

# BoM Temperature App Brief

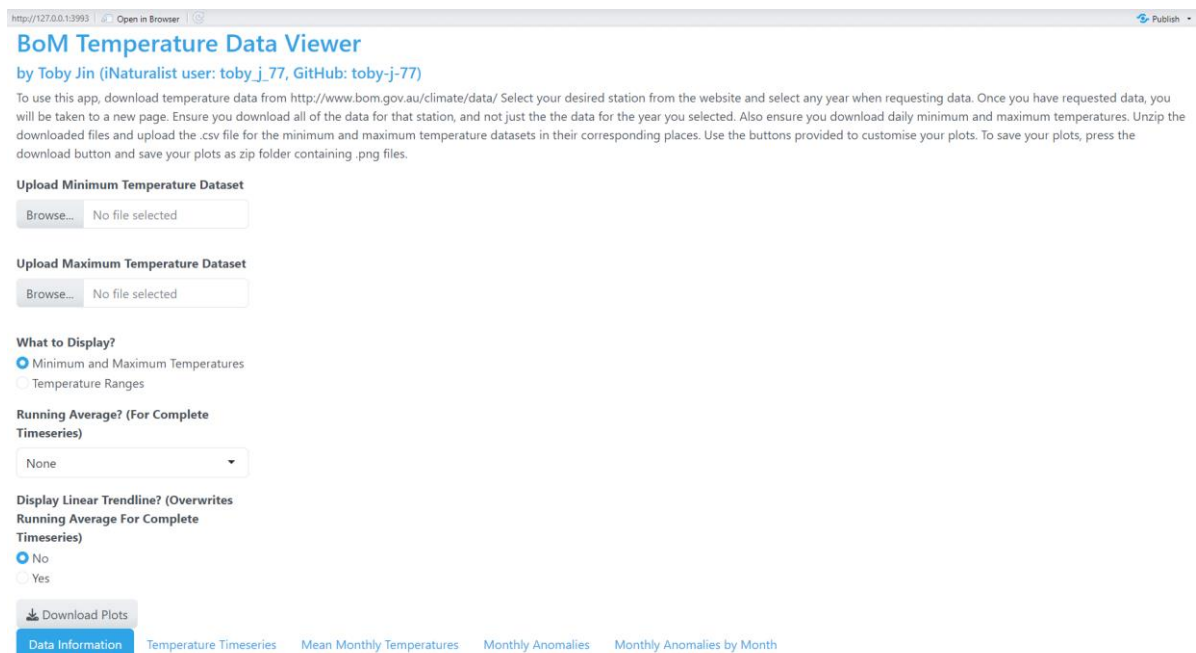
This document is simplified from the README.md document for the BoM\_temperature\_viewer\_app repository on GitHub: [https://github.com/toby-j-77/BoM\\_temperature\\_viewer\\_app.git](https://github.com/toby-j-77/BoM_temperature_viewer_app.git). Please consult that document for more information if required.

## Purpose of the web app

The purpose of this application is to allow users to create informative plots about temperature data from the Bureau of Meteorology. Although the BoM website can produce simple plots of temperature data for a given station, it does not easily provide a platform for users to explore the entire dataset and create plots that show temperature trends, or monthly anomalies. This app provides an interactive UI that allows users to visualise different plots produced from daily minimum and daily maximum temperature from the BoM's various weather stations.

## UI

The application has a very simple UI (Figure 1). It takes 2 file inputs, and 3 additional inputs to customise plots or change what plots are displayed.



