# Exposure (Vulnerability Sub-Indices)

Data Dictionary

Exposure is a component of the vulnerability index framework developed in 2007 by the Intergovernmental Panel on Climate Change (IPCC). Exposure is defined a direct measure of a household’s, community’s, or population’s contact with a certain event, such as a natural hazard. In phase 1 of AusEnHealth, exposure has been considered for three particular natural hazards: extreme heat, extreme cold, and air pollution.

This document defines the parameters used in exposure sub-indices, a crucial component in the creation of AusEnHealth’s vulnerability indices. For more information, please see the AusEnHealth Methods Report, hosted at <https://frontiersi.com.au/ausenhealth-digital-twin/>.

## Climate (Extreme Heat, Extreme Cold)

Parameters Specific to Climate

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| **Parameter** | **Description and Derivation** |
| AvgTemp | Average temperature (°C). |
|  | This parameter is derived from daily gridded temperature datasets. These data were accessed through the Long Paddock’s Scientific Information for Land Owners (SILO) database, with original data provided by the Australian Bureau of Meteorology (BOM). Gridded data has been aggregated to selected spatial geographies and averaged over selected temporal resolutions. |
| rHist\_tHeatAvg | Historically ranked average temperature, with heat high (%). Otherwise referred to as heat high percent. |
|  | This parameter is derived from average temperature by comparing each region to its own historical values. A region value of 0 means that region is the coldest in its history. Likewise, a region value of 1 means that region is the hottest in its history. |
| rSpat\_rHist\_tHeatAvg | Spatially ranked historical temperature percentiles, with heat high (%). |
|  | This parameter is derived from historically ranked average temperature by comparing each region’s historical percentile to the rest of Australia at a given time. A region value of 0 means that region is the least extreme historical heat across Australia at a given time. Likewise, a region value of 1 means that region is the most extreme historical heat across Australia at a given time. |
| cSpat\_rHist\_tHeatAvg | Categorical representation of spatially ranked historical temperature percentiles, with heat high. |
|  | This parameter derived by splitting percentiles into ascending quintiles. A value of 1 represents the bottom 20 percent, and a value of 5 represents the top 20 percent. |
| nAtRisk\_tHeat | The number of “at risk” temperature days. |
|  | The parameter is derived using historically ranked average temperature percentiles by recording the number of days in the given temporal resolution in which temperature exceeds the 85th historical percentile. |
| nHighRisk\_tHeat | The number of “high risk” temperature days. |
|  | The parameter is derived using historically ranked average temperature percentiles by recording the number of days in the given temporal resolution in which temperature exceeds the 95th historical percentile. |
| rHist\_tHeat | Summed historically ranked daily temperature, with heat high. |
|  | This parameter is derived from by comparing each region to its own historical values each day in a given temporal resolution and summing the result. This parameter is an improvement on rHist\_tHeatAvg, as it captures variation in historical heat. However, as the result is a sum of percentiles, the result it not easy to interpret. |
| rSpat\_rHist\_tHeat | Spatially ranked summed historical temperature percentiles, with heat high (%). |
|  | This parameter is derived from summed historically ranked daily temperature by comparing each region’s summed historical percentiles to the rest of Australia at a given time. A region value of 0 means that region is the least extreme historical heat across Australia at a given time. Likewise, a region value of 1 means that region is the most extreme historical heat across Australia at a given time. |
| cSpat\_rHist\_tHeat | Categorical representation of spatially ranked summed historical temperature percentiles, with heat high. |
|  | This parameter derived by splitting percentiles into ascending quintiles. A value of 1 represents the bottom 20 percent, and a value of 5 represents the top 20 percent. |
| nHW\_EHF | Number of heatwave days. |
|  | This parameter is derived using the excess heat factor calculation, which is based on a combination of long term and shot term historical daily temperature values. If the result of the calculation is above 0, a day is declared a heatwave day. For more information, please see the Methods Report, hosted at <https://frontiersi.com.au/ausenhealth-digital-twin/>. |
| nSHW\_EHF | Number of severe heatwave days. |
|  | This parameter is derived using the excess heat factor calculation, which is based on a combination of long term and shot term historical daily temperature values. If the result of the calculation is above the 85th percentile of historical calculations, a day is declared a severe heatwave day. For more information, please see the Methods Report, hosted at <https://frontiersi.com.au/ausenhealth-digital-twin/>. |
| EHFAvg | Average non-zero excess heat factor values. |
|  | This parameter is derived using the excess heat factor calculation, which is based on a combination of long term and shot term historical daily temperature values. All positive excess heat factor days are averaged to produce this result to indicate the how significant heatwaves were in a given region. For more information, please see the Methods Report, hosted at <https://frontiersi.com.au/ausenhealth-digital-twin/>. |
| rSpat\_EHFAvg | Spatially ranked average non-zero excess heat factor values. |
