EU-CIRCLE

A pan-European framework for strengthening Critical Infrastructure resilience to climate change

D2.2 Report on Climate related hazards information collection mechanisms

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Statement

This deliverable defines existing databases of climate hazard information sources, either primary or through user defined modules, and recognises data accessibility, considering data access policy issues, for the purpose of the EU-CIRCLE project. It is joined contribution of Task 2.3 Climatic hazard related information collection and processing tools [Lead NCSRD] from the WP2 - Climatic Data Capture and Processing [Lead NCSRD].

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Preparation Slip			
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V0.2	24/03/2017	Suggested databases, table of climate/access policies issues information.	Nadia Politi (NCSRD)
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Executive Summary

Deliverable D2.2 is associated with Task 2.3 *Climatic hazard related information collection and processing tools* that includes the definition of existing sources of climate hazard information sources, either primary or through user defined modules, and recognise its access policies. The metadata processing of the data will pave the way for subsequent processing of the actual data in order to match any envisaged scenario, subject to data specific constraints. This work primarily required the investigation and listing of relevant climate related databases, meteorological services, weather forecasting models over Europe (focusing on the location of the project case studies) according their potential suitability, data availability, their accessibility (access policy of the data), as well as the limitations in being utilized.

For each database, datasets suitability should be based on:

- Data quality, Quality Control activities.
- Data accuracy, data evaluation and comparison exercises.
- Data availability, considering the time period, coverage and operational scenario of each mission, the performance of data production and the effects of changes over time in the way the measurements were made.
- Data accessibility, considering data access policy issues.
- Data provenance, considering the origin, evolution and status of the algorithms and processes applied to the data.
- Quantitative error/uncertainty derived through error modeling.

For the description of data availability and the access policy of the data, it was mandatory to construct a specific Report - Table in order to gather all the necessary and useful type of information that provides each database for the user. Each table associated with the corresponding database will serve as a report tool where the user can run through, in order to get basic information about the data collection mechanisms. This table uses four classifications from which, each one is divided in sub-categories. These classifications are: data location, data access and terms of use, data information and technical description of the data.
The objective of this deliverable is to perform an assessment of the status and efficiency of all the available climate information that could contribute to assessing the climate related hazards on the operation of CIRP.

Contents

1 Introduction

The exchange of meteorological and other environmental data and climate information of the most important organisations, were presented in detail on the deliverable 2.1 “Report on Typology of Climate Related Hazards”.

Data are available from the download page of each climate database/agency/organisation and are provided according to terms and conditions stated. These terms specify the access policies of the data that may include registration or not, free open access or with charging and limitations according to the purposes of use them.

The majority of these organisations facilitate free and unrestricted data, like World Meteorological Organisation (WMO), European Environmental Agency (EEA) and European Centre for Medium Range Weather Forecast (ECMWF). The Copernicus programme provides users with free, full and open access to environmental data. No registration is required for discovery and view services while registration free of charge is a prerequisite to download Sentinel and other data. For the Emergency Management service, data production can be requested only by "authorized users" while the maps produced by the service are available on the service web portal and can be downloaded without registering. The catalogue is available in interactive format and in pdf. In HadEX data are available from the download page without charge for the purposes of private study and scientific research, according to terms and conditions of the organisation of the Met Office Hadley Centre. Several climate databases provide visualization and data handling software, web interface and application programs developed for data access to data archived (WEB-API) or encoding and decoding formats (like GRIP-API for GRIB editions.)

Each organisation service stores its data in a predefined data format over the area of interest typically a domain of the model integration, typically in GRIB and NetCDF. For point based data, many other formats are available (.csv, xml, ascii).

It is obvious that each Database follows a specific framework for providing climate information, depending on terms of use data, data access policy, type of available data, web interface and other characteristics. It was deemed necessary to make a Table-Report with the description of the aforementioned classifications for each climate source in order to know exactly how we have to proceed to download all the requested climate related data, based on the location of the project’s case studies.

2 Methodology

The methodology of this deliverable is associated to the objective of this deliverable, which is to perform an assessment of the status and efficiency of all the available climate information that could contribute to assessing the climate related hazards on the operation of CI. This work, primarily associated with *Task 2.1 Overview of existing climate information and metadata,* required the investigation and listing of all climate related databases, meteorological services, weather forecasting models over Europe (focusing on the location of the project case studies), and it's already linked to Deliverable 2.1 "Report on Typology of Climate Related Hazards".

The following steps of this analysis, associated with *Task 2.3 Climatic hazard related information collection and processing tools*, based on the type of information of EU-CIRCLE case studies, introduce the need to classify the aforementioned climate data provided from each Database, Service, Organisation or Project, on a detailed Table, according to their potential suitability, data availability, their accessibility (access policy of the data), as well as the limitations in being utilized.

For each database, datasets suitability should be based on:

- Data quality, Quality Control activities.
- Data accuracy, data evaluation and comparison exercises.
- Data availability, considering the time period, coverage and operational scenario of each mission, the performance of data production and the effects of changes over time in the way the measurements were made.
- Data accessibility, considering data access policy issues.
- Data provenance, considering the origin, evolution and status of the algorithms and processes applied to the data.
- Quantitative error/uncertainty derived through error modeling.

We had to make an overview of the selected climate related databases and complete the table with the requested fields where the particular information was explicit and available. The description of how this table is constructed and the type of information completed in for each field that includes is explained in the following chapter.

3 Introduction for the creation of Report-Table

For the description of data availability and the access policy of the data, it was mandatory to construct an analytical Table in order to gather all the necessary and useful type of climate information that provides each database for the user. Each table associated with the corresponding database will serve as a report tool where the user can run through, in order to get basic information about the data collection mechanisms. This table uses four classifications that each one is divided in sub-categories of fields. This classification includes:

Data location: Data location provides the general information of the climate source:

-the name of the database,
-the operator of the organisation or service that manages the database,
-the website address,
-contact details,
-the general description of the task that serves,
-interactive applications (for data selection or maps selection),
-the outlook of the platform (if it's expanded, updated etc.).

Data access and Terms of use: It is necessary to know the access policy of the data in order to retrieve the selected climate information. This field includes:

-the registration of the user (if it is obligatory or not),
-the cost of service (free of charge or not),
-limitations or restrictions to download some particular data after registration (some data may be publicly available or for authorised users),
-the purpose of use of the data,
-the data transport architecture and protocol for retrieving the requested data,
-citation and acknowledgement must be included whenever publish research or applications are based in whole or in part on these data.

Data information: This field describes:

-the climate variables which are available, including, indices, maps and other data,
-the area coverage (global, continent, country, region),
-the temporal resolution of data,
-the spatial resolution of data,
-the uncertainties of data.

Technical description: The technical description includes mainly:

-the predefined file type format of the derived products (grib, netcdf, ascii, csv, gis),
-the file size for storage estimation,
-the metadata format according to WMO[1], CF[2] or other type that can be available,
-APIs service, like web interface (webAPI) tools or other application programming tool to allow authorised and commercial users to have access some internal features and data.

[1] https://www.wmo.int/pages/index_en.html
[2] http://cfconventions.org/

4 Presentation Tables of the selected Databases

Based on the collection of selected climate sources, the following Tables present the analytical description for each Database/ Organisation or Project, according to the needs of EU-CIRCLE case studies.

