Department of Climate Change, Energy, the Environment and Water

NSW Climate Data Portal variables dictionary

Version 1.1

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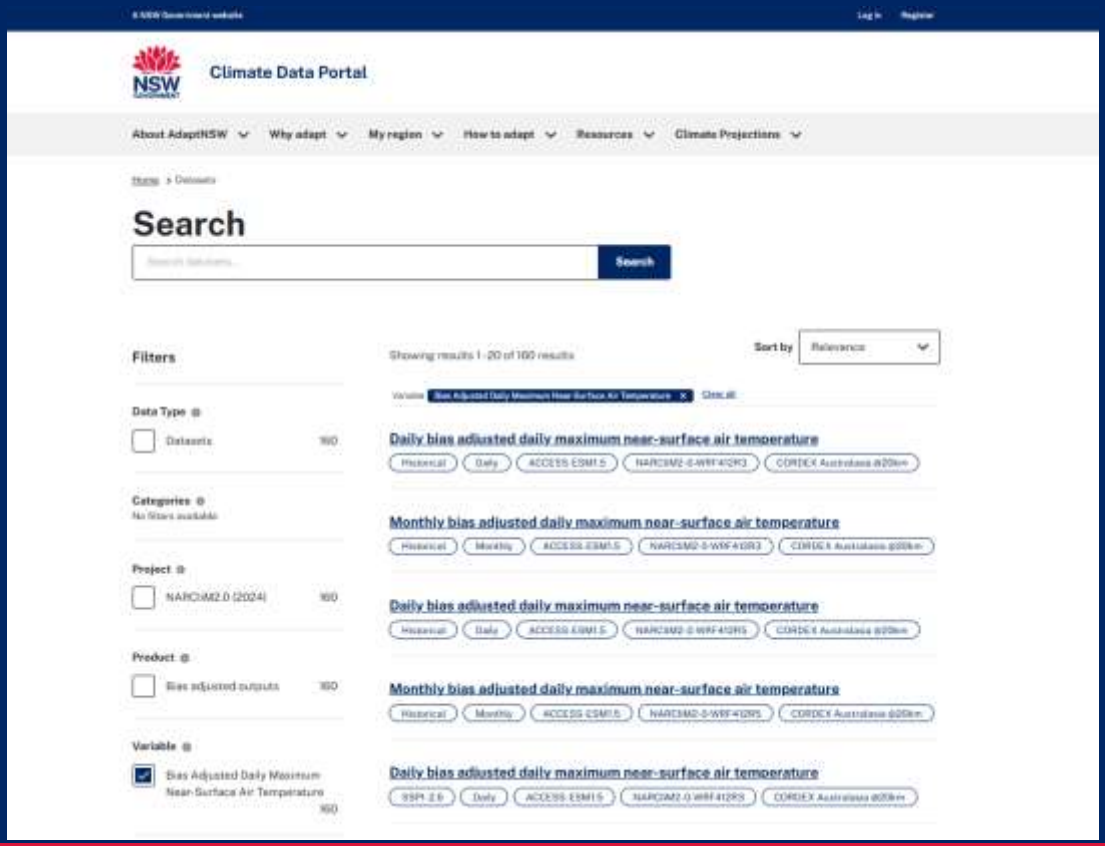

NSW GOVERNMENT

Acknowledgement of Country

Department of Climate Change, Energy, the Environment and Water acknowledges the traditional custodians of the land and pays respect to Elders past, present and future.

We recognise Australian Aboriginal and Torres Strait Islander peoples' unique cultural and spiritual relationships to place and their rich contribution to society.

Artist and designer Nikita Ridgeway from Aboriginal design agency – Boss Lady Creative Designs, created the People and Community symbol.

NSW Climate Data Portal variables dictionary

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More information

Please read the Terms and Conditions for NARCliM Data 2025 and the NSW Climate Data Portal User Guide before using the Climate Data Portal. For questions about the NSW Climate Data Portal or the NARCliM climate projections and data, please contact NARCliM@environment.nsw.gov.au

For more information about NARCliM in general, please visit the AdaptNSW website: https://www.climatechange.environment.nsw.gov.au/narclim

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Contents

1 Getting started

1.1 Purpose of this document

This document provides a description of the climate variables and indices available on the NSW Climate Data Portal ("the Portal). Variables are components of the datasets on the Portal that are the specific physical parameters produced by the NARCliM climate simulations, such as temperature, precipitation and radiation. Climate indices, for the purpose of this document, are considered derivations of variables to provide meaningful data to often sector-specific uses. You can use this variables dictionary to assess variable relevance and potential use-cases for their applications.

1.2 About the NSW Climate Data Portal

The Portal has been designed to provide easy access to the NSW and Australian Regional Climate Model project version 2.0 (NARCliM2.0) CMIP6[1] climate simulations for users experienced in or building capacity using climate data. As a user, you should have some familiarity with the NetCDF file format (www.unidata.ucar.edu/software/netcdf/), which is how NARCliM data are stored and which has shaped the Portal design. The user interface of the Portal provides common features for:

- searching and discovering available NARCliM simulations,
- filtering and finding data,
- refining a selection tailored to an area and time range of interest, and
- exporting the data in a range of formats.