|  | This parameter is derived from average non-zero excess heat factor values by comparing each region’s average to the rest of Australia at a given time. A region value of 0 means that region had the least extreme heatwaves on average across Australia at a given time. Likewise, a region value of 1 means that region had the most extreme heatwaves on average across Australia at a given time. |
| cSpat\_EHFAvg | Categorical representation of spatially ranked average non-zero excess heat factor values. |
|  | This parameter derived by splitting percentiles into ascending quintiles. A value of 1 represents the bottom 20 percent, and a value of 5 represents the top 20 percent. |
| rHist\_tColdAvg | Historically ranked average temperature, with cold high (%). Otherwise referred to as cold high percent. |
|  | This parameter is derived from average temperature by comparing each region to its own historical values. A region value of 0 means that region is the hottest in its history. Likewise, a region value of 1 means that region is the coldest in its history. |
| rSpat\_rHist\_tColdAvg | Spatially ranked historical temperature percentiles, with cold high (%). |
|  | This parameter is derived from historically ranked average temperature by comparing each region’s historical percentile to the rest of Australia at a given time. A region value of 0 means that region is the least extreme historical cold across Australia at a given time. Likewise, a region value of 1 means that region is the most extreme historical cold across Australia at a given time. |
| cSpat\_rHist\_tColdAvg | Categorical representation of spatially ranked historical temperature percentiles, with cold high. |
|  | This parameter derived by splitting percentiles into ascending quintiles. A value of 1 represents the bottom 20 percent, and a value of 5 represents the top 20 percent. |
| nAtRisk\_tCold | The number of “at risk” temperature days. |
|  | The parameter is derived using historically ranked average temperature percentiles by recording the number of days in the given temporal resolution in which temperature less than the 15th historical percentile. |
| nHighRisk\_tCold | The number of “high risk” temperature days. |
|  | The parameter is derived using historically ranked average temperature percentiles by recording the number of days in the given temporal resolution in which temperature is less than the 5th historical percentile. |
| rHist\_tCold | Summed historically ranked daily temperature, with cold high. |
|  | This parameter is derived from by comparing each region to its own historical values each day in a given temporal resolution and summing the result. This parameter is an improvement on rHist\_tColdAvg, as it captures variation in historical cold. However, as the result is a sum of percentiles, the result it not easy to interpret. |
| rSpat\_rHist\_tCold | Spatially ranked summed historical temperature percentiles, with cold high (%). |
|  | This parameter is derived from summed historically ranked daily temperature by comparing each region’s summed historical percentiles to the rest of Australia at a given time. A region value of 0 means that region is the least extreme historical cold across Australia at a given time. Likewise, a region value of 1 means that region is the most extreme historical cold across Australia at a given time. |
| cSpat\_rHist\_tCold | Categorical representation of spatially ranked summed historical temperature percentiles, with cold high. |
|  | This parameter derived by splitting percentiles into ascending quintiles. A value of 1 represents the bottom 20 percent, and a value of 5 represents the top 20 percent. |
| nHW\_ECF | Number of coldwave days. |
|  | This parameter is derived using the excess cold factor calculation, which is based on a combination of long term and shot term historical daily temperature values. If the result of the calculation is above 0, a day is declared a coldwave day. For more information, please see the Methods Report, hosted at <https://frontiersi.com.au/ausenhealth-digital-twin/>. |
| nSHW\_ECF | Number of severe heatwave days. |
|  | This parameter is derived using the excess cold factor calculation, which is based on a combination of long term and shot term historical daily temperature values. If the result of the calculation is above the 85th percentile of historical calculations, a day is declared a severe coldwave day. For more information, please see the Methods Report, hosted at <https://frontiersi.com.au/ausenhealth-digital-twin/>. |
| ECFAvg | Average non-zero excess heat factor values. |
|  | This parameter is derived using the excess cold factor calculation, which is based on a combination of long term and shot term historical daily temperature values. All positive excess cold factor days are averaged to produce this result to indicate the how significant coldwaves were in a given region. For more information, please see the Methods Report, hosted at <https://frontiersi.com.au/ausenhealth-digital-twin/>. |
| rSpat\_ECFAvg | Spatially ranked average non-zero excess cold factor values. |
|  | This parameter is derived from average non-zero excess cold factor values by comparing each region’s average to the rest of Australia at a given time. A region value of 0 means that region had the least extreme coldwaves on average across Australia at a given time. Likewise, a region value of 1 means that region had the most extreme coldwaves on average across Australia at a given time. |
| cSpat\_ECFAvg | Categorical representation of spatially ranked average non-zero excess cold factor values. |
|  | This parameter derived by splitting percentiles into ascending quintiles. A value of 1 represents the bottom 20 percent, and a value of 5 represents the top 20 percent. |