4.1 European Climate Assessment & Dataset (ECA&D)

Table of data availability and accessibility		
Data location	**Platform/Database**	*European Climate Assessment & Dataset (ECA&D) and the ENSEMBLES Observations gridded dataset (E-OBS)*
	Operator	*EUMETNET* *Royal Netherlands Meteorological Institute (KNMI)*
	Website	*http://www.ecad.eu*
	Contact	*eca@knmi.nl*
	Description of the platform	*ECA&D is receiving data from 68 participants for 64 countries and the ECA dataset contains 43156 series of observations for 12 elements at 10582 meteorological stations throughout Europe and the Mediterranean 76% of these daily series can be downloaded from this website. The station series are then blended with those from nearby stations and the Global Telecommunication System (GTS) to create series that are as long as possible.* *For each station 72 indices are calculated, each describing changes in the mean or extremes of climate. 26 indices follow the definitions recommended by the CCl/CLIVAR/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI, marked with *).* *Recent extreme events. Each event is placed in the context of climate change*
	Interactive applications	*Interactive maps*
	Outlook	*The dataset is continuously expanded and new data and stations are included regularly. The dataset is updated monthly*
	Data quality	*Quality control procedures and homogeneity* *checks are performed that lead to flags ("OK", "suspect" or "missing")*
Data access/ Terms of Use	**Data User Registration (yes/no)**	*no*
	If yes fields	-
	Cost of service/data	*Free of charge*
	Access restrictions: Unrestricted (publicly available) or Restricted data (authorized users)	*"downloadable": 76% of these daily series are **publicly available** from this website.* *"non-downloadable": data are used for research projects conducted by ECA&D staff or jointly by ECA&D staff and other research groups. You can contact us for suggestions for joint research. The "non-downloadable" data may be available from the data provider directly, as well as additional data.*
	Purpose of use	*non-commercial, research and education*
	Data transport architecture and protocol	*OPeNDAP*
	Citation and acknowledgement	***For ECA&D:*** *"We acknowledge the data providers in the ECA&D project. Klein Tank, A.M.G. and Coauthors, 2002. Daily dataset of 20th-century surface air temperature and precipitation series for the European Climate Assessment. Int. J. of Climatol., 22, 1441-1453. Data and metadata available at http://www.ecad.eu"*
Data	**Area coverage (global,**	*Europe/Mediterranean area/countries*

information	continent, country, region)	
	Variables	*Minimum temperature* *Mean temperature* *Maximum temperature* *Precipitation amount* *Sea level pressure* *Snow depth* *Relative humidity* *Sunshine duration* *Cloud cover* *Wind speed* *Maximum wind gust* *Wind direction*
	Provenance	*National Meteorological Services, Universities as well as by other data providers*
	Spatial resolution	*10582 meteorological stations throughout Europe and the Mediterranean*
	Temporal resolution	*daily*
	Quantitative error/uncertainty	-
Technical description	File type	*ASCII, txt*
	Indicative file size	*(86Mb - 1.2Gb)*
	Metadata format (CF/ WMO standards, other)	*WMO*
	Related API (yes/no)	*no*
	Link/type (e.g. WebAPI/MARS, python, GribAPI, …)	-

4.2 ENSEMBLES Observations gridded dataset (E-OBS)

Table of data availability and accessibility		
Data location	**Platform/Database**	*European Climate Assessment & Dataset (ECA&D) and the ENSEMBLES Observations gridded dataset (E-OBS)*
	Operator	*EUMETNET* *Royal Netherlands Meteorological Institute (KNMI)*
	Website	*http://www.ecad.eu*
	Contact	*eca@knmi.nl*
	Description of the platform	*E-OBS is a daily gridded observational dataset for precipitation, temperature and sea level pressure in Europe based on ECA&D information. The full dataset covers the period 1950-01-01 until 2016-08-31 (latest version available: 15). It has originally been developed and updated as parts of the ENSEMBLES (EU-FP6) and EURO4M (EU-FP7) projects. Currently it is maintained and elaborated as part of the UERRA project (EU-FP7).*
	Interactive applications	*Visualize daily maps*
	Outlook	*The dataset is continuously expanded and new data and stations are included regularly. The dataset is updated monthly*
	Data quality	*Quality control procedures and homogeneity checks are performed that lead to flags ("OK", "suspect" or "missing")*
Data access/ Terms of Use	**Data User Registration (yes/no)**	*yes*
	If yes fields	*User registration is mandatory for access to E-OBS grids.(name and email address)*
	Cost of service/data	*Free of charge*
	Access restrictions: Unrestricted (publicly available) or Restricted data (authorized users)	*"downloadable": 76% of these daily series can be downloaded from this website.* *"non-downloadable": data are used for research projects conducted by ECA&D staff or jointly by ECA&D staff and other research groups. You can contact us for suggestions for joint research. The "non-downloadable" data may be available from the data provider directly, as well as additional data.*
	Purpose of use	*non-commercial research and education*
	Data transport architecture and protocol	*OPeNDAP*
	Citation and acknowledgement	***For E-OBS temperature and precipitation data:*** *"We acknowledge the E-OBS dataset from the EU-FP6 project ENSEMBLES (http://ensembles-eu.metoffice.com) and the data providers in the ECA&D project (http://www.ecad.eu).* *Haylock, M.R., N. Hofstra, A.M.G. Klein Tank, E.J. Klok, P.D. Jones, M. New. 2008: A European daily high-resolution gridded dataset of surface temperature and precipitation. J. Geophys. Res., 113, D20119, doi:10.1029/2008JD10201"* ***For E-OBS sea level pressure data:*** *"We acknowledge the E-OBS dataset from the EU-FP6 project ENSEMBLES (http://ensembles-eu.metoffice.com) and the data providers in the ECA&D project (http://www.ecad.eu).* *Van den Besselaar, E.J.M., M.R. Haylock, G. van der Schrier and A.M.G. Klein Tank. 2011: A European Daily High-resolution Observational Gridded Data set of Sea Level Pressure. J. Geophys. Res., 116, D11110, doi:10.1029/2010JD015468"*
Data information	**Area coverage (global, continent, country,**	*Europe/Mediterranean area/countries*

Technical description	region)	
	Variables	*daily mean temperature TG, daily minimum temperature TN, daily maximum temperature TX, daily precipitation sum RR and daily averaged sea level pressure PP*
	Provenance	*National Meteorological Services, Universities as well as by other data providers, ENSEMBLES project*
	Spatial resolution	*Area: 25°N-75°N x 40°W-75°E. There are 4 different versions: 2 grid resolutions x 2 grid flavours. Data is made available on a 0.25 and 0.5 degree regular lat-lon grid, as well as on a 0.22 and 0.44 degree rotated pole grid, with the north pole at 39.25°N, 162°W. The regular grid is the same as the monthly CRU data grids available from the Climatic Research Unit. The rotated grid is the same as used in many ENSEMBLES Regional Climate Models. Besides 'best estimate' values, separate files are provided containing daily standard errors and elevation. See Haylock et al. (2008) and van den Besselaar et al. (2011) for further details. The Global 30 Arc-Second Elevation Data Set (GTOPO30), a global raster Digital Elevation Model (DEM) with a horizontal grid spacing of 30 arc seconds (approximately 1 kilometre) developed by USGS is used for the elevation file.*
	Temporal resolution	*daily*
	Quantitative error/uncertainty	*Inhomogeneities are present within the station data, that show quite large absolute and relative differences and biases to existing datasets that have been developed with very dense station networks, and the standard errors delivered with the data appear to significantly underestimate the true interpolation error (http://www.ecad.eu/documents/Evaluationpaper.pdf)*
	File type	*NetCDF, ASCII or binary*
	Indicative file size	*86Mb - 1.2Gb*
	Metadata format (CF, WMO, …)	*CF-1.4*
	Related API (yes/no)	*no*
	Link/type (e.g. WebAPI/MARS, python, GribAPI, …)	*-*

