Collaborative Project

WP 3
Task 3.1 Collection and quality control of observational, modelling and sector relevant data

Availability and Characteristics of Data Sources

Project No. 265192– CLIM-RUN

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2. Synopsis

In this deliverable, observational, model and sector relevant data are collected and presented. These data will be added to the CLIM-RUN data repository to support the case studies analysis and to assess new modelling tools.

3. Introduction

3.1. Description and justification of the need of collecting and disseminating data for the Mediterranean area

The need for reliable and detail climate information as well as the development of climate service centers is vast. This need is especially true for regions whose economic growth and social development depend considerably on adjustment to climate variability and change. The Mediterranean is considered as such a vulnerable region and was renowned as a climate change "hot-spot", i.e. a region particularly susceptible to global warming. For example, the Mediterranean is especially vulnerable to changes in the water cycle and the impact of global warming on human activities and natural ecosystems is of major concern (Rosenzweig, 2007; Plan Bleu, 2009). Economic and environmental changes at the global and regional level could potentially create new hazards in the Mediterranean and intensify existing ones such as flooding (e.g. Switzerland in 2005), heat waves (e.g., summer 2003), droughts (e.g., Spain and Portugal, 2004-2005), wild fires (e.g., Portugal 2003; Greece 2008) and Alpine glacier melting (e.g., Switzerland 2003, Frauenfelder et al., 2005). As a vulnerable climate change "hot spot", the Mediterranean, already suffers from water stress and faces major problems of desertification, erosion and decline in land and marine biodiversity (Giorgi, 2006; Plan Bleu, 2009). In fact, several generations of climate change projections have consistently indicated much warmer and drier conditions in the Mediterranean, particularly in the spring and summer seasons (Giorgi and Lionello, 2008). Currently, there is a lack of a well developed climate service network in the Mediterranean, despite of all the aforementioned climate issues. This lack of climate information brings the need for collecting and disseminating data for the Mediterranean. Consequently, CLIM-RUN aims at developing a protocol for applying new methodologies

and improved modelling that is relevant to and usable by various sectors of society. CLIM-RUN follows a learning strategy in which the early involvement of stakeholders is crucial. This early involvement aims to establish a productive two-way communication that identifies climate information needs and assesses the envisioned protocol for selected inter-dependent sectors. Of particular significance are the sectors of energy, tourism and natural hazards (wild fires). Uniquely, CLIM-RUN aims to develop a novel, bottom-up approach directly involving stakeholders early in the process. This intends to develop improved modelling and downscaling tools to optimally respond to the specific needs of end users.

The energy and tourism sectors deserve particular attention due to their economic and social relevance. In regards to the energy sector, the Mediterranean seeks to play a strategic role in Europe by limiting GHG emissions to avert climate change by utilizing renewable energy projects (Komendantova et al). Specifically, this could be established by trading renewable energy quotas among European member states and from electricity imported from renewable sources outside the EU (Komendantova et al., 2009; Club of Rome 2008, http://www.clubofrome.org/eng/home/). Examples of this include the Mediterranean Solar Plan (MSP) as well as the Desertec Industrial Initiative (DII) (Knies et al., 2008). Both projects aim to reduce GHG emissions by utilizing solar energy. Enhanced use of solar power could address the increasing energy demand for summer cooling and, along with wind energy, provide the energy source to power desalinization plants needed in the more arid Mediterranean. Climate service centers could potentially be equally important to the tourism sector, as well. Mediterranean countries, due to their geographical location, attract 30% of global international tourism arrivals. In 2007, Mediterranean countries received around 275 million international tourists. Being a job-creating and foreign currency-generating sector, international tourism is an important

component of the countries' economic development (UNWTO, 2008). However, climate is essential in the destination choice of tourists (Besancenot, 1989; Lohmann, M. and E. Kaim, 1999; Scott, D., et al., 2008) and thus, if heat waves and summer temperatures increase, less tourists may be attracted to the Mediterranean regions which may favour more northerly areas, instead (Perry, 2001; Amelung, B. and D. Viner, 2006). In addition, winter tourism related to the skiing industry could also suffer tremendously from the projected decrease in snow cover and upward move of the snowline projected under warmer conditions (Giorgi and Lionello 2008; Agrawarla 2007; Muller, 2009). The aforementioned sectors, tourism and energy, will be complemented by a cross-cutting issue (forest fires) and by integrated case studies in which multiple sectors are involved.

3.2. Description of the aim of this deliverable

In this deliverable, observational, model and sector relevant data (environmental parameters directly related to the sector under discussion) are gathered to support the case studies analysis and to assess new modelling tools. The observational datasets will comprise climate, atmosphere and ocean data available through existing databases (e.g., ECA&D), EU projects (e.g., CIRCE, ENSEMBLES), WMO initiatives (e.g., MEDARE), other projects (e.g., ACRE), CLIM-RUN partners, and further contacts with National Meteorological and Hydrological Services (NHMS) in the Mediterranean.

4. Main Results

4.1. Data to be collected within the CLIMRUN project

4.1.1. Description of what kind of data is aimed to be collected during the project

Atmospheric data

With regard to atmospheric data, emphasis will be put on the Essential Climate Variables (ECVs) for the surface and upper-air observations, as described in numerous Global Climate Observing System (GCOS) publications (see e.g. the GCOS Implementation Plan).

