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Report for Deliverable 1.1 (D1.1): DARE list of sources from UERRA WP1

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This document presents the report for the Deliverable 1.1 (D1.1) entitled: *A comprehensive list of possible additional sources that can be accessed for digitisation and encoding*, which has been elaborated by the University Rovira i Virgili (URV) in cooperation with the University of East Anglia (UEA) and the National Meteorological Administration of Romania (NMA-RO) for the Work Package 1 (WP1 on Data Rescue and development, gridded and observational datasets) committed under the EU-FP7-funded collaborative project entitled *Uncertainties in Ensembles of Regional Reanalyses* (UERRA: Grant agreement no.: 607193).

UERRA is aimed at developing an ensemble system of regional reanalyses (RRA) to contribute to climate services, monitoring and research for Copernicus by means of enhancing both long-term datasets (either station-based data or gridded products) of Essential Climate Variables (ECVs) at the synoptic-scale and improving uncertainty estimation of the information content of these datasets.

Brunet and Jones (2011) have shown that only a small fraction of the total of surface weather and climate observations at the finer time scales recorded across the world is available for use in any climate assessment and application. However, a remarkable part of these records not currently usable are kept in un-digitised formats in both on-line and physical archives around the world, pending digitisation and potentially at risk of being lost forever.

A data rescue (DARE) exercise will be conducted under WP1 to improve both gridded and reanalysis products and to contribute to reduce their uncertainties, which are mainly related to the still limited spatial and temporal data availability. This restricted data availability will be improved by adding new digitised data for those climatic variables and locations that can have a higher impact to enhance RRA in Europe after the recovery effort. The focus of this DARE effort in UERRA will be put on those European data-sparse regions for both 20th century sub-periods, the post-1961 and pre-1961 sub-periods, as indicated in the UERRA research proposal.

In order to improve climate data availability and accessibility over poorly documented European regions in the 20th century, WP1 has first explored current availability of digitised data maintained at the Meteorological Archival and Retrieval System (MARS) Archive of the European Centre for Medium Weather Forecast (ECMWF); observations that are the basic input for European Reanalysis, but for which there isn't any catalogue. This reality has made it necessary to decode the data and produce a metadata file listing stations details, variables recorded, observing times and periods. This examination of currently available digitised data in use in Regional Reanalysis (RRA) has also included other on-line databanks that also contain already digitised and usable climate data at the synoptic scale. This first step will in addition enable us to set the specific targets in WP1 and avoid duplicating efforts.



To identify relevant data sources containing un-digitised synoptic observations for Europe in scanned and other formats, WP1 has also built upon the EURO4M DARE effort to produce a comprehensive list of historical climate data holders and sources with relevant un-digitised, but imaged data over Europe, as a first step to carry out additional DARE activities. In this regard, the evaluation of the currently basic input in use for Reanalysis at the ECMWF has been extracted by the UEA partner, while searches of other digital databanks have been carried out by the URV partner, which has also been the partner responsible for the compilation of the data sources and contacting the data holders, from where relevant and un-digitised data are being digitised by URV after identifying and gathering the relevant imaged sources and checking their unavailability at the MARS Archive.

The report is divided into two sections in addition to this introduction: 1) Data holders explored and accessed to identify and gather relevant climate data sources for Europe, either in digital or imaged format, and 2) Data sources examined and gathered to identify un-digitised and relevant climate data to be digitised, which includes a comprehensive list of potential sources that can be accessed for digitisation and encoding.

Section 1: Data holders explored and accessed to support the DARE efforts in UERRA

1.1. Introduction

The needs for high-resolution datasets underpin the progress to consolidate the recovery of historical observations. The European National Meteorological and Hydrological Services (NMHSs) have made efforts to enhance their national climate datasets through recovering historical observations, but not always have these efforts increased data availability in use for relevant organisations at the regional and global scales. UERRA will enable a pan-European approach to achieve this objective, rather than many fragmented national attempts and will provide to all the European users reliable and easily accessible data and information.

DARE activities are crucial for recovering climate observations, which include locating relevant data sources, accessing and inventorying the data they contain to identify, either digitised or un-digitised data, for setting the targets for digitisation under WP1. This involves, as first step, identifying which are the basic station-data input in current Reanalysis products available at the ECMWF and other relevant databanks that also contain digitised observations. This previous step will enable to better focus the WP1 DARE effort to avoiding duplicate digitisation of already available records in digital format and to better identify those European sub-regions and sub-periods of the 20th century for which climate data are sparse and in more urgent need for recovery.

