weatherOz: An API Client for Australian Weather and Climate Data Resources in R

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1 Department of Primary Industries and Regional Development of Western Australia, Perth, Western Australia 6000, Australia **2** No affiliation **3** 360info, Monash University, Australia **4** Wave Data Labs, Wollongong, New South Wales, 2500, Australia **5** The University of Queensland, School of Agriculture and Food Sustainability, Gatton, Queensland 4343, Australia **6** rOpenSci **7** Grattan Institute, Carlton, Victoria 3053, Australia **8** University of Southern Queensland, Centre for Crop Health, Toowoomba, Queensland 4350, Australia **9** Curtin University, Centre for Crop and Disease Management, Curtin Biometry and Agricultural Data Analytics, Bentley, Western Australia 6102, Australia

Summary

Researchers and policy makers use weather data in a variety of ways. Agriculture applications of the data are used in several types of models and decision support tools, to estimate leaf wetness, crop yield, crop growth stage, physiological stress or forecasting crop disease epidemics or insect pest population levels (De Wolf et al., 2003; A. Sparks et al., 2017; Venäläinen & Heikinheimo, 2002). Other areas of use include mapping potential renewable energy, *e.g.*, wind or solar potential for exploration purposes (Ramachandra & Shruthi, 2007). The data can also be used by decision makers for municipalities to help plan for extreme weather events, energy needs and other infrastructure (Alcoforado et al., 2009; Svensson & Eliasson, 2002).

weatherOz offers R users with a single interface to access Australian climate and weather data sources providing a standardised way of easily querying and retrieving Australian climate and weather data.

Statement of need

Australian weather data availability is fragmented and difficult to easily access repeatedly or programmatically for use in research activities. Previously the R package, bomrang (A. H. Sparks et al., 2017), provided easy access to data available from the Australian Bureau of Meteorology (BoM) in R. However, difficulties with accessing the data and restrictive polices caused us to archive this package. Therefore, we created weatherOz to replace and at the same time, improve upon bomrang and provide R users with a package that allowed for easy of access to multiple sources of Australian climate and weather data while providing a unified approach to working with different data sources. There are two sources of Australia-wide climate and weather station observations and data, BoM and Queensland Government's Scientific Information for Landowners (SILO) (Jeffrey et al., 2001) database, hosted by the Queensland Department of the Environment, Science and Innovation (DESI) and one source for Western Australia only weather station data, the Department of Primary Industries and Regional Development of Western Australia's (DPIRD) database. BoM provides files through their public anonymous FTP server (Australian Bureau of Meteorology, 2024) and data from both the SILO and DPIRD databases are available through APIs.

weatherOz provides access to data from the SILO database are made available under a Creative

Commons Attribution 4.0 International (CC BY 4.0) licence including the Patched Point data available "from 1889 to yesterday" for approximately 8,000 weather station locations located at post-offices, airports, police stations, national parks and private properties (SILO, 2024), and Data Drill data, which are spatially interpolated data covering Australian land surfaces. The DPIRD weather station network includes approximately 200 weather stations with data available from the year 2000 in Western Australia with the majority being located in the south-western part of the state and are available in time-steps from minute to annual summaries with the default being daily values and is made available under a Creative Commons Attribution Licence 3.0 (CC BY 3.0 AU), though users must register for a free API key to use the resource. BoM data that are supported include forecasts, both précis and coastal, agriculture bulletins and satellite and radar imagery and are available under a Creative Commons Attribution (CC BY) licence.

Features

The package is fully documented with a quick-start vignette that provides details about how to set up the API keys and go about frequently conducted tasks, *e.g.*, fetching daily summary weather data from DPIRD and SILO as well as maps of station locations in the DPIRD and SILO station networks. Additionally, each data source has a dedicated vignette that details how to fetch data from that source and includes greater detail about the functionality of the package. Most users will likely use get_patched_point() (station data), get_data_drill() (spatially interpolated gridded data) or get_dpird_summaries() to retrieve summarised weather station data values. Most functions return a data.table (Barrett et al., 2024), with the exception of some specialised functions discussed later.

Weather station metadata available through weatherOz is richer than what is available from SILO alone and includes geographic location as longitude, latitude and state, elevation, dates available, open or closed status and in the case of DPIRD stations, more detailed information including uptime and hardware details about the stations themselves is available through get_stations_metadata().

Two specialised functions for data available from BoM, get_radar_imagery() and get_satellite_imagery(), return either terra (Hijmans, 2024) or stars (Pebesma & Bivand, 2023) native objects or a magick object (Ooms, 2024), respectively. Three other specialised functions are available for APSIM users providing apsimx ".met" objects of weather data from both DPIRD and SILO (Miguez, 2024) in an R session, *e.g.*, get_dpird_apsim(), get_data_drill_apsim() and get_patched_point_apsim().

weatherOz strives to unify the users experience, this includes the function arguments across the API requests as much as possible and also renaming the return object columns such that they follow a common naming scheme no matter which data source. This does mean that the column names do not match the data source, but make working with data from the different APIs more manageable.

Acknowledgements

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