Enhancing availability, accessibility and quality of land-surface/station-based climate time-series: the EURO4M and UERRA experiences and their links

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Introduction:

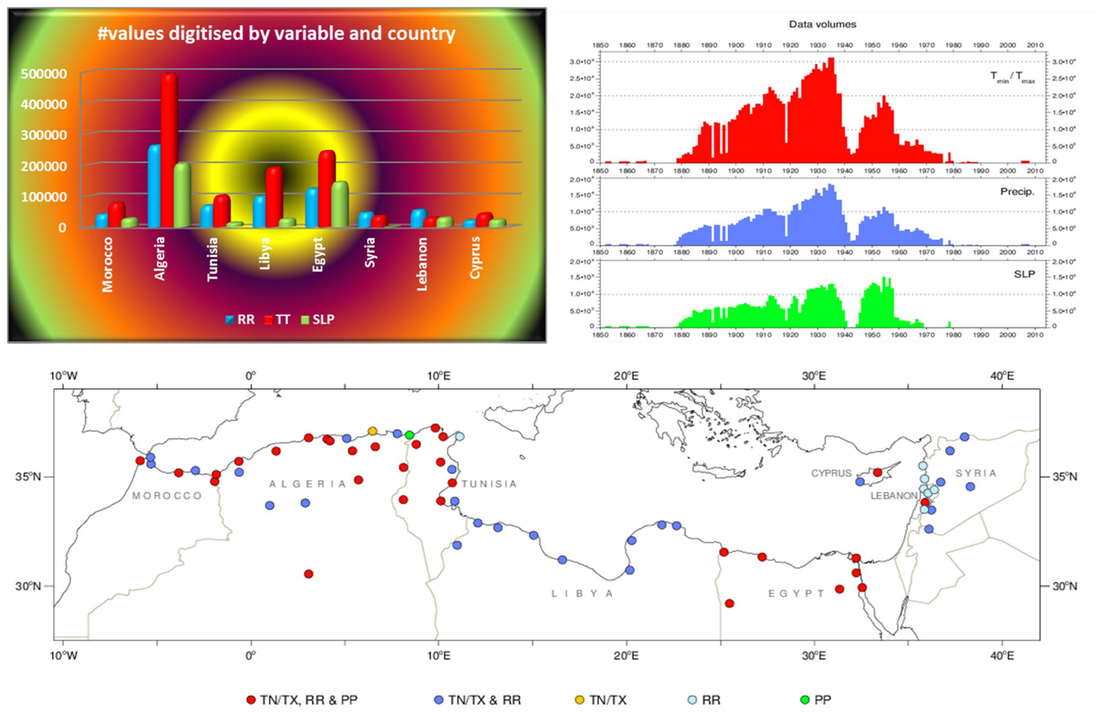
Despite the fact that international and national activities, together with initiatives from international and national agencies and projects, have increased the availability of and accessibility to historical climate data worldwide, present availableness of historical surface climate data is still somewhat inadequate even over the better documented regions (e.g. Europe, US) and very poor over data-sparse regions (e.g. Africa, South and Central America). Although most of the funding agencies are reluctant to provide support to data rescue (DARE) activities, several international (e.g. the US Climate Data Modernisation Program -CDMP-, the Atmospheric Circulation Reconstructions over the Earth -ACRE-) and regional (e.g. the Mediterranean Data Rescue -MEDARE-) initiatives have made progress to recover our rich climate heritage in recent years by means of scanning original logbooks and making the images freely available, or by digitising the historical records.

In addition, the World Meteorological Organization (WMO) has impelled DARE projects among National Meteorological Services (NMS) worldwide, resulting in enhanced national climate data availability. However, this not always resulted in improved accessibility to digitised records. Most of the NMS have not made accessible the new digitised data due to national policies for data exchange, despite that very recent (June 2015) modification of the WMO Resolution 40 to include the free exchange of data from the Regional Basic Synoptic Network (RBSN) and GCOS Surface Network (GSN) networks. All of this points to the need to continue harassing NMS to get them persuaded on the need for data exchange.

DARE activities require coordination to avoid duplicating efforts, what has also brought the need for implementing an International Data Rescue Portal (I-DARE) to stimulate new DARE activities and foster discoverability of, and coordination between, existing DARE activities and projects.