• Air temperature at 2 m – including measuring times, mean, maximum and minimum values

• Precipitation – daily and monthly totals

• Atmospheric pressure, surface and upper levels

• Humidity, including specific and relative humidity at the surface and upper-air levels (radio-sondes)

• Wind speed and direction

• Energy budget components

• Clouds

• Greenhouse gases

• Air pollutants including ozone, aerosols and others

Terrestrial data

For terrestrial and hydrological data, the repository will include data on:

• Land cover and vegetation type, fPAR, Leaf Area Index

• Albedo

• Soil moisture

• Soil physical properties

• Soil chemical properties

• Soil temperature

• Groundwater level

• Lake levels

• River discharge

• Snow cover

Oceanic data

Marine data holdings will comprise:

• Sea surface temperatures as well as data from upper deep layers of the water column

• Salinity at the surface, upper layers and deep water

Energy data

Energy data will comprise national data and information provided by international organizations (e.g. Energy Information Agency, International Energy Agency and Observatoire Méditerranéen de l'Energie) for each country such as:

• Total energy production and consumption, total CO_2 emissions

• Petroleum: production, consumption, stocks, reserves, capacity, import, export, CO_2 emissions

• Natural Gas: production, consumption, reserves, import, export, CO_2 emissions

• Coal: production, consumption, reserves, import, export, CO_2 emissions

• Electricity: generation, production, consumption, capacity, import, export, distribution losses

• Renewables: electricity generation, electricity consumption, biofuel production and consumption

Water Resources

Water resources will rely on national data as well as on data provided by international organizations such as AQUASTAT of the FAO, specifically comprising:

• Total exploitable water

• Total renewable water resources (surface and groundwater)

• Surface water storage capacity (dams)

• Water use: water withdrawal by sector, waste water treatment and re-use

• Irrigated area and irrigation potential

Land Use data

With regards to information on land use, information is given on areal estimates and (digital) maps of:

• Arable land

• Permanent crops cultivated

• Cultivated land (arable and permanent crop)

Population, Economy and Development

This data group includes a collection of basic demographic and country-specific base data:

- Population indices: total population, rural population; urban population, population density, active population (by sector)
- Human Development index (HDI)

4.1.2. Table presenting the most essential variables of each sector

Table 1: Observational and sectoral data to be collected and added to the CLIM-RUN data repository.

Atmosphere/climate data		Oceanic data	
Air temperature at 2 m		Sea temperature	
	Daily/monthly mean		Surface
	Daily/monthly maximum		Upper Layers
	Daily/monthly minimum	Salinity	
Precipitation			Surface
	Daily totals		Upper layers
	Monthly totals	Water resources	
Atmospheric pressure		Total exploitable water	
	Surface	Total renewable water resources	
	Upper levels		Surface
Wind			Groundwater

Atmosphere/climate data		Oceanic data	
	Velocity	Surface water storage capacity (dams)	
	Direction	Water use	
Energy budget components			water withdrawal by sector
Clouds		Sectoral data	
Greenhouse gases		Tourism	
Air pollutants			Tourist arrivals
	Ozone		Accommodation establishments
	Aerosols and others	Energy	
Terrestrial data			Electricity Generation
Albedo			Electricity Consumption
Soil Moisture		Forest fires	
Soil Temperature			Number of fires
Groundwater level			Size of fires
Snow cover			Forest fire risk

4.2. Availability and characteristics of the existing data sources

4.2.1.**Presentation of the existing data sources, data repositories or centres, as well as a description of the characteristics of the datasets that can be freely provided by them, for each of the following sectors:**

Climate observations

Climate models

Water related data

Energy related data

Tourism information

Forest fire data

Table 2: Climate data table 1

ACRONYM	DATA SOURCES	WEBSITE
ATMOSPHERIC DATA		
BADC	The British Atmospheric Data Centre	http://badc.nerc.ac.uk/home/
Climate Wizard The Nature Conservancy	Climate Wizard The Nature Conservancy	http://www.climatewizard.org/
CRU	Climatic Research Unit	http://www.cru.uea.ac.uk
ECA&D	European Climate Assessment & Dataset Project	http://eca.knmi.nl/
ECMWF	European Centre for Medium-Range Weather Forecasts	http://www.ecmwf.int/products/data/archive/descriptions/e4/index.html
GEOSS	The Global Earth Observation System of Systems	http://www.earthobservations.org/geoss.shtml

ACRONYM	DATA SOURCES	WEBSITE
GCOS	Global Climate Observing System	http://gosic.org/ios/GCOS-main-page.htm
GHCN	Global Historical Climatology Network	http://www.ncdc.noaa.gov/temp-and-precip/ghcn-gridded-products.php
GCMD (NASA)	Global Change Master Discovery	http://gcmd.gsfc.nasa.gov/
GOSIC	The Global Observing Systems Information Center	http://gosic.org/gosic/GOSIC-program.htm
GSOD	Global Summary Of the Day (NOAA)	http://www.ncdc.noaa.gov/cgi-bin/res40.pl?page=gsod.html
IGRA	Integrated Global Radiosondes Archive	http://www.ncdc.noaa.gov/oa/climate/igra/
IPCC	Intergovernmental Panel on Climate Change	http://www.ipcc-data.org/
KNMI Climate Explorer	Royal Netherlands Meteorological Institute	http://climexp.knmi.nl/start.cgi?someone@somewhere
NCDC	National Climate Data Center	http://www.ncdc.noaa.gov/oa/ncdc.html
NCEP/NCAR Project	NOAA/ESRL *Physical Sciences Division*	http://www.esrl.noaa.gov/psd/data/reanalysis/reanalysis.shtml