As second step, which has built upon the already located and accessed data sources in the EU-funded EURO4M project, new searches to locate and access new climate data sources and holders containing additional synoptic observations for the main ECVs (from air pressure, temperature, humidity, wind, sunshine, cloudiness to precipitation and snow-depth) have been undertaken in order to identify the relevant data to be digitised and enhance the input of the RRA in Europe.

Therefore, this section provides in its two sub-sections information on the activities carried out for identifying data-sparse European sub-regions and sub-periods of the 20th century and supplies knowledge on the data holders located and accessed from which relevant imaged data will be digitised to enhance European RRA. The latter will be carried out by encompassing searches in both on-line and physical data holders from national and international archives and repositories, in order to locate and gain access to relevant climate data and metadata sources for data-sparse European countries.

1.2. Identifying data-sparse European sub-regions for the two halves of the 20th century



Partners involved in UERRA WP1, UEA and URV, have gained access to a number of on-line climate data holders and repositories in order to identify currently available synoptic observations in use for generating Reanalysis products, as the first step to set the DARE targets under WP1.

The main data holders and providers accessed for identifying currently available digital data include the following ones:

- The Meteorological Archival and Retrieval System (MARS), the main repository of meteorological data across Europe maintained at the European Centre for Medium-Range Weather Forecasts (ECMWF: <http://www.ecmwf.int/>), from where climate records in digital format have been explored after decoding to identify which are the poorest European sub-regions and sub-periods of the 20th century that are more in need of the recovery to enhance European RRA. Useful metadata files have been produced by the UEA partner to explore which synoptic observations are already kept at the MARS Archive for the post-1957 period, looking at both spatial and temporal gaps, but with the focus placed on the spatial infilling.
- The International Surface Pressure Databank version 2 (ISPDv2: <ftp://ftp.ncdc.noaa.gov/pub/data/ispd/>) has been developed under the auspices of the Global Climate Observing System (GCOS) Working Group on Surface Pressure and the World Climate Research Program WCRP/GCOS Working Group on Observational Data Sets for Reanalysis by NOAA Earth System Research Laboratory (ESRL), NOAA's NCDC, and the Climate Diagnostics Center (CDC) of the University of Colorado's Cooperative Institute for Research in Environmental Sciences (CIRES). This databank, mainly containing hourly air pressure observations, constitutes the basic input for pre-1957 Reanalysis, such as ERA20C from ECMWF. The identification of the digitised data already available for this period will enable to set the targets for the temporal and spatial infilling of the first half of the 20th century and, therefore, to make possible to extend back in time some of the key climate time-series in Europe.
- The Koninklijk Nederlands Meteorologisch Instituut (KNMI) European Climate Assessment and Dataset (ECA&D: <http://eca.knmi.nl/>), which contain digitised daily and sub-daily observations for Europe for most of the ECV throughout the 20th century.
- From National Climate Data Systems (CDMS) of the Western Balkans NMHS (Albania; Bosnia & Herzegovina; Macedonia, the FYR; Montenegro and Republika Srpska) for the post-1949 observing period, after coordinating with the World Meteorological Organization (WMO) and the United Nations Development Programme project entitled “Regional Cooperation in South Eastern Europe for Meteorological, Hydrological and Climate Data Management and Exchange to support Disaster Risk Reduction”.
- From the national database of the Romanian Meteorological Administration (NMA-RO), which contains digitised climatological and synoptical observations recorded at meteorological stations of Romania for the 20th century

From these databanks and CDMS a clear picture of what is more in need to improve the basic input of European RRA has emerged, pointing to Eastern and Southern European sub-regions and countries as the more in need for data rescue and development under UERRA. Specifically, countries poorly represented in European RRA are those located in Eastern Europe (from Poland to the Balkan countries) and the Eastern and Southern Mediterranean and Middle East countries, all of them are within the borders of the UERRA window and where the Reanalysis products show a poorer performance.