Here we provide the results and experience gained under the EU-funded European Reanalysis and Observations for Monitoring (EURO4M) and Uncertainties in Ensembles of Regional Reanalysis (UERRA) projects to enhance DARE coordination and the availability and accessibility to climate observations and time-series in support of an enhanced European capability to produce robust and timely climate services and high-resolution regional reanalyses.

Fig. 1. No. of digitised values by variable and country (upper left), the data volumes by variable (upper right) and the location of the stations (bottom) subjected to the EURO4M's recovery efforts



2. The UERRA contribution:

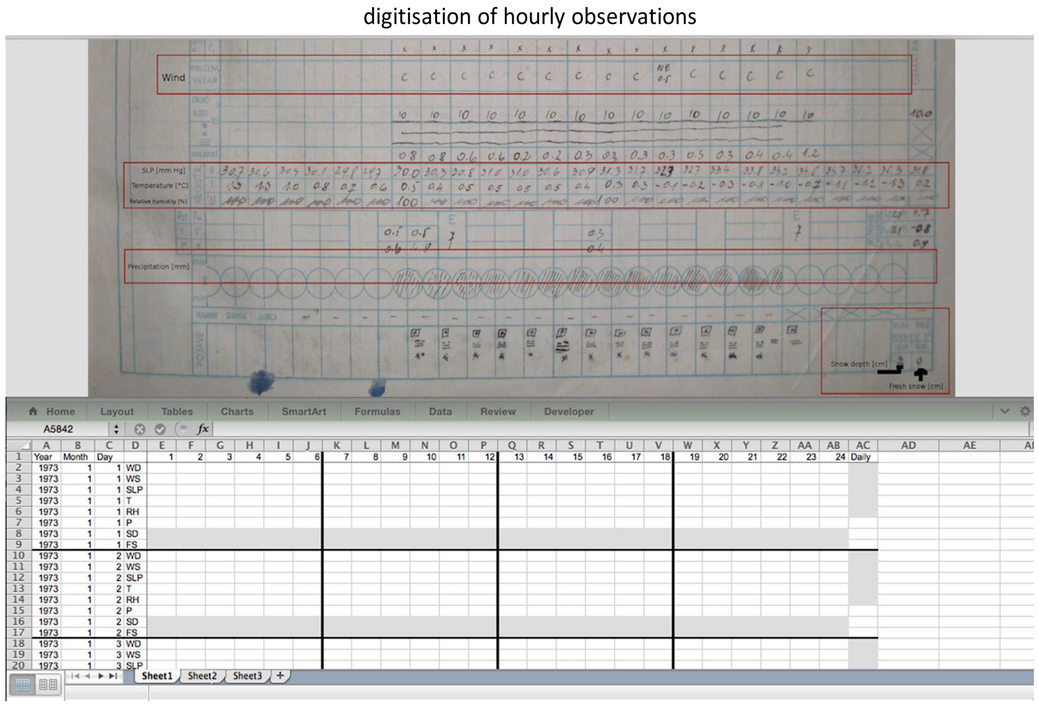
Building upon the data sources gathered and experience gained under EURO4M, the new EU-funded UERRA project, aimed at enhancing both the data input and methodologies for the development of high-resolution European regional reanalysis. Renewed efforts have been placed on recovering sub-daily observations for the key reanalysis variables (e.g. hourly sea level pressure, temperatures, dew point, wind speed and direction, relative humidity and daily snow-depth and precipitation) over European data-sparse sub-regions (e.g. the Mediterranean Basin, Eastern and Central Europe, The Balkans and Turkey) and sub-periods (e.g. pre- and post-1950).

In this occasion, to know, first, the availability of digitised data that support current European regional reanalysis made it necessary to explore the MARS Archive at ECMWF and crosscheck it with the gathered by EURO4M scanned data-sources. New holdings were located and accessed and several European NMS (e.g. Germany, Slovenia, Spain and Catalonia) Archives explored, as well as data coordination with other initiatives (e.g. ISPD, ISTI-DARE team).

Given the scarce availability of on-line scanned sources, which mainly contain pre-1950 data, a liaison with NMS was required to access their un-digitised, but scanned, climate records, benefiting both the involved NMS and the whole scientific community thanks to the links established through MEDARE and the WMO Commission for Climatology. Also a better strategy to digitise the identified records was set up to principally infill in spatial gaps in data-sparse regions (e.g. some southern and western Mediterranean countries, central and eastern Europe or the Balkan and Turkey countries) for the post-1950 period.