ACRONYM	DATA SOURCES	WEBSITE
PRUDENCE Project	Prediction of Regional scenarios and Uncertainties for Defining European Climate change risks and Effects	http://prudence.dmi.dk/
SEE VCCC	South Eastern European Virtual Climate Change Centre	http://www.seevccc.rs
UNEP GEOportal	United Nations Environment Programme (Global Environment Outlook)	http://geodata.grid.unep.ch/extras/dataproviders.php
WMO-CLIVAR project	Climate Variability and Predictability project	http://www.clivar.org/organization/etccdi/indices.php
WMO MEDARE Initiative	Mediterranean climate Data Rescue project	http://www.omm.urv.cat/MEDARE/index.html
WorldCLIM (data for ArcGIS)	Global Climate Data WorldCLIM	http://www.worldclim.org/
Ensembles	Ensembles	http://www.ensembles-eu.org/

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ACRONYM	DATA SOURCES	WEBSITE
CIRCE	Climate Change and Impact Research: The Mediterranean Environment	http://www.circeproject.eu
CIMME	Climate Change and Impacts in the Eastern Mediterranean and Middle East	http://www.cyi.ac.cy/climatechangemetastudy
World Resources Institute	Earth Trends Environmental Information	http://earthtrends.wri.org
SATELLITE DATA		
WRMC-BSRN	World Radiation Monitoring Center- Baseline Surface Radiation Network	http://www.bsrn.awi.de/en/data/data_retrieval_via_pangaea/
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites	http://www.eumetsat.int/Home/index.htm

ACRONYM	DATA SOURCES	WEBSITE
NESDIS	The National Environmental Satellite, Data, and Information Service	http://www.nesdis.noaa.gov/AboutNESDIS.html
REVERB/ECHO (NASA)	Reverb metadata and service discovery tool	http://www.echo.nasa.gov/reverb/about_reverb.htm
WIST (NASA)	The Warehouse Inventory Search Tool	https://wist.echo.nasa.gov/wist-bin/api/ims.cgi?mode=MAINSRCH&JS=1
AIR POLLUTANTS-EMISSIONS-OZONE-AEROSOLS		
CDIAC	Carbon Dioxide Information Analysis Center	http://cdiac.ornl.gov/
EMEP	*European Monitoring and Evaluation Programme*	http://www.emep.int/ http://tarantula.nilu.no/projects/ccc/network/index.html
GEIA-ACCENT	The Global Emissions Inventory Activity-Atmospheric Composition Change: the European Network (ACCENT)	http://accent.aero.jussieu.fr/database_table_inventories.php
NCAR (ACD)	NCAR Atmospheric Chemistry Division	http://acd.ucar.edu/~emmons/DATACOMP/camp_table.htm

ACRONYM	DATA SOURCES	WEBSITE
SEE VCCC	South Eastern European Virtual Climate Change Centre	http://www.seevccc.rs
WDCGG (WMO)	World Data Centre for Greenhouse Gases Measurements of greenhouse and related trace gas species	http://gaw.kishou.go.jp/wdcgg/products/cd-rom/cd_14/A/menu/data.html
World Resources Institute	Earth trends The Environmental Information Portal	http://earthtrends.wri.org/searchable_db/index.php?theme=3
WOUDC (WMO)	World Ozone and Ultraviolet Radiation Data Centre	http://www.woudc.org/index_e.html
OCEAN DATA		
GOOS	The Global Ocean Observing System	http://gosic.org/ios/GOOS-Main-Page.htm
MOON	Mediterranean Operational Oceanography Network	http://www.moon-oceanforecasting.eu/
TERRESTIAL DATA		

ACRONYM	DATA SOURCES	WEBSITE
GTOS/GT-NET	Global Terrestrial Observing System	http://www.fao.org/gtos/GT-NET.html http://gosic.org/ios/about-GTOS-observing-system.htm

Details of the datasets described in this section are provided in table 2.

Atmospheric data

With regard to atmospheric data, the above table includes links to websites that provide data information on air temperature, including measuring times, mean, maximum and minimum values (GHCN), precipitation (GHCN), atmospheric pressure, humidity, wind speed and direction (IGRA), clouds (PRUDENCE project) e.t.c. Data include both high resolution gridded data (ECA&D, CRU) as well as daily output data from regional climate models (EU-ENSEMBLES). Data is available for anywhere in the world (Climate Wizard) and more specifically for Europe (ECA&D), the Greater Mediterranean (WMO MEDARE Initiative), the Mediterranean (CIMME) and the Middle East (CIMME). In addition, data is available for various time periods dating as back as 1880 to present.

Satellite data

Satellite data include environmental satellite data about Earth's weather, atmosphere, oceans, land, near-space conditions etc . Satellites used in the collection of data include both geostationary (i.e. Meteosat First Generation (MFG), Meteosat Second Generation (MSG) and Meteosat Third Generation (MTG) meteorological satellites), polar orbiting satellites (i.e. the EUMETSAT Polar System (EPS) is Europe's first polar orbiting operational meteorological satellite system and it is the European contribution to the Initial Joint Polar-Orbiting Operational Satellite System (IJPS)) and Low Earth Orbiting (LEO) satellites, flying at an altitude of around 1,300 km. In addition, ground networks are in charge for

receiving and turning the satellite data into useful products for end users. This includes ground receiving stations, the satellite control centre and data processing application facilities.