## Air Quality

Parameters Specific to Air Pollution

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| **Parameter** | **Description and Derivation** |
| AvgCO | Average carbon monoxide (µg/m3). |
|  | This parameter is derived from daily gridded carbon monoxide estimates from Copernicus Atmosphere Monitoring Service (CAMS) global reanalysis dataset. Gridded data has been aggregated to selected spatial geographies and averaged over selected temporal resolutions. |
| rHistSpat\_AvgCO | Combined spatial and historical percentile ranking of average carbon monoxide (AvgCO). |
|  | This parameter is derived from average pollutant values, specifically by comparing a region’s pollutant level at a given time to the full set of spatial and historical pollutant data. A region value of 0 means that region has the lowest pollutant value across Australia at any time. Likewise, a region value of 1 means that region had the highest pollutant value across Australia at any time. |
| cHistSpat\_AvgCO | Categorical representation of combined spatial and historical percentile ranking of average carbon monoxide (AvgCO). |
|  | This parameter derived by splitting percentiles into ascending quintiles. A value of 1 represents the bottom 20 percent of all spatial and historical data, and a value of 5 represents the top 20 percent. |
| rSpat\_AvgCO | Spatially ranked average carbon monoxide. |
|  | This parameter is derived from the related air pollutant values by comparing each region’s average to the rest of Australia at a given time. A region value of 0 means that region had the lowest pollutant concentration on average across Australia at a given time. Likewise, a region value of 1 means that region had the highest pollutant concentration on average across Australia at a given time. |
| cSpat\_AvgCO | Categorical representation of spatially ranked average carbon monoxide values. |
|  | This parameter derived by splitting percentiles into ascending quintiles. A value of 1 represents the bottom 20 percent, and a value of 5 represents the top 20 percent. |
| NOT1\_AvgCO | Number of days average carbon monoxide exceeded the overall average. Otherwise referred to as number over threshold 1 (NOT1). |
|  | The parameter is derived using the averaged related air pollutant concentration by recording the number of days in the given temporal resolution in which the pollutant exceeds the overall average (50th percentile). |
| NOT2\_AvgCO | Number of days average carbon monoxide exceeded the 85th percentile of all data. Otherwise referred to as number over threshold 2 (NOT2). |
|  | The parameter is derived using the averaged related air pollutant concentration by recording the number of days in the given temporal resolution in which the pollutant exceeds the 85th percentile of all available data. |
| AvgO3 | Average ozone (µg/m3). |
|  | This parameter is derived from daily gridded carbon monoxide estimates from Copernicus Atmosphere Monitoring Service (CAMS) global reanalysis dataset. Gridded data has been aggregated to selected spatial geographies and averaged over selected temporal resolutions. |
| rHistSpat\_AvgO3 | Combined spatial and historical percentile ranking of average ozone (AvgCO). |
|  | This parameter is derived from average pollutant values, specifically by comparing a region’s pollutant level at a given time to the full set of spatial and historical pollutant data. A region value of 0 means that region has the lowest pollutant value across Australia at any time. Likewise, a region value of 1 means that region had the highest pollutant value across Australia at any time. |
| cHistSpat\_AvgO3 | Categorical representation of combined spatial and historical percentile ranking of average ozone (AvgCO). |
|  | This parameter derived by splitting percentiles into ascending quintiles. A value of 1 represents the bottom 20 percent of all spatial and historical data, and a value of 5 represents the top 20 percent. |
| rSpat\_AvgO3 | Spatially ranked average ozone. |
|  | This parameter is derived from the related air pollutant values by comparing each region’s average to the rest of Australia at a given time. A region value of 0 means that region had the lowest pollutant concentration on average across Australia at a given time. Likewise, a region value of 1 means that region had the highest pollutant concentration on average across Australia at a given time. |
| cSpat\_AvgO3 | Categorical representation of spatially ranked average ozone values. |
|  | This parameter derived by splitting percentiles into ascending quintiles. A value of 1 represents the bottom 20 percent, and a value of 5 represents the top 20 percent. |
| NOT1\_AvgO3 | Number of days average ozone exceeded the overall average. Otherwise referred to as number over threshold 1 (NOT1). |
|  | The parameter is derived using the averaged related air pollutant concentration by recording the number of days in the given temporal resolution in which the pollutant exceeds the overall average (50th percentile). |
| NOT2\_AvgO3 | Number of days average ozone exceeded the 85th percentile of all data. Otherwise referred to as number over threshold 2 (NOT2). |
|  | The parameter is derived using the averaged related air pollutant concentration by recording the number of days in the given temporal resolution in which the pollutant exceeds the 85th percentile of all available data. |
