



Reconstructing long temperature series over North African and Middle East countries: A joint EURO4M-WMO/MEDARE effort

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1. Overview

- Regarding availability and accessibility to long-term and high-quality air surface temperature records, there are still many data scarce regions worldwide. Among them, the Greater Mediterranean Region (GMR) particularly over its southern and eastern parts is one of the world regions worst documented and with a poorest data representation in accessible global or regional databases.
- Aimed at ameliorating climatic data availability and their accessibility over this key climatic region, a joint effort between the EU-funded European Reanalysis and Observations for Monitoring project (EURO4M: http://www.euro4m.eu/Data_archaeology_in_the_Mediterranean_region.html), linked to the World Meteorological Organization (WMO)/Mediterranean Data REscue Initiative (MEDARE: <http://www.omm-urv.cat/MEDARE/index.html>) is being carried out with the focus on both enhancing availability of climatic data over southern and Middle East Mediterranean countries and accessibility to historical climatic records, ensuring their traceability.
- The aim of this contribution is, therefore, to provide insights on the joint effort being carried out for enhancing historical climate series availability, accessibility and traceability over southern and eastern parts of the GMR, show the progress made so far and present the strategy adopted for ameliorating currently scarce data availability (see Figure 1 for current data availability at ECA&D)

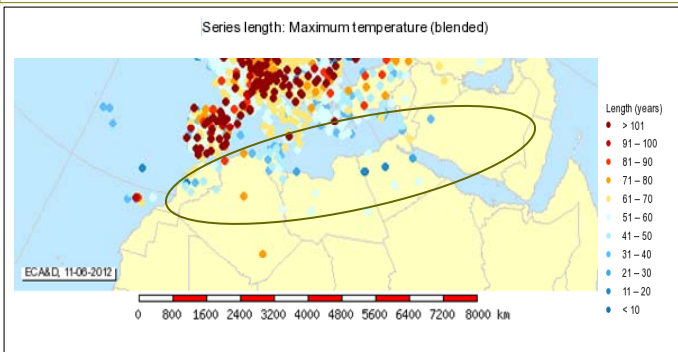


Fig. 1 Currently availability of daily maximum temperature series at ECA&D showing approximate length of records (see scarcity of station over the encircled area)

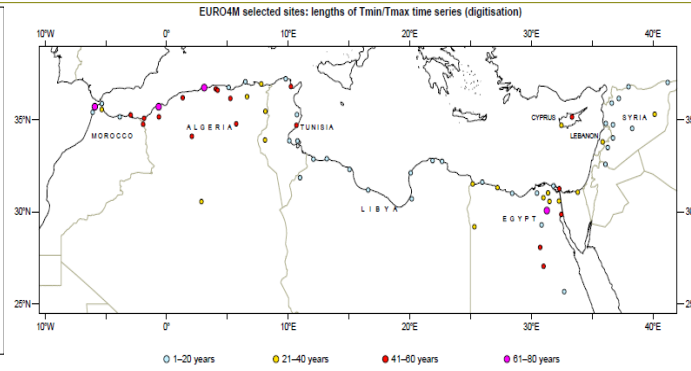


Fig. 2 Location map of the daily maximum and minimum temperature series being recovered, quality controlled and homogenised under the joint effort of EURO4M and the WMO/MEDARE Initiative. The different colours give information on the extent of the digitisation effort being carried out by providing the approximate length of the digitised data under this joint effort

2. Recovering the past heritage of Mediterranean climate records and lessons learnt

- Exploring and gathering climate data images from both on-line repositories and physical archives
 - On-line repositories used (e.g. the CDMIP at <http://www.ncdc.noaa.gov/oa/climate/cdmip/cdmip.html>), the BADC at <http://badc.nerc.ac.uk/browse/badc/portal/images/metobs> contributed by ACRE: <http://www.met-acre.org/>)
 - Imaged data from physical archives (e.g. Fontainebleau, historical archives at Météo-France, Italian Air Force and Romanian NMHS, Ebro Observatory Library)
- Organising the images gathered and defining and implementing a digitisation plan
- Details on the temperature network being recovered and digitised under the joint effort: Figure 2 gives details on the targeted locations where ancient temperature observations have been recorded, along with their approximate lengths, and Table 1, Table 2 and Table 3 contain details on climate data sources relevant for the GMR
- Problems encountered with data sources: gaps in data sources and lack of data continuity (Figure 3 gives a glimpse to the missing periods for Oran's temperature series), poor scanning and images readability (missing pages, headers, data not readable), changes in data formats making difficult digitisation
- Lessons and needs learnt from the recovering effort:
 - Need for preserving original sources after scanning (not 100% perfect scanning is feasible)
 - Need for ensuring full traceability of the data digitised to their original data sources
 - Visual cross-checking to assure consistency (data in sources against data digitised) and make easier the digitisation after giving feedback
 - Need for previous coordination among different data rescue (DARE) efforts in order to avoid duplication of efforts