The screenshot shows the web application interface for the BoM Temperature Data Viewer. At the top, the title "BoM Temperature Data Viewer" is displayed, followed by the user information "by Toby Jin (iNaturalist user: toby.j.77, GitHub: toby-j-77)". Below this, a paragraph of instructions explains how to use the app: downloading data from the BoM website, selecting a station and year, downloading daily minimum and maximum temperatures, unzipping the files, and uploading the .csv files to the app. The interface includes two file upload sections: "Upload Minimum Temperature Dataset" and "Upload Maximum Temperature Dataset", each with a "Browse..." button and a "No file selected" status. Below these are three configuration sections: "What to Display?" with radio buttons for "Minimum and Maximum Temperatures" (selected) and "Temperature Ranges"; "Running Average? (For Complete Timeseries)" with a dropdown menu set to "None"; and "Display Linear Trendline? (Overwrites Running Average For Complete Timeseries)" with radio buttons for "No" (selected) and "Yes". At the bottom, there is a "Download Plots" button and a row of five tabs: "Data Information" (highlighted in blue), "Temperature Timeseries", "Mean Monthly Temperatures", "Monthly Anomalies", and "Monthly Anomalies by Month".

**Figure 1** BoM Temperature App with default settings.

All plots that are generated are displayed at the bottom. A total of 4 plots are displayed at one time:

1. **Temperature Timeseries:** The minimum and maximum daily temperatures (or daily temperature ranges) plotted against time. This is displayed as a line graph.
2. **Mean Monthly Temperature:** The mean minimum and mean maximum temperature (or mean temperature range) calculated for each month of the year based on the years of data provided. This is displayed as a barchart.
3. **Monthly Anomalies:** The monthly anomaly of minimum and maximum temperatures (or temperature range) for each month in each year plotted against time. The monthly anomaly is defined as the mean minimum (or maximum) temperature of a given month in a given year minus the mean minimum (or maximum) temperature of that month across all years.
4. **Monthly Anomalies by Month:** This is a panel of plots that breaks up the Monthly Anomalies into individual timeseries for each month.

## Features

### Data input

There are 2 datasets that users need to input: the minimum daily temperature dataset and the maximum temperature dataset. (Refer to section **Downloading BoM Data** to see how to download BoM Data). The input datasets are in the form of .csv files. This app will automatically check whether the two datasets are from the same station or not, but cannot check whether the minimum or maximum temperature datasets are loaded to the correct place.

### What to display?

This option allows users to choose to display either plots that show minimum and maximum temperatures (if the option **Minimum and Maximum Temperatures** is selected), or temperature ranges (if the option **Temperature Ranges** is selected)

### Running Average? (For Complete Timeseries)

This option allows users to add a running average across the **Temperature Timeseries** plot. By default, no running average is supplied, but users can specify whether they wish to add a 7 day, 31 day, or 365 day running average.

When calculating running averages for datasets that contain large sections of no data, if the consecutive days with no data is equal to, or exceeds that of the running average length, then the running average will stop before the period of no data and start again after the period of no data. If the number of consecutive days with no data is less than the running average length, missing values are linearly interpolated. This ensures that running averages do not run across large data gaps.

### Display Linear Trendline?

This option will allow users to display linear trends in the data. By default, no trendline (least squares regression line) is shown for any of the plots. This option affects all plots except **Mean Monthly Temperatures**.

If a running average is being displayed for the **Temperature Timeseries** plot, then the linear trendline will not be displayed for that plot.

### Download plots

This option downloads the plots that are currently displayed in a zip file. Due to the size of some of the datasets, it may take a few seconds to generate the plots, and the download button may appear to be 'unresponsive'.

## Creating the Web App

### Required R version and R Packages

This app was built in R version 4.4.2. The packages required to run this app are bslib v.0.7.0, forecast v.8.24.0, RColorBrewer v1.1-3, shiny v. 1.10.0, tidyverse v.2.0.0, and zip v. 2.3.3. (Any other packages in which these packages depend on should also be installed).

### Workflow for app creation

Prior to creating the app, code for binding data and creating the required plots have been written to create the plots for a single pair of datasets. This process at times required custom functions. One important custom function was the **split\_fill()** function for ensuring that the running average did not jump across large parts of no data in datasets that had long periods of no data. This was the only instance where AI (Microsoft Copilot) was used in the creation of the web app.