The Portal is also intended to offer you an efficient way to download NARCliM climate data. Rather than submitting a manual data request, NARCliM data on the Portal is open access and offers a time-effective way to review and download data. As a user, you should review this document, the Glossary of terms , and the user guide to help you navigate the Portal. For additional information about NARCliM, please refer to the National Computational Infrastructure website (https://nci.org.au/) and the *NARCliM2.0 Technical Notes* [PDF 4MB].

The Portal is built on the CKAN framework (https://ckan.org/), an open-source software for open data catalogues. For more information on CKAN, see Appendix A, or visit the CKAN webpage.

1.3 Structure of the Portal

The Portal stores data records as 2 types: collections and datasets.

A collection is simply a term for a group of datasets. The collections created by the Department of Climate Change, Energy, the Environment and Water are variable and index datasets that share a

[1] Coupled Model Intercomparison Project (CMIP) phase 6.

common product type, domain/spatial extent, scenario and frequency. In other words, an ensemble of all global climate models (GCMs) and regional climate models (RCMs) for a variable or index with common characteristics.

A dataset of NARCliM simulations is based on a unique set of conditions:

- **Variable** name (such as near-surface air temperature (tas))
- **Project** (NARCliM2.0)
- **Product** type (e.g. postprocessed outputs, bias-adjusted outputs and climate indices)
- **Domain** (spatial extent, such as South-East Australia @4km)
- **Experiment/Scenario** (i.e. Historical, SSP1-2.6, SSP2-4.5, SSP3-7.0[2])
- **Frequency** (i.e. daily, monthly or yearly)
- **Ensemble member** - GCM (Global Climate Model) and RCM (Regional Climate Model)

A dataset also contains the complete time series of the dataset (i.e. Historical is 1951 to 2014, SSPs are 2015 to 2100).

1.4 Searching for variables on the Portal

On the Portal, the variables are listed by their full name (i.e., Near-Surface Air Temperature), not the variable acronym (i.e. tas). Variables are easily searchable if you filter on "Product". Variables are arranged by product type, currently including:

- Postprocessed outputs – 18 CORDEX CORE climate variables
- Bias adjusted outputs – 3 temperature and precipitation variables with bias adjustment applied
- Climate indices calculated from bias adjusted outputs – 2 climate indices that use bias-adjusted variables as their inputs.
- Climate indices – 29 climate indices, which are related to temperature, heatwaves, precipitation, drought and fire

In this document, variables and indices are ordered by these product types.

[2] Shared Socio-economic Pathway (SSP) scenarios.

2 Postprocessed variables

The following 18 variables are available under Product type “Postprocessed outputs”. These NARCliM2.0 variables are considered “CORDEX Core variables” and comply with CORDEX guidelines.

2.1 Daily Maximum Near-Surface Air Temperature (tasmax)

Description: Near-Surface Air Temperature is the temperature of the air near the Earth’s surface, measured at a height of 2 m above the ground. The Daily Maximum is the maximum Near-Surface Air Temperature reached on each day. Near-Surface Air Temperature is equivalent to the same temperature variable that is reported as part of daily weather reports.

Utility: It is of interest to all sectors and is a fundamental variable for any application of climate data.

Unit: Degrees in Kelvin (K)

Frequency in NARCliM2.0: Daily and Monthly

Bias Adjusted: Maximum Near-Surface Air Temperature is also available as bias-adjusted (tasmaxAdjust).

2.2 Daily Minimum Near-Surface Air Temperature (tasmin)

Description: Near-Surface Air Temperature is the temperature of the air near the Earth’s surface, measured at a height of 2 m above the ground. The Daily Minimum is the minimum Near-Surface Air Temperature reached on each day. Near-Surface Air Temperature is equivalent to the same temperature variable that is reported as part of daily weather reports.

Utility: It is of interest to all sectors and is a fundamental variable for any application of climate data.

Unit: Degrees in Kelvin (K)

Frequency in NARCliM2.0: Daily and Monthly

Bias Adjusted: Minimum Near-Surface Air Temperature is also available as bias-adjusted (tasminAdjust).

2.3 Near-Surface Air Temperature (tas)

Description: Near-Surface Air Temperature is the temperature of the air near the Earth’s surface, measured at a height of 2 m above the ground. Near-Surface Air Temperature is equivalent to the same average temperature variable that is reported as part of daily weather reports.

Utility: It is of interest to all sectors and is a fundamental variable for any application of climate data.

Unit: Degrees in Kelvin (K)

Frequency in NARCliM2.0: Daily and Monthly

2.4 Precipitation (pr)

Description: Precipitation is the water that falls from the atmosphere to the Earth's surface, including rain, snow, sleet, hail and drizzle.

Utility: It is of interest to all sectors and is a fundamental variable for any application of climate data.

Unit: Kilograms per square metre per second (kg/m2/s) (can be converted to millimetres)

Frequency in NARCliM2.0: Daily and Monthly

Bias Adjusted: Precipitation is also available as bias-adjusted (prAdjust).

2.5 Evaporation including Sublimation and Transpiration (evspsbl)

Description: Evaporation is the vaporisation of water. This incorporates sublimation, when snow and ice turn into water vapour; and evaporation, when plants release water vapor into the air through their leaves. It is a fundamental climate variable, as rates of evaporation typically increase with warmer temperatures and lower humidity. Evaporation rates typically decrease with cooler temperatures or when the atmosphere is humid and saturated with water vapour. Evaporation influences how much water plants need to survive, relative humidity and landscape hydrology.

Utility: This variable is primarily of interest to agriculture and water management sectors.