Abbrev. name	Data book series	Year range	Collection of climatic data books	Morocco	Algeria	Tunisia	Egypt	Libya	Cyprus	Lebanon	Syria	Other
ABCM-France	Annales du Bureau Central Météorologique de France	1878-1913	Collection of climatic data books									
BM-Algerie	Bulletin Météorologique de l'Algérie	1877-1938										
BQRM-Maroc	Bulletin quotidien de renseignements météorologique du Maroc	1953-1978										
SM-Tunis	Service Météorologique de Tunis	1907-1932	ABCM-France	1878-1913	1878-1913	1878-1913	1878-1913	1878-1913	1878-1913	1878-1913	1878-1913	1878-1913
BM-Cirenaica	Bollettino Meteorologico della Cirenaica	1928-1931	BQRM-Maroc	1953-1978	1953-1978	1953-1978	1953-1978	1953-1978	1953-1978	1953-1978	1953-1978	1953-1978
BMA-Italiana	Bollettino Meteorologico dell'Africa Italiana	1932-1936	SM-Tunis	1907-1932	1907-1932	1907-1932	1907-1932	1907-1932	1907-1932	1907-1932	1907-1932	1907-1932
MR-Egypt	Meteorological Report, Cairo Daily Weather Report, Egypt Monthly Weather Report, Egypt Helwan Observatory	1900-1963	BMA-Italiana	1932-1936	1932-1936	1932-1936	1932-1936	1932-1936	1932-1936	1932-1936	1932-1936	1932-1936
MWR-Israel	Monthly Weather Report, Israel	1947-1975	MR-Egypt	1900-1963	1900-1963	1900-1963	1900-1963	1900-1963	1900-1963	1900-1963	1900-1963	1900-1963
AULO-Beirut	American University-Lee Observatory, Beirut	1891-1975	MWR-Israel	1947-1975	1947-1975	1947-1975	1947-1975	1947-1975	1947-1975	1947-1975	1947-1975	1947-1975
BCM-Lebanon	Bulletin Climatologique Mensuel, Lebanon	1928-1970	AULO-Beirut	1891-1975	1891-1975	1891-1975	1891-1975	1891-1975	1891-1975	1891-1975	1891-1975	1891-1975
AO-Ksara	Annales de l'Observatoire de Ksara	1921-1971	BCM-Lebanon	1928-1970	1928-1970	1928-1970	1928-1970	1928-1970	1928-1970	1928-1970	1928-1970	1928-1970
MCD-Syria	Monthly Climatological Data, Syria	1955-1975	AO-Ksara	1921-1971	1921-1971	1921-1971	1921-1971	1921-1971	1921-1971	1921-1971	1921-1971	1921-1971
UK-CR-DWR	UK Climatological Returns UK Daily Weather Reports	1881-1920	MCD-Syria	1955-1975	1955-1975	1955-1975	1955-1975	1955-1975	1955-1975	1955-1975	1955-1975	1955-1975
			UK-CR-DWR	1881-1920	1881-1920	1881-1920	1881-1920	1881-1920	1881-1920	1881-1920	1881-1920	1881-1920

Table 1: Collections of climatic data books being available from NOAA (all collections, but the last one) and BADC (just the last collection, i.e. UK-CR/DWR) and the year range (limits) which is covered with daily data for the South Mediterranean (North Africa and Middle East).

Table 2: Periods covered with daily data for each country of the South Mediterranean by NOAA- and BADC-accessible data books (see Table 1 for details of book collections).