4.3 Global Precipitation Climatology Centre (GPCC)

Table of data availability and accessibility		
Data location	**Platform/Database**	*GPCC*
	Operator	*GPCC is operated (since 1988) by Deutscher Wetterdienst (German Meteorological Service) under auspices and umbrella of World Meteorological Organization (WMO).*
	Website	*http://gpcc.dwd.de, e-mail: gpcc@dwd.de*
	Contact	*Deutscher Wetterdienst (German Meteorological Service)* *P. O. Box 10 04 65* *D-63004 Offenbach* *Tel.: +49(0) 69/8062-2900,* *Fax: +49(0) 69/8062-3987* *e-mail: gpcc@dwd.de* *Dr. Andreas Becher (Head of GPCC) e-mail: andreas.becker@dwd.de*
	Description of the platform	*The Global Precipitation Climatology Centre (GPCC) provides global precipitation analyses for monitoring and research of the earth's climate. The centre is a German contribution to the World Climate Research Programme (WCRP) and to the Global Climate Observing System (GCOS).* *The general task and functions of GPCC is to compile global precipitation data sets on in-situ (rain gauge) data. The products are designed for the global climate research community and especially suitable for: Verification of climate models; Investigation of climate anomalies, Variability and special phenomena such as El Niño – Southern Oscillation; Determination of the Earth's water balance and budgets.*
	Interactive applications	*Access to GPCC's Gridded Products: The different gridded monthly precipitation data sets of GPCC can be visualized in maps or downloaded in ASCII format using the GPCC – Visualizer from the web site http://gpcc.dwd.de. Other products can be provided on e-mail request.* *Download Portal:* *Ftp://ftp-anon.dwd/pub/data/gpcc/html/Download_gate.html*
	Outlook	*The GPCC centre asks to the countries to provide the centre with daily precipitation data in order to create and analyse the daily pattern of precipitation globally.*
	Data quality	*The GPCC's data processing steps include Quality Control (QC) and harmonization of the station meta data, quality assessment of the precipitation data and choice of data from the different sources deemed suitable for a particular product, interpolation of the station-related data to a regular mesh system, and calculation of the spatial means for different grid resolutions (2.5°, 1°, 0.5° grid).*
Data access/ Terms of Use	**Data User Registration (yes/no)**	-
	If yes fields	-
	Cost of service/data	*Free of charge* *Free for specific users* *Free for everyone* *Subject of charges*
	Access restrictions: Unrestricted (publicly available) or Restricted data (authorized users)	*All meteorological services in the freely accessible area of the DWD website are part of the DWD's basic-level services* *Since many of station data are supplied by national weather and/or*

		Hydrological services or institutes there are restrictions according to GPCC accepted following policy: the access to the gridded data sets (monthly) is free; the station data received will not be passed to 3rd parties; the data received will be used for scientific purposes only.
	Purpose of use	
	Data transport architecture and protocol	*The scientific and technical functions of the GPCC are mandated with the "Implementation and Data Management Plan for the Global Precipitation Climatology Project (GPCP)" (WMO/TD No. 367).*
	Citation and acknowledgement	-
Data information	**Area coverage (global, continent, country, region)**	*Global*
	Variables	*gridded monthly precipitation data sets*
	Provenance	*Germany's National Meteorological Service, the Deutscher Wetterdienst (DWD)*
	Spatial resolution	*Gridded precipitation data – grid points: 0.5^0x0.5^0, 1^0x1^0, 2.5^0x2.5^0 (latitude, longitude)*
	Temporal resolution	*Climatology, Monthly, Daily*
	Quantitative error/uncertainty	-
Technical description	**File type**	*netCDF, ASCII*
	Indicative file size	*unknown*
	Metadata format (CF, WMO, …)	-
	Related API (yes/no)	
	Link/type (e.g. WebAPI/MARS, python, GribAPI, …)	*unknown*

4.4 ECMWF ERA-Interim reanalysis

Table of data availability and accessibility		
Data location	**Platform/Database**	*ERA-Interim global atmospheric reanalysis*
	Operator	*European Centre for Medium-Range Weather Forecasts (ECMWF)*
	Website	*http://www.ecmwf.int/en/research/climate-reanalysis/era-interim*
	Contact	**http://www.ecmwf.int/en/about/contact-us**
	Description of the platform	***"ECMWF periodically uses its forecast models and data assimilation systems to 'reanalyse' archived observations, creating global data sets describing the recent history of the atmosphere, land surface, and oceans. Reanalysis data are used for monitoring climate change, for research and education, and for commercial applications.*** ***Current research in reanalysis at ECMWF focuses on the development of consistent reanalyses of the coupled climate system, including atmosphere, land surface, ocean, sea ice, and the carbon cycle, extending back as far as a century or more. The work involves collection, preparation and assessment of climate observations, ranging from early in-situ surface observations made by meteorological observers to modern high-resolution satellite data sets. Special developments in data assimilation are needed to ensure the best possible temporal consistency of the reanalyses, which can be adversely affected by biases in models and observations, and by the ever-changing observing system."*** **[source: http://www.ecmwf.int/en/research/climate-reanalysis]** ***"ERA-Interim is a global atmospheric reanalysis from 1979, continuously updated in real time.*** *The data assimilation system used to produce ERA-Interim is based on a 2006 release of the IFS (Cy31r2). The system includes a 4-dimensional variational analysis (4D-Var) with a 12-hour analysis window. The spatial resolution of the data set is approximately 80 km (T255 spectral) on 60 vertical levels from the surface up to 0.1 hPa.* *ERA-Interim data can be downloaded from the ECMWF Public Datasets web interface or from MARS (class=ei, expver=1). For a detailed documentation of the ERA-Interim Archive see Berrisford et al. (2011)."* **[source: http://www.ecmwf.int/en/research/climate-reanalysis/era-interim]**
	Interactive applications	*Data selection from:* **http://apps.ecmwf.int/datasets/data/interim-full-daily/levtype=sfc/**
	Outlook	*The dataset is continuously updated. Current availability period: 1979-01-01 to 2017-02-28.*
	Data quality	*Quality is determined by the atmospheric model limitations and meteorological observational quality and density. This is the global dataset, and data quality can be estimated locally in comparison to e.g. local station-based observations.*
Data access/ Terms of Use	**Data User Registration (yes/no)**	*yes*
	If yes fields	*User registration is mandatory for access to ECMWF ERA-Interim fields: (1) ECMWF web user ID, or (2) ECMWF user with the token access.*
	Cost of service/data	*Free of charge*
	Access restrictions: Unrestricted (publicly available) or Restricted	*Most relevant fields (e.g. near-surface air temperature, total precipitation amount, wind speed components) are publicly available.*

	data (authorized users)	*Terms of use available from:* **http://apps.ecmwf.int/datasets/data/interim-full-daily/licence/**
	Purpose of use	*"The Licensee is authorised to use on a non-exclusive basis the Archive Products for its own purposes, including **research**, **education** and activities for **commercial** gain.* *The Licensee shall not reproduce, distribute, license, transfer, assign, sell, disclose or otherwise forward the Archive Products, whether in their original form or as part of a service where the original numerical values of the Archive Products can be accurately rebuilt from the service, to any third party, without the **prior written consent of the Licensor**."* **[source: http://apps.ecmwf.int/datasets/data/interim-full-daily/licence/]**
	Data transport architecture and protocol	-
	Citation and acknowledgement	*"Please use this as the main scientific reference to ERA-Interim:* *Dee, D. P., Uppala, S. M., Simmons, A. J., Berrisford, P., Poli, P., Kobayashi, S., Andrae, U., Balmaseda, M. A., Balsamo, G., Bauer, P., Bechtold, P., Beljaars, A. C. M., van de Berg, L., Bidlot, J., Bormann, N., Delsol, C., Dragani, R., Fuentes, M., Geer, A. J., Haimberger, L., Healy, S. B., Hersbach, H., Hólm, E. V., Isaksen, L., Kållberg, P., Köhler, M., Matricardi, M., McNally, A. P., Monge-Sanz, B. M., Morcrette, J.-J., Park, B.-K., Peubey, C., de Rosnay, P., Tavolato, C., Thépaut, J.-N. and Vitart, F. (2011), The ERA-Interim reanalysis: configuration and performance of the data assimilation system. Q.J.R. Meteorol. Soc., 137: 553–597. doi: 10.1002/qj.828"* **[source: https://software.ecmwf.int/wiki/display/CKB/How+to+reference+or+acknowledge+ERA-Interim+data+in+a+publication]**
Data information	**Area coverage (global, continent, country, region)**	*global*
	Variables	*Large number of surface, model level, potential temperature level, potential vorticity level and pressure level variables.*
	Provenance	*ECMWF*
	Spatial resolution	*80 km x 80 km (T255 spectral)*
	Temporal resolution	*Instantaneous, daily, monthly*
	Quantitative error/uncertainty	*https://software.ecmwf.int/wiki/display/CKB/ERA-Interim+known+issues*
Technical description	**File type**	*NetCDF and GRIB*
	Indicative file size	*Up to several GBs, depending on the user request. ECMWF imposed a limit of 20GB per download.*
	Metadata format (CF, WMO, …)	**http://apps.ecmwf.int/codes/grib/param-db**
	Related API (yes/no)	*yes*
	Link/type (e.g. WebAPI/MARS, python, GribAPI, …)	*WebAPI/MARS*