1.3. Exploring data holders and providers of imaged data for digitisation of synoptical observation in support of enhanced European RRA

Data holders and providers of imaged/scanned climate data and metadata have been also examined to locate, access and inventor additional and relevant un-digitised data sources and set feasible digitisation targets, as listed below:

- The NOAA/NCDC Climate Data Modernization Project (CDMP: http://docs.lib.noaa.gov/rescue/data_rescue_home.html), where most of the located and recovered data sources come from.
- The Météo-France (<http://france.meteofrance.com/>) archives (<ftp://ftp.meteo.fr/>) where French overseas historical observations have been taken from there.
- The on-line repository of scanned climate data kept by the Republic Hydro-meteorological Service of Serbia (http://www.hidmet.gov.rs/ciril/meteorologija/klimatologija_godisnjaci.php) Climatological Archive. This repository contains imaged sources of climatological and synoptical observations recorded at meteorological stations of the Former Yugoslav Republic from 1949 onwards.
- The World Meteorological Organization (WMO) MEditerranean DAta REscue (MEDARE) Initiative (<http://app.omm.urv.cat/urv/>), from where both imaged metadata and climate data have been mainly collected for the Mediterranean Basin and Middle East.
- The Atmospheric Circulation Reconstructions over the Earth (ACRE) project (<http://badc.nerc.ac.uk/browse/badc/corral/images/metobs>), from where climate data for a few relevant sources containing data for Middle East countries are being collected.
- The archive of Romanian Meteorological Administration (NMA-RO) contains imaged sources of climatological and synoptical observations recorded at meteorological stations in Romania since 19th century (see Figure 1). Sub-daily data are available for digitisation, too (e.g. 6-hourly precipitation amount since 1970s).

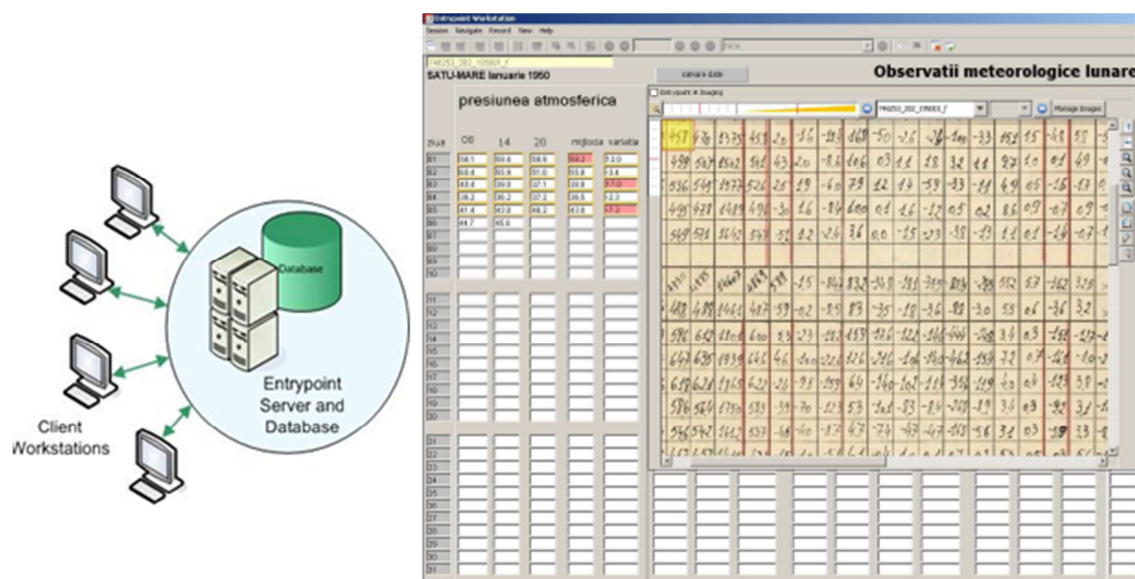


Figure 1. The image-entry solution at NMA-RO for scanned sources of data with zoom and field monitoring functions



We have also explored a few physical Archives and Libraries in order to locate further sources of climate data that enable us to infill gaps and missing periods for stations and records recovered from the other on-line data sources. Searches have been conducted in the Météo-France Library in Paris, by staff of this meteorological service, and in Ebro's Observatory (EO) Library (Tortosa, Spain) by URV staff, with the latter returning an abundant number of relevant data sources.

Very recently, NCDC staff have identified truly unique international climate holdings containing observations over the entirety of continental Europe, especially for WW2, that were never captured anywhere else and remain largely un-imaged and un-digitised, but that are being catalogued and will soon be placed on-line. In coordination with the International Surface Temperature Initiative (ISTI: <http://www.surface temperatures.org/>), UERRA's WP1 in connexion also with Copernicus Climate Services will place efforts to find a suitable mechanism for liaising in a strategic partnership to recover the European data. These new unique data sources will allow WP1 to digitise data over a key sub-period for which the basic input for RRA is highly limited, gaining advantage from taking part and contribute to this international DARE effort.

