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For more information visit http://ecem.climate.copernicus.eu

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1. General

1.1 Description

Bias-adjusted datasets of precipitation (TP) have been constructed for three periods:

- Historical
- Seasonal Forecasts
- Climate Projections

Historical:
This dataset is based on the ERA-Interim Reanalysis. The precipitation bias adjustment is carried out by calibrating the parameters of the gamma distribution of ERA-Interim based on the E-OBS (http://eca.knmi.nl/download/ensembles/ensembles.php) dataset (version v12.0, 1979-2014) of gridded observed precipitation. Both the original (i.e. unadjusted) and the bias-adjusted datasets are available. Full discussion of the datasets used and the techniques is given in Jones et al. (2017) – see Section 3.2 Citations.

Seasonal Forecasts:
Various estimates of the skill of each seasonal forecast system are provided (currently correlations), along with eventually an example forecast. The skill assessments compare the hindcasts from each forecast system with the bias-adjusted historical data described above. (The country-averaging of the observational data is done slightly differently for comparison with the seasonal hindcasts, so the values reported will be marginally different to those shown when using the Historical data alone.) We are using data from three forecast systems that will be available from the C3S Climate Data Store for seasonal forecasts; currently we are using data from ECMWF System 4, the Met Office GloSea5-GC2 and Météo-France System 5 models. The seasonal forecasting data is described in more detail in the Seasonal Forecasting User Guidance Note (available through the Demonstrator).

Climate Projections:
Bias-adjusted climate projections have been provided by C3S CLIM4ENERGY (see http://clim4energy.climate.copernicus.eu/report-climate-projection-dataset and http://clim4energy.climate.copernicus.eu/sites/default/files/C4E_ClimateProjection4Energy_dataset_v4_summary.pdf) and processed by ECEM.

Processing by ECEM involved interpolation to a standard 0.5° latitude/longitude grid, and calculation of country and cluster averages. Projections are available for seven regional climate model (RCM)/global climate model (GCM) combinations (Table 1) and for two Representative Concentration Pathways (RCP4.5 and RCP8.5). Historical forcing is used from 1979-2005, and RCP forcing from 2006-2100.

1.2 Units

Millimetres (mm)
1.3 Links
Historical data on a standard 0.5° latitude/longitude grid, as well as country and cluster averages, are available from ftp://ecem.climate.copernicus.eu.

Bias-adjusted climate projection data on a standard 0.5° latitude/longitude grid will also be available from ftp://ecem.climate.copernicus.eu.

The original seasonal hindcast and forecast data will be available from the C3S Climate Data Store http://climate.copernicus.eu/climate-data-store.

1.4 Data format
Gridded Historical data are available from the ECEM ftp portal in netCDF format (see Section 1.3 above). For Historical and Climate Projections, national and cluster averages are available in csv format through the ECEM Demonstrator (and from the ECEM ftp portal).

For seasonal forecasting data, the country-scale data shown in the Demonstrator can be downloaded from the Demonstrator and will eventually be available from the ECEM ftp portal.

1.5 Keywords
Precipitation (TP):
Precipitation is measured using a rain gauge. The height of this gauge above the ground varies from country to country, and the design of the gauge itself may also vary. Where snowfall is a dominant fraction of the precipitation in the cold months (e.g. Russia) the gauge may be 1-3 metres above the ground and will be protected by circular hedges around it, to try to reduce wind speeds near the gauge so snowflakes can fall in. Despite these efforts, precipitation amounts during snowfall are considered to be less than they should be because of the effects of wind on the snowflakes. Numerous undercatch experiments have been undertaken and snowfall totals could be up to 50% too low.

1.6 Contact
Colin Harpham (c.harpham@uea.ac.uk), Phil Jones (p.jones@uea.ac.uk) and Alberto Troccoli (alberto.troccoli@wemcouncil.org) – for historical and climate projection datasets.

Philip Bett (philip.bett@metoffice.gov.uk) for seasonal forecasts.

2. Dataset Coverage
2.1 Geographic area
For the ECEM domain 27° N to 72° N by 22° W to 45° E.

2.2 Temporal resolution
Historical and Climate Projection data: daily, monthly, seasonal (DJF, MAM, JJA, SON) and annual. Anomalies with respect to 1981-2010 are also available (provided in both mm and %), together with long-term averages (for 1981-2010 and 2035-2064) - for all resolutions except daily.

The seasonal forecasting data is available as seasonal averages only.

2.3 Time period

Historical: 1979 to 2016

Seasonal forecasting data: The skill estimates are based on the time periods spanned by the hindcasts of each forecasting system separately. The ECMWF System 4 hindcasts cover 1981-2010, the Météo-France System 5 hindcasts cover 1993-2014, and the Met Office GloSea5 hindcasts cover 1993-2015.