4.5 EURO-CORDEX regional climate models' simulations

Table of data availability and accessibility		
Data location	**Platform/Database**	EURO-CORDEX regional climate models' simulations
	Operator	Earth System Grid Federation (ESGF)
	Website	*https://esg-dn1.nsc.liu.se/projects/esgf-liu/* *https://esgf-data.dkrz.de/projects/esgf-dkrz/* *https://esgf-index1.ceda.ac.uk/projects/esgf-ceda/* *...*
	Contact	esgf-user@lists.llnl.gov
	Description of the platform	***"The Earth System Grid Federation (ESGF) maintains a global system of federated data centers that allow access to the largest archive of climate data world-wide. The ESGF datanode at the National Supercomputer Centre, Linköping, is Sweden's first datanode in the ESGF framework. It is a joint activity of NSC and the Swedish Meteorological and Hydrological Institute (SMHI). NSC is an independent organization within Linköping University (LiU), and is funded by the Swedish Research Council via SNIC (Swedish National Infrastructure for Computing)."*** **[source: https://esg-dn1.nsc.liu.se/projects/esgf-liu/]**
	Interactive applications	*Data selection from:* **https://esg-dn1.nsc.liu.se/search/cordex/**
	Outlook	*The content of ESGF is being continuously expanded (not limited to CORDEX & EURO-CORDEX simulations).*
	Data quality	*Quality is determined by the regional climate model limitations. This is the European wide dataset, and data quality can be estimated locally in comparison to e.g. local station-based observations.*
Data access/ Terms of Use	**Data User Registration (yes/no)**	*yes*
	If yes fields	-
	Cost of service/data	*Free of charge*
	Access restrictions: Unrestricted (publicly available) or Restricted data (authorized users)	*Database search is unrestricted, file download available after registration. For account creation see: e.g.* **https://www.earthsystemcog.org/projects/cog/tutorials_web .** *For different regional climate models, either unrestricted* ***or*** *non-commercial research or educational uses are set.* **[cf. http://cordex.dmi.dk/joomla/images/CORDEX/cordex_terms_of_use.pdf]**
	Purpose of use	**http://cordex.dmi.dk/joomla/images/CORDEX/cordex_terms_of_use.pdf**
	Data transport architecture and protocol	*ESGF*
	Citation and acknowledgement	*"We acknowledge the World Climate Research Programme's Working Group on Regional Climate, and the Working Group on Coupled Modelling, former coordinating body of CORDEX and responsible panel for CMIP5. We also thank the climate modelling groups (listed in Table* ***XX*** *of this paper) for producing and making available their model output. We also acknowledge the Earth System Grid Federation infrastructure an international effort led*

		by the U.S. Department of Energy's Program for Climate Model Diagnosis and Intercomparison, the European Network for Earth System Modelling and other partners in the Global Organisation for Earth System Science Portals (GO-ESSP).” **[source: http://cordex.dmi.dk/joomla/images/CORDEX/cordex_terms_of_use.pdf]**
Data information	**Area coverage (global, continent, country, region)**	*Europe*
	Variables	*Specified here:* ***http://is-enes-data.github.io/cordex_archive_specifications.pdf***
	Provenance	*ESGF and specific modelling groups.*
	Spatial resolution	*12.5 km x 12.5 km, 50 km x 50 km, 0.11° x 0.11°, 0.44° x 0.44°*
	Temporal resolution	*Instantaneous (3hr, 6hr), daily/monthly/seasonal means*
	Quantitative error/uncertainty	*“All CORDEX simulations have to be formatted according to the* ***CORDEX archive specifications*** *and to the* ***CORDEX variables requirement tables*** *and undergo strict quality control (QC) before being published on the CORDEX-ESGF data nodes.”* **[source: https://www.cordex.org/index.php/experiment-guidelines/cordex-data-submission]**
Technical description	**File type**	*NetCDF (NetCDF4 compressed)*
	Indicative file size	*Up to several hundreds of GBs, depending on the user request.*
	Metadata format (CF, WMO, …)	*CF*
	Related API (yes/no)	*yes*
	Link/type (e.g. WebAPI/MARS, python, GribAPI, …)	*ESGF Search RESTful API* **[https://earthsystemcog.org/projects/cog/esgf_search_restful_api]**

4.6 AQUAMAPS

Table of data availability and accessibility		
Data location	Platform/Database	*AQUAMAPS*
	Operator	*FAO*
	Website	*http://www.fao.org/nr/water/aquamaps/*
	Contact	*jippe.hoogeveen@fao.org*
	Description of the platform	*AquaMaps is the FAO global online spatial database on water and agriculture. It makes accessible through a simple interface regional and global spatial datasets on water resources and water management considered as a standard information resource, produced by FAO or by external data providers.* *AquaMaps is complementary to AQUASTAT, FAO's Information System on Water and Agriculture. While AQUASTAT focuses on collecting mainly statistical data and qualitative information on (sub)country level, AquaMaps concentrates on geographical information. For most of the maps that have been generated by spatial modeling, Aquastat information has been used to calibrate and validate the model results.* *AquaMaps builds on the FAO GeoNetwork data catalogue, from which it retrieves a thematic collection of layers, data and metadata, allowing users to query, explore, and download spatial data in commonly used GIS format.* *The collection of dataset is organized by themes analysed on variables' fields*
	Interactive applications	*Interactive maps*
	Outlook	*Data is updated as deemed necessary*
	Data quality	*The station data were interpolated as a function of latitude, longitude and elevation using thin-plate smoothing splines. The accuracy of the interpolations are assessed using cross-validation and by comparison with other datasets.*
Data access/ Terms of Use	Data User Registration (yes/no)	*no*
	If yes fields	-
	Cost of service/data	*All FAO's standalone software models and other tools can be downloaded free, for use directly in the field or to assist in research projects*
	Access restrictions: Unrestricted (publicly available) or Restricted data (authorized users)	*All requests for translation and adaptation rights and for resale and other commercial use rights should be addressed to copyright@fao.org or submitted via the online Licence Request Form when downloading. (http://www.fao.org/contact-us/terms/en/)*
	Purpose of use	-
	Data transport architecture and protocol	-
	Citation and acknowledgement	*Mark New, David Lister, Mike Hulme and Ian Makin: A high-resolution data set of surface climate over global land areas. Climate Research, 2000, Vol 21, pg 1-25* *In general check the analytical description of the datasets.*
Data	Area coverage (global,	*Global, European*

information	continent, country, region)	
	Variables	• *River and water bodies: regional hydrographic networks derived from Hydrosheds.* • *Irrigation and infrastructures: area equipped for irrigation, dams.* • *Hydrological basins: global and regional layers of hydrological basins derived from Hydrosheds.* • *Climate: Monthly grids of precipitation and reference evapotranspiration.* • *Models: output grid of FAO global soil water balance model (GlobWat), including modeled actual evapotranspiration, runoff and infiltration.* • *Analyses: examples of global analyses performed on the basis of the above mentioned dataset.*
	Provenance	
	Spatial resolution	*15 arc-seconds, 10 arc minutes*
	Temporal resolution	*mean monthly, yearly*
	Quantitative error/uncertainty	*unknown*
Technical description	File type	*Raster and vector layer - ASCII-grids, tif raster files,*
	Indicative file size	
	Metadata format (CF, WMO, …)	*ISO 19115:2003/19139 1.0*
	Related API (yes/no)	*no*
	Link/type (e.g. WebAPI/MARS, python, GribAPI, …)	*no*