Unit: Kilograms per square metre per second (kg/m2/s) (can be converted to millimetres)

Frequency in NARCliM2.0: Daily and Monthly

Other relevant variables: Relative Humidity (Section 2.9) and Specific Humidity (Section 2.10).

2.6 Near-Surface Relative Humidity (hurs)

Description: Relative humidity is the humidity relative to the maximum potential humidity of a given temperature. Absolute humidity is the mass of water vapor in an air mass, measured in grams per square metre. As warmer air holds more water vapour, relative humidity will be higher for the same mass of water vapour at cooler temperatures than it would be at higher temperatures.

Utility: Relative humidity is of interest to the health, energy and agriculture sector. Higher relative humidity can affect human health by reducing the effectiveness of body temperature self-regulation through sweating. It can affect the energy sector by increasing energy demand as people seek greater comfort (e.g. by using air conditioning). Changes in relative humidity can affect the

growth of plants, as high relative humidity can limit the ability of plants to draw water and nutrients from soils, and low relative humidity can cause water stress and lower growth.

Units: Percent (%)

Frequency in NARCliM2.0: Daily and Monthly

2.7 Near-Surface Specific Humidity (huss)

Description: Specific humidity is the mass of water vapour per kilogram of moist air. Moist air can be composed of a mixture of any of the following: dry air, water vapour, cloud liquid, cloud ice, rain and falling snow. It is represented as a fraction derived from the ratio of water vapour to moist air.

Utility: Specific humidity is used for tracking moisture trends, modelling heat fluxes, and improving weather prediction modelling, especially for precipitation and cloud formation. It is also used to compute relative humidity, dew point and vapor pressure, which are essential for meteorological and agricultural applications.

Units: Number

Frequency in NARCliM2.0: Daily and Monthly

2.8 Near-Surface Wind Speed (sfcWind)

Description: Near-Surface Wind Speed is the speed of horizontal wind movement at the Near-Surface. It is based on the greatest wind speed, regardless of which direction it is blowing.

Utility: Wind speed is of interest to multiple sectors, including disaster risk reduction and for the energy sector in relation to wind power generation.

Units: Metres per second (m/s)

Frequency in NARCliM2.0: Daily and Monthly

2.9 Eastward Near-Surface Wind (uas)

Description: Eastward Near-Surface Wind is the speed of wind that blows towards the east direction. This is often referred to as ‘westerly wind’. This provides more information on the direction of wind and can provide greater insights into atmospheric circulation and weather dynamics compared to Near-Surface Wind Speed.

Utility: Wind speed is of interest to multiple sectors, including disaster risk reduction and for the energy sector in relation to wind power generation. For eastern Australia, Eastward Near-Surface Wind are winds that have come across the continent across the dry centre.

Units: Metres per second (m/s)

Frequency in NARCliM2.0: Daily and Monthly

2.10 Northward Near-Surface Wind (vas)

Description: The Northward Wind is the speed of wind that blows towards the north direction. This is often referred to as a 'southerly wind'. This provides more information on the direction of wind and can provide greater insight into atmospheric circulation and weather dynamics compared to Near-Surface Wind Speed.

Utility: Wind speed is of interest to multiple sectors, including disaster risk reduction and for the energy sector in relation to wind power generation. For the east coast of Australia, Northward Near-Surface Wind are winds that have come up from the south and often across the Tasman Sea.

Units: Metres per second (m/s)

Frequency in NARCliM2.0: Daily and Monthly

2.11 Surface Air Pressure (ps)

Description: Surface Air Pressure is the force that all air in a vertical column above an area of the Earth's surface would have on the surface. Areas with warm air typically have lower air pressure because it is less dense. Air Pressure decreases as altitude increases, as there is less air to exert force compared to sea-level areas.

Utility: Surface Air Pressure can provide information on weather dynamics such as the movement of fronts and troughs.

Units: Pascals (Pa)

Frequency in NARCliM2.0: Daily and Monthly

2.12 Sea Level Pressure (psl)

Description: Sea Level Pressure is the air pressure for a location, which is adjusted to account for that area's altitude. Sea Level Pressure is the air pressure that a given location would have if it was at sea level. Compared to Surface Air Pressure, it makes air pressure across different areas with different elevations comparable. This is used to identify weather systems and related weather phenomena such as cyclones with greater accuracy across large areas.

Utility: Sea Level Pressure can provide information on weather dynamics such as the movement of fronts and troughs.

Units: Pascals (Pa)

Frequency in NARCliM2.0: Daily and Monthly

2.13 Surface Downwelling Longwave Radiation (rlds)

Description: Surface Downwelling Longwave Radiation is the longwave radiation received at the surface of the Earth. Longwave radiation refers to thermal radiation in the infrared spectrum. Downwelling refers to the radiation that is emitted towards the Earth's surface. The primary source of Surface Downwelling Longwave Radiation is the thermal energy re-emitted from the atmosphere

towards the Earth by clouds and greenhouse gases such as carbon dioxide. The thermal energy re-emitted by the atmosphere originates from the atmosphere absorbing thermal energy emitted by outgoing longwave radiation from the Earth's surface.

Utility: Radiation variables provide data on energy radiation from the sun and from the Earth to determine the Earth's energy balance.