| AvgNO2 | Average nitrogen dioxide (µg/m3). |
|  | This parameter is derived from daily gridded carbon monoxide estimates from Copernicus Atmosphere Monitoring Service (CAMS) global reanalysis dataset. Gridded data has been aggregated to selected spatial geographies and averaged over selected temporal resolutions. |
| rHistSpat\_AvgNO2 | Combined spatial and historical percentile ranking of average nitrogen dioxide (AvgCO). |
|  | This parameter is derived from average pollutant values, specifically by comparing a region’s pollutant level at a given time to the full set of spatial and historical pollutant data. A region value of 0 means that region has the lowest pollutant value across Australia at any time. Likewise, a region value of 1 means that region had the highest pollutant value across Australia at any time. |
| cHistSpat\_AvgNO2 | Categorical representation of combined spatial and historical percentile ranking of average nitrogen dioxide (AvgCO). |
|  | This parameter derived by splitting percentiles into ascending quintiles. A value of 1 represents the bottom 20 percent of all spatial and historical data, and a value of 5 represents the top 20 percent. |
| rSpat\_AvgNO2 | Spatially ranked average nitrogen dioxide. |
|  | This parameter is derived from the related air pollutant values by comparing each region’s average to the rest of Australia at a given time. A region value of 0 means that region had the lowest pollutant concentration on average across Australia at a given time. Likewise, a region value of 1 means that region had the highest pollutant concentration on average across Australia at a given time. |
| cSpat\_AvgNO2 | Categorical representation of spatially ranked average nitrogen dioxide values. |
|  | This parameter derived by splitting percentiles into ascending quintiles. A value of 1 represents the bottom 20 percent, and a value of 5 represents the top 20 percent. |
| NOT1\_AvgNO2 | Number of days average nitrogen dioxide exceeded the overall average. Otherwise referred to as number over threshold 1 (NOT1). |
|  | The parameter is derived using the averaged related air pollutant concentration by recording the number of days in the given temporal resolution in which the pollutant exceeds the overall average (50th percentile). |
| NOT2\_AvgNO2 | Number of days average nitrogen dioxide exceeded the 85th percentile of all data. Otherwise referred to as number over threshold 2 (NOT2). |
|  | The parameter is derived using the averaged related air pollutant concentration by recording the number of days in the given temporal resolution in which the pollutant exceeds the 85th percentile of all available data. |
| AvgNO | Average nitrogen monoxide (µg/m3). |
|  | This parameter is derived from daily gridded carbon monoxide estimates from Copernicus Atmosphere Monitoring Service (CAMS) global reanalysis dataset. Gridded data has been aggregated to selected spatial geographies and averaged over selected temporal resolutions. |
| rHistSpat\_AvgNO | Combined spatial and historical percentile ranking of average nitrogen monoxide (AvgCO). |
|  | This parameter is derived from average pollutant values, specifically by comparing a region’s pollutant level at a given time to the full set of spatial and historical pollutant data. A region value of 0 means that region has the lowest pollutant value across Australia at any time. Likewise, a region value of 1 means that region had the highest pollutant value across Australia at any time. |
| cHistSpat\_AvgNO | Categorical representation of combined spatial and historical percentile ranking of average nitrogen monoxide (AvgCO). |
|  | This parameter derived by splitting percentiles into ascending quintiles. A value of 1 represents the bottom 20 percent of all spatial and historical data, and a value of 5 represents the top 20 percent. |
| rSpat\_AvgNO | Spatially ranked average nitrogen monoxide. |
|  | This parameter is derived from the related air pollutant values by comparing each region’s average to the rest of Australia at a given time. A region value of 0 means that region had the lowest pollutant concentration on average across Australia at a given time. Likewise, a region value of 1 means that region had the highest pollutant concentration on average across Australia at a given time. |
| cSpat\_AvgNO | Categorical representation of spatially ranked average nitrogen monoxide values. |
|  | This parameter derived by splitting percentiles into ascending quintiles. A value of 1 represents the bottom 20 percent, and a value of 5 represents the top 20 percent. |
| NOT1\_AvgNO | Number of days average nitrogen monoxide exceeded the overall average. Otherwise referred to as number over threshold 1 (NOT1). |
|  | The parameter is derived using the averaged related air pollutant concentration by recording the number of days in the given temporal resolution in which the pollutant exceeds the overall average (50th percentile). |
| NOT2\_AvgNO | Number of days average nitrogen monoxide exceeded the 85th percentile of all data. Otherwise referred to as number over threshold 2 (NOT2). |
|  | The parameter is derived using the averaged related air pollutant concentration by recording the number of days in the given temporal resolution in which the pollutant exceeds the 85th percentile of all available data. |
| AvgPM1 | Average particulate matter (<1μm) (µg/m3). |