Fig. 2 shows an example of a scanned data source and a spreadsheet where the data to be digitised are highlighted to make the digitisation task more efficient, while Fig. 3 and Fig. 4 provide the results of the digitisation effort carried out so far, and the location of the stations, along with the approximate length of the records and no. of observations per day.

Fig. 2. An example of scanned data source and spreadsheet provided to the UERRA digitisers to make more efficient the digitisation of hourly observations



1. The EURO4M contribution:

Under the EURO4M project, a joint coordination effort that involved several Mediterranean NMS through the WMO/MEDARE Initiative and international and European databanks and repositories was successfully carried out to enhance availability of and accessibility to long climate records over data-sparse Mediterranean sub-regions: North African and Middle East countries.

To identify the climate records to be subjected to digitisation and avoid duplication, it was carried out a coordination exercise involving the examination of international and regional databanks (e.g. CRU-datasets, ISPD, GHCN-D, ECA&D), both on-line (e.g. CDMP, BADC) and in physical repositories of imaged data in various scientific institutions across Europe (e.g. Ebro's Library, Meteo-France, AeMet and Italian historical archives), funded projects (e.g. ERA-CLIM, CIRCE, Millennium, Salvá-Sinobas), major DARE initiatives (e.g. ACRE, MEDARE) and relevant Mediterranean NMS (e.g. Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Syria, Tunisia) were also involved in an attempt to fill in temporal and spatial gaps of the instrumental record of those Mediterranean sub-regions. Once the records to be digitised and developed (i.e. their quality and homogeneity ensured), were identified and gathered, a data exchange involving the aforementioned NMS was proposed to extend back in time the climate record as far as possible. This exchange was partially successful: only Libya, along with France, Italy and Spain (for their overseas data) agreed to exchange their assets, while others rejected the exchange as it implied making the digitised series publicly accessible.

About 2.7M station values of daily (sub-daily) maximum and minimum temperature and precipitation (sea level pressure) were digitised and made freely available to several international databanks and repositories. Fig. 1 provides information on the total amount of recovered values by variables and countries, the data volumes and the location map of the stations for which climate records have been extended back in time, while in Brunet et al. (2013 and 2014) the used data sources and details on the dataset developed are provided.

Fig. 4. Location map of the stations being digitised under UERRA and providing summarised information on the approximate length of the records for each variable and the no. of observations per day at each station