4.7 Copernicus Services

Table of data availability and accessibility		
Data location	**Platform/Database**	**Copernicus**
	Operator	*The Programme is coordinated and managed by the European Commission. It is implemented in partnership with the Member States, the European Space Agency (ESA), the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), the European Centre for Medium-Range Weather Forecasts (ECMWF), EU Agencies and Mercator Océan.*
	Website	http://www.copernicus.eu/
	Contact	*http://copernicus.eu/main/contact-us*
	Description of the platform	*Copernicus is a European Union Programme aimed at developing European information services based on satellite Earth Observation and in situ (non-space) data.* *Vast amounts of global data from satellites and from ground-based, airborne and seaborne measurement systems are being used to provide information to help service providers, public authorities and other international organisations improve the quality of life for the citizens of Europe. The Copernicus Programme covers six thematic areas: land, marine, atmosphere, climate change, emergency management and security.*
	Interactive applications	-
	Outlook	*The Land Monitoring Service, the Marine Environment Monitoring Service (CMEMS), the Atmosphere Monitoring Service (CAMS), the mapping component of the Copernicus Emergency Management Service (EMS - Mapping) are now delivered in an operational mode.* *The Climate Change Service (C3S) and Security Service are still in a development phase.* *The availability of downstream services (i.e. value-added services based on the above-mentioned Copernicus services) is depending on downstream providers.*
	Data quality	*Homogenised time series of in-situ observations and associated metadata, reprocessed climate data records from satellites, output from global and regional reanalyses, outputs from climate models including projections*
Data access/ Terms of Use	**Data User Registration (yes/no)**	*No registration is required for discovery and view services*
	If yes fields	*Registration free of charge is a prerequisite to download Sentinel and other data.*
	Cost of service/data	*Free of charge*
	Access restrictions: Unrestricted (publicly available) or Restricted data (authorized users)	*1) http://copernicus.eu/data-access-satellite* *For the Emergency Management service, data production can be requested only by "authorized users" while the maps produced by the service are available on the service web portal and can be downloaded without registering.*
	Purpose of use	*https://sentinel.esa.int/documents/247904/690755/Sentinel_Data_Legal_Notice*
	Data transport architecture and protocol	*Sentinel products are provided for download via HTTP* *Marine products via CSW, WMS, SUBSETTER*

Data information	**Citation and acknowledgement**	**https://sentinel.esa.int/documents/247904/690755/Sentinel_Data_Legal_Notice**
	Area coverage (global, continent, country, region)	*Europe*
	Variables	***Sentinel-1 is a Synthetic Aperture Radar (SAR) and its data is very valuable for the observation and study of: sea ice, winds and waves, forest, agriculture, soil moisture, land surface movements, etc.*** ***Sentinel-2 is a Multi Spectral Imager (MSI) whose data will benefit the observation and study of: land use, land cover, coastal conditions, etc.*** ***Sentinel-3 includes three main instruments: a radar altimeter, an Ocean and Land Color Instrument (OLCI) and a Sea and Land Surface Temperature Radiometer (SLSTR). Its data products address almost all domains of Earth Sciences.*** ***Sentinel-4 and Sentinel-5 are in preparation and will be missions dedicated to the atmosphere composition*** *Data are available through the web portals operated by the various Copernicus service lines:* *(1) Land-related data: http://land.copernicus.eu (land cover, land use, settlements, DEM)* *(2) Atmosphere-related data: http://atmosphere.copernicus.eu (air quality, atmospheric composition, greenhouse gas)* *(3) Marine-related data: http://marine.copernicus.eu (sea level, ocean temperature, currents, chemistry, biology)* *(4) Emergency-related data: http://emergency.copernicus.eu (Rapid Mapping, Risk and Recovery Mapping)* *(5) Climate change-related data: http://climate.copernicus.eu (in situ and satellite-based observations, re-analysis of the Earth climate and modelling scenarios)*
	Provenance	*Copernicus Services*
	Spatial resolution	*Depends on specific variable.*
	Temporal resolution	*Depends on specific variable.*
	Quantitative error/uncertainty	*In addition to the quality control based on specific variables innovation statistics (detection of spikes, large biases, …), a second quality control has been developed and is based on dynamic height innovation statistics (detection of small vertically constant biases).*
Technical description	**File type**	*.ZIP archive file format. Click and download, shopping cart, batch download. A maximum of 2 concurrent downloads per user is allowed in order to ensure a download capacity for all users.*
	Indicative file size	*Depending on the user request.*
	Metadata format (CF, WMO, …)	*Depends on various services, e.g., http://land.copernicus.eu/in-situ/lucas/lucas-2012/view*
	Related API (yes/no)	*no*
	Link/type (e.g. WebAPI/MARS, python, GribAPI, …)	*no*

4.8 European Forest Fire Information System (EFFIS)

Table of data availability and accessibility		
Data location	**Platform/Database**	European Forest Fire Information System (EFFIS)
	Operator	the Joint Research Centre (JRC) of the European Commission (EC)
	Website	http://effis.jrc.ec.europa.eu/about-effis/brief-history/
	Contact	jesus.san-miguel@jrc.ec.europa.eu giorgio.liberta@jrc.ec.europa.eu effis@jrc.ec.europa.eu
	Description of the platform	*The European Forest Fire Information System (EFFIS) supports the services in charge of the protection of forests against fires in the EU countries and provides the European Commission services and the European Parliament with updated and reliable information on wild-land fires in Europe. The EFFIS network is made up of experts on forest fires from 40 countries and international organizations (e.g. FAO, UNECE). Its main role is to provide advice for the implementation and further development of EFFIS and recommendations for improved forest fire prevention in the European and Mediterranean regions. The networks are officially referred to as the Expert Group on Forest Fires (EGFF).* **[source: http://effis.jrc.ec.europa.eu/about-effis/effis-network/]**
	Interactive applications	*Data maps from:* **http://effis.jrc.ec.europa.eu/applications/**
	Outlook	*A number of specific applications are available through EFFIS like current situation with today meteorological fire danger maps and forecast up to 6 days, daily updated maps of hot spots and fire perimeters. The public access to the database currently allows the users to retrieve general information such as maps of the number of fires for a selected year and for the countries for which data are available. Further analysis possibilities will be added in the near future.*
	Data quality	*ECMWF (European Centre for Medium-Range Weather Forecasts) Seasonal Forecasting System named S4 (System 4)*
Data access/ Terms of Use	**Data User Registration (yes/no)**	*no*
	If yes fields	-
	Cost of service/data	*Free of charge*
	Access restrictions: Unrestricted (publicly available) or Restricted data (authorized users)	*By using the data provided you acknowledge the following license and terms of use under this license at* *http://effis.jrc.ec.europa.eu/about-effis/data-license/* *and* *http://effis.jrc.ec.europa.eu/about-effis/technical-background/rapid-damage-assesment/* *For any request of data which is not available through the EFFIS Web services (e.g. historic data, extracts of the fire database, or raw burned area perimeters) the stakeholder has to fill in the data request form and send it to EFFIS:* *Data request form available at:* *http://effis.jrc.ec.europa.eu/media/cms_page_media/54/EFFIS.DataDissemiNationAgreement2016.pdf*
	Purpose of use	*Restriction/limitation of liability at http://effis.jrc.ec.europa.eu/about-effis/data-license/*
	Data transport architecture and	*Through http://effis.jrc.ec.europa.eu/reports-and-publications/annual-fire-reports/ and WMS*