|  | This parameter is derived from daily gridded carbon monoxide estimates from Copernicus Atmosphere Monitoring Service (CAMS) global reanalysis dataset. Gridded data has been aggregated to selected spatial geographies and averaged over selected temporal resolutions. |
| rHistSpat\_AvgPM1 | Combined spatial and historical percentile ranking of average particulate matter (<1μm) (AvgCO). |
|  | This parameter is derived from average pollutant values, specifically by comparing a region’s pollutant level at a given time to the full set of spatial and historical pollutant data. A region value of 0 means that region has the lowest pollutant value across Australia at any time. Likewise, a region value of 1 means that region had the highest pollutant value across Australia at any time. |
| cHistSpat\_AvgPM1 | Categorical representation of combined spatial and historical percentile ranking of average particulate matter (<1μm) (AvgCO). |
|  | This parameter derived by splitting percentiles into ascending quintiles. A value of 1 represents the bottom 20 percent of all spatial and historical data, and a value of 5 represents the top 20 percent. |
| rSpat\_AvgPM1 | Spatially ranked average particulate matter (<1μm). |
|  | This parameter is derived from the related air pollutant values by comparing each region’s average to the rest of Australia at a given time. A region value of 0 means that region had the lowest pollutant concentration on average across Australia at a given time. Likewise, a region value of 1 means that region had the highest pollutant concentration on average across Australia at a given time. |
| cSpat\_AvgPM1 | Categorical representation of spatially ranked average particulate matter (<1μm) values. |
|  | This parameter derived by splitting percentiles into ascending quintiles. A value of 1 represents the bottom 20 percent, and a value of 5 represents the top 20 percent. |
| NOT1\_AvgPM1 | Number of days average particulate matter (<1μm) exceeded the overall average. Otherwise referred to as number over threshold 1 (NOT1). |
|  | The parameter is derived using the averaged related air pollutant concentration by recording the number of days in the given temporal resolution in which the pollutant exceeds the overall average (50th percentile). |
| NOT2\_AvgPM1 | Number of days average particulate matter (<1μm) exceeded the 85th percentile of all data. Otherwise referred to as number over threshold 2 (NOT2). |
|  | The parameter is derived using the averaged related air pollutant concentration by recording the number of days in the given temporal resolution in which the pollutant exceeds the 85th percentile of all available data. |
| AvgPM10 | Average particulate matter (<10μm) (µg/m3). |
|  | This parameter is derived from daily gridded carbon monoxide estimates from Copernicus Atmosphere Monitoring Service (CAMS) global reanalysis dataset. Gridded data has been aggregated to selected spatial geographies and averaged over selected temporal resolutions. |
| rHistSpat\_AvgPM10 | Combined spatial and historical percentile ranking of average particulate matter (<10μm) (AvgCO). |
|  | This parameter is derived from average pollutant values, specifically by comparing a region’s pollutant level at a given time to the full set of spatial and historical pollutant data. A region value of 0 means that region has the lowest pollutant value across Australia at any time. Likewise, a region value of 1 means that region had the highest pollutant value across Australia at any time. |
| cHistSpat\_AvgPM10 | Categorical representation of combined spatial and historical percentile ranking of average particulate matter (<10μm) (AvgCO). |
|  | This parameter derived by splitting percentiles into ascending quintiles. A value of 1 represents the bottom 20 percent of all spatial and historical data, and a value of 5 represents the top 20 percent. |
| rSpat\_AvgPM10 | Spatially ranked average particulate matter (<10μm). |
|  | This parameter is derived from the related air pollutant values by comparing each region’s average to the rest of Australia at a given time. A region value of 0 means that region had the lowest pollutant concentration on average across Australia at a given time. Likewise, a region value of 1 means that region had the highest pollutant concentration on average across Australia at a given time. |
| cSpat\_AvgPM10 | Categorical representation of spatially ranked average particulate matter (<10μm) values. |
|  | This parameter derived by splitting percentiles into ascending quintiles. A value of 1 represents the bottom 20 percent, and a value of 5 represents the top 20 percent. |
| NOT1\_AvgPM10 | Number of days average particulate matter (<10μm) exceeded the overall average. Otherwise referred to as number over threshold 1 (NOT1). |
|  | The parameter is derived using the averaged related air pollutant concentration by recording the number of days in the given temporal resolution in which the pollutant exceeds the overall average (50th percentile). |
| NOT2\_AvgPM10 | Number of days average particulate matter (<10μm) exceeded the 85th percentile of all data. Otherwise referred to as number over threshold 2 (NOT2). |
|  | The parameter is derived using the averaged related air pollutant concentration by recording the number of days in the given temporal resolution in which the pollutant exceeds the 85th percentile of all available data. |
