

## **The Lightning Network LAMPINET of the Italian Air Force Meteorological Service**

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### **Introduction**

Italian Air Force Meteorological Service (IAFMS) set up a lightning network and put it in operation during 2004. The network is based on Vaisala technology with 15 IMPACT ESP sensors distributed on the peninsula and islands. Performances of the network can reach a detection efficiency of 90% and location accuracy of 0,5 km all over Italian area. Basic requirements, for the design of the network, were highest reliability and the use of a technology which could allow the integration with lightning detection networks managed by other National Meteorological Services, in order to achieve the best coverage possible. Basic scientific and technical details of the network along with operational implementation and planned exploitation of the network information, with several post-processing products, are presented.

### **The LAMPINET Network**

During the design phase the Italian Air Force Meteorological Service fixed the requirements of a lightning detection network. With the technological support of Vaisala Inc. from Tucson, Arizona, USA, it was fixed a Detection Efficiency of 90% for discharge with a Peak Current superior to 50 kA, and a Location Accuracy of 0,5 km was fixed, within a large part of national area. This is defined as the area where the confidence of location within 0,5 km is 50% or more. The IAFMS acquired IMPACT-ESP sensors, Vaisala technology, connected with the operative centre, Centro Nazionale di Meteorologia e Climatologia Aeronautica (CNMCA), in Pratica di Mare, few km south of Rome, through dedicated 64 kbps LAN lines. 8 sensors (centre-south Italy) have been installed during 2004, while in spring 2005 has been installed the second group of sensors of other 7 IMPACT-ESP in north Italy. All sensors are working properly. A 16° sensor is stored in Pratica di Mare for training.

### **The IMPACT ESP Sensor**

IMPROVED Accuracy through Combined Technology Enhanced Sensitivity & Performance Sensor, why is that?! Because IMPACT-ESP sensor:

- Detects the wideband electromagnetic field signature of lightning discharge and extracts features from waveforms;
- Detects radio frequency energy from CC and IC discharges in a bandwidth of 1 kHz to 350 kHz;
- Measures the angle to the discharge, the time of signal arrival, the peak signal strength, the rise time and width of the discharge;
- Determines the magnetic direction at the time of initial peak of discharge;
- The system LP2000 must include and use data from at least 2 sensors to calculate the location of the discharge.

### **The LAMPINET Architecture**

The LAMPINET lightning network is based on the principles of REDUNDANCY, EASY INTEGRATION, HIGH EFFICIENCY, BEST ACCURACY. Redundancy consists that every IMPACT ESP sensor is connected to a double system of location.

The locations are computed by LP2000 workstations, SUN BLADE 150 (SUN SPARC 650-II processor), and every time an IMPACT ESP sensor detects lightning activity, it sends a report to LP2000a and LP2000b, independently.

Locations are then archived by DA2000 workstations (SUN BLADE 150), a and b, on a Sybase digital archive. To present in real time locations the Italian Air Force Meteorological Service Units personnel uses Vaisala's LTRAX software, while to retrieve archived data in the National Centre, CNMCA, in Pratica di Mare, researchers use Vaisala's FALLS software.

### **The LAMPINET Post-processing**

The LAMPINET lightning network data are: directly displayed in integration with infrared and visible satellite images and radar acquisitions; converted in ASCII messages for several civil institutions; used as reference in studies, for example, on cloud convection, like in the EUMETSAT financed fellowship for the development of a new nowcasting tool for the prediction of strong convection by means of MSG-SEVIRI images.

### **The EXCHANGE of information**

The Italian Air Force Meteorological Service has proposed to share its sensors detections with other European Institutes; at the moment it has received the interested answer from:

INM Instituto Nacional de Meteorologia – Spain

DWD Deutscher Wetterdienst – Germany

HNMS Hellenic National Meteorological Service – Greece

The Italian Air Force Meteorological Service hopes for future positive new contacts.

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