

THE ITALIAN NATIONAL INSTITUTE OF STATISTICS (ISTAT) SURVEY ON METEOROLOGICAL NETWORKS IN ITALY

Luca Salvati, Simona Ramberti, Stefano Tersigni

Istituto Nazionale di Statistica, Progetto Statistiche Ambientali e Sviluppo Sostenibile, Via A. Ravà 150, I-00142 Roma; E-mail: lsalvati@istat.it

Abstract

LA RILEVAZIONE SUI GESTORI DELLE RETI DI MONITORAGGIO AGRO-METEO-CLIMATICO IN ITALIA.

In questo lavoro viene presentata la rilevazione sui gestori delle reti di monitoraggio agro-meteo-climatico in Italia, condotta nel 2008 dall'ISTAT. Tale rilevazione, inserita in una più ampia attività dell'ISTAT nell'ambito delle statistiche meteorologiche, mira a fornire un quadro, aggiornato e dettagliato, delle principali reti di misura meteorologiche attualmente funzionanti in Italia. Sono stati contattati, mediante un'indagine postale e telefonica, più di 600 potenziali gestori suddivisi in base alla copertura nazionale, regionale e locale della propria rete. La lista anagrafica dei gestori è stata predisposta a partire da precedenti lavori bibliografici, integrata attraverso interviste a funzionari ed esperti dei principali servizi meteorologici nonché tramite ricerche ad hoc via internet. La lista anagrafica include i servizi nazionali (Aeronautica Militare, SIAN-ex UCEA e Corpo Forestale dello Stato) e quelli regionali costituiti a seguito del trasferimento delle competenze del servizio Idrografico e Mareografico alle Regioni, i servizi regionali e provinciali (se presenti) di agro-meteorologia, gli osservatori geofisici sperimentali, gli istituti di ricerca (CNR, CRA, ENEA, etc.), le università e le scuole agrarie, i consorzi di bonifica e quelli di difesa dalle avversità meteoriche, i consorzi agrari, le autorità di bacino, le comunità montane ed altri enti minori. Ad ogni rispondente è stato sottoposto un questionario volto alla raccolta di informazioni di sintesi sulle caratteristiche della rete gestita, in termini di consistenza delle stazioni, di strumentazione installata, di produzione e controllo di qualità dei dati. I risultati dell'indagine descrivono le caratteristiche delle stazioni di monitoraggio censite attraverso appositi indicatori di copertura sul territorio, in base alla tipologia degli enti gestori, alle grandezze rilevate ed alla zona geografica in cui operano.

Introduction

Increasing interest on climate and its impact on natural and agricultural ecosystems in the framework of climate change is demonstrated by consistent growth of research activities in such field (e.g. Salvati et al., 2005). Several databases and indexes are actually available at the different scales (global, *sovra*-national, national, regional) and many statistical indexes were introduced in order to describe climate characteristics. Indexes suggest that a large historical data set is necessary to identify relationships between the different variables involved in climate events. In this respect, it is critical to have efficient tools in order to extract information from large databases and to deliver relevant information for environmental risk management (e.g. Perini et al., 2007). The aim of this paper is to illustrate the project carried out by the Italian National Institute of Statistics which is aimed at developing a database from a large number of gauging stations in order to provide, through a GIS-based scheme, estimations of several climatic, meteorological, agro-meteorological, and hydrological statistics and indicators. The statistical survey aimed at collecting a large data set of meteorological observations is described here. The survey is requested to collect and produce climatic information at a detailed geographical and time scale over an enough large period.

Materials and Methods

In the past, meteorological observations were carried out in Italy by the Meteorological Service of the National Air Force, the Central Office for Crop Ecology of the Ministry of Agricultural and Forestry Policies, as well as

by the Central Hydrographical Service. With their large networks, the three institutions guaranteed a rather good coverage of the national territory. In addition, since 1926, the Italian National Institute of Statistics (Istat) disseminates meteorological data collected from gauging stations located over Italy. The reform of national technical services, carried out at the end of 1990s, shifted the central hydrological network to the twenty administrative regions (i.e. at the NUTS-2 level). In addition, several agro-meteorological services started their activity at the regional level since early 1980s. Finally, a lot of meteorological networks with smaller numbers of gauging stations at work continued to operate in that period throughout Italy, especially in the northern regions. Although the monitoring potential of these networks is good due to the generally high-data quality, the complete national coverage and the quite satisfactory spatial resolution of the gauging networks, the heterogeneity of the information collected is high.

