Chapter 23

Mashing-Up Weather Networks Data to Support Hydro-Meteorological Research

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ABSTRACT

The use of Web technologies for the collection and visualization of geoscientific data has significantly increased the availability of free sensor data over the Internet. This work aims at designing a Web mashup for the aggregation of meteorological variables (precipitation, humidity, pressure, etc.) published on the Web by several weather networks and the rendering of query results through a graphic interface in a homogeneous way. The mashup approach is particularly suitable to provide an easy to develop and quickly deployed application capable to support HM scientists in their everyday activity. As a significant case study of the adoption of the tool, the authors consider the severe flash-flood event that occurred in fall 2011 in the Liguria region, Italy. To this end, they base their analysis on the aggregated rainfall data observed by an official and a personal weather network.

INTRODUCTION

Hydro-Meteorological (HM) science has made significant progress over the last decade. Although new modeling tools and methodologies for collecting and analyzing observational data are now nationally and internationally available, large quantity and complexity of datasets and formats create a significant obstacle in operating with data. Observational data, HM models and the necessary ICT (Information and Communications Technology) infrastructures are not always...
available at the same time. Indeed they are often unevenly distributed between different research institutes, HM services and operational agencies.

To be fruitfully exploited huge datasets, whether from remote sensing instruments such as radar networks, or from ground-based observational sensors, need to be easily available. Availability implies easy to locate, easy to obtain the necessary permissions for use, and the presence of appropriate tools to handle the different formats and meta-data associated with different data types (Parodi, et al., 2011). Furthermore, HM scientists are constantly requiring support from ICT technologies and seeking for global certified management tools to deal with extreme HM events such as heavy precipitation and floods. For these reasons the design, development and deployment of user-friendly interfaces aiming to abstract HMR services provision from the underlying e-Infrastructure complexities and specific implementations, became of paramount importance to Earth scientists. The use of Web technologies for the collection and visualization of geoscientific data has significantly increased the availability of free sensor data over the Internet. It is therefore essential, from an HM scientist point of view, the deployment of ICT initiatives and tools enabling rapid data retrieving from different web sources, as well as the development of functionalities able to aggregate, homogenize, and visualize these datasets.

The chapter introduces a mashup application aimed to collect hydro-meteorological data spread in the Web by different sources. We describe some technical issue involving the access and retrieving of meteorological information through Web service technology. Then we discuss the rearranging of these heterogeneous data according to a common format (WaterML) and their visualization through a graphic tool Google Map. To give an overview of the intended use of our tool, we present a case study related to a severe flash-flood event recently occurred over the city of Genoa, Italy.

Section 2 presents motivations that address our work along with some related work. Section 3 gives some technical insight of our mashup aimed to visualize precipitation data provided by multiple weather networks. Section 4 briefly discusses the potential of our tool dealing with a real case scenario. Section 5 gathers conclusions.

IT SOLUTIONS TO HMR NEEDS

In 2010, as a major activity of the DRHIMS project (http://www.drihms.eu), a series of web polls in the HMR and ICT communities were conducted aimed at better understanding the existing gap between HMR requirements and ICT offer. The HMR polls registered a total amount of 182 answers and the ICT near 100. Amongst the main observations, the analysis of the questionnaires revealed data-related issues such as: interoperability (models, formats, metadata, etc.); availability; extensiveness (amount and size of data). This is well testified, for example by the answers to one of the “hot topic” HMR questions: “Rank (in a 5 point scale) the importance to have easy access to data in formats that are easy to handle”. The average result (4.28) testifies the degree of awareness between HM researchers, about the need of tools to tackle data access issues. Moreover, the analysis also pointed out the lack of commonly accepted tools for interchanging and merging scientific data from different sources and of common libraries for processing and visualizing scientific data and metadata. From this survey clearly emerged the urgency to develop IT initiatives and tools enabling rapid data discovery from different sources, from satellites to Personal Weather Stations (PWS), their collection and the development of functionalities to homogenize, compare and visualize these datasets.

In the last years have appeared a number of applications and projects to retrieve and visualize vast amounts of Earth science data from remote sensing observations and models. “The Live Linked Open Sensor Database” (Le Phuoc, et
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