| AvgPM2.5 | Average particulate matter (<2.5μm) (µg/m3). |
|  | This parameter is derived from daily gridded carbon monoxide estimates from Copernicus Atmosphere Monitoring Service (CAMS) global reanalysis dataset. Gridded data has been aggregated to selected spatial geographies and averaged over selected temporal resolutions. |
| rHistSpat\_AvgPM2.5 | Combined spatial and historical percentile ranking of average particulate matter (<2.5μm) (AvgCO). |
|  | This parameter is derived from average pollutant values, specifically by comparing a region’s pollutant level at a given time to the full set of spatial and historical pollutant data. A region value of 0 means that region has the lowest pollutant value across Australia at any time. Likewise, a region value of 1 means that region had the highest pollutant value across Australia at any time. |
| cHistSpat\_AvgPM2.5 | Categorical representation of combined spatial and historical percentile ranking of average particulate matter (<2.5μm) (AvgCO). |
|  | This parameter derived by splitting percentiles into ascending quintiles. A value of 1 represents the bottom 20 percent of all spatial and historical data, and a value of 5 represents the top 20 percent. |
| rSpat\_AvgPM2.5 | Spatially ranked average particulate matter (<2.5μm). |
|  | This parameter is derived from the related air pollutant values by comparing each region’s average to the rest of Australia at a given time. A region value of 0 means that region had the lowest pollutant concentration on average across Australia at a given time. Likewise, a region value of 1 means that region had the highest pollutant concentration on average across Australia at a given time. |
| cSpat\_AvgPM2.5 | Categorical representation of spatially ranked average particulate matter (<2.5μm) values. |
|  | This parameter derived by splitting percentiles into ascending quintiles. A value of 1 represents the bottom 20 percent, and a value of 5 represents the top 20 percent. |
| NOT1\_AvgPM2.5 | Number of days average particulate matter (<2.5μm) exceeded the overall average. Otherwise referred to as number over threshold 1 (NOT1). |
|  | The parameter is derived using the averaged related air pollutant concentration by recording the number of days in the given temporal resolution in which the pollutant exceeds the overall average (50th percentile). |
| NOT2\_AvgPM2.5 | Number of days average particulate matter (<2.5μm) exceeded the 85th percentile of all data. Otherwise referred to as number over threshold 2 (NOT2). |
|  | The parameter is derived using the averaged related air pollutant concentration by recording the number of days in the given temporal resolution in which the pollutant exceeds the 85th percentile of all available data. |
| AvgSO2 | Average sulphur dioxide (µg/m3). |
|  | This parameter is derived from daily gridded carbon monoxide estimates from Copernicus Atmosphere Monitoring Service (CAMS) global reanalysis dataset. Gridded data has been aggregated to selected spatial geographies and averaged over selected temporal resolutions. |
| rHistSpat\_AvgSO2 | Combined spatial and historical percentile ranking of average sulphur dioxide (AvgCO). |
|  | This parameter is derived from average pollutant values, specifically by comparing a region’s pollutant level at a given time to the full set of spatial and historical pollutant data. A region value of 0 means that region has the lowest pollutant value across Australia at any time. Likewise, a region value of 1 means that region had the highest pollutant value across Australia at any time. |
| cHistSpat\_AvgSO2 | Categorical representation of combined spatial and historical percentile ranking of average sulphur dioxide (AvgCO). |
|  | This parameter derived by splitting percentiles into ascending quintiles. A value of 1 represents the bottom 20 percent of all spatial and historical data, and a value of 5 represents the top 20 percent. |
| rSpat\_AvgSO2 | Spatially ranked average sulphur dioxide. |
|  | This parameter is derived from the related air pollutant values by comparing each region’s average to the rest of Australia at a given time. A region value of 0 means that region had the lowest pollutant concentration on average across Australia at a given time. Likewise, a region value of 1 means that region had the highest pollutant concentration on average across Australia at a given time. |
| cSpat\_AvgSO2 | Categorical representation of spatially ranked average sulphur dioxide values. |
|  | This parameter derived by splitting percentiles into ascending quintiles. A value of 1 represents the bottom 20 percent, and a value of 5 represents the top 20 percent. |
| NOT1\_AvgSO2 | Number of days average sulphur dioxide exceeded the overall average. Otherwise referred to as number over threshold 1 (NOT1). |
|  | The parameter is derived using the averaged related air pollutant concentration by recording the number of days in the given temporal resolution in which the pollutant exceeds the overall average (50th percentile). |
| NOT2\_AvgSO2 | Number of days average sulphur dioxide exceeded the 85th percentile of all data. Otherwise referred to as number over threshold 2 (NOT2). |
|  | The parameter is derived using the averaged related air pollutant concentration by recording the number of days in the given temporal resolution in which the pollutant exceeds the 85th percentile of all available data. |