	protocol	
	Citation and acknowledgement	*Data were provided by the European Forest Fire Information System EFFIS http://effis.jrc.ec.europa.eu) of the European Commission Joint Research Centre* *San-Miguel-Ayanz, J., Schulte, E., Schmuck, G., Camia, A., Strobl, P., Libertà, G., Giovando, Boca, R., Sedano, F., Kempeneers, P., McInerney, D., Withmore, C., Santos de Oliveira, S., Rodrigues, M., Durrant, T., Corti, P., Oehler, F., Vilar L., Amatulli, G. (2012) Comprehensive monitoring of wildfires in europe: the European Forest Fire Information System (EFFIS), in John Tiefenbacher (Ed.), Approaches to Managing Disaster -Assessing Hazards, Emergencies and Disaster Impacts,pp. 87-105, InTech, ISBN 978 - 953 - 51 – 0294* **[source: http://effis.jrc.ec.europa.eu/media/cms_page_media/54/EFFIS.DataDisseminationAgreement2016.pdf]**
Data information	**Area coverage (global, continent, country, region)**	*Europe, Middle East and North Africa 2015*
	Variables	*Annual reports on forest fires reports in Europe* *Burned Area Perimeters* *Hot Spots – VIIRS* *Hot Spots - MODIS* *The Rapid Damage Assessment (RDA) module of EFFIS has been implemented since 2003 to map burned areas during the fire season, by analyzing MODIS daily images with 250 m spatial resolution. For the monitoring of burned areas during the summer, daily images from the MODIS instruments on board of TERRA and AQUA satellites are acquired and processed few hours after the acquisition by MODIS.*
	Provenance	*Joint Research Centre (JRC) of the European Commission (EC)*
	Spatial resolution	*The EFFIS Rapid Damage Assessment provides the daily update of the perimeters of burnt areas in Europe for fires of about 40 ha or larger.*
	Temporal resolution	*Instantaneous (3hr, 6hr), daily/monthly/seasonal means*
	Quantitative error/uncertainty	*If the point of ignition is detected (and possibly also the ignition device), the fire cause might be identified and reported in the database as certain (however in some cases, even with known point of ignition, the cause cannot be identified and remains unknown). If not, the fire cause is to be reported as either uncertain or unknown*
Technical description	**File type**	*Pdf, .csv*
	Indicative file size	*Depending on the user request.*
	Metadata format (CF, WMO, …)	*unknown*
	Related API (yes/no)	*no*
	Link/type (e.g. WebAPI/MARS, python, GribAPI, …)	*no*

4.9 European Flood Awareness System (EFAS)

Table of data availability and accessibility		
Data location	**Platform/Database**	*European Flood Awareness System (EFAS)*
	Operator	*EFAS has been developed and tested at the Joint Research Centre (JRC), the European Commission's in house science service, in close collaboration with the National Meteorological and Hydrological Services (NMHSs), European Civil Protection and other research institutes.* *EFAS has become operational since October 2012, under the umbrella of Copernicus Emergency Management Service (Copernicus EMS) providing early flood warnings across Europe.* ***The Operational EFAS** is being executed by several consortia dealing with different operational aspects: • **EFAS Hydrological data collection** centre - a Spanish consortium of REDIAM (ES) and ELIMCO (ES) - collects historic and real time discharge and water level data across Europe in support to EFAS • **EFAS Meteorological data collection** centre - a German consortium of KISTERS AG and Deutscher Wetterdienst - collects historic and real time meteorological data across Europe. • **EFAS Computational** centre - European Centre for Medium-Range Weather Forecasts (UK) - provides daily operational EFAS forecasts and post-processing and 24/7 support to the technical system and hosts and operates the EFAS-Information System platform • **EFAS Dissemination** centre - a consortium of Swedish Meteorological and Hydrological Institute, Rijkswaterstaat Waterdienst (the Netherlands Water service) and Slovak Hydro-Meteorological Institute - analyses EFAS outputs on a daily basis and disseminates information to the partners and the ERCC European Response and Coordination Centre* *The European Commission is responsible for contract management. The Joint Research Centre further provides support for EFAS through research and development.*
	Website	*https://www.efas.eu/*
	Contact	*efas@jrc.ec.europa.eu; info@efas.eu; JRC: efas@jrc.ec.europa.eu*
	Description of the platform	*The European Flood Awareness System is a European Commission initiative to increase preparedness for riverine floods across Europe.* *The disastrous floods in Elbe and Danube rivers in 2002 confronted the European Commission with non-coherent flood warning information from different sources and of variable quality, complicating planning and organization of aid. In response to this event, the European Commission initiated the development of a European Flood Awareness System (EFAS) to increase the preparedness for floods in Europe. Following a Communication of the Commission in 2002 on the Elbe and Danube floods in 2002, the Joint Research Centre of the European Commission was assigned with the task to develop EFAS. Its development has been financially supported by DG ENTR, DG ECHO, the European Parliament as well as Germany, the Czech Republic, Austria, Hungary and Slovakia through detachment of National Experts.* *The aim of EFAS is to gain time for preparedness measures before major flood events strike particularly for trans-national river basins both in the Member States as well as on European level. This is achieved by providing complementary, added value information to the National hydrological services and by keeping the European Response and Coordination Centre informed about ongoing floods and about the possibility of upcoming floods*

		across Europe. *The European Flood Awareness System (EFAS) is the first operational European system monitoring and forecasting floods across Europe. It provides probabilistic, flood early warning information up to 10 days in advance to its partners: the National Hydrological Services and the European Response and Coordination Centre (ERCC).* *EFAS is an operational service under the umbrella of the Copernicus emergency management service and is fully operational since October 2012.* *More information: http://efas-is.jrc.ec.europa.e ; http://floods.jrc.ec.europa.eu*
	Interactive applications	*Real time EFAS information is only accessible by EFAS partners, via username and password (PARTNER LOGIN area of the first main EFAS web page: www.efas.eu).* *The EFAS Dissemination center (e-mail: dissemination@efas.eu) sends e-mails to the corresponding EFAS Partners in order to inform them that a possible flood event is upcoming (more details can be found on the EFAS-IS web interface). These EFAS early warnings (via e-mails) are of three types: EFAS Flood alerts, EFAS Flood watches and EFAS Flash Flood watches. In addition, EFAS Dissemination center sends daily the EFAS ERCC overview to the Emergency Response Coordination Centre of EC, including information on ongoing floods in Europe as reported by national services, EFAS Flood alerts, EFAS Flood watches and EFAS Flash Flood watches.*
	Outlook	*Further analysis possibilities will be added in the near future.*
	Data quality	*The EFAS Dissemination centre is looking for feedback from Partners side regarding all EFAS warnings issued (about their reliability, the area concerned, the time of issuing etc.). Every two months all relative information is published in the EFAS Bulletin.*
Data access/ Terms of Use	**Data User Registration (yes/no)**	*Yes (free for the general public only for background information for the EFAS services).*
	If yes fields	*Only for EFAS partners after registration*
	Cost of service/data	*Free of charge the access to the EFAS services for the EFAS Partners and for the general public only for background information for the EFAS services.*
	Access restrictions: Unrestricted (publicly available) or Restricted data (authorized users)	*The access to the main EFAS web page is free to the public for background information on the current EFAS services and for the main tabs.* *The authorized users are the Partners to EFAS and they have password protected access to the services (notifications, warnings for floods) that refer to their area and described above in* Interactive applications *field of this table*
	Purpose of use	*Only the EFAS Partners receive in a daily basis (when needed) EFAS warnings in order to be informed the Civil Protection agencies and other country state or local stakeholders to take proactive measures to minimize the risk to flood hazardous forecasted phenomena.*
	Data transport architecture and protocol	*The European Flood Awareness System provides probabilistic flood forecast information more than 48 hours in advance to National Authorities via e-mails*
	Citation and acknowledgement	*Data were provided by the European Flood Awareness System EFAS (http://www.efas.eu) of the European Commission Joint Research Centre* *"On the operational implementation of the European Flood Awareness System (EFAS)"* *Smith, P, Pappenberger, F, Wetterhall, F, Thielen, J, Krzeminski, B, Salamon, P, Muraro, D, Kalas, M, Baugh, C* *Technical memorandum* *European Commission Joint Research Centre, Institute for Environment and*