Once code for the plots has been created, the app was incrementally developed by adapting that code into code that would produce reactive shiny objects. Plots were sequentially added in the order they appear in at the bottom of the app. Additional input features were added only after all plots have been created.

## Downloading BoM data:

Users must download both the minimum and maximum daily temperature datasets from the same station, so the following instructions must be followed twice:

Step 1: Go to <http://www.bom.gov.au/climate/data/> and follow instructions to download daily temperature data (Figure 2). The year chosen does not matter as long as that year contains data.

The screenshot shows the BoM Climate Data Online interface. On the left, there are navigation links: Maps - averages, Climate change, Extremes and records, About Australian climate, and Data services. The main content area is divided into three steps:

- 1: Selected: Daily maximum temperature**  
Data about: Temperature  
Type of data: Observations (selected), Statistics  
Frequency: Daily (selected), Monthly  
Maximum temperature (selected)  
A red box highlights the text: "Daily maximum temperature data and graphs for a selected year. Data download for one or all years."
- 2: Select a weather station in the area of interest**  
sydney  
Find  
Matching towns: Sydney, NSW, 33.87°S, 151.21°E; Sydney Cove, NSW, 33.87°S, 151.20°E; Sydney Island, QLD, 16.69°S, 139.46°E; Sydney Island, QLD, 13.42°S, 141.70°E  
Nearest Bureau stations: 066214 Sydney (Observatory Hill) NSW (1.3km away); 066160 Centennial Park NSW (3.6km away); 066196 Sydney Harbour (Wedding Cake West) NSW (6.0km); 066037 Sydney Airport AMO NSW (9.1km away); 066194 Canterbury Racecourse AWS NSW (9.7km away)  
Data available for the selected station: A bar chart showing data availability from 1850 to 2000, with a legend for 100% and 0%.  
Select year: 2025
- 3: Get the data**  
Station number: 066214  
Get Data (Opens in new window)  
Don't clear this number  
Note: most stations do not collect all data types. Searching will ensure relevant stations.

**Figure 2** Accessing BoM data. The example here shows downloading daily maximum temperature data, but the same method is used to download daily minimum temperature data.

Step 2: Press **Get Data**, and a new window will open. Ensure that you press the button **All years of data** (shown in the red box) to ensure you download all of the data available from that station (Figure 3). This will result in a .zip file being downloaded.

The screenshot shows the BoM Climate Data Online interface for the Sydney (Observatory Hill) station. The page title is "Daily maximum temperature Sydney (Observatory Hill)". Below the title, there is a link "About this page". A red box highlights the "All years of data" button, which is next to the "1 year of data" button. Below the buttons, there is a table showing the daily maximum temperature for the year 2025. The table has columns for the months of the year and rows for each day of the year. The data is presented in a grid format.

