

An Independent Overview of the National Weather Service in Italy

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At the end of April 2006, people who had previous contacts with the General Office for Meteorology (Ufficio Generale per la Meteorologia, or UGM) of Italy received a short note on the letterhead of Aerial Squadron Command-General Office for Meteorology of the Italian Air Force. The subject of this note, signed by Gen. Massimo Capaldo, the head of the UGM, was the constitution of a new General Office for Aerial Space and Meteorology (Ufficio Generale Spazio Aereo e Meteorologia, or USAM) starting on 1 May 2006. Gen. Capaldo did not explain the reason for the change. The note also stated that starting on the same day the UGM was terminated, the personnel of UGM transferred to the new office.

The purpose of USAM is to support the Italian Air Force (Aeronautica Militare Italiana) chief of staff with technical direction and development of meteorological techniques. USAM also represents Italy in international organizations like the World Meteorological Organization (WMO). The purpose of the new office was therefore very similar to the old UGM, but the personnel was significantly reduced to about one-third (from 70 to about 20 people), so the change seemed dictated at least in part by economic factors. Indeed, the operational meteorology branch, the National Center for Aeronautical Meteorology and Climatology (Centro Nazionale di Meteorologia e Climatologia Aeronautica, or CNMCA), has remained as before, with more than 850 employees. Among the tasks of this center are the dissemination

of forecasts for the air force and for national civil protection and to safeguard life at sea.

In analyzing the meaning of this change from UGM to USAM, we will try to give an overview of both current and possible future scenarios of meteorology in Italy.

HISTORY. As in many other European countries, the birth of the Italian Weather Service can be traced back to a Royal Decree—in this case, the decree in November 1876 that established the Central Royal Office of Meteorology (Regio Ufficio Centrale di Meteorologia, or RUCM) at the Collegio Romano building in Rome. The task of RUCM was to provide meteorological observations, synoptic analyses, and possibly meteorological forecasts, then called “presages.”

Strong links with the military establishment date back to 1913, when the Royal Italian Aerological Society (Società Reale Italiana di Aerologia) was instituted with the specific aim to set up the first atmospheric vertical sounding systems. This may be considered the operational starting point of the modern configuration of the Italian meteorological service. The link with the military was established in 1925 when the RUCM was transformed into the National Weather Service, Presages Office, directly under the Aeronautics Commissioner. In 1931 (during the Fascist era), the Weather Service became part of the War Ministry and relocated headquarters to the new Aeronautics Building in Rome. Just before the end of the Second World War, the national weather service (Servizio Meteorologico–Aeronautica Militare, or SMAM) assumed a structure that, in large measure, was conserved until recently as UGM, and now USAM.

This evolution suggests that the postwar Italian democratic governments apparently never considered instituting a national weather service as a civilian public body. Indeed, the official Web site of USAM (www.meteoam.it) states (author’s translation from the Italian): “The fundamental change from the Presages Office to a component of the Armed Forces did not permit in Italy the birth, as in the other European countries,

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of a civil meteorological service; the Air Force Meteorological Service assumed those functions.” This sentence implies that the transition from Presages to the military was inevitable, due, on one hand, to the historical role of the Italian Air Force and, on the other hand, to the lack of a well-recognized meteorological scientific community within the country. After about 60 years, the situation remains the same.

THE EUROPEAN SCENE. In Europe there are 31 weather services, including Russia and the former countries of the Eastern bloc (a general overview is given by the INM at www.aemet.es/en/enlaces?opcl=serv&opc2=eu). Italian meteorology is nearly alone in its military-dominated tradition. Only Greece also has a national meteorological service managed entirely by the military. Some services with long and outstanding traditions in meteorology, like those of the northern European countries, the Met Office in the United Kingdom, and Meteo France, are civil organizations with some specific restrictions. For example, the Met Office is still “owned” by the Secretary of State for Defence. However, the Met Office is one of the most transparent organizations in this field, and from its Web site (www.metoffice.com/corporate/annualreport0607/index.html) one can get an annual report on every bit of activity and an open financial statement that even lists the salaries of the employees. We may take the organization of the Met Office as a paradigm of a European Weather service. The 2006–07 report shows a total of 1,750 personnel. The annual budget of the Met Office is around 226 million euro (M€).

