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A Quality-Control-Oriented Database for a Mesoscale Meteorological Observation Network

C. Lussana (1), M. Ranci (1), and F. Uboldi (2)

(1) arpa lombardia, regional weather service, milan, Italy (c.lussana@arpalombardia.it), (2) Consultant, Novate Milanese, Milan, Italy (uboldi@magritte.it)

In the operational context of a local weather service, data accessibility and quality related issues must be managed by taking into account a wide set of user needs. This work describes the structure and the operational choices made for the operational implementation of a database system storing data from highly automated observing stations, metadata and information on data quality.

Lombardy's environmental protection agency, ARPA Lombardia, manages a highly automated mesoscale meteorological network. A Quality Assurance System (QAS) ensures that reliable observational information is collected and disseminated to the users. The weather unit in ARPA Lombardia, at the same time an important QAS component and an intensive data user, has developed a database specifically aimed to: 1) providing quick access to data for operational activities and 2) ensuring data quality for real-time applications, by means of an Automatic Data Quality Control (ADQC) procedure.

Quantities stored in the archive include hourly aggregated observations of: precipitation amount, temperature, wind, relative humidity, pressure, global and net solar radiation.

The ADQC performs several independent tests on raw data and compares their results in a decision-making procedure. An important ADQC component is the Spatial Consistency Test based on Optimal Interpolation. Interpolated and Cross-Validation analysis values are also stored in the database, providing further information to human operators and useful estimates in case of missing data.

The technical solution adopted is based on a LAMP (Linux, Apache, MySQL and Php) system, constituting an open source environment suitable for both development and operational practice. The ADQC procedure itself is performed by R scripts directly interacting with the MySQL database. Users and network managers can access the database by using a set of web-based Php applications.