		Sustainability, Ispra, Italy *Submitted to "Flood Forecasting: A Global Perspective" (Eds. Thomas E Adams & Thomas C. Pagano) April 2016* *https://www.ecmwf.int/sites/default/files/elibrary/2016/16337-operational-implementation-european-flood-awareness-system-efas.pdf* *An updated full list of EFAS publications or publications related to EFAS can be found under https://www.efas.eu/about-efas.html* *EFAS Bulletin https://www.efas.eu/efas-bulletins.html*
Data information	**Area coverage (global, continent, country, region)**	*EFAS domain: Europe, Extended EFAS domain: Europe plus extension to the east including Turkey, Middle and far East and north Africa*
	Variables	*Probability of exceeding (high, medium, low) a flood threshold (a return period of flooding: <2 years - no flooding is expected; >2 years and < 5 years - flooding is expected, no significant damages are expected; > 5 years and < 20 years - significant flooding is expected ; >20 years – potentially sever flooding is expected.*
	Provenance	*The services are prepared and provided by the three centres of EFAS: the (main operational) EFAS Computational center run by ECMWF, the EFAS Dissemination center and the EFAS centers for gathering the Meteorological and Hydrological data.*
	Spatial resolution	*The EFAS services are provided in country, periphery, and local and more specifically in catchments level.*
	Temporal resolution	*The EFAS warnings are issued from a couple of days up to ten days in advance.*
	Quantitative error/uncertainty	*unknown*
Technical description	**File type**	*Pdf, e-mail, GIs files, .csv,*
	Indicative file size	*Depending on the user request dataset.*
	Metadata format (CF, WMO, …)	*unknown*
	Related API (yes/no)	*no*
	Link/type (e.g. WebAPI/MARS, python, GribAPI, …)	-

4.10 Earth2Observe (WCI portal)

Table of data availability and accessibility		
Data location	**Platform/Database**	*Earth2Observe ("Global Earth Observation for Integrated Water Resource Assessment")*
	Operator	*Plymouth Marine Laboratory (PML) website (http://www.pml.ac.uk/index)*
	Website	http://www.earth2observe.eu/ https://wci.earth2observe.eu/portal/
	Contact	bac@pml.ac.uk
	Description of the platform	*EartH2Observe "Global Earth Observation for Integrated Water Resource Assessment" is a collaborative project funded under the DG Research FP7 programme. The project begun in January 2014 and will run for 4 years, until the end of 2017. The overall objective is to contribute to the assessment of global water resources through the use of new Earth Observation datasets and techniques. For this purpose, the project will integrate available earth observations, in-situ datasets and models, to construct a consistent global water resources reanalysis dataset of sufficient length (at least 30 years). The resulting datasets will be made available through an open Water Cycle Integrator data portal: the European contribution to the GEOSS/WCI approach. The datasets will be downscaled for application in case-studies at regional and local levels, and optimized based on identified European and local needs supporting water management and decision making.* *The WCI portal is an open source project built by Plymouth Marine Laboratory's Remote Sensing Group. The portal builds on the development of several other EU funded projects, past and present, that PML have involvement in. You can find the code on GitHub at https://github.com/earth2observe-pml/GISportal*
	Interactive applications	*Possibility to produce a temporal graph to visualize a parameter evolution in a selecting geographic area.*
	Outlook	-
	Data quality	
Data access/ Terms of Use	**Data User Registration (yes/no)**	*Details of the datasets, including which organisation produced the data, the metadata, license information and how and where to access the data can be found in the eartH2Observe section of the PML Data Portal*
	If yes fields	-
	Cost of service/data	-
	Access restrictions: Unrestricted (publicly available) or Restricted data (authorized users)	*Open and freely accessible data services*
	Purpose of use	
	Data transport architecture and protocol	*OPeNDAP, WMS and WCS available using THREDDS Data Server: https://wci.earth2observe.eu/thredds, provided by TU Wien* - FTP server : wci.earth2observe.eu ftp://wci.earth2observe.eu/data/primary/public/tuwien/
	Citation and acknowledgement	*unknown*
Data	**Area coverage (global,**	Global, in situ

information	continent, country, region)	
	Variables	*Data catalogue; an online searchable catalogue of datasets, with meta data and Linked Data* *https://wci.earth2observe.eu/data* *https://wci.earth2observe.eu/data/group/earth2observe* *In situ data: groundwater, surface water, water quality, soil moisture, precipitation and evaporation*
	Provenance	*PML*
	Spatial resolution	*global*
	Temporal resolution	*Daily and Monthly*
	Quantitative error/uncertainty	-
Technical description	File type	*Ascii*
	Indicative file size	*Depends on the user request dataset.*
	Metadata format (CF, WMO, …)	-
	Related API (yes/no)	*unknown*
	Link/type (e.g. WebAPI/MARS, python, GribAPI, …)	*unknown*

4.11 EUMETSAT CM SAF

Table of data availability and accessibility		
Data location	**Platform/Database**	*EUMETSAT Satellite Application Facility on Climate Monitoring (CM SAF)*
	Operator	*"The CM SAF is joint venture of the following NMHSs together with EUMETSAT" [source: http://www.cmsaf.eu/EN/Overview/ConsortiumPartners/Consortium_Partners_node.html]*
	Website	*http://www.cmsaf.eu/EN/Home/home_node.html*
	Contact	*http://www.cmsaf.eu/EN/Service/UHD/UHD_node.html*
	Description of the platform	***"The Satellite Application Facility on Climate Monitoring (CM SAF) aims at the provision of satellite-derived geophysical parameter data sets suitable for climate monitoring. CM SAF provides climatologies for Essential Climate Variables (ECV), as required by the Global Climate Observing System implementation plan in support of the UNFCCC. Several cloud parameters, surface albedo, radiation fluxes at the top of the atmosphere and at the surface as well as atmospheric temperature and humidity products form a sound basis for climate monitoring of the atmosphere. The products are categorized in monitoring data sets obtained in near real time and data sets based on carefully intercalibrated radiances. The CM SAF products are derived from several instruments on-board operational satellites in geostationary and polar orbit, i.e., the Meteosat and NOAA satellites, respectively. The existing data sets will be continued using data from the instruments on-board the new EUMETSAT Meteorological Operational satellite (MetOP). The products have mostly been validated against several ground-based data sets both in situ and remotely sensed. The accomplished accuracy for products derived in near real time is sufficient to monitor variability on diurnal and seasonal scales. Products based on intercalibrated radiance data can also be used for climate variability analysis up to inter-annual scale. A central goal of the recently started 2nd Continuous Development and Operations Phase of the CM SAF (2012–2017) is to further improve all CM SAF data sets to a quality level that allows for studies of inter-annual variability. "*** *[source: http://www.cmsaf.eu/EN/Overview/Mission&Mandate/Mission&Mandate_node.html]*
	Interactive applications	*Data selection from: https://wui.cmsaf.eu/safira/action/viewProduktSearch*
	Outlook	*The dataset is continuously updated. Availability period depends on the variable, satellite type and specific sensor.*
	Data quality	*Quality is determined by the satellite, retrieval and algorithm limitations. This is the global dataset, and data quality can be estimated locally in comparison to e.g. local station-based observations.*
Data access/ Terms of Use	**Data User Registration (yes/no)**	*yes*
	If yes fields	*Basic description of the user is needed (email address).*
	Cost of service/data	*Free of charge*
	Access restrictions: Unrestricted (publicly available) or Restricted	*"Please do not re-distribute CM SAF data to 3rd parties. The use of the CM SAF products is granted free of charge to every interested user, but we have an essential interest to know how many and what users the CM SAF has. This helps to ensure the CM SAF operational services as well as its evolution*

