

## Progress in data rescue activity in Italy: the experience of CRA-CMA and Air Force Met Service

- ✓ **Maria Carmen Beltrano** - CRA-CMA
- ✓ **Gianpaolo Mordacchini** - Air Force Met Service

Producers of meteorological data are Institutions managing weather station networks. In Italy, in this field, the main institutions operating at the National level are the Air Force Met Service and CRA-CMA (Council for Research and Experimentation in Agriculture - Research Unit for Climatology and Meteorology applied to Agriculture). Many other regional and local weather or agro-meteorological services exist, but they are operating only since the last decades <sup>(1)</sup>. Both the mentioned Institutions have a quite long history, but different features regarding spatial distribution, observation parameters and monitoring (e.g. sub-daily or daily) time scales.

Instituted in 1876 as the first National meteorological service, the "Ufficio Centrale di Meteorologia" (Central Meteorological Office, from which CRA-CMA itself took its origin), gathered in the course of the years the longest and most complete historical collection of Italian weather data from observatories, which in some cases dated back to the second half of XIX century. Observatories include stations through the Italian Country, and also in the former Yugoslavia and in the northern Africa (at least until the end of the 2nd World War), many of which recording sub-daily observations. The resulting archive is composed of about 3300 folders, corresponding to about 850 data series, of which (about) 200 longer than 50 years. About 40 of these stations are still operating, while 20 of them have records longer than one century.

Air Force Met Service, on the other hand, is collecting meteorological data in Italy since 1923-25, by means of observatories (all synoptic stations) located in the airports and in coastal or mountain sites <sup>(2)</sup>. Moreover the Service continued to preserve data from abroad (old Italian colonies: Horn of Africa, Libya, etc.) in periods ranging from 1880 to 1960, also if observations are not continuous and vary very much from station to station. Almost all Italian data from year 1950 to present, and a little part of the foreign ones, are available in digital format ("electronic archive").

A serious problem in Italy is that Regional governments, other Institutions and private Centers continue to maintain their own weather or agro-meteorological networks and services, each of which independently managed, with sporadic or no cooperation at all. Partly they were instituted for specific purposes, partly they derive from the National Hydrographic Service (monitoring of river basins from 1917 until 1<sup>st</sup> October 2002). Such a situation makes it extremely difficult to carry out unitary or coordinated National projects of data sharing or rescue. The constitution of a unique and homogeneous historical archive seems to be, at present, quite far from being reached.

Anyway, mainly in the last years, CRA-CMA and Air Force Met Service started working at least in good agreement, in leading a common database of metadata and data <sup>(3)</sup>, and in sharing its rescue experiences. Concerning this field, they are carrying out five different actions: preserving, cataloging, meta-dating, scanning and digitizing data still in paper format.

To guarantee availability and accessibility of all the information contained in the paper documents, few years ago we started an hard work of cataloging the existing material, while a parallel scanning activity was also initiated, in order to preserve and recover all possible information inferable from the paper supports. It was also noted that the available material is a rich source of historical information recorded both by the directors and the observers. As an example, in an inset called "Notes on the weather", the observer wrote in his own words remarks concerning special weather events. Sometimes these remarks represent information about natural events, colorful or poetic comments about atmospheric phenomena, many times saying also something about damages or descriptions of events and happenings not strictly meteorological, but still of interest under the historical and social viewpoint.

Concerning meta-dating, we were able to implement a specific database collecting all the available information about each weather station present in the paper archive, and to describe its data consistency. More specifically, we are collecting: the typology of the station, its name, its location and other geographical background information, the barometric height, the time of observation, the director and observers name (changing over time), the instrumentation, the consistency of each variable, as far as each paper format is concerned (filled or empty cell) and any other available information. Cataloging makes it possible to recognize as useful the information (metadata) of interest for reconstructing the history of each weather station, providing a key to critically analyze and homogenize the historical datasets. Furthermore, even as first effort to overcome the problem mentioned above, a more complex relational database (part of the "electronic archive") describing the metadata of all the Italian - operational and historical - stations, has been realized and is still populating (more than 2,300 observational platforms are currently feeding the database, even if the information has still to be gradually refined).

In the last years a huge effort in data digitalization has been performed. This activity started at CRA-CMA in 1989, and the program involved only digitization of the main parameters: in the paper archive, each series consists of a ten-day formatted data, filled by volunteer observers, reporting daily or sub-daily measures concerning air temperature, humidity, pressure, wind speed and direction, precipitation, sun duration, radiation, evaporation, and other additional observations, such as cloud cover and cloud type, snow, etc. It can be estimated that there are more than 6 million data records for each parameter. At present our estimate indicates that about 35% of the

archive has been digitized. Already digitized data are stored into the National Agrometeorological Database (BDAN) <sup>(4)</sup>. Digitization activity started at the Air Force Met Service much later, and was performed in order to fill many gaps inside the "electronic archive" (since 1950) <sup>(5)</sup>, and to extend, backward from 1950, the time series for some locations. Up to present only two time series of hourly full bulletins (Florence and Naples) have been completed since the beginning of the observations, in 1925.

It is important to remember that historical paper documents can contain more information than those already digitized and stored in the databases, and in any case they should be a reference for a subsequent control of the typing. Concerning the scanning activity, digital photo equipment have been recently purchased (CRA-CMA get a professional one). CRA-CMA carried out its activities within the framework of two project, the first one within the international RESMAR, while the second, the so called ASTRO-project, received support by the Foundation "Cassa di Risparmio di Trento e Rovereto", paving the way to a long and laborious scanning program. Air Force Met Service scanned (thanks to three successive public tenders realized from 2007 to 2009 with the Italian Civilian Protection sponsorship) over than 23,000 station forms. In the same context about 90,000 weather-maps of the Mediterranean area before 1964 (from paper and microfilm support) and 70,000 instrumental diagram (thermo-hygrometers, anemometers, rain gauges and barographs) were scanned. At the moment this Service is trying to get funds to complete the rescue of the station forms, particularly subject to deterioration, and is looking for partnership of voluntary associations. A good example of this kind of partnership, presently in due course, is the one with the "Centro Meteorologico Lombardo", possessing a very good expertise in this field.

CRA-CMA and Air Force Met Service would like to pursuit a common digitization program for the whole archives, which would allow us to preserve all the important and unique information content of the paper documents. Nevertheless both the Institutions are facing huge economic problems, related to the intrinsic difficulty to find appropriate public or private financial support for meteorological data rescue.

## Notes

- 1) Some exceptions are to be done about few historical Institutions, such as the University of Urbino, whose the observatory (founded by father A. Serpieri) still retains data since 1850, almost continuously since 1884. It must be said that the World's first meteorological network was active in Italy as early as the XVII century by the Grand Duchy of Tuscany (built by father L. Antinori) although, to our knowledge, all measurements are hopelessly lost.
- 2) Actually also the Air Force Met Service arose in 1923-25 as an operational branch of the "Ufficio Centrale". The same historical building, which remained until today the seat of the CRA-CMA, was previously the headquarters of the "Collegio Romano", in which operated the eminent physicist father A. Secchi.
- 3) As main participants in the National Agricultural System (SIAN) by the "Ministry of Agriculture, Food and Forestry".
- 4) CMA operative tool for collecting and managing the data is available at the link: [www.sian.it/bdan/index.do](http://www.sian.it/bdan/index.do) (restricted access).
- 5) Info about the data availability are freely available on the website: [clima.meteoam.it](http://clima.meteoam.it).