Units: Watts per square metre (w/m^2)

Frequency in NARCliM2.0: Daily and Monthly

2.14 Surface Downwelling Shortwave Radiation

Description: Surface Downwelling Shortwave Radiation is the shortwave radiation received at the surface of the Earth. Shortwave refers to thermal radiation in the optical spectrum, primarily emitted by the sun. Downwelling refers to the radiation that is emitted towards the Earth's surface. Radiation variables provide data on energy radiation from the sun and from the Earth to determine the Earth's energy balance. The primary source of Surface Downwelling Shortwave Radiation is the thermal energy emitted by the sun and transmitted to the Earth and its atmosphere.

Utility: Radiation variables provide data on energy radiation from the sun and from the Earth to determine the Earth's energy balance.

Units: Watts per square metre (w/m^2)

Frequency in NARCliM2.0: Daily and Monthly

2.15 Total Cloud Fraction (clt)

Description Total Cloud Fraction is the fraction of the sky covered by clouds. A completely clear sky would be 0%, whereas a sky covered by clouds would be 100%. It is estimated from several variables such as specific humidity, temperature, air pressure, the atmospheric mass of cloud ice and relative humidity.

Utility: Total Cloud Fraction provides detailed information on sunshine availability which is of interest to a wide variety of sectors. It is particularly of interest to the energy and agriculture sector as it indicates the suitability of weather for solar power generation and plant growth.

Units: Percent (%)

Frequency in NARCliM2.0: Daily and Monthly

2.16 Atmospheric Grid-Cell Area (areacella)

Description: Atmospheric Grid-Cell Area is the 2-dimensional (2D) area of the model grid cells. Atmospheric Grid-Cell Area is one of three static grid cell property variables, which are time-independent fixed variables and are the same for each model and projection.

Utility: This variable provides information about the grid cells in the modelling process and may be useful for some applications of climate data.

Units: Square metres (m^2)

Frequency in NARCliM2.0: Static

2.17 Land Area Fraction (sftlf)

Description: Land Area Fraction is the percentage of the grid cell in the models that includes land. For example, a grid cell in the ocean would be 0% Land Area Fraction, and a coastal grid cell that includes a portion of ocean and estuarine waters may be 60%. Land Area Fraction is one of three static grid cell property variables, which are time-independent fixed variables and are the same for each model and projection.

Utility: This variable provides information about the grid cells in the modelling process and may be useful for some applications of climate data.

Units: Percent (%)

Frequency in NARCliM2.0: Static

2.18 Surface Altitude (orog)

Description: Surface Altitude is the elevation of the grid cell area in the models. Surface Altitude is one of three static grid cell property variables, which are time-independent fixed variables and are the same for each model and projection.

Utility: This variable provides information about the grid cells in the modelling process and may be useful for some applications of climate data.

Units: Metres (m)

Frequency in NARCliM2.0: Static

3 Bias-adjusted variables

The following 3 variables are available under Product type "Bias adjusted outputs". Bias adjustment is only performed on variables with observational records. For NARCliM2.0, this currently only includes maximum and minimum near-surface air temperature and precipitation. Bias adjustment variables were generated using the method defined by D. Argüeso, J. P. Evans, and L. Fita (https://doi.org/10.5194/hess-17-4379-2013). For further information on bias adjustment, see AdaptNSW.

3.1 Daily Maximum Near-Surface Air Temperature (tasmaxAdjust)

Description: Near-Surface Air Temperature is the temperature of the air near the Earth's surface, measured at a height of 2 m above the ground. The Daily Maximum is the maximum Near-Surface Air Temperature reached on each day. Near-Surface Air Temperature is equivalent to the same temperature variable that is reported as part of daily weather reports. Bias adjustment is performed by using the NARCliM2.0 historical modelling data and comparing it against the observational record.

Utility: It is of interest to all sectors and is a fundamental variable for any application of climate data.

Unit: Degrees in Kelvin (K)

Frequency in NARCliM2.0: Daily and Monthly

3.2 Daily Minimum Near-Surface Air Temperature (tasminAdjust)

Description: Near-Surface Air Temperature is the temperature of the air near the Earth's surface, measured at a height of 2 m above the ground. The Daily Minimum is the minimum Near-Surface Air Temperature reached on each day. Near-Surface Air Temperature is equivalent to the same temperature variable that is reported as part of daily weather reports. Bias adjustment is performed by using the NARCliM2.0 historical modelling data and comparing it against the observational record.

Utility: It is of interest to all sectors and is a fundamental variable for any application of climate data.

Unit: Degrees in Kelvin (K)

Frequency in NARCliM2.0: Daily and Monthly

3.3 Precipitation (prAdjust)

Description: Precipitation is the water that falls from the atmosphere to the Earth's surface, including rain, snow, sleet, hail and drizzle. Bias adjustment is performed by using the NARCliM2.0 historical modelling data and comparing it against the observational record.

Utility: It is of interest to all sectors and is a fundamental variable for any application of climate data.

Unit: Kilograms per square metre per second (kg/m2/s) (can be converted to millimetres)

Frequency in NARCliM2.0: Daily and Monthly

4 Bias-adjusted climate indices

The following 2 variables are available under Product type “Climate indices calculated from bias adjusted outputs”.

4.1 Number of days where maximum temperature is greater than or equal to 35°C (TXge35)

Description: The number of days where maximum temperature is greater than or equal to 35°C is used as an index for the number of hot days. Prolonged hot days where maximum temperatures are 35°C or above increase the incidence of illness and death, particularly among vulnerable people.