Air pollutants

Air pollutant data include *data primarily for the ozone, aerosols and heavy metals. For example, the* CDIAC deals mainly with atmospheric concentrations of carbon dioxide and other radiatively active gases (i.e. the role of the terrestrial biosphere and the oceans in the biogeochemical cycles of greenhouse gases; emissions of carbon dioxide from fossil-fuel consumption and land-use changes; long-term climate trends; the effects of elevated carbon dioxide on vegetation; and the vulnerability of coastal areas to rising sea level) and the EMEP provides data on the European regional air quality concerning acidification, eutrophication, ground level ozone, heavy metals, persistent organic compounds and atmospheric particles.

Ocean data

Ocean data give information on sea temperatures, salinity and sea level. The **GOOS** is a permanent global system for observations, modeling and analysis of marine and ocean variables to support operational ocean services worldwide whereas the MOON provides data that are more specific to the Mediterranean. Monthly mean sea-level data for various sites across the Mediterranean are publicly available from the 'Permament Service for Mean Sea Level' (PSMSL;

http://www.psmsl.org/data/obtaining/). These data cover various time periods from a few months to a maximum of ~60 years.

Terrestrial data

The terrestrial data repository includes data on**:** river discharge, water use, ground water, lake levels, snow cover, glaciers and ice caps, permafrost and seasonally-frozen ground, albedo, land cover , fraction of absorbed photosynthetically active radiation (fAPAR), leaf area index (LAI), biomass and fire disturbance (GT-NET).

Table 3: Climate data table 2 – A more detailed description of available services in climate observations and models

Dataset	Type of data	Variables											Spatial resolution	Temporal horizon	Temporal resolution	Data policy	Notes	Links
		Precipitation	Mean	Max Temperature	Min Temperature	Cloud Cover	Aerosols	Solar radiation	Solar radiation	Wind intensity	Extreme wind	Humidity						
DeSurvey	Statistical downscaling	•	•	•	•								1km	1970-2001	Daily		Other variables available	
ECA&D	Station observations	•	•	•	•	•				•	•	•	NA	Typically 1951-2011 available	Daily	Public	Other variables available	http://eca.knmi.nl/
HOAPS	Satellite	•											0.5x0.5	1988-2005	Monthly			http://www.hoaps.zmaw.de/

GPCP	Satellite	•											2.5x2.5	1979-2008	Monthly			http://www.gewex.org/gpcpdata.htm
CMAP	Satellite	•											2.5x2.5	1979-2007	Pentad and Monthly			http://www.esrl.noaa.gov/psd/data/gridded/data.cmap.html
TRMM	Satellite	•											0.25x0.25	1998-2001	Monthly			http://trmm.gsfc.nasa.gov/
CRU TS 3.1	Gridded observations	•	•	•	•	•						•	0.5x0.5	1901-2009	Monthly	Available BADC (registration required)	Humidity expressed as water vapour	http://www.cru.uea.ac.uk/cru/data/hrg/
(Had)CRU Tem3	Gridded observations		•										Global 5x5°	1850-2010	Monthly	Available from BADC (registration required)		http://www.cru.uea.ac.uk/cru/data/temperature/

				Global 1200km 250km	1850-2010	Monthly			http://data.giss.nasa.gov/gistemp/
GISS	Gridded observations		•	Global 1200km 250km	1850-2010	Monthly			http://data.giss.nasa.gov/gistemp/
GHCN (v3)	Gridded observations		•	Global 5x5°	1850-2010	Monthly			http://www.ncdc.noaa.gov/temp-and-precip/ghcngridded-products.php
GHCN (v2)	Gridded observations	•		Global 5x5°	1850-2010	Monthly			http://www.ncdc.noaa.gov/temp-and-precip/ghcn-gridded-products.php
HadCRUH	Gridded observations		•	5x5°	1973-2003	Monthly	Non-commercial	Specific and relative humidity	http://www.metoffice.gov.uk/hadobs/hadcruh/

CPC GHCN/CAMS	Gridded observations		•										0.5x0.5° 1.0x1.0° 2.5x2.5°	1948-2010	Monthly			ftp://ftp.cpc.ncep.noaa.gov/wd51yf/GHCN_CAMS/
GEBA	Station observations					•		•	•				NA	Typically 1985-2000	Monthly	Contact Martin Wild (ETH)		http://www.geba.ethz.ch/
ISCCP D2	Satellite							•	•				Global 2.5x2.5°	1984-2006	Monthly			http://iridl.ldeo.columbia.edu/SOURCES/.NASA/.ISCCP/.D2/
AJONC	Satellite							•	•				Europe 0.1x0.1°	1996-2005	Hourly	Contact C.Canellas (Météo-France)		

SRB	Satellite						•	•			1x1°	1983-2007	Three-hourly			http://eosweb.larc.nasa.gov/PRODOCS/srb/table_srb.html
ERA40	Model reanalysis	•	•			•	•	•	•	•	1.125x1.125°	1957-2002	Three-hourly			http://www.ecmwf.int/research/era/ERA-40_Atlas/
ERA Interim	Model reanalysis	•	•			•	•	•	•	•	0.7x0.7°	1979-2011	Three-hourly			http://data-portal.ecmwf.int/data/d/interim_daily/
ERA Interim (CNRM corrected)	Model reanalysis	•									0.7x0.7°	1989-2001			In development	

