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 climate 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)

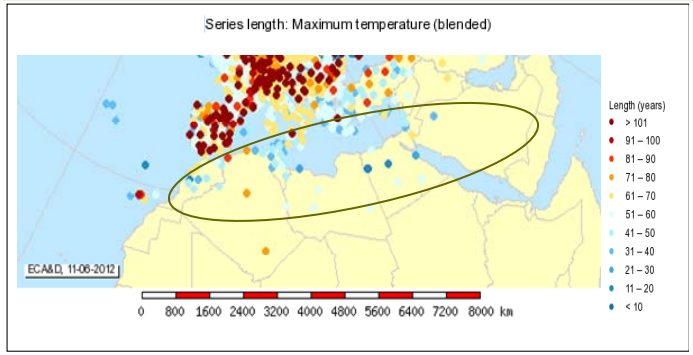

Fig. 1 Currently availability of daily maximum temperature series at ECA&D showing approximate length of records (see scarcity of station over the encircled area

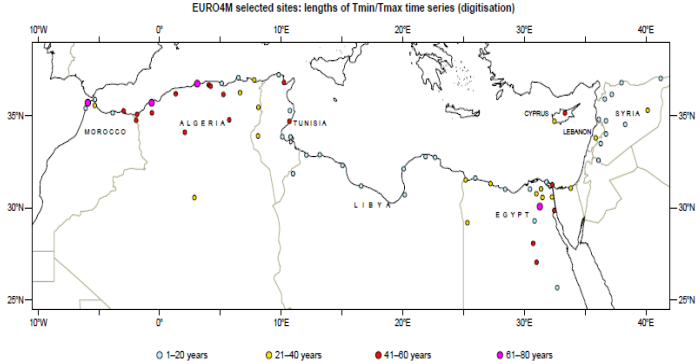

Fig. 2 Location map of the daily maximum and minimum temperature series being recovered, quality controlled and homogenised under the joint effort of EURO4M and the WMO/MEDARE Initiative. The different colours give information on the extend of the digitisation effort being carried out by providing the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

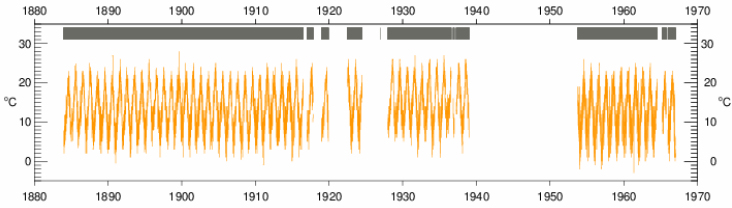

Fig. 3 An example of discontinuous data for Oran's (Algeria) temperature series for which any of the data sources located provided information

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 trough 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

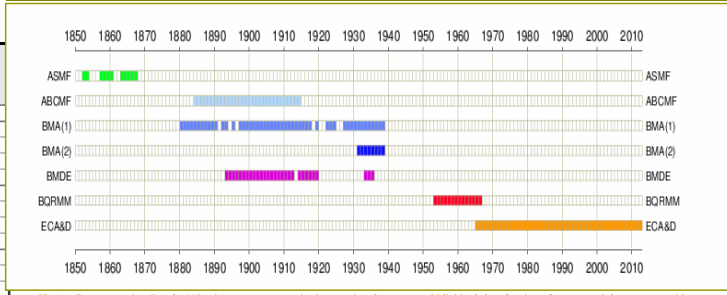

Fig. 4. Reconstructing Oran's (Algeria) temperature series by merging the recovered/digitised data fractions from several data sources with recent observations. In this case using the EC&D accessible data in order to ensure success if any failure in the agreement with the Algerian NMHS would happen

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 CDMP at http://www.ncdc.noaa.gov/oa/climate/cdmp/cdmp.html, the BADC at http://badc.nerc.ac.uk/browse/badc/corral/images/metobs contributed by ACRE: http://www.met-acre.org/)
  - Imaged data from physical archives (e.g. Fontainebleau, historical archives at Meteo-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
ABCM-France	Annales du Bureau Central Météorologique de France	1878–1913
BM-Algerie	Bulletin Météorologique de l'Algerie	1877–1938
BQRM-Maroc	Bulletin quotidien de reseignements météorologique du Maroc	1953–1978
SM-Tunis	Service Météorologique de Tunis	1907–1932
BM-Cirenaica	Bolletino Meteorologico della Cirenaica	1928–1931
BMA-Italiana	Bollettino Meteorologico dell'Africa Italiana	1932–1936
MR-Egypt	Meteorological Report. Cairo Daily Weather Report. Egypt Monthly Weather Report. Egypt Helwan Observatory	1900–1963
MWR-Israel	Monthly Weather Report. Israel	1947–1975
AULO-Beirut	American University–Lee Observatory. Beirut.	1891–1975
BCM-Lebanon	Bulletin Climatologique Mensuel. Lebanon	1928–1970
AO-Ksara	Annales de l' Observatoire de Ksara	1921–1971
MCD-Syria	Monthly Climatological Data. Syria	1955–1975
UK-CR/DWR	UK-Climatological Returns UK-Daily Weather Reports	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).

Collections of climatic data books	Morocco	Algeria	Tunisia	Libya	Egypt	Israel/Palestine	Lebanon	Syria	Cyprus
ABCM-France	1878–1912	1879–1913	1888–1913		1888–1913	1906–1913	1895–1913		
BM-Algerie	1909–1934	1877–1938	1927–1938						
BQRM-Maroc	1953–1978	1953–1978							
SM-Tunis			1907–1932						
BM-Cirenaica				1928–1931					
BMA-Italiana				1932–1936					
MR-Egypt					1900–1963	1924–1933			
MWR-Israel						1947–1975			
AULO-Beirut						1912–1915	1891–1975	1912–1915	
BCM-Lebanon							1928–1970	1928–1956	
AO-Ksara							1921–1971		
MCD-Syria							1955–1975		
UK-CR/DWR	1894–1920				1900–1904				1881–1920

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

Collections of Météo-France Climate data held in National Archives site Fontainebleau	Number of boxes	Period of records
Marine (logbooks)	725	1879-1985
France surface climate with voluntary observers reports	790	1739-1972
France synoptic stations (CRQ)	1304	1923-1970
France semaphore and lighthouses	252	1868-1970
German observations WWII (logbooks)	53	1940-1944
France military stations (CRQ, original logbooks)	75	1913-1953
Primary school (TCM)	55	1865-1908
Overseas territories, Southern and Antarctic Lands	140	1833-1988
African ex-colonies and foreign countries (CRQ, TCM, ...)	773	1833-1989
Others	100	
Total	4287	

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

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