Collection of Météo-France Climate data held in National Archives site Fontainebleau	Number of boxes	Period of records
Morocco (logbooks)	228	1879-1988
France surface climate with voluntary observers reports	790	1799-1972
France synoptic stations (CRO)	1304	1923-1970
France synoptic and hydrological	282	1808-1970
French observations WWI (logbooks)	58	1940-1944
French military stations (CRO, original logbooks)	75	1913-1953
Primary school (TCM)	55	1865-1908
Devisans territories, Southern and Antarctic Lands	140	1833-1988
African ex-colonies and foreign countries (CRO, TCM, ...)	273	1833-1989
Others	100	
Total	4287	

Table 3: Description of the Météo-France holdings kept in Fontainebleau

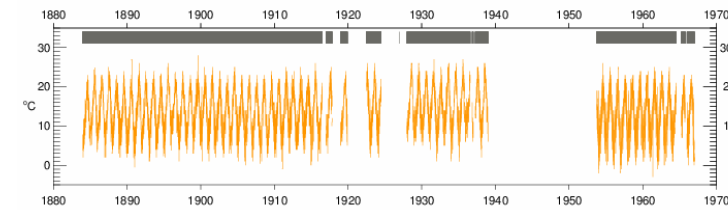


Fig. 3 An example of discontinuous data for Oran's (Algeria) temperature series for which any of the data sources located provided information

3. The development of merged and daily adjusted surface temperature time-series for southern and eastern Mediterranean locations

- Merging the recovered and digitised records with recent observations from data producers and holders. Figure 4 shows the combination of the different data sources used for reconstructing Oran's temperature series
- Joining DARE efforts in the region in order to extend further back in time the instrumental record, enhance data availability and accessibility, including data sharing, and involve data holders in the GMR (mainly NMHS) in DARE activities through capacity development
- Fostering through WMO/MEDARE an exchange exercise with the relevant NMHS in the GMR and involving them in the development of long and high-quality climate series
 - Agreements achieved so far: NMHS from Algeria, Cyprus and Libya (under discussion with Jordan and Morocco's NMHS), most including training in QC and homogenisation
 - Difficulties encountered: slowness of the data exchange, reluctance to data sharing beyond EURO4M and MEDARE datasets (although the recovered fractions of time-series under EURO4M will be made freely available to global and regional databanks)
 - Need for applying a country-specific data exchange policy for accessing to the recent parts of the climate series developed under the effort
- Time series Quality Controlling (QC), by applying the RCLimDex with extra QC functionalities (e.g. flat-lines, large inter-daily differences or rounding tests), and their homogenisation at the daily scale by using three relative approaches (e.g. C3-SNHT, HOMER, ACMANT) to estimate uncertainties

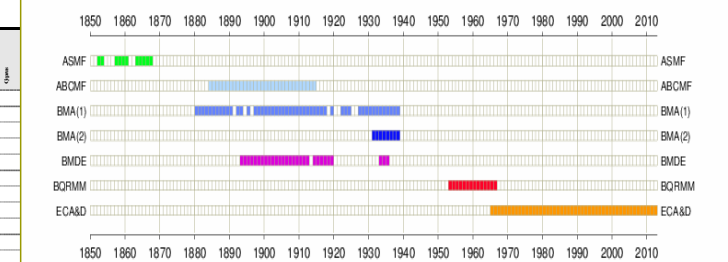


Fig. 4. Reconstructing Oran's (Algeria) temperature series by merging the recovered/digitised data fractions from several data sources with recent observations. In this case using the ECA&D accessible data in order to ensure success if any failure in the agreement with the Algerian NMHS would happen

4. Conclusions

- Potential for extending back in time the instrumental record over the targeted GMR sub-regions by further locating, imaging, organising and making accessible historical data sources for filling in gaps from on-line repositories
- Need for coordination between national (e.g. NMHS) and international DARE efforts (e.g. ISTI, WMO/MEDARE, ACRE) in order to avoid duplication and maximise their efficiency
- Need for involving data owners and producers on DARE activities in order to enhance and place in value their national historical climate data assets
- Need for capacity development in the integrated field of DARE methods, including time-series quality control and homogenisation at lower time scales than at a monthly basis, addressed to technicians and scientists involved in DARE