SAFRAN	Observations reanalysis		•					•	•	•		8kms over France	1900-2010	Hourly	Contact Météo-France	Also being developed for the Iberian Peninsula. Contact P. Quintana-Seguí (Observatori de l'Ebre (Universitat Ramon Llull – CSIC))	
E-Obs (v5.0)	Gridded observations	•			•	•						0.25x0.25°	1950-2011	Daily	Non-commercial		http://eca.knmi.nl/download/ensembles/download.php
ENSEMBLES regional	Dynamical downscaling	•	•				•		•	•	•	25kms Europe	1960-2001	Six-hourly	Non-commercial		http://www.ensembles-eu.org/

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Name	Type											Resolution	Period	Frequency	Access		URL
ENSEMBLES regional	Scenarios – A1B emissions	•	•				•		•	•	•	25kms Europe	1950-2100	Six-hourly	No commercial		http://www.ensembles-eu.org/
HistALP	Gridded observations	•	•									1x1 and 10 min (4-19E;43-49N)	1800-2003	Monthly			http://www.zamg.ac.at/histalp/content/view/28/1/index.html
Land Surface Hydrology Research Group	Combination of NCEP reanalysis and observations	•	•			•		•		•		1°x1°	1948-2008	Three-hourly and daily	Public		http://hydrology.princeton.edu/data.pgf.php
NCEP CFSR	Reanalysis	•	•			•	•	•		•		0.3°, 0.5°, 1.0°, and 2.5°	1979-2010	Three-hourly	Public		http://dss.ucar.edu/datasets/ds093.0/
GPCC (v5)	Gridded observations	•										0.5x0.5; 1.0x1.0; 2.5x2.5	1901-2009	Monthly	Public		http://gpcc.dwd.de/

MODIS	Satellite global				•					10 kms	2000-2009	Daily			http://nsidc.org/data/modis/visualization_aids/cmg_browse/index.html
Seviri	Satellite regional				•								Registration required for Earth Observation Portal (EUMETSAT)		http://www.eumetsat.int/Home/Main/DataProducts/HowtoUseOurProducts/SP_20110131154217380?l=en
RegCM ERA-Interim	Model simulation interactive aerosols				•					50kms	2000-2009	6h			
aeronet	Station Observations				•					NA	Station dependent				http://aeronet.gsfc.nasa.gov/

Details of the datasets described in this section are provided in the table 3.

Station data

The European Climate Assessment and Dataset database (ECA&D), hosted by KNMI (http://eca.knmi.nl/) provides access to daily station data from across Europe for a variety of variables (see Figure 1). For the period 1951-2010 publicly available station series exist for the Mediterranean region (28-47N, -10-40E, as defined in the CIRCE project) for up to 61 stations, depending on the variable (Figure 1). Other non-public datasets are available from ECA&D for the Mediterranean region.
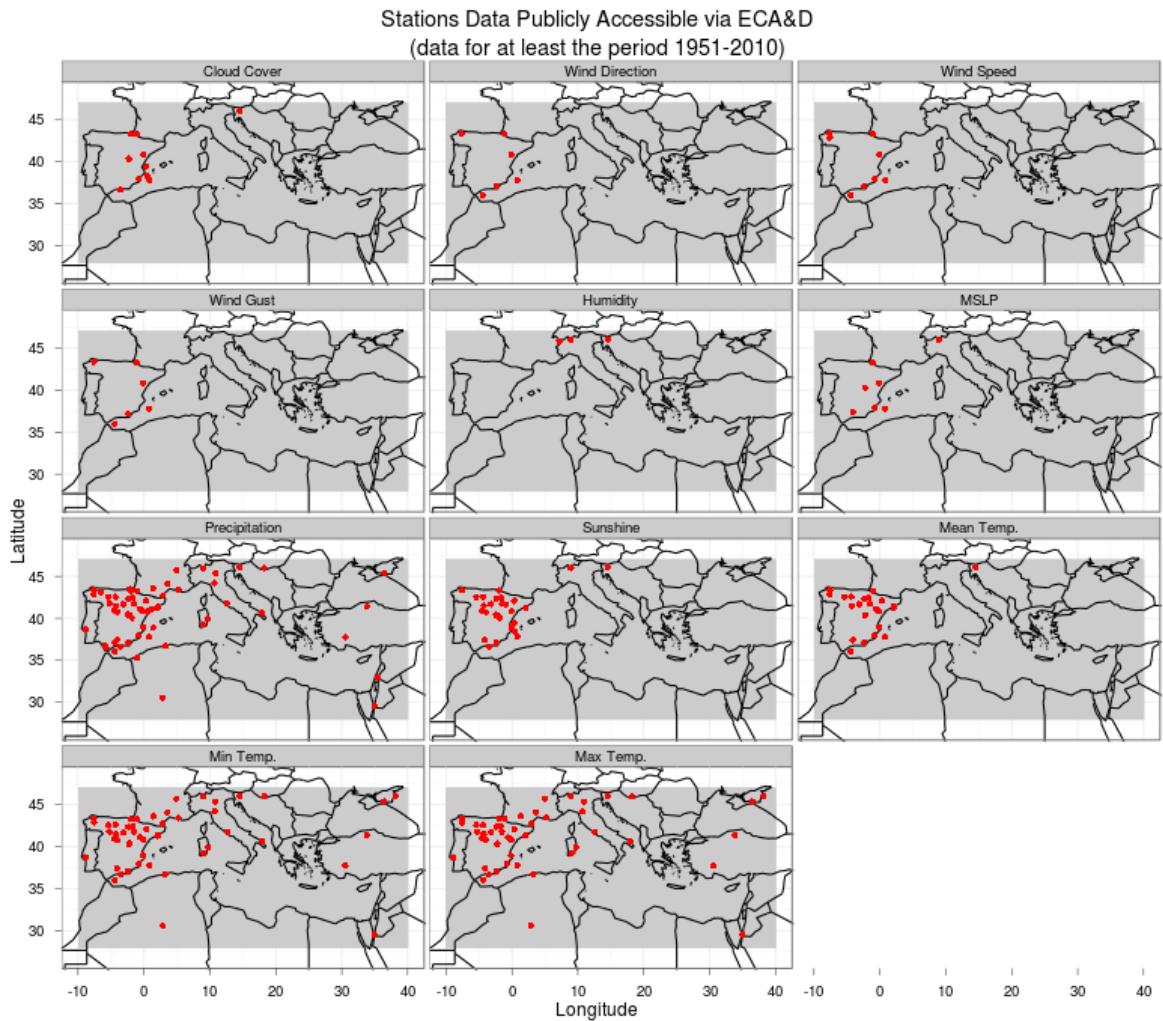
Figure 1: Publicly available station data available in the ECA&D database. Only stations that have data for at least the period 1951-2010, and which lie in the Mediterranean area are shown.