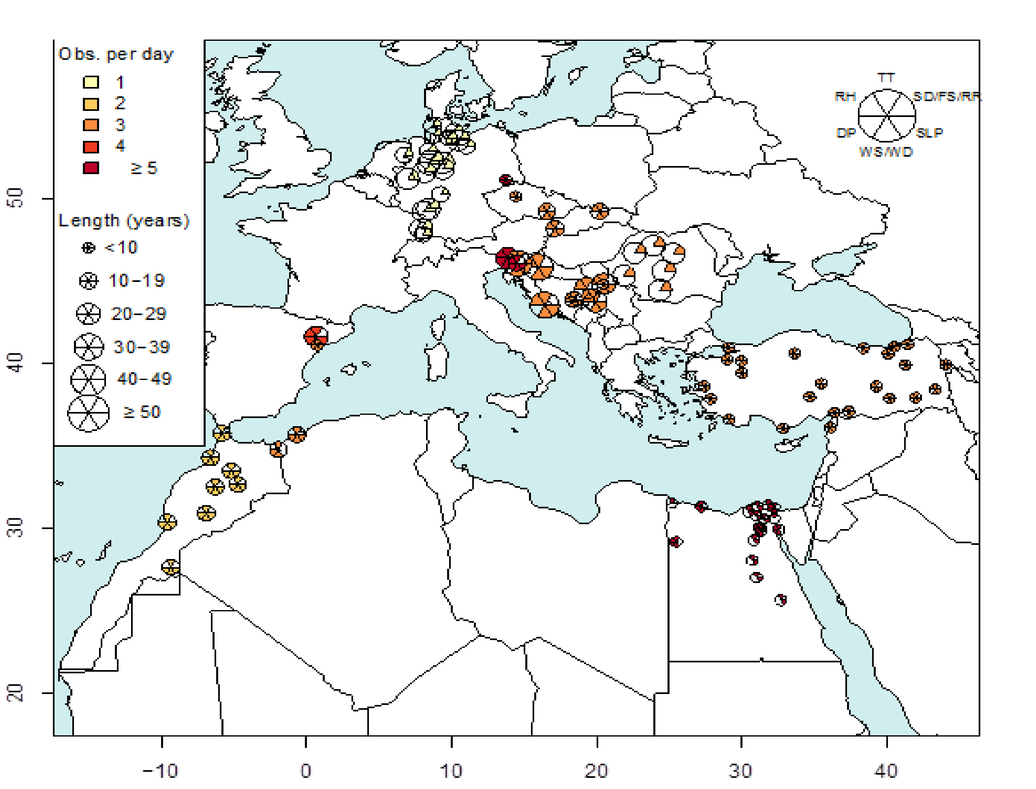
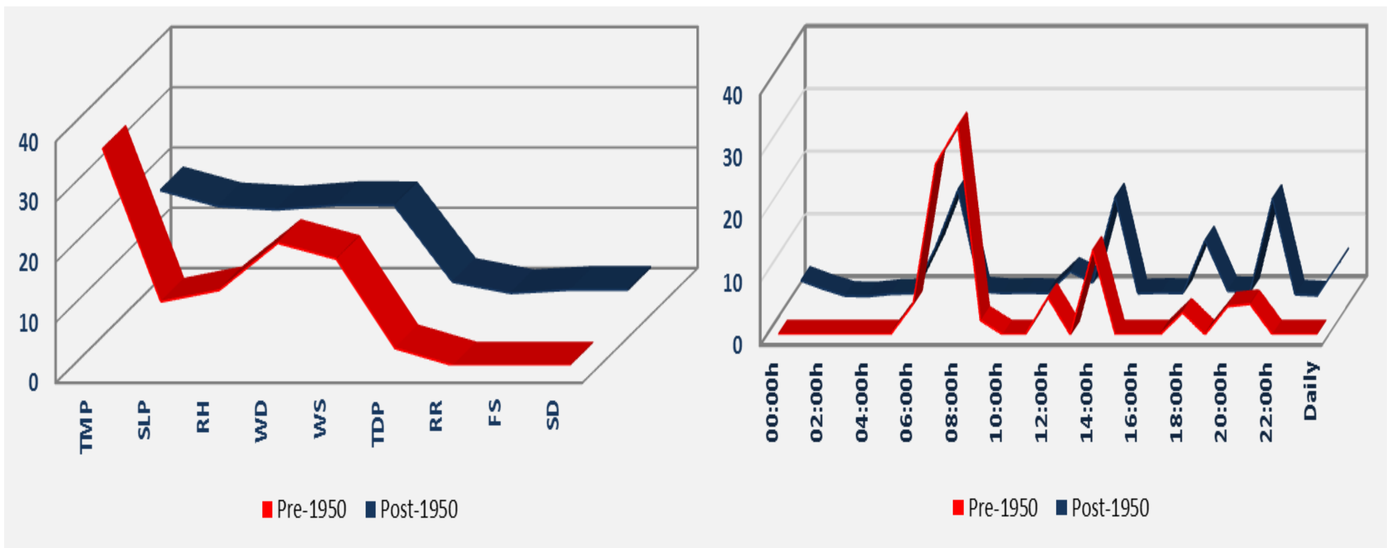


Fig. 3 Percentage of digitised values by variable (left panel) and by observing times (right panel) for pre-1950 and post-1950 periods : ~1M and ~5M station values respectively



3. Conclusions:

Most if not all of the post-1950 surface climate observations are kept in NMS databanks and archives, either in digital or hard-copy formats, as well as a big fraction of pre-1950 data. Therefore, involving NMS in the recovery and development of these data is essential. The Global Framework for Climate Services provide an opportunity to continue persuading NMS on the need to recover and generate observations of quality, especially for the 20th century, which is the most important period to support reanalysis or gridded products that are necessary to analyse our changing climate.

Involving the NMS in DARE components of funded C3S research projects is one of the effective paths to pave the way and enhance climate data availability, since it benefits both in advancing the scientific knowledge and in NMSs capabilities to ensure observations of high standard. The EURO4M and UERRA projects are a clear example of both benefits.

Reference list:

Brunet M., Jones PD, Jourdain, S., Efthymiadis, D., Kerrouche, M., Boroneant C. 2013. Data sources for rescuing the rich heritage of Mediterranean historical surface climate data. Geosciences Data Journal, 0: 1-13. DOI: 10.1002/gdj3.4

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