Utility: This index is primarily of interest to health, energy, urban planning and agriculture sectors.

Units: Number (days)

Frequency in NARCliM2.0: Monthly and Yearly

4.2 Number of days where minimum temperature is less than 2°C (TNlt2)

Description: The number of days where minimum temperature is less than 2°C is used as an index for the number of cold nights. The number of cold nights is important for the survival of some important plant species. For example, some common temperate fruit species require sufficiently cold winters to produce flower buds, and some alpine ecosystems are reliant on cold nights. Other plant species may experience frost damage at this temperature.

Utility: This index is primarily of interest to agriculture and biodiversity sectors.

Units: Number (days)

Frequency in NARCliM2.0: Monthly and Yearly

5 Temperature related climate indices

The following 12 variables are the temperature related indices available under Product type "Climate indices". These have not been bias-adjusted.

5.1 Cooling Degree Days (CDDcold18°C)

Description: If the daily average temperature is above 18°C, the difference between that temperature and 18°C is counted as Cooling Degree Days. For example, if the daily mean temperature is 25°C, then the Cooling Degree Days at that location is 7. If the average temperature on a given day is below 18°C, the Cooling Degree Days is 0. These values are summed over a month or a year to estimate how much cooling (like air conditioning) might be needed.

Utility: This index is useful for forecasting energy demand, planning building climate control (air conditioning demand) and climate impact assessments.

Unit: Degree-Days (Kd)

Frequency in NARCliM2.0: Monthly and Yearly

5.2 Diurnal Temperature Range (DTR)

Description: Also called Daily Temperature Range, DTR refers to the difference between the daily maximum and minimum temperatures. It's a simple but important climate metric that helps describe how much temperatures fluctuate within a single day. For example, if the highest temperature during the day is 30°C and the lowest at night is 15°C, then DTR = 30°C - 15°C = 15°C. Daily DTR is then averaged to produce Monthly DTR or Yearly DTR.

Utility: This index is used to assess climate variability, heat stress and agricultural conditions. DTR plays a significant role in agriculture because it directly affects plant growth, crop yield, and overall farm productivity. A narrow DTR might indicate cloud cover or high humidity, a wide DTR often occurs in dry, clear-sky conditions.

Unit: Degrees in Kelvin (K)

Frequency in NARCliM2.0: Monthly and Yearly

5.3 Frost Days (FD)

Description: Frost Days is the count of the number of days in a month or year when the daily minimum temperature falls below 0°C. For example, if a month has 5 days below 0°C, then the monthly Frost Days is 5.

Utility: It's commonly used in climate studies, agriculture, and environmental planning. It is used to assess crop damage potential, growing season planning, pest and disease control or crop varietal selection and suitability to climate risks for an area.

Units: Number (days)

Frequency in NARCliM2.0: Monthly and Yearly

5.4 Growing Degree Days (10°C) (GDDgrow10)

Description: This index is a measure of heat accumulation used to estimate growth and development of plants and insects during the growing season. It uses daily average temperature and assumes that growth and development occur when the temperature is above 10°C. GDD is calculated for each day, if the result of the calculation is negative, then GDD is set to zero for that day. These values are summed over a month or a year to estimate total growing degree days.

Utility: This index has application in agriculture (crop maturity estimation, planting schedules and harvest times), entomology (insect life cycle) and viticulture (grape development and quality potential)

Units: Degree-Days (Kd)

Frequency in NARCliM2.0: Monthly and Yearly

5.5 Growing Season Length (GSL)

Description: This index is a measure of the duration of the period in a year when conditions are suitable for plant growth. It set the start date as the first span of at least 6 consecutive days after 1 July of daily average temperature above 5°C. It sets the end date as the first span of at least 6 consecutive days after following 1 January of daily average temperature below 5°C. The total number of days between these two periods is considered the Growing Season Length for that year

Utility: GSL is especially important in agriculture, ecology and climate change studies. In agriculture, it is useful for determining the planting and harvesting windows. In ecology, it can be used in monitoring species distribution and ecosystem productivity. In climate studies, it can be used to monitor shifts in seasonal patterns relative to global warming.

Units: Number (days)

Frequency in NARCliM2.0: Yearly

5.6 Heating Degree Days (18°C) (HDDheat18)

Description: Like Cooling Degree Days, but opposite, if the average temperature on a given day is below 18°C, the difference between that temperature and 18°C is counted as Heating Degree Days. For example, if the average daily temperature is 13°C, then the Heating Degree Days at that location is 5. If the average temperature on a given day is above 18°C, the Cooling Degree Days is 0. These values are summed over a month or year to estimate how much heating might be needed.

Utility: This index is useful for forecasting energy demand, planning building climate control (heating demand) and climate impact assessments.

Unit: Degree-Days (Kd)

Frequency in NARCliM2.0: Monthly and Yearly

5.7 Percentage of days with minimum temperature below the 10th percentile (TN10p)

Description: This index measures the frequency of unusually cold nights in terms of daily minimum temperature in a month or year. It is the percentage of days in a month or year where the daily minimum temperature is below the 10th percentile of the NARCliM base reference period (1990-2009). Percentiles are calculated for each day using a 5-day moving window.

Utility: TN10p helps monitor cold extremes and is useful for agriculture (identifying frost risk periods), public health (exposure to cold-related illnesses), and climate change studies (reduction in cold extremes over time).

