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| **Use Case Name** | ***Heat wave health impacts #4 – Assessment of Heat Health Effects of Climate Change*** |
| **Sector** | *Health* |
| **Reference** | ***SEC-HEA-UCT-006*** |
| **Scope of decision-making** | Conduct research assessments and quantify the effects of Climate Change on heath, with a focus on temperatures, air pollution and urban climate. |
| **Actor** | **Name:** Dr. Clare Heaviside  **Name of organisation:** Public Health England  **Job title:** Principal Climate Change Scientist. Co-editor of the Health Effects of Climate Change in the UK 2012.  **Country:** United Kingdom |
| **ECV/CII** | Mostly atmospheric temperature at 2m (maximum and minimum daily temperature, temperature anomalies, temperatures above a threshold depending on climatology), dew point temperature at 2m. Such values are usually averaged for a running window of 2 or 3 days for heat and longer for cold effects (up to 28 days).  When asked which CII would she prioritise she says it is complicated and if looking at mortality as a health outcome, temperature is usually the best metric (daily mean or daily maximum) but having apparent temperature or other similar metrics pre-computed could be useful. Some of the CII for infrastructure (like indoor temperatures estimations) could also be useful for the health community. |
| **Data source** | Current: observations, reanalysis and climate projections. She does not consider to use seasonal forecast products in the future. |
| **Type of required product** | She mostly uses raw data, but she and her team would like very much to be able to use a cloud platform to interact with the data. In particular the possibility to have available tools like R to deal with other tools like python, CDOs, NetCDF files, etc, could be very beneficial for the health community. Visualisation tools 'GIS' style (combining environmental information and infrastructure information with Climate Data) could be also very beneficial. Many people in the health sector are not able to process and analyse raw data files. |
| **Application** | These reports and studies provide scientific evidence of the impacts of climate change on health. They help shape policies for mitigation and adaptation. Also, it help raise awareness and then help prevent the worst impacts by helping efforts to reduce carbon footprints at citizen, city and national level and protect the population from the impacts of climate change. |
| **Current sources** | Coupled Model Intercomparison Project and Inter-Sectoral Impact Model Inter-comparison Project derived datasets, MetOffice (HadAM3P), ECWMF (ERA-Interim), among other, UKCIP. Also Environmental data and Health data is needed from many disparate sources. |
| **Key characteristics of the climate information** | |
| **Timeliness** | Impacts on health at present conditions are computed and then projected into the future. Then, most up to date past data is important to have. |
| **Frequency of update** | Unimportant for this user. |
| **Horizontal spatial resolution** | At the present they use 25 km global from the UK Climate Impacts Programme data (UKCP09) projections, and use the 5 km gridded observations from the UK Met Office. It would be ideal to have data at 1 km. |
| **Horizontal Spatial coverage** | Some case studies for cities of London, and Birmingham, England, but usually across the UK split at regional level, sometimes Europe-wide and World-wide. |
| **Vertical spatial resolution** | Surface data, at 2 meters since the impacts are on health and population exposure.  Vertical information for the boundary layer may be used sometimes to couple with regional models for downscaling. |
| **Vertical spatial coverage** | Surface data. |
| **Temporal resolution** | Mostly daily and they also work with monthly data for Climate Projections. Having daily data would be also ideal in that case. Sub-daily data (6 hourly) would be necessary for boundary and initial conditions when coupled to the existing in-house urban heat island modelling using WRF for specific cities. |
| **Temporal coverage** | Past data must be combined with epidemiological data, so this limits the usability range. Ideally in the past, from present date 1, 10, up to 40 years in the past at most. In the future, the typical climate projection times. |
| **Normal flow of events -** *The typical flow of events from user request, to successfully obtaining the climate data, to using the data. Document the step-by-step chain of activities.* | |
| **Internal or external processing** | Some research is carried out in house (e.g. High resolution modelling of Urban climate using WRF). She also very closely collaborates (per example, co-directing PhD thesis) with several universities across England that could by doing parts of the work 'externally'. |
| **Details on data processing / manipulation** | Retrospective analysis using reanalysis and temperature anomalies are performed.  The relationship between temperature and mortality derived and then projected into the future using the climate information provided by Global Circulation Models, and sometimes a combination of those with regional model such WRF.  Results are comparison between current state and future state of variables like percentage of hot days, distribution of extremely hot days, estimated change in cumulative summer mortality among others.  A particular example can be found in Hajat, S., Vardoulakis, S., **Heaviside, C**. and Eggen, B. (2014) Climate change effects on human health: projections of temperature-related mortality for the UK during the 2020s, 2050s, and 2080s. *Journal of Epidemiology & Community Health.* **68** (7), 641-648. In this paper they look at heat and cold impacts on mortality for the UK for current and future projections using the HadRM3-PPE-UK model (which was the one which was used for the UKCP09 projections). They say that they just downloaded the entire netcdf file and extracted the dates/areas required. The past climate data was based on the met office MIDAS stations. |
| **Tools for data processing** | The raw data is generated with the Met Office Unified model, averaged up to the desired regional level and threshold combining two days ahead (heatwave definition). |
| **User requirements in relation to accessibility and visualisation** | |
| **Accessibility** | She would like to have her results (papers, reports) shared at the CDS. She may want as well that the CDS would share tools developed using the Cloud facilities and the data from the CDS. Sharing other data, like epidemiological/health data would be problematic. |
| **Visualisation capabilities required** | Being able to create maps combining various kinds of information (climate data, environmental and infrastructure data) together with the results would be very beneficial. It is important to be able to grid the data using specific shapefiles. She says 'GIS'-like plotting tools would be useful. R software as interface for using other tools available in the tool box at developer level (cloud level) would be very important to interact with the health community. This community is not in general versed in python or CDO (but of course research groups are). |
| **Quality requirements -** *What information do users require about the quality of climate information in order to use the climate information. Essentially ECMWF wants to know what is the minimum ‘quality’ that is required in order for the user to decide whether or not to use the dataset.* | |
| **Level of skilfulness** | She says she cannot reply properly about this. She comments that quality is assumed to be of good level when a dataset from a community (climate science in this case) is used by another community. |
| **Validation of data** | They trust that a correct validation is done by the data providers and would expect a source/reference for proof of validation (e.g. paper or report). Their own research goes through a validation processes by publishing in peer review papers. Proper validation is assumed to be done by the data provider. |
| **Meta data** | The same that for validation. |
| **Stability** | *-* |
| **Uncertainty representation** | When calculating health impacts using climate data, there are a number of sources of uncertainty, including within the data sources and the epidemiology, but also concerning the range of climate scenarios and time frames involved, and uncertainty in future demographics. Therefore these users tend to present uncertainty in estimation of impacts using the range in derived health coefficients, and they would normally choose a subset of climate data to give a further range of possible impacts. For example they might calculate impacts using 3 emissions scenarios (high, medium, low) or RCPs, or use 1 emission scenario but look at different future time periods. In the past they have used all the available variants of a climate model which are based on different physics option to get a range in our results. So they don’t combine all uncertainties into one value but look at the range of uncertainty of impacts for different sets of climate data. As in many sectors, uncertainty of health impacts is very difficult to communicate. |
| **26. Other** | - |