2. Data sources explored, accessed and gathered for DARE efforts under UERRA WP1

After contrasting both current availability of digitised data for RRA and the scanned data from the different data holders explored above, the UERRA DARE targets have been identified and provisionally set the plan for their recovery and development, to leave room for the inclusion of the new data source amid the WP1 targets.

A comprehensive list of data sources has been, then, elaborated from the data holders and providers described in the previous section, which has been ordered alphabetically and provides data source title and holder, the period covered and also the countries and/or the locations included by each source:

Annales du Bureau Central Météorologique de France; (Paris, Gauthier-Villars).

Periods covered by this source obtained from NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_french.html): 1877–1882, 1888–1898, 1900–1904, 1907–1908, and 1910–1913; for same source at EO: 1883–1887, 1899, 1905–1906 and 1914; and from Météo-France: 1909. Several sites covered in Morocco, Algeria, Tunisia, Egypt and France.

Annuaire de la Société Météorologique de France; (Paris, Au lieu des Séances de la Société). Periods covered by this source held at Météo-France: 1849–1884, 1900–1924, and from the volume of 1861 held at EO: 1857–1860. Relevant information is for Oran (Algeria).

Annuaire de l'Institut Météorologique de Bulgarie; located at Ebro's Observatory Library which covers the period 1899–1926 for a few locations across Bulgarie.

Bulletin Météorologique de l'Algerie at NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_algeria.html), covering the periods: 1877–1890, 1892–1893, 1895, 1897–1917, 1919–1938 and stations in Morocco, Algeria, Tunisia

Bulletin Météorologique Séismique et Magnétique, Istambul-Kandilli vl.1-69; located at Ebro's Observatory Library which covers the period 1934–1963 for Istanbul (Turkey).

Bulletin quotidien de renseignements météorologique du Maroc. From the source held at NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_morocco.html), the periods covered are 1953–1968, 1977–1978 and from the volumes held at Météo-France archives the period 1953–1991, covering sites for Morocco and Algeria.

Cairo. Meteorological Report, held at NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_egypt.html), covering the periods: 1900–1926, 1931–1940 and for stations over Egypt.



Egypt. Daily Weather Report, located at NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_egypt.html), covering the periods: 1907–1922, 1924–1940, 1945–1957 and for sites in Egypt.

Egypt. Monthly Weather Report; Egypt (Cairo, Egyptian Meteorological Authority), climate data for 1957–1963 from the source held at NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_egypt.html) and for 1956–1962 and 1973–1981 from the volumes held at EO for sites in Egypt (Giza, Tahrir)

Ergebnisse der meteorologischen beobachtungen an des landesstationen in bosnien-hercegovina im jahre; located at Ebro's Observatory Library which covers the period 1902–1913 for a few sites across Bosnia & Herzegovina.

Helwan. Meteorological Report, Royal Observatory Helwan; Egypt (Cairo, National Printing Department). Period covered by NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_egypt.html) holdings: 1942–1947, 1952–1953; and by EO holdings: 1909–1932 and 1942–1953. All of them contain climate data for Helwan (Cairo region, Egypt).

Historical Meteorological Recordings from the UK Colonial Registers and Royal Navy Logbooks (CORRAL); located at BADC (<http://badc.nerc.ac.uk/browse/badc/corral/images/metobs/mediterranean/Malta>) for Malta for the period 1852–1947.

Idojarasi delentes magyarorszagol = Witterungsbericht von Ungarn; held at NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_hungary.html) which covers the period 1934–1944 for Budapest climate time-series.

Idojarasi napilentes magyarorszagol = Monthly Weather Report of Hungary; obtained from NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_hungary.html) which covers the period 1945–196 for Budapest climate time-series (Hungary).

Izvestaj meteoroloske opservatorije u Beogradu; held at NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_yugoslavia.html) shows climatological data from Belgrade (Republic of Serbia) for the period 1920–1945.

Meteorologische Beobachtungen Angestellt auf der K. K. Sternwarte; located at NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_poland.html) shows climatological data from Krakau (Poland) for the period 1881–1914.

