**ARCADIA-IMPACT Model Overview**

**MORTALITY: Input data**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Name** | **Size** | **description** |
|  | Pre-calculated and saved in: heat\_impact\_data.mat | | |
| 1 | Mortality\_Threshold\_RR | [nGridCells, 9] | Data on mortality thresholds and Relative Risk for each GOR, linked to underlying grid Column 1 and 2: Lon and Lat of grid cell  Column 3: NUTS1/GOR name index 1-13 (Inc. RoI) (see GOR\_names)  Column 4: Threshold TMean above which heat related mortality will occur by GOR. Source: Vardoulakis et al., (2014) and Hajat et al., (2014)  Column 5-9: Exposure-Risk relationship (% change in mortality for each 1degeeC increase in Mean Temp above the Mortality Threshold for all ages and by age group (see Age\_group for description). Source: Vardoulakis et al., (2014) and Hajat et al., (2014)).  \*\*Nb. Column order of gridcells (lon, lat) is the same for Mortality\_Thresholds\_RR, dailyDeatRate and Population. |
| 2 | dailyDeathRate | [nGridCells, 7] | Estimated externally - Gridded data on the daily death rate per day (2011). For all ages and per age group. Estimated:   1. Unitary Authority (UA) shapefile UK Data Service, 2011 Census boundaries[[1]](#footnote-1) (match boundaries used by UK-SSPs) 2. Mortality per UA in 2011 ((ONS[[2]](#footnote-2) for England and Wales; NRScotland for Scotland[[3]](#footnote-3); NISRA[[4]](#footnote-4) for NI)   [nGridCells\* lon, lat, dailyDeathRate] |
| 3 | GOR\_names | [12,1] | 'East Midlands (England)'  'East of England'  'London'  'North East (England)'  'North West (England)'  'Northern Ireland'  'Republic of Ireland'  'Scotland'  'South East (England)'  'South West (England)'  'Wales'  'West Midlands (England)'  'Yorkshire and The Humber' |
| 4 | Population (per age group) | {nClimScen}  [nGridCells, 7] | Estimated externally – UK Population data (all ages) uses 2011 census-based UK gridded data (1km). Source: Reis, S. et al. (2017) https://doi.org/10.5285/0995e94d-6d42-40c1-8ed4-5090d82471e1  Gridded data from UK-SSPs SSP5 for future projections population (all ages)(1km).  Population data per age group was only available from the 2011 UK ONS census and UK-SSPs database at the Local Authority District (LAD) level (389 units). Used to estimate population per age group at 1km and 12km.  [nGridCells\* lon, lat, population all\_ages; 0-64; 65-74; 75-84; 85+]  nClimScen = 4 climate scenarios (BL, 2020s, 2030s, 2050s) |
|  | Population\_aggregate | [5,4] | For each climate scenario (columns)  gives the aggregate UK population and split by age groups (rows).  For Near Past data source as above. Data per LA from UK-SSPs SSP5 for future projections split per age group (demographics) gridded to 12km.  Used to calculate additional heat related deaths per 100,000 population for all ages and each age group. |
| 5 | Age\_group | [5,1] | Description of the age group classes used ['All'; '0-64'; '65-74'; '75-84'; '85+']. Based on Vardoulakis et al., (2014) and Hajat et al., (2014) |
|  | Read into model from local folder path… | | |
| 7 | ARCADIA\_land\_RCM\_raw\_past  ARCADIA\_land\_RCM\_raw\_1\_5C  ARCADIA\_land\_RCM\_raw\_2\_0C  ARCADIA\_land\_RCM\_raw\_3\_0C | {nGridCells}  (12, 14800) | .csv files of daily TMean (one per grid cell) from Bristol HEAT model, based on UKCP18 data. These are read in, saved and used for mortality calculations. Grid coordinates also extracted from file names to provide grid ID for mapping based on lat\_UK\_RCM.mat and long\_UK\_RCM.mat. |
| 8 | lat\_UK\_RCM.mat | [82,112] | From Bristol HEAT model, these are read in and provide latitude based on coordinate given in file names from 7 above. Saved in gridID. |
| 9 | long\_UK\_RCM.mat | [82,112] | Bristol HEAT model, these are read in and provide longitude based on coordinate given in file names from 7 above. Saved in gridID. |

**Model parameters**

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | daysPerYear | 360/365 | UKCP18 raw data has 360 days per year (30 days per month).  Bias corrected data has 365 day per year as it uses Gregorian calendar and includes leap years (removed in code to keep year length uniform). |
| 2 | adaptScen | 3 | Used to calculate results for hypothetical adaptation in the form of acclimatisation by adjusting MortalityThreshold. This defines three scenarios the user can currently test:  No Adaptation = 1;  Adaptation + = 2;  Adaptation ++ = 3  values are set in adaptIncrement |
| 3 | socioEcScen | 2 | Defines number of runs that have been set up to capture different socio-economic scenarios. Currently 2: Climate change only and climate change and socio-economic change in the form of changes in population. |

**User defined parameters that can be changed in model**

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | BiasCorrected | [0 or 1] | User can define whether to run raw or bias corrected data by selecting 0 (Raw) or 1 (Bias corrected). |
| 2 | adaptIncrement | [0,1,2] | User can define how MortalityThreshold will be adjusted to account for adaptation in the form of natural acclimatisation. The number of scenario options are set by adaptScen. The values for each scenario are set here, in this case no adaptation (no change), adjusting the mortality threshold by 1°C and adjusting the mortality threshold by 2°C. |
|  | impactMetric | [1,2….] | 1 = Runs Mortality calculations  2 = Runs Labour productivity calculations  Tbd -Add more and option to ‘run all’. |

**TBD: Add table for Labour productivity as above….**

**Input data**

1. Labour\_productivity\_ERFs
2. Labour\_productivity\_ERFs\_acc
3. Work Intensity

**User defined:**

1. Acclimatised [0 or 1]

1. [UK Data Service | Census Data (jisc.ac.uk)](https://www.statistics.digitalresources.jisc.ac.uk/dataset/2011-census-geography-boundaries-local-authorities/resource/c6844602-8ad2-466e-adbf) [↑](#footnote-ref-1)
2. [Deaths registered monthly in England and Wales - Office for National Statistics (ons.gov.uk)](https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/datasets/monthlyfiguresondeathsregisteredbyareaofusualresidence); [[ARCHIVED CONTENT] Release Edition Reference Tables - ONS (nationalarchives.gov.uk)](https://webarchive.nationalarchives.gov.uk/ukgwa/20150907083844/http:/www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-275375) – BY AGE [↑](#footnote-ref-2)
3. [Monthly Data on Births and Deaths Registered in Scotland | National Records of Scotland (nrscotland.gov.uk)](https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/vital-events/general-publications/weekly-and-monthly-data-on-births-and-deaths/monthly-data-on-births-and-deaths-registered-in-scotland); [Deaths Time Series Data | National Records of Scotland (nrscotland.gov.uk)](https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/vital-events/deaths/deaths-time-series-data) – BY AGE (groupings slightly different) [↑](#footnote-ref-3)
4. [Death Statistics | Northern Ireland Statistics and Research Agency (nisra.gov.uk)](https://www.nisra.gov.uk/publications/death-statistics) – Estimated breakdown in age based on figures by age for whole NI, then applied to council areas as no age specific regional data available. [↑](#footnote-ref-4)