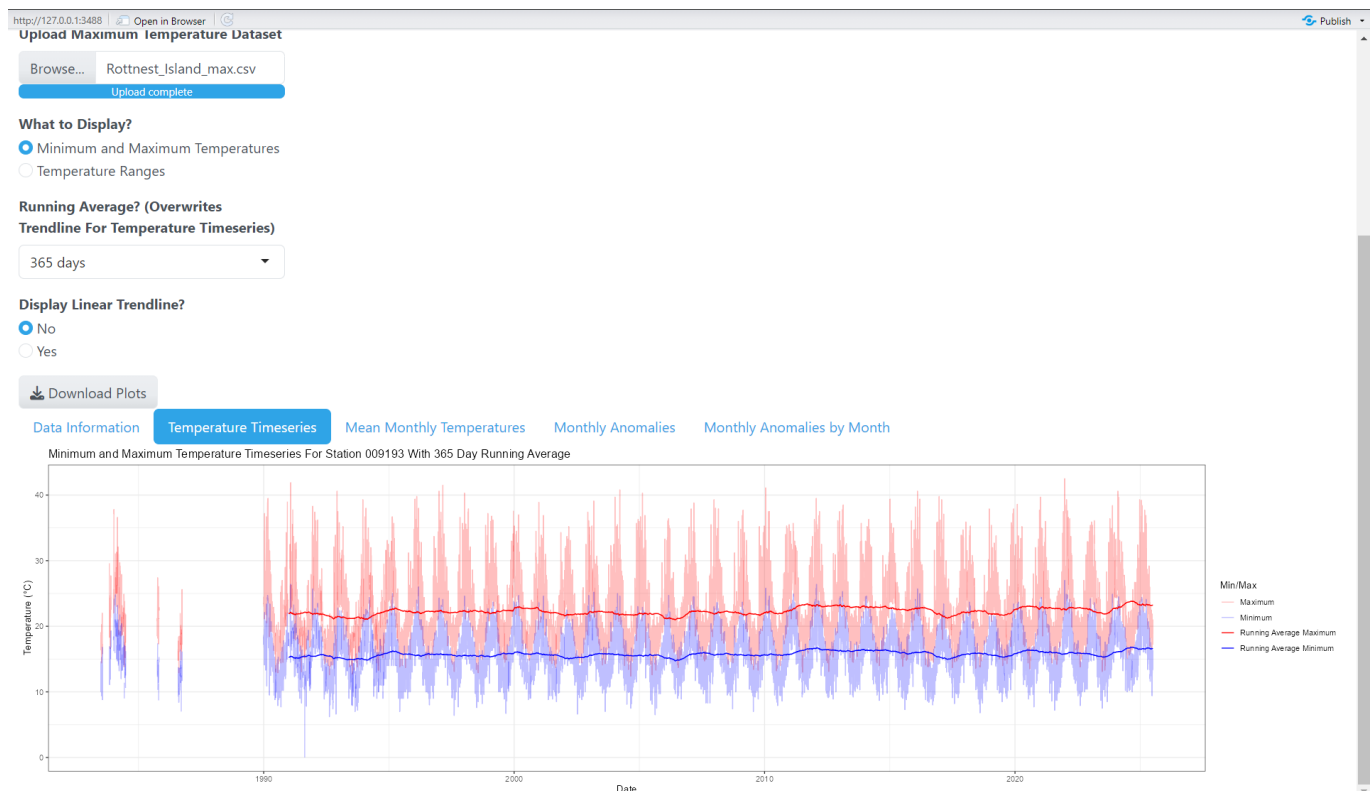
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1st	29.4	27.8	28.8	23.5	19.5	20.6	15.8					
2nd	23.9	28.9	28.0	25.5	19.7	18.2	17.7					
3rd	27.1	30.0	25.9	27.5	22.7	19.2	18.8					
4th	29.2	29.5	26.9	26.0	22.8	14.1	19.4					
5th	31.2	32.1	27.7	27.0	24.5	18.9	18.4					
6th	31.7	29.3	27.7	27.5	24.2	17.1	21.9					
7th	23.0	30.0	26.7	27.7	26.2	20.1	17.2					
8th	20.3	28.1	27.0	22.5	19.9	16.4	16.8					
9th	24.4	29.5	27.8	24.4	19.0	15.4	20.3					
10th	27.2	25.1	28.0	24.2	23.8	18.2	16.2					
11th	28.3	27.4	23.7	28.5	21.3	17.5	18.5					
12th	28.6	29.1	27.4	26.3	21.6	17.2	19.5					
13th	29.3	28.5	28.0	26.7	22.6	16.3	17.9					
14th	29.6	26.8	29.5	27.3	24.2	18.1	19.8					
15th	29.9	26.8	31.0	23.2	19.3	19.3	14.6					
16th	21.6	23.0	37.1	22.7	20.0	17.5	18.2					
17th	20.8	24.2	22.5	24.2	22.1	19.1	17.4					
18th	24.3	25.1	25.3	25.6	16.4	17.8	16.6					
19th	24.6	27.5	27.6	28.3	17.5	18.6	19.1					
20th	25.5	23.6	28.0	29.6	20.8	19.2	18.7					
21st	26.0	22.7	28.1	28.0	20.6	19.2	18.7					

**Figure 3** Download button (outlined in the red box) for downloading all data.

Step 3: Extract the zip folder and use the .csv file for the app.