Units: Percent (%)

Frequency in NARCliM2.0: Monthly and Yearly

5.8 Percentage of days with minimum temperature above the 90th percentile (TN90p)

Description: This index measures the frequency of unusually warm nights in terms of daily minimum temperature in a month or year. It is the percentage of days in a month or year where the daily minimum temperature is above the 90th percentile of the NARCliM base reference period (1990-2009). Percentiles are calculated for each day using a 5-day moving window.

Utility: TN90p helps monitor warm extremes, especially at nighttime and is useful for public health (warm nights reduce relief from daily heat stress), agriculture (crop respiration and growth cycles), and climate change studies (a shift to warmer nighttime temperatures over time).

Units: Percent (%)

Frequency in NARCliM2.0: Monthly and Yearly

5.9 Percentage of days with maximum temperature below the 10th percentile (TX10p)

Description: This index measures the frequency of cold days in terms of daily maximum temperature in a month or year. It is the percentage of days in a month or year where the daily maximum temperature is below the 10th percentile of the NARCliM base reference period (1990-2009). Percentiles are calculated for each day using a 5-day moving window.

Utility: TX10p helps monitor cold day extremes and is useful for public health (exposure to cold-related stress during the day), agriculture (reduced crop growth or frost risk), and climate change studies (tracking reductions in cold extremes over time).

Units: Percent (%)

Frequency in NARCliM2.0: Monthly and Yearly

5.10 Percentage of days with maximum temperature above the 50th percentile (TX50p)

Description: This index measures the frequency of typical daytime temperatures in terms of daily maximum temperature in a month or year. It is the percentage of days in a month or year where the daily maximum temperature is above the 50th percentile of the NARCliM base reference period (1990-2009). Percentiles are calculated for each day using a 5-day moving window.

Utility: TX50p is useful for understanding baseline temperature conditions for a region, comparing shifts in central tendency of daytime temperatures over time, and may be used in combination with extreme indices like TX90p (hot days) and TX10p (cold days).

Units: Percent (%)

Frequency in NARCliM2.0: Monthly and Yearly

5.11 Percentage of days with maximum temperature above the 90th percentile (TX90p)

Description: This index measures the frequency of unusually hot days in terms of daily maximum temperature in a month or year. It is the percentage of days in a month or year where the daily maximum temperature is above the 90th percentile of the NARCliM base reference period (1990-2009). Percentiles are calculated for each day using a 5-day moving window.

Utility: TX90p helps monitor hot day extremes and is useful for public health (periods of elevated heat stress), agriculture (crop vulnerability to heat damage), urban planning (heat-resilient infrastructure design) and climate change studies (tracking increase in hot day frequencies over time).

Units: Percent (%)

Frequency in NARCliM2.0: Monthly and Yearly

5.12 Warm Spell Duration Index (WSDI)

Description: WSDI is used to quantify the duration of unusually warm periods within a year. It is an annual count of days that are part of warm spells, defined as more than or equal to 6 consecutive days where the daily maximum temperature is at or above the 90th percentile during the NARCliM base reference period (1990-2009). For example, if a year has 3 warm spells, lasting 7, 6 and 10 days respectively, then the WSDI for that year is 23 days.

Utility: WSDI is used for monitoring heatwave-like events and their trends over time. This is critical for public health (heat stress), agriculture (crop damage), urban planning (urban heat island mitigation) and climate change risk assessments.

Units: Number (days)

Frequency in NARCliM2.0: Yearly

6 Heatwave related climate indices

The following 5 variables are the heatwave indices available under Product type "Climate indices". These have not been bias-adjusted.

Heatwave indices using NARCliM2.0 are calculated over a 5-month austral summer period (November to March) per year, due to the high impacts of heatwaves over Australia during this period. It also represents how hot heatwaves are compared to expected summertime conditions. Heatwave indices are calculated using the Excess Heat Factor (EHF) method, the current official definition adopted nation-wide. They are therefore not based on regional thresholds, have been developed to represent Australian heatwaves and incorporate desirable properties for analysis of a range of distinct heatwave characteristics. EHF estimates the accumulated heat excess over three consecutive days. It uses historical and projected daily average temperature, and the 95th percentile average temperature of the NARCliM2.0 base reference period (1990-2009).

6.1 Heatwave Amplitude for EHF heatwaves (HWA)

Description: The index Heatwave Amplitude is the peak daily temperature during the hottest heatwave of a year.

Utility: HWA helps quantify the severity of extreme heat events in a year, especially in terms of peak temperature stress. It is useful for public health planning (heat stress and mortality risk), infrastructure resilience (energy demand, transport systems) and climate change monitoring (changes in heat extremes).

Units: Degrees in Kelvin (K)

Frequency in NARCliM2.0: Yearly

6.2 Heatwave Duration for EHF heatwaves (HWD)

Description: The index Heatwave Duration is the number of days of the longest heatwave, as defined by Excess Heat Factor (EHF), in year identified by Heatwave Number (HWN).

Utility: HWD helps assess the persistence of extreme heat events in a year. It is useful for public health (increase risks), agriculture (crop damage and yield reduction), infrastructure resilience (energy demand, transport systems) and climate change monitoring (changes in heat intensity and length).

Units: Number (days)

Frequency in NARCliM2.0: Yearly

6.3 Heatwave Frequency for EHF heatwaves (HWF)

Description: The index Heatwave Frequency is the number of days in a year that contribute to heatwaves, as defined by Excess Heat Factor (EHF), as defined by Heatwave Number (HWN).