High-resolution gridded data

Several high-resolution datasets for the Mediterranean region exist. The particular merit of these data is that they provide a sufficiently high resolution for the verification of Regional Climate Models (RCMs). Vidal et al. (2009) classify the construction of high-resolution gridded datasets into four groups, of which three have been used to derive datasets[1] for all or part of the Mediterranean region:

Interpolation of surface observations, possibly including satellite observations from the recent past

Statistical or dynamical downscaling of reanalysis data

Combining global reanalysis data with observations through objective interpolation techniques.

Under the type-1 group the E-Obs dataset (Haylock et al., 2008) is a 25km gridded product that is available for non-commercial use and consists of daily precipitation and minimum, maximum, and mean surface temperature data for land areas across the European domain. This dataset was developed within the framework of the EU-ENSEMBLES project. The data cover the area: 25N-75N, 40W-75E and are available on a 0.22 and 0.44 degree rotated pole grid, with the north pole at 39.25N, 162W (http://eca.knmi.nl). It should be noted, however, that there is a relatively low station coverage across the south of the Mediterranean domain and the Middle-East (see

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[1] The fourth method defined by Vidal et al. (2009) of forcing a RCM using global reanalysis boundary conditions and assimilating observations is currently underway for the Iberian Peninsula (Sáenz, 2008) although the datasets are not currently available.

Haylock et al., 2008 their Figure 1), which leads to a lower confidence and utility of the data for these regions.

For France, the SAFRAN dataset is available, which contains gridded observations (8km) at the 1-hour resolution for and covers the period 1958-2008 for a variety of variables (precipitation, temperature, specific humidity, wind speed, solar radiation and infrared radiation). This product (type-3 group) has been developed by combining the ECMWF global reanalysis data with surface observations from the Météo-France database (Vidal et al., 2010).

Low-resolution gridded data

The latest version of the land-based CRU gridded data series is CRU TS3.1, which has the advantages over earlier versions of containing more station series (although few additions across the Mediterranean) and that no homogenization corrections have been applied to the data. The 3.1 version entirely supersedes the previous TS3.0 version. HadCRUT3 combines land and sea surface temperature (SSTs) to form a more spatially complete series. In the KNMI climate explorer database, a version of the merged CRU temperature data and the Hadley Centre's SST (HadCRU) series is available where the merger is produced using the fraction of land area in each grid. This produces improvements at coastal locations, and particularly when analyzing regional scale anomalies (see Osborn, 2011). Hence this series may be more useful than the original version of the data when used in the context of the ClimRun project.

Reanalysis data

Reanalysis data use assimilation methods initially developed for numerical weather forecasts. Such products are spatially complete and consist of multiple-variables in four dimensions. The ERA-interim data set is the latest product from the ECMWF (Dee et al.,

2011). The data begin in 1979 and are routinely updated to near-real time. The data consist of both surface and upper atmosphere variables. The term 'interim' is used for this dataset in anticipation for a much larger project, which will produce a dataset covering the twentieth century. In addition, NOAA/NCEP produce a reanalysis dataset. The latest NCEP reanalysis available is CFSR (Saha *et al.*, 2010). The 20th Century Reanalysis data set (Compo et al., 2006; 2011) provides a different approach to the other reanalyses considered, in that only MSLP, sea ice, sea surface temperatures, atmospheric CO2 concentrations and solar/volcanic forcings are used. While the primary aim of this approach is to produce a long-time series of data, the exclusion of certain parameters may allow the data to be used to infer the significance of forcings when compared with observed datasets and model output.