Climate projections: 1979 to 2100 (with historical forcing to 2005, then RCP forcing)

2.4 Spatial resolution

Historical and Climate Projections: Half-degree grid boxes (0.5° by 0.5° latitude/longitude) for the ECEM domain. Data are also available as averages for 33 European countries and for 96 E-Highway 2050 Clusters (http://www.e-highway2050.eu/fileadmin/documents/Results/D2_2_European_cluster_model_of_the_Pan-European_transmission_grid_20072015.pdf).

Seasonal forecasting data is presented at the country scale only. The underlying forecast systems run at different resolutions: ECMWF System 4 and Météo-France System 5 are at approximately 80 km resolution, and the Met Office GloSea5 system is at approximately 60 km resolution. The data provided from C3S however had been regridded up to 1° resolution, for all three systems.

3. Usage

3.1 License conditions

According to the Copernicus Climate Change Service (C3S) conditions (see Copernicus Data Licence: http://climate.copernicus.eu/sites/default/files/repository/20170117_Copernicus_License_V1.0.pdf).

3.2 Citation(s)


Molteni, T. Stockdale, M. Balmaseda, G. Balsamo, R. Buizza, L. Ferranti, L. Magnusson,


4. Lineage statement

4.1 Original data source

The underlying historical gridded precipitation data come from the ERA-Interim Reanalysis (original resolution is daily and ~0.7° latitude/longitude). Various station and gridded observational datasets were used to bias adjust this reanalysis. The sources of these datasets are given in Jones et al. (2017).

ERA-Interim: https://www.ecmwf.int/en/research/climate-reanalysis/era-interim

The original seasonal hindcast and forecast data will be available from the C3S Climate Data Store http://climate.copernicus.eu/climate-data-store. See the Seasonal Forecasting User Guidance Note (available through the Demonstrator) for further details of the seasonal forecast models used.

The climate projection data come from CORDEX (http://www.cordex.org/) simulations bias adjusted by CLIM4ENERGY (Version 1 (beta-test)) – original resolution is daily, and ~0.11° latitude/longitude (~12 kms).

C3S CLIM4ENERGY projections: http://clim4energy.climate.copernicus.eu/access-products

Also available from the C3S ESGF node: https://esgf-node.ipsl.upmc.fr/search/c3s-energy/ (select CORDEX-adjust as the Project, bias-adjusted-output as the Product, and CDFT22-WFDEI as the Bias adjustment (see the CLIM4ENERGY documents for the other parameters to be selected).

4.2 Tools used in the production of indicators/dataset

Various widely-used statistical tools developed during the bias adjustment of climate projections and reanalyses have been used. These are discussed in Jones et al. (2017) – see Section 3.2 Citations.
Seasonal forecasting data was processed using standard open source python libraries, including numpy, scipy, matplotlib, and the SciTools packages iris and cartopy, originally developed at the Met Office.

5. Data quality

The quality of the historical data has been assessed in the ECEM Milestone 2.1.1 (please contact the ECEM team for a copy of this report). This assessment was undertaken using (1) the difference between the original ERA-Interim and the bias-adjusted ERA-Interim based on the 1979-2014 period and (2) the standard deviation (SD) of the differences over the 36 years divided by the standard deviation of the bias-adjusted values. The second metric indicates that for the majority of the region covered by the data, the SD of the differences was less than 30% of the SD of the bias-adjusted values.

The seasonal forecasting data currently included in the Demonstrator consists of correlations which provide a measure of the current skill of each system. ECEM Deliverable D2.2.1 discusses these skill measures and the system skill in more detail (please contact the ECEM team for a copy of this report).

The standard climate projection plots provided in the Demonstrator include the ensemble mean, as well as individual climate models and the smoothed maximum-minimum range as a measure of inter-model uncertainty. By default, to provide an indication of model performance for the historical period, the WFDEI data used to bias adjust the climate model data are plotted together with the adjusted reanalysis data. Further details are provided in ECEM Deliverable D2.4.1 (please contact the ECEM team for a copy of this report) and Clim4Energy Deliverable D6.1 (http://clim4energy.climate.copernicus.eu/report-climate-projection-dataset).
<table>
<thead>
<tr>
<th>7-member sub-ensemble names used by CLIM4ENERGY (GCM and RCM)</th>
<th>4-letter code used in ECEM filename (RCM+GCM)</th>
<th>Code used in ECEM Demonstrator menu (RCM/GCM)</th>
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<td>RCMO</td>
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<td>RCIC</td>
<td>RCM 7 (RCA4/EC-Earth)</td>
</tr>
</tbody>
</table>

Table 1: RCM and GCM combinations for climate projections
List of available ECEM Variable Fact Sheets (VFS)

**Climate variables:**

C01  Air temperature (TA)
C02  Precipitation (TP)
C03  Relative humidity (RH)
C04  Wind speed (WS)
C05  Radiation (GHI)
C06  Mean sea level pressure (PSL)
C07  Snow depth (SD)

**Energy variables:**

E01  Energy demand
E02  Hydropower generation
E03  Solar power generation
E04  Wind power generation