Utility: HWF helps assess how often in terms of days that populations and ecosystems are exposed to extreme heat events in a year. It is useful for public health (heat-related illness prevention), agriculture (stress on livestock and crops), urban planning (heat-resilient infrastructure) and climate change monitoring (changes in extreme heat occurrence).

Units: Number (days)

Frequency in NARCliM2.0: Yearly

6.4 Heatwave Magnitude for EHF heatwaves (HWM)

Description: The index Heatwave Magnitude is the mean temperature of all heatwaves, as defined by Excess Heat Factor (EHF), in a year.

Utility: HWM helps assess the intensity that populations and ecosystems are exposed to during extreme heat events in a year. It is useful for public health (heat-related illness risk assessment), agriculture (stress on livestock and crops), urban planning (heat-resilient infrastructure) and climate change monitoring (changes in extreme heat intensity).

Units: Degrees in Kelvin (K)

Frequency in NARCliM2.0: Yearly

6.5 Heatwave Number for EHF heatwaves (HWN)

Description: The index Heatwave Number is the number of distinct individual heatwaves, as defined by Excess Heat Factor (EHF), that occur each summer (November to March) in a year. A heatwave is defined as 3 or more days where the EHF is positive.

Utility: HWN helps assess how often extreme heat events occur in a year. It is useful for public health (heat-related illness risk assessment), agriculture (stress on livestock and crops), urban planning (energy systems, infrastructure) and climate change monitoring (trends in frequency).

Units: Number

Frequency in NARCliM2.0: Yearly

7 Precipitation related climate indices

The following 6 variables are the precipitation related indices available under Product type “Climate indices”. These have not been bias-adjusted.

7.1 Consecutive Dry Days (CDD)

Description: Consecutive Dry Days Measures the longest stretch of days within a year where no significant rainfall occurred. "Dry" is defined as a daily precipitation totals below the threshold of 1mm. For example, if the longest stretch of consecutive days in one year with no measurable rainfall is 100, then Consecutive Dry Days at that location for that year equals 100.

Utility: This index helps assess drought severity and water stress by identifying extended dry spells that may impact agriculture, ecosystems, and water supply planning. It can be also used to monitor climate variability.

Unit: Number (days)

Frequency in NARCliM2.0: Yearly

7.2 Consecutive Wet Days (CWD)

Description: Consecutive Wet Days measures the longest stretch of days within a year where measurable rainfall occurred. “Wet” is defined as a daily precipitation total equal to or above the threshold of 1mm. For example, if the longest stretch of consecutive days in one year with measurable rainfall above 1mm is 100, then Consecutive Wet Days at that location for that year equals 100.

Utility: This index helps assess rainfall potential and water stress by identifying extended wet spells that may impact agriculture, ecosystems, and water supply planning. It can be also used to monitor climate variability.

Unit: Number (days)

Frequency in NARCliM2.0: Yearly

7.3 Number of heavy precipitation days (greater than 10mm) (R10mm)

Description: This index is used to measure moderate to heavy precipitation events. It is measured as the monthly or yearly number of days when the daily precipitation is greater than 10 millimetres. R10mm reflects the frequency of wet days with substantial rainfall.

Utility: R10mm helps assess changes in rainfall patterns, especially in relation to flooding, soil erosion and agricultural impacts and can be used in climate monitoring and adaptation planning.

Units: Number (days)

Frequency in NARCliM2.0: Monthly and Yearly

7.4 Number of heavy precipitation days (greater than 20mm) (R20mm)

Description: This index is used to measure heavy precipitation events. It is measured as the monthly or yearly number of days when the daily precipitation is greater than 20 millimetres. R20mm reflects the frequency of wet days with intense rainfall.

Utility: R20mm helps assess changes in rainfall patterns, especially in relation to flooding, soil erosion, agricultural impacts and even infrastructure stress and can be used in climate monitoring and adaptation planning.

Units: Number (days)

Frequency in NARCliM2.0: Monthly and Yearly

7.5 Total precipitation from extremely wet days (R99p)

Description: R99p refers to the monthly or yearly total precipitation from extremely wet days. An extremely wet day is defined as a day with precipitation greater than the 99th percentile of wet days (≥1mm) in the NARCliM base reference period (1990-2009).

Utility: This index is useful for monitoring changes in extreme precipitation patterns. It's used in climate impact assessments across sectors like agriculture, water resources and disaster risk management.

Units: Number (days)

Frequency in NARCliM2.0: Monthly and Yearly

7.6 Simple (Daily) Precipitation Intensity Index (SDII)

Description: SDII is used to measure the average intensity of rainfall on wet days (rainfall greater than or equal to 1mm). It involves calculating the daily precipitation amount on wet days by the number of wet days in a year. Therefore, SDII gives the mean precipitation per wet day, indicating how intense rainfall tends to be when it occurs. A higher SDII, for example, suggests higher intensity events, even if they are infrequent. Days with less than 1mm rainfall are not considered.

Utility: SDII has utility for agriculture (soil erosion potential or crop damage), hydrology (flood risk and water resource planning) and climate change studies (changes in rainfall intensity over time)

Units: Millimetres per day (mm/day)

Frequency in NARCliM2.0: Yearly

8 Drought related climate indices

The following 3 variables are the drought related indices available under Product type “Climate indices”. They have not been bias-adjusted.