In 2007 Istat carried out a research project entitled "Meteo-climatic and hydrologic indicators". The aim of this project, which was included in the National Statistical Program (2008-2010), is to implement a geographical data-warehouse with meteorological, agro-meteorological, and hydrological daily values measured since 1951 from more than 6.000 gauging stations provided by several national, regional, and local institutions. The project is conducted within the partnership of the Central Office for Crop Ecology (Cra-Cma) and the Meteorological Service of the Italian Air Force.

The project has the following objectives: (i) to provide a complete survey of the Italian institutions collecting

Table 1 - The survey of meteorological networks in Italy: provisional data.

| Service/institution name (type) | No. institutions | Estimated number of stations working | Average length of time series (years) | Spatial coverage |
|---|------------------|--------------------------------------|---------------------------------------|------------------|
| Military Air Force | 1 | 100 | > 50 | National |
| C. Office for Crop Ecology | 1 | 200 | > 50 | National |
| Regional hydrological services | 20 | 4.000 | > 50 | Regional |
| Agro-meteorological Services | 20 | 1.000 | > 20 | Regional |
| Corpo Forestale dello Stato | 1 | 100 | > 10 | National |
| National Research Council | 20 | > 50 | > 30 | Local |
| Council for agricultural research | 50 | 200 | > 30 | Local |
| Agro-meteorological services of provinces | 10 | 200 | > 15 | Provincial |
| Agricultural consortia | > 350 | 250 | > 10 | Local |
| Climatic and geophysical observatories | > 20 | 100 | > 40 | Local |
| Universities, schools other institutions | > 20 | > 50 | > 20 | Local |

meteorological data through the own network of gauging stations and (ii) to collect these data into a geographical data-warehouse in order to improve procedures for environmental monitoring. Survey of meteorological networks was done on national services, regional services (e.g. rural development agencies) and local institutions (e.g. research institutes). Based on the results of statistical data collecting, checking, and imputation of lacking values, the data-warehouse will allow us to estimate the main climate variables at high spatial resolution. Finally, a set of indicators describing the interaction of climate with biological, agronomic, pedological, and hydrological themes will be estimated, through down-scaling approaches, at various administrative spatial scales (e.g. municipalities, local labour systems, agricultural homogeneous regions) in order to achieve integration with other statistical (e.g. socio-economic) variables obtained at those scales.

Results

The survey was conducted on more than 600 respondents. Respondents include meteorological services working at the national level, regional authorities and local institutions operating in the environmental field (Table 1). The respondent's list was compiled by dedicated searches on the web, by collecting information through the national

meteorological services and by interviews with experts working at the regional and local level. Data were collected through a statistical survey in 2007-2009 by using software tools and data capturing. Metadata from each considered station were collected through CATI interviews with holders of each network. The number of collected stations is rapidly increasing and it is expected to reach a size of about 6.000 gauging stations in a few months. A geo-database was developed in ORACLE/ARCGIS environment in order to properly store collected time series data of all the variables. A dedicated module will calculate climatic indicators for environmental surveillance in agriculture, public health, tourism and water use on a day, week, month, or year basis. Statistical and geo-statistical analyses will be carried out in order to produce estimates of meteorological variables over the whole Italy at a fine spatial scale.

Conclusions

The framework presented here will allow us in producing long time series thematic indicators across the whole national territory at an adequate spatial scale (Perini, 2004). In fact, complex evaluation of climatic events needs to develop a comprehensive framework in which several aspects should be combined, including (i) climatic (hydro-meteorological) data and indices, (ii) soil quality and topography, (iii) crop cover (vegetation) conditions, and (iv) other human factors, like land use, population growth and others. The next step of the present

work will be the full integration of this GIS-database with other geographical database developed by Istat at the municipality detail (or finer scales) and concerning important socio-economic fields with a potential link with climate.

References

- APAT (2007). *Annuario dei dati ambientali*. Roma.
- ISTAT (2005). *Statistiche meteorologiche. Anni 2000-2002*. Roma (Annuario n. 29).
- Perini L. (2004). *Atlante agroclimatico*. CRA-UCEA & MIPAF, Roma.
- Perini L., Salvati L., Ceccarelli T. et al. (2007). *Atlante agroclimatico II - Scenari di cambiamento climatico*. CRA-UCEA & MIPAF, Roma.
- Salvati L., Libertà A., Brunetti A. (2005). *Bio-climatic evaluation of drought severity: a computational approach using dry spells*, *Biota*, 5, 67-77.