Two additional projects are underway, which will produce reanalysis data that may be of use in the CLIMRUN project: EURO4m (http://www.euro4m.eu/) and ERA-clim (http://www.era-clim.eu/). EURO4m will produce regional reanalysis products, whereas ERA-clim aims to improve global reanalyses. Both of these projects started in 2011 and there the reanalysis products may only become available towards the end of the CLIMRUN timeframe.

Downscaled data

Downscaled data at the 1km resolution are available for certain areas of the Mediterranean as produced for the project 'DeSurvey'. Seven variables (mean, maximum and minimum temperature; precipitation; evaporation and U/V wind components) were downscaled from the ERA-40 dataset, for six regions across the Mediterranean (Corsica/Sardinia, 8-10E, 39-43N; Greece, 19-29E, 34-42N; Northern Italy, 6-16E, 42-

48N; Southern Italy, 11-19E, 36-42N; Spain, 10W-4E, 34-44N and Tunisia, 7-13E, 30-38N). These daily data were constructed using thin-plate spline interpolation (Kostopoulou et al, 2010). The data are available for the period 1970-2001 and are available from the Climatic Research Unit.

The ENSEMBLES downscaling portal will be adapted in the framework of the CLIM-RUN project according to the case study needs (http://meteo.unican.es/ensembles). The downscaling portal is an interactive user-friendly tool to ease downscale low resolution outputs from the GCMs to the local scale required for end users. Time series of different local variables of interest for the case studies (energy, tourism and wild fire) will be produced by using this tool for the target locations.

Satellite observations

Several datasets exist that have been compiled using remotely sensed (satellite) observations. The typical advantages of such series is that they are spatially complete, although they are temporally limited to a start date of the late 1970s/early 1980s.

Climate models

Daily output data from 6 regional climate models developed at KNMI (Netherlands), CNRM (France), ETHZ (Switzerland), MPI (Germany), METO (UK) and METNO (Norway) within the framework of the EU ENSEMBLES project (www.ensembles-eu.org) are available. All models were developed at a high horizontal resolution (25 km × 25 km) under the IPCC SRES A1B scenario.

Furthermore, three high resolution regional climate models, the ENEA, CNRS-IPSL and MPI-HH developed within the framework of EU-CIRCE project are also accessible (http://www.circeproject.eu). These models use a fully coupled Mediterranean Sea and their resolution varies from 25 to 35 km.

Finally, the Hadley Centre PRECIS regional climate modeling system is available. The model simulations were performed at the Cyprus Institute within the framework of the CIMME project (www.cyi.ac.cy/climatechangemetastudy), which studies 'Climate Change and Impacts in the Eastern Mediterranean and Middle East'. The model has a horizontal resolution of 25km. In preparation for the IPCC's fifth assessment report, data from global climate models are being assembled by the Coupled Model Intercomparison Project Phase 5 (CMIP5). These data may be less relevant for ClimRun than the RCM output described above, but may be of use in certain applications. The CMIP5 data are available from the Earth System Grid's data portal (http://pcmdi3.llnl.gov/esgcet/home.html) and new model runs are being added to this database at the time of writing.

Table 4: Water data table

ACRONYM	DATA SOURCES	WEBSITE
ACSAD	Arab Center for the Studies of Arid Zones and Dry lands	http://www.acsad.org/
AQUASTAT	FAO's global information system on water and agriculture	http://www.fao.org/nr/water/aquastat/main/index.stm
EMWIS	Euro-Mediterranean Information System on know-how in the Water sector	http://www.emwis.org
EUROSTAT	Statistical office of the European Union	http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database
GEOSS	The Global Earth Observation System of Systems	http://www.earthobservations.org/geoss.shtml
GCMD (NASA)	Global Change Master Directory	http://gcmd.gsfc.nasa.gov/
HOA	Hydrological Observatory of Athens	http://hoa.ntua.gr/

ACRONYM	DATA SOURCES	WEBSITE
ICARDA	International Center for Agricultural Research in the Dry Areas	http://www.icarda.org/Facelift.htm
PHG	Palestinian Hydrology Group	http://www.phg.org/fromthefield.asp
Plan Bleu	Regional Activity Center	http://www.planbleu.org/donnees/eau/simed/eau_simed_uk.html
World Resources Institute	Earth Trends Environmental Information	http://earthtrends.wri.org
WHYCOS	World Hydrological Cycle Observing System	http://www.whycos.org/cms/home

The water data repository consists of links to websites that provide information on total exploitable water, total renewable water resources (surface and groundwater), surface water storage capacity (dams), water use (water withdrawal by sector, waste water treatment and re-use), irrigated area and irrigation potential. Information and data are available for the Mediterranean (i.e. Plan Bleu), the Euro-Mediterranean (i.e. EMWIS), across the globe (AQUASTAT, GCMD (NASA)) and nationally for Athens (i.e. HOA) and Palestine (i.e. PHG).