## Common

Parameters Utilised in Both Climate and Air Quality Adaptive Capacity Sub-Indices

*There are no parameters common to both climate and air quality exposure sub-indices.*

## Spatial Ranking

Methodology Applied to all Spatially Ranked Parameters

A number of parameters are converted to spatially ranked percentiles for use in the creation of overall vulnerability indices. As this method is frequently applied, a small summary of the method is given below.

Spatially ranked percentiles are created in AusEnHealth by taking national data for a parameter at a specific time, and using Rstudio’s frank function to produce, in ascending order, indexed spatial ranks. Arguments are selected in the frank function to continue recording missing values (na.last = "keep"), and to set ties as the minimum rank of the set of tied values (ties.method = c("min")). The result is then divided by the number of regions to produce a percentile ranking, which provides a consistent scale from 0 to 1 for index creation.

A spatial percentile represents how high or low that parameter is compared to the rest of Australia at that time. For example, if a region’s temperature spatial percentile is 1 in January 2011, that means that region is the hottest in Australia for the month of January 2011.

## Historical Ranking

Methodology Applied to all Historically Ranked Parameters

A number of parameters are converted to historically ranked percentiles for use in the creation of overall vulnerability indices. As this method is frequently applied, a small summary of the method is given below.

Historically ranked percentiles are created in AusEnHealth by taking each region’s data for a parameter over that parameter’s temporal extent, and using Rstudio’s frank function to produce, in ascending order, indexed historical ranks. Arguments are selected in the frank function to continue recording missing values (na.last = "keep"), and to set ties as the minimum rank of the set of tied values (ties.method = c("min")). The result is then divided by the number of regions to produce a percentile ranking, which provides a consistent scale from 0 to 1 for index creation.

At any given time, a region’s percentile represents how high or low that parameter is compared to the region’s history. For example, if a region’s historical temperature percentile is 1 in January 2011, that means that region is the hottest it has ever been across all collected historical monthly data for that region.