	data (authorized users)	*according to users' needs and requirements. Each new user shall register at CM SAF in order to retrieve the data.* *[source: system generated email during the retrieval phase from the CM SAF FTP server]*
	Purpose of use	*All intellectual property rights of the CM SAF products belong to EUMETSAT. The use of these products is granted to every interested user, free of charge. If you wish to use these products in publications, presentations, web pages etc., EUMETSAT's copyright credit must be shown by displaying the words "copyright (year) EUMETSAT" on each of the products used.* *[source: system generated email during the retrieval phase from the CM SAF FTP server]*
	Data transport architecture and protocol	*FTP*
	Citation and acknowledgement	*"When exploiting EUMETSAT/CM SAF data you are kindly requested to acknowledge this contribution accordingly and make reference to the CM SAF, e.g. by stating "The work performed was done (i.a.) by using data from EUMETSAT's Satellite Application Facility on Climate Monitoring (CM SAF)". It is highly recommended to clearly identify the product version used. An effective way to do this is the citation of CM SAF data records via the digital object identifier (doi). The doi of the data sets can be retrieved through http://www.cmsaf.eu/doi."* *[source: system generated email during the retrieval phase from the CM SAF FTP server]*
Data information	**Area coverage (global, continent, country, region)**	*Global, continent, region (depends on variable)*
	Variables	*Fractional cloud cover, cloud type, cloud top temperature, cloud top height, cloud top pressure, cloud optical thickness, cloud phase, cloud water path, surface radiation components (outgoing, incoming, net; SW and LW), surface albedo, top of the atmosphere radiation components, vertically integrated water vapour,* ***Layered vertically integrated water vapour and layer mean temperature and relative humidity for 5 layers, Temperature and mixing ratio at 6 pressure levels*** ***[source: http://www.cmsaf.eu/EN/Products/AvailableProducts/OperationalProducts/Operational_Products_node.html]***
	Provenance	*EUMETSAT CM SAF*
	Spatial resolution	*Depends on specific variable.*
	Temporal resolution	*Instantaneous, daily means, monthly means*
	Quantitative error/uncertainty	*Depends on specific variable and product (http://www.cmsaf.eu/EN/Documentation/Documentation/Documentation_node.html)*
Technical description	**File type**	*NetCDF*
	Indicative file size	*Up to several GBs, depending on the user request.*
	Metadata format (CF, WMO, …)	*CF and specific CM SAF file naming convention: http://www.cmsaf.eu/EN/Products/NamingConvention/download_NamingCconvention.pdf?__blob=publicationFile&v=6*
	Related API (yes/no)	*unknown*
	Link/type (e.g. WebAPI/MARS, python, GribAPI, …)	*unknown*

4.12 Central Historical Database of the Institute of Meteorology and Water Management – National Research Institute

Table of data availability and accessibility		
Data location	**Platform/Database**	*Central Historical Database of the Institute of Meteorology and Water Management – National Research Institute (IMWM – NRI)*
	Operator	*The Institute of Meteorology and Water Management – National Research Institute (IMWM – NRI)* *[source: http://www.imgw.pl/en/]*
	Website	*http://www.pogodynka.pl/*
	Contact	*bok@imgw.pl*
	Description of the platform	*The Central Historical Database includes:* *– Central Hydrological Database,* *– Central Database of Climate Data broken down into data from meteorological and precipitation stations.* *The Central Hydrological Database contains data from around 900 water gauges with daily and characteristic flow records, with the longest sequences since 1951 (about 1/3 of the number of stations) and the others since 1971 or shorter ones. For 1160 stations there is a collection with data describing the location, equipment and other features of the measurement sites.* *In the Central Hydrological Database are also collected data on water conditions, water temperatures, extraordinary observations, and ice and overgrowth phenomena. This cover the period from 1991 till now.* *The Central Database of Climatological Data includes the following data:* *– from 65 meteorological stations: date data (with eight deadlines) and daily since 1961 for 10 stations, since 1966 for 49 stations and shorter sequences for others,* *– from 245 meteorological stations in total: data from 4 (3) times and daily since 1951 for 39 stations, since 1956 for 21 stations, since 1961 for 69 stations and other stations since the 1980s or shorter,* *– data of precipitation from 1680 total precipitation stations since 1951 for 333 stations, since the 1960s for 81 stations and shorter for other stations.* *[source: http://www.imgw.pl/]*
	Interactive applications	*The Central Historical Database system software allows for quick set of data selection and to quick calculation of statistical characteristics (their record for collection or printout) or graphical representation (either on a chart or on a map of Poland).*
	Outlook	*The dataset is continuously expanded and new data and stations are included regularly. The dataset is updated monthly. Access to the database through the website contact: bok.gdynia@imgw.pl.*
	Data quality	*Quality control procedures and homogeneity* *checks are performed that lead to flags ("OK", "suspect" or "missing").*
Data access/ Terms of Use	**Data User Registration (yes/no)**	*No*
	If yes fields	-
	Cost of service/data	*Free data for academic work done by students*
	Access restrictions: Unrestricted (publicly available) or Restricted data (authorized users)	*Since many of stations data are supplied by national weather and/or hydrological services or institutes there are restrictions according to IMWM – NRI accepted following policy: the station data received will not be passed to 3rd parties; the data received will be used for scientific purposes only.*
	Purpose of use	*Commercial, research and education*

Data information	**Data transport architecture and protocol**	*FTP*
	Citation and acknowledgement	*n/a*
	Area coverage (global, continent, country, region)	*Observational-measurement system covers the territory of Poland*
	Variables	*Basic measurement and observation programme from synoptic stations:* *- atmospheric pressure at meteorological site,* *- air temperature at 2 m above the ground,* *- air temperature at ground level,* *- air humidity,* *- wind speed and direction,* *- precipitation volume,* *- soil condition,* *- type of snow cover,* *- snow depth,* *- water equivalent of snow,* *- horizontal visibility,* *- duration of sunshine,* *- cloud cover,* *- types of clouds,* *- meteorological phenomena,* *- hydrometeors, lithometeors.* *Measurements from climatological stations:* *- air temperature at 2 m above the ground,* *- air temperature at ground level,* *- air humidity,* *- wind speed and direction,* *- precipitation volume,* *- soil condition,* *- type of snow cover,* *- snow depth,* *- water equivalent of snow,* *- cloud cover,* *- meteorological phenomena,* *- complementary visual observations go round the clock.* *Measurements and observations from precipitation stations:* *- precipitation volume,* *- snow cover depth,* *- type of snow,* *- water equivalent of snow,* *- complementary visual observations go round the clock.* *Measurements and observations from water gauge sites:* *- water level,* *- ice phenomena,* *- ice cover thickness,* *- river bed growing over with plants,* *- water temperature,* *- hydrometric measurements,* *- flow rate curve,* *- volume of discharge.*
	Provenance	
	Spatial resolution	*Depends on specific variable.* *62 synoptic stations (38 1st order stations, 24 2nd order stations)* *200 climatological stations (56 3rd order stations, 144 4th order stations)* *627 precipitation stations (all 5th order stations)*

Technical description		*861 stations of water gauge sites* *8 stations of weather radars* *8 stations of detection system of atmospheric lightnings*
	Temporal resolution	*Depends on specific variable.*
	Quantitative error/uncertainty	*Depends on specific variable.*
	File type	*.csv*
	Indicative file size	*Up to several GBs, depending on the user request.*
	Metadata format (CF, WMO, …)	*WMO*
	Related API (yes/no)	*No*
	Link/type (e.g. WebAPI/MARS, python, GribAPI, …)	