By comparison, USAM has an annual budget of about 100 M€ (i.e., about \$150 million), half of which goes to pay the personnel, about 900 people. This figure includes all the personnel in USAM and CNMCA. Of the other half of the budget, about 35 M€ are contributions to international organizations including the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT). This money comes from the Italian Department of Defense budget, but official published documents do not break down the categories. In addition to this direct government funding, USAM also gets income by providing services to Italian government agencies and other private and public administrations. The largest customer is the National Agency for Flight Assistance (Ente Nazionale Assistenza al Volo, or ENAV), which provides about 15 M€ to USAM. The remaining amount (about 3–5 M€) is mainly obtained from the

Italian state television (RAI) and the Department of Civil Protection (DPC).¹

In the Met Office, about 114 M€ are contributed by the Public Weather Service, 44 M€ from the Ministry of Defence, 26 M€ from Department of Environment Food and Rural Affairs (Defra), 6 M€ from the Civil Service, and 36 M€ for the commercial activity. The Public Weather Service provides environmental forecasts and climatological services. More than 75% of its funding is from the Ministry of Defence. These figures are interesting because they give an idea of the span of Met Office activities (for example, most of the climate research is funded by Defra), and also because the 26 M€ is an order of magnitude greater than all meteorological research funding in Italy.

Even though the Met Office is owned by the Ministry of Defense, Met Office researchers do not have a uniform and are civil servants. By contrast, the USAM officers have military degrees, follow a military career, and wear uniforms. More significantly, Met Office research is well known all over the world, and its climate simulations are a fundamental part of the Intergovernmental Panel on Climate Change (IPCC). The Met Office also has been managing the weather radar network since late 1970s. The same cannot be said of USAM or its predecessor UGM, which focused on ordinary administration.

RECENT DEVELOPMENTS. The development and management of a meteorological radar network is a basic function of modern weather services, especially for nowcasting flash floods and severe storms. However, UGM never started a systematic project toward establishing a weather radar network. As a result, to this point only northern Italy has been partially monitored by regional radars, sponsored by regional civilian entities. The shortcomings of the national service, and in particular the need for weather radar coverage, was demonstrated in the last 10 years by very destructive events, such as the Piedmont floods in 1994 (70 victims) and 2000, and the Soverato tragedy in Calabria (a flash flood that killed 30 people camping along a dry stream bed).

These events also reinforced perceptions that regional and national cooperation in meteorology was

¹ These figures are not released by USAM (no official figures are obtainable from USAM even on written request). However, we have obtained them through different sources that we consider reliable, including retired top-level officials of both the Italian Meteorological Service and ENAV.

inefficient. Starting in the early 1990s, the Italian State–Region Conference, a governmental institution that rules the interactions between the central government and the regions, promoted meetings to establish a national distributed weather service. The objective was to standardize regions with very different backgrounds, needs, and experiences. UGM was not involved in such meetings, and the discussions lasted until 2001 because of the large differences to be resolved.

In May 2001 a governmental decree (known as the Soverato Decree) gave the Italian Department of Civil Protection (DPC) the task of building a network of “Regional Functional Centers” (CFs) and completing the coverage of Italy with a radar network. UGM had only a couple of weather radars linked to the main airports at that time. Regions like Veneto, Emilia Romagna, Friuli-Venezia Giulia, Piemonte, and Abruzzo had weather radar managed by civilian operators, belonging to regional weather services that at the time were converging into a network.

The purpose of CFs is to collect data and to monitor the weather and hydrological situation and identify risks of severe weather, inundation, and landslide. This is a complete reversal from the previous situation, in which USAM/UGM was directly involved in civil protection but had no means to make a regional high-resolution forecast. (UGM had not even maintained a direct connection to the National Hydrographic Service, which was responsible for the data on the status of surface water such as streams, rivers, and lakes.) All sites for the planned radar network have now been chosen, and Italy will soon be covered by about 30 radars (a large number is necessary because of the very complex topography), some of them with dual-polarization capability. In this way, the DPC network has minimized its dependence on the USAM.

NATIONAL AND REGIONAL SERVICES.

The forecast is provided by USAM and, based on these forecasts, warnings are issued by DPC. These warnings can be corrected by the regional centers only if they have better predictive capability than USAM (e.g., higher resolution, data assimilation of regional data, nonhydrostatic models). Regional centers are funded by regional governments (and authorized by DPC based on performance review). The Italian system of civil protection and warnings has been structured as described by an Italian Prime Minister directive on 27 February 2004 (available in

Italian at the DPC Web site: www.protezionecivile.it/cms/attach/editor/centroFunzionale/direttiva_idro.pdf). This document established rules and procedures for hydrometeorological warnings and mentioned UGM as one possible provider of weather data and forecasts. Before 2001, a few regional operational centers, formed by local governments, had developed good forecast capabilities using Limited Area Models (LAMs). Most of these attempts were simply based on the availability of LAMs on the Internet, but some of them produced interesting results with nonhydrostatic models.

Forecasting for a region with very complex terrain, such as Italy, requires a high-resolution LAM, and in the early 1990s UGM launched the project called Consortium for Small-scale Modelling (COSMO) in cooperation with the Swiss, German, and Greek weather services. The purpose of COSMO was to develop a nonhydrostatic, high-resolution LAM to become the operational forecast model for the participating nations. As a result of COSMO, UGM acquired use of the LAM of the Deutscher Wetterdienst, which itself was roughly derived from The Pennsylvania State University-NCAR Mesoscale Model 5 (MM5). At present, USAM runs this LAM on computers at the ECMWF. (Note that UGM and its predecessor have not developed their own global circulation model, unlike other European services.)