8.1 Standardised Precipitation Index (3-month window) (SPI03)

Description: SPI03 quantifies precipitation anomalies over a 3-month window and is used to help assess short-term drought conditions. A positive SPI indicates above-average precipitation (wet conditions). A negative SPI indicates below-average precipitation (dry conditions). Zero SPI indicates median precipitation. Monthly mean precipitation rate is used as an input.

Utility: Standardised Precipitation Index is a widely used metric for measuring and monitoring drought conditions based on precipitation. It can be used to compare across different climate zones. Because it is based on only precipitation, it does not consider factors like evapotranspiration or temperature that may be useful for water demand analysis. Additionally, SPI may be less reliable in arid regions with practically no rainfall.

Units: Index number

Frequency in NARCliM2.0: Monthly

8.2 Standardised Precipitation Index (6-month window) (SPI06)

Description: Standardised Precipitation Index is a widely used metric for measuring and monitoring drought conditions based on precipitation. SPI06 quantifies precipitation anomalies over a 6-month window and is used to help assess short-term drought conditions. A positive SPI indicates above-average precipitation (wet conditions). A negative SPI indicates below-average precipitation (dry conditions). Zero SPI indicates median precipitation. Monthly mean precipitation rate is used as an input.

Utility: Standardised Precipitation Index is a widely used metric for measuring and monitoring drought conditions based on precipitation. It can be used to compare across different climate zones. Because it is based on only precipitation, it does not consider factors like evapotranspiration or temperature that may be useful for water demand analysis. Additionally, SPI may be less reliable in arid regions with practically no rainfall.

Units: Index number

Frequency in NARCliM2.0: Monthly

8.3 Standardised Precipitation Index (12-month window) (SPI12)

Description: Standardised Precipitation Index is a widely used metric for measuring and monitoring drought conditions based on precipitation. SPI12 quantifies precipitation anomalies over a 12-month window and is used to help assess longer-term drought conditions. A positive SPI indicates above-average precipitation (wet conditions). A negative SPI indicates below-average precipitation (dry conditions). Zero SPI indicates median precipitation. Monthly mean precipitation rate is used as an input.

Utility: Standardised Precipitation Index is a widely used metric for measuring and monitoring drought conditions based on precipitation. It can be used to compare across different climate zones. Because it is based on only precipitation, it does not consider factors like evapotranspiration or temperature that may be useful for water demand analysis. Additionally, SPI may be less reliable in arid regions with practically no rainfall.

Units: Index number

Frequency in NARCliM2.0: Monthly

9 Fire related climate indices

The following 2 variables are the drought related indices available under Product type “Climate indices”. They have not been bias-adjusted.

9.1 Forest Fire Danger Index (FFDI)

Description: FFDI is a widely used metric in Australia that estimates the potential severity of bushfires on a given day and location. It was developed by CSIRO scientist A.G. McArthur and is a key component of the country's fire danger rating system. FFDI combines several weather and environmental factors to assess fire risk, including air temperature, wind speed, relative humidity and vegetation dryness (a ‘drought factor’). The rating system is

- 0–11: Low–Moderate
- 12–24: High
- 25–49: Very High
- 50–74: Severe
- 75–99: Extreme
- 100+: Catastrophic

Utility: FFDI categories are used by emergency services and communities to help prepare for bushfire threats, response planning, climate and hazard assessments, and long-term fire risk trends.

Units: Number representing the rating

Frequency in NARCliM2.0: Daily

9.2 Number of days where FFDI is greater than 50 (FFDIgt50)

Description: The Forest Fire Danger Index (FFDI) represents an estimate of fire weather risk. The FFDI is calculated from temperature, relative humidity and wind speed, as well as a number representing fuel dryness. This index is simply the number of fire days with and FFDI rating of 50 or greater. It includes Severe, Extreme and Catastrophic ratings.

Utility: By understanding the number of days per month or year of severe or greater fire danger rating, emergency services and communities can better prepare for bushfire threats and plan response. It also contributes to the understanding of how ecosystems may need to respond or adapt to changing probable fire conditions in the future. However, it may not be comparable across different bioclimatic zones and regions.

Units: Number (days)

Frequency in NARCliM2.0: Monthly and Yearly

10 Appendices

10.1 Appendix A: NSW Climate Data Portal technical information

The NSW Climate Data Portal is built on the CKAN framework (https://ckan.org/), an open-source software for open-data catalogues. CKAN is widely used for enterprise data projects and access.

CKAN offers developers a tool that provides an expansive set of tools to deliver end users a robust, interconnected system of functionality that has the following features:

- Stores metadata, not data itself (in principle); makes it easy to find data.
- Data must be available on the internet in a permanent URL & directly linkable & no captcha.
- Structure data; no tables inside pdf or doc; common offenders: statistic bulletins; no table as images.
- Open formats: CSV, json, xml. GeoTIFF.
- Open licenses: Open data & content can be freely used, modified, and shared by anyone for any purpose – http://opendefinition.org (EX: CC 4.0, OdbL, OGL).
- CKAN uses Apache Solr as its search engine. For further details check the Solr documentation (https://solr.apache.org/guide/6_6/searching.html#searching).

Other data platforms in New South Wales that are built on CKAN include:

- NSW SEED Portal (Sharing and Enabling Environmental Data) https://www.seed.nsw.gov.au/
- NSW Planning Portal https://www.planningportal.nsw.gov.au/