Meteoroloska osmatranija u Beogradu; held at NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_yugoslavia.html) shows climatological data from Belgrade (Republic of Serbia) for the period 1951–1965.

Meteoroloski godisnjak. I; held at NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_yugoslavia.html) which cover the period 1949–1978 for some sites located at Slovenia, Republika Srpska, Bosnia & Herzegovina, Macedonia the FYR, Croatia and Montenegro.

Meteoroloski godisnjak. I; obtained from the Republic Hydrometeorological Service of Serbia (http://www.hidmet.gov.rs/ciril/meteorologija/klimatologija_godisnjaci.php) Climatological Archive which cover a larger period 1949–2012 for some meteorological stations located in Bosnia & Herzegovina, Croatia, Macedonia, the FYR, Montenegro, Republika Srpska and Slovenia.

Prace Obserwatorium Meteorologii i Klimatologii Wroclawskiego Obserwacje dobowe we Wroclawiu; obtained from NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_poland.html) which covers the period 1956–1963 for Wroclaw (Poland).



Prace zakładu i Obserwatorium Meteorologii i Klimatologii obserwacje dobowe we Wroclawiu; held at NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_poland.html) which covers the period 1946-1955 for Wroclaw (Poland).

Resultati osmatranija u Beogradu; located at NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_yugoslavia.html) shows climatological data from Belgrade (Republic of Serbia) for the period 1946-1950.

Rocenka povetnostnich posoro vani site statniho ustavu meteorologickeho; held at NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_czech_republic.html) covering the period 1916-1946 for some sites located at the Czech republic and the Slovak Republic.

Rocenka povetnostnich pozorovani meteorologickeho stanie Republiky Ceskoslovenshe; also held at NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_czech_republic.html) for the period 1948-1968 for some sites located at the Czech Republic and the Slovak Republic.

Rocenka povetnostnych pozorovani observatoria na Lomnickom Stite; located at NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_czech_republic.html) for the period 1940-1974 for some sites located at the Czech republic and the Slovak Republic.

Service Météorologique de Tunis, obtained from NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_tunisia.html). Periods covered are 1907–1911 and 1921–1932 for sites in Tunisia

Tableau Climatologique Mensuel. Series A, held at MEDARE database, covering the period 1874–2009 for the following Algerian stations and specific periods: Skikda-Cap Bougarouni, 1921–1980; Bejaia-Cap Carbon, 1910–1975; Laghouat-Aflou DSA, 1874–2009.

Tableau Climatologique Mensuel. Series B, held at Météo-France, including data for the 1899–1938 and 1944–1963 periods and for the following Tunisian stations: Bizerte - Cap Blanc: 1899–1938, 1958–1963; Bizerte - Karouba: 1920–1936, 1944–1959; Bizerte - Roland Garros: 1951–1963; Tunis-el-Aouina: 1925–1936, 1946–1957; Jendouba: 1946–1957; Kairouan: 1930–1936, 1946–1957; Gafsa: 1931–1936, 1945–1957; Sfax: 1946–1957; Gabes: 1925–1936, 1946–1957

Taglicher wetterbericht; held at NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_germany.html) shows climatological data for some sites spread over Germany for the period 1930-1945.

Taglicher wetterbericht (Deutscher Wetterdienst); located at NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_germany.html) contains climatological data for some locations across Germany for the period 1953-1975.

Taglicher wetterbericht (Meteorologisches Amt fur Nordwestdeutschland); held at NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_germany.html) covers the period 1946-1952 for some locations in Germany.

UK Climatological Returns (from ACRE project), the following countries, stations and specific periods are available: For Morocco: Cape Spartel (Tanger region) for the 1894–1920 period. For Cyprus: Nicosia General Hospital, 1901–1922; Nicosia Observatory: 1907–1910; Paphos G. Hospital, 1901–1922 and Paphos Ktima, 1901–1922. For Egypt: Alexandria, 1901–1904. For Syria: Mount Lebanon, 1890–1904.

UK Daily Weather Reports (from ACRE project). Climate data for the following Egyptian sites: Mersa Matruh, 1923–1930; Cairo, 1916–1930; Alexandria, 1916–1922.

Wyniki Pormiarw la le'snich stacjach meteorologicznych; located at NCDC/CDMP (http://docs.lib.noaa.gov/rescue/data_rescue_poland.html) covers the period 1949-1960 for some locations across Poland.



References

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