By the time of COSMO, some Italian regions had developed weather services of their own with forecast capabilities. A few of these organizations and universities had already developed similar or better meteorological LAMs, including the capability for data assimilation even before the establishment of the CFs.

Among the regional services that developed forecast capability, most notable are Emilia Romagna, Piemonte, Liguria, Veneto, Lombardia, Friuli, and Abruzzo. Their budgets and the number of people involved vary greatly and range between 8–9 M€ per year for 100 people (like Emilia Romagna) to less than 1 M€ and 10 people for Abruzzo. This does not include installation of new instrumentation like radars. These regional forecast groups interact with USAM mainly to buy the ECMWF data for the initialization of their LAMs. Some of the regional services use other data—for instance from the U.S. National Centers for Environmental Prediction (NCEP)—and the weather information is released to several customers, like DPC. In recent months DPC has signed an agreement with USAM to provide free ECMWF data to CFs.

DISSEMINATION OF METEOROLOGICAL INFORMATION.

The information that reaches the public is channeled through RAI and commercial TV networks. RAI has a very prominent contract with USAM for the service. Weather officers in uniform present the forecast several times a day on the three RAI TV channels. Images or animations from the *Meteosat* Second Generation (MSG) satellite are also shown. They do not show images from the radar network composite, even though they could get it easily from DPC.

USAM, like other services, cooperates with ENAV, DPC, public administrations, and private organizations. However, according to the Italian legislative decree (on 9 May 2005, following one of the many ENAV reorganizations), ENAV makes its own forecasts for all Italian airports. The contract with USAM only provides noncustomized weather forecasts along air routes and the dissemination of ENAV reports through the Aeronautical Fixed Telecommunication Network (AFTN) system (this is the reason for ENAV's 15-M€ annual payments to USAM).

In 2005, UGM signed an agreement with the National Agency for the Environmental Protection and Technical Services (Agenzia per Protezione dell'Ambiente e per i servizi Tecnici, or APAT) to furnish just meteorological and climatological data. Unfortunately, this agreement does not, for example, provide chemical weather forecasts, even for the most polluted areas like the Po Valley.

INTERNATIONAL COLLABORATIONS.

Because USAM is the only meteorological representative for Italy internationally, the agency acquires all international data available (like the analysis and forecast field of ECMWF). These data are then sold on request not only to the private companies, but also to national agencies (like DPC) or public administrations (like regional authorities). USAM provides ECMWF data for universities and research centers at a cost of about 35 k€ per year. USAM sells only ECMWF data to DPC for about 1.2 M€ per year, which we estimate to be four times the actual cost of the ECMWF data. As taxpayers, we feel this is very contradictory behavior, because Italy funds ECMWF and thus the data should be available for a nominal cost to any research institution.

To our knowledge, USAM has not participated in the GMES (Global Monitoring for Environment and Security) program, as other European services have. GMES is the most comprehensive European program

involving meteorological and environmental data. However, the project to establish a EUMETSAT Satellite Application Facility (SAF) to support operational Hydrology and Water Management (Hydrology SAF, or H-SAF) started in September 2005. The H-SAF Consortium includes operational services and scientific institutes from twelve EUMETSAT members or cooperating states, with USAM as a host institute.

THE CONSEQUENCES FOR ITALIAN METEOROLOGY.

The strong bond between the national weather service and the military may have delayed the emergence of professional meteorologists in Italy who embrace the scientific aspect of meteorology, and in particular remote sensing. Until the early 1960s, the only way to study meteorology-related disciplines was to pursue a military career. The only textbooks were published by the Ministry of Defense and were at a high-school level. USAM presently teaches meteorology to the other armed forces (navy and army) and occasionally cooperates with universities in teaching. In Italian universities today, fewer than 10 associate or full professors teach meteorology or atmospheric physics. The popularity of teaching meteorology, although rising, is still quite low, and there is not a single Ph. D. course in meteorology. The highly qualitative forecasts by UGM and the very limited instrumentation probably alienated many young students and left them with the conviction that meteorology was not a real science.

Of all the Earth sciences in Italy, meteorology is the most poorly funded. The challenges facing the Italian scientists have been very well outlined in a 2006 EOS article by De Vivo et al. Although the overall expenses for scientific research are less than 1% of the gross domestic product (less than half the rate in other industrialized countries), the distribution of the funding among the various sectors is incomprehensible. Particle physics, solid state physics, and astrophysics have the largest share. In part this is due to the creation of National Institutes (the most influential being the National Institute of Nuclear Physics), which have their research funds assigned by the government at the beginning of each fiscal year. Meteorology could have been attached to the National Institute of Geophysics (now National Institute of Geophysics and Volcanology, or INGV), but instead this research body was dominated until a few years