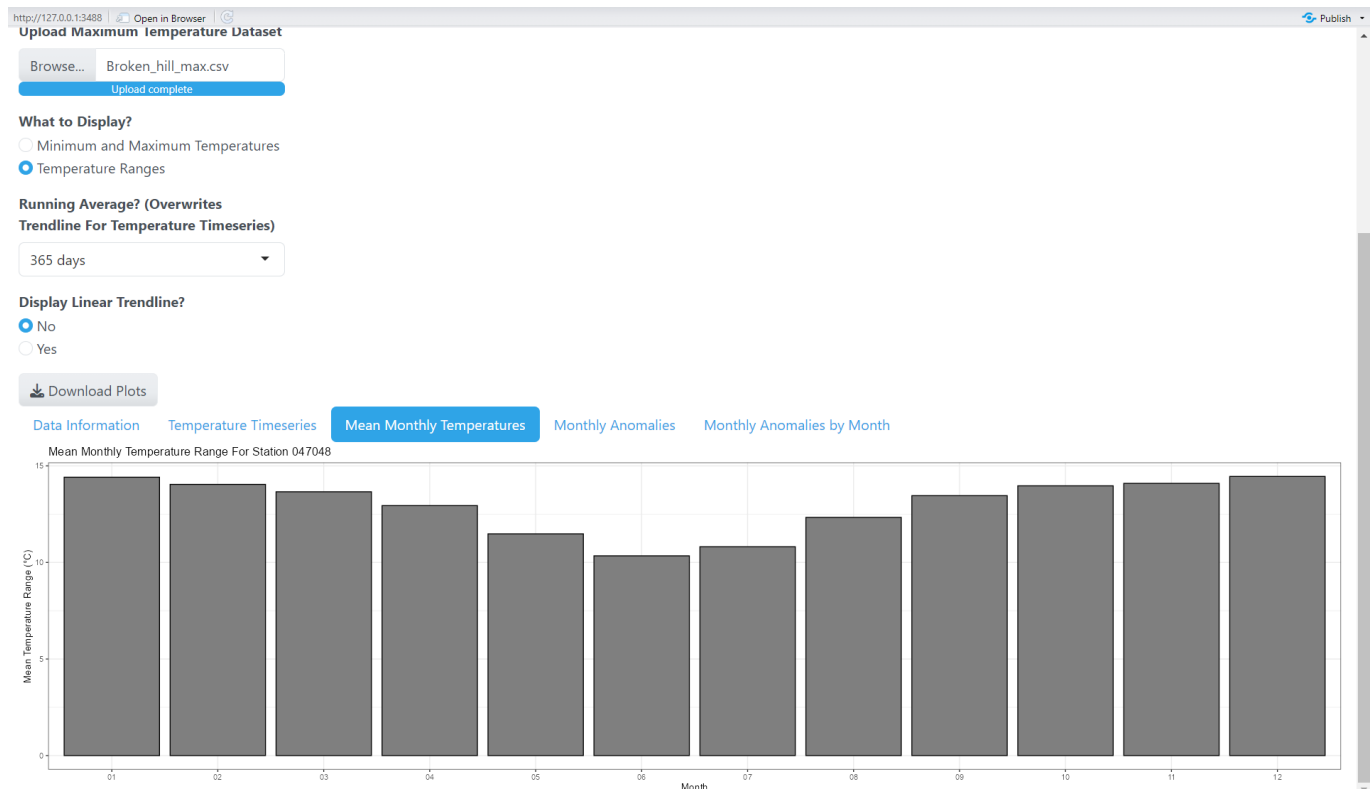
## Example of app usage

### 1. Annual running average of Rottnest Island temperatures (Figure 4).



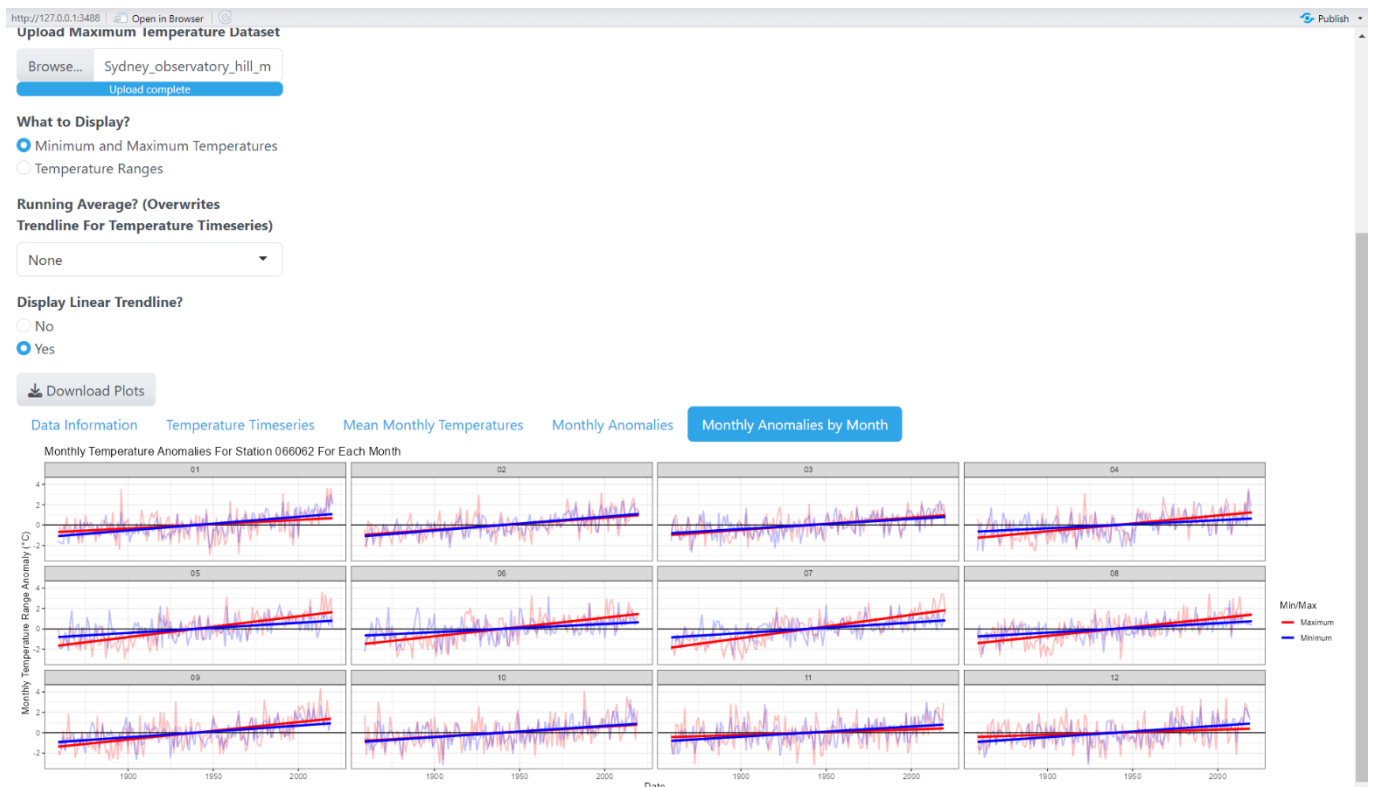
**Figure 4** Timeseries of daily temperatures with annual running average for Rottnest Island (Station 009193).

### 2. Temperature ranges for each month at Broken Hill (Figure 5).



**Figure 5** Barchart of mean daily temperature ranges for each month at Broken Hill (Station 047048).

### 3. Temperature trends for each month in Sydney (Figure 6).



**Figure 6** Trends of monthly temperature anomalies in Sydney (Station 066062).

## References

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