Table 5: Energy data table

ACRONYM	DATA SOURCES	WEBSITE
EEA	European Environment Agency	http://www.eea.europa.eu/data-and-maps
EEI	European Energy Institute	http://en.openei.org/wiki/European_Energy_Institute
EUROSTAT	Statistical office of the European Union	http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database
GEOSS	The Global Earth Observation System of Systems	http://www.earthobservations.org/geoss.shtml
IEA	International Energy Agency	http://www.iea.org
OME	Observatoire Méditerranéen de l'Energie	http://www.ome.org
Plan Bleu	Regional Activity Center	http://www.planbleu.org/

ACRONYM	DATA SOURCES	WEBSITE
World Resources Institute	Earth Trends Environmental Information	http://earthtrends.wri.org

The energy data repository contains links to websites that give information on total energy production and consumption (total CO_2 emissions), petroleum (production, consumption, stocks, reserves, capacity, import, export, CO_2 emissions), natural gas (production, consumption, reserves, import, export, CO_2 emissions), coal (production, consumption, reserves, import, export, CO_2 emissions), electricity (generation, production, consumption, capacity, import, export, distribution losses) and renewable (electricity generation, electricity consumption, biofuel production and consumption).   Data is available for the Mediterranean (i.e. OME, Plan Bleu), Europe (i.e. EEA, EEI, EUROSTAT) and across the globe (i.e. IEA, World Resources Institute).

Table 6: Fire emissions data table

ACRONYM	DATA SOURCES	WEBSITE
GFED	Global Fire Data	http://www.globalfiredata.org/
Ministry of Environment, Energy and Climate Change	Forest Special Secretariat of the Ministry of Environment, Energy and Climate Change	http://www.ypeka.gr/
EFFIS	European Forest Fire Information System, Joint Research Centre, European Commission	http://effis.jrc.ec.europa.eu/
WWF	Pyroskopio	http://www.oikoskopio.gr/pyroskopio/

The fire emission data repository aims to give information on the number and size of fires as well as forest fire risk. For example, data provided from the Forest Special Secretariat of the Ministry of Environment, Energy & Climate

Change include forest fire data that cover a period of fifteen years, for the entire Greek territory. Creation of the data is based upon the post fire inventories documented by each forest service. Forest fire data contain the number of fire events per day and the total area burnt with detailed information on different land use types (i.e. forest, agricultural land, etc.). Furthermore, this inventory contains data concerning the response of the fire service to each fire event as well as its duration.

The Global Fire Emissions Database (GFED) combines satellite information on fire activity and vegetation productivity to estimate gridded monthly burned area and fire emissions, as well as scalars that can be used to calculate higher temporal resolution emissions for use in large-scale atmospheric and biogeochemical studies. In the framework of CLIM-RUN, fire emissions are retrieved from the GFED to be used as input for the atmospheric model COSMO-ART. The COSMO-ART simulations will be performed by the National Observatory of Athens (NOA) in order to assess the fire risk and air pollution during the 2007 wildfire events in Greece.

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 most up to date information on the current fire season in Europe and in the Mediterranean area is provided. This includes today meteorological fire danger maps and forecast up to 6 days, daily updated satellite images of the last 7 days, maps of the latest hot spots and fire perimeters also updated daily.

Pyroskopio of WWF is another integrated database for the forest fires in Greece. The aim of Pyroskopio is to provide sound and user friendly information on fires to citizens and services. The information that can be extracted from the database is graphical representation of the burnt area, the number and the severity of fires and can be used for research or operational purposes. The fire data cover the period of 1983-2008 for the entire country of Greece.

Table 7: Land use- agriculture data table

ACRONYM	DATA SOURCES	WEBSITE
AQUASTAT	FAO's Global Information system on water and agriculture	http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en
FAOSTAT	Food and Agriculture Organization of the United Nations	http://faostat.fao.org/site/339/default.aspx

ACRONYM	DATA SOURCES	WEBSITE
GCMD (NASA)	Global Change Master Directory	http://gcmd.gsfc.nasa.gov/
HWSD	Harmonized World Soil Database	http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/global-terrain-slope.html?sb=6
IFA	International Fertilizer Industry Association	http://www.fertilizer.org/ifa/ifadata/search
IPG	Institute of Physical Geography Hydrology Group (Goethe-University Frankfurt)	http://www.geo.uni-frankfurt.de/ipg/ag/dl/datensaetze/index.html
UC Berkeley Geospatial Data Repository	University of California, Berkeley	http://gis.lib.berkeley.edu:8080/
USDA	United States Department of Agriculture	http://www.usda.gov/oce/weather/pubs/Other/MWCACP/world_crop_country.htm#westernasia http://www.pecad.fas.usda.gov/cropexplorer/

ACRONYM	DATA SOURCES	WEBSITE
EEA	European Environment Agency	http://www.eea.europa.eu/data-and maps/data#c12=corine+land+cover+version+13
World Resource Institute	Earth trends The Environmental Information Portal	http://earthtrends.wri.org/searchable_db/index.php?theme=8

Land use data repository contains information such as arable land, permanent crops cultivated as well as cultivated land (arable and permanent crop).

Table 8: Population and economy data table

ACRONYM	DATA SOURCES	WEBSITE
AQUASTAT	FAO's global information system on water and agriculture	http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en
EUROSTAT	Statistical office of the European Union	http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database

ACRONYM	DATA SOURCES	WEBSITE
SEDAC	Socioeconomic Data and Applications Center	http://sedac.ciesin.columbia.edu/gpw/
University of California, Berkeley	UC Berkeley Geospatial Data Repository	http://gis.lib.berkeley.edu:8080/
World Resources Institute	Earth trends The Environmental Information Portal	http://earthtrends.wri.org/searchable_db/index.php?theme=4

The population and economy data group repository contains links to websites that aim to collect basic demographic and country-specific base data such as population indices (total population, rural population, urban population, population density, active population (by sector) and Human Development index (HDI).

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