seasonal, rather than annual, criteria. In general the minimum threshold for adjustment is a 0.3 °C difference in the annual mean. Exceptions include:
 - where seasonal criteria are met (0.3 °C in two seasons, or 0.5 °C in a single season), in which case details are given; or
 - for the 1964 observation time change, which standardised the time for taking all observations at 9.00 am.
- Comparative stations: stations against which the station's data was compared statistically.
- Merged stations: stations from which data was sourced and merged to enable adjustment (see Notes above).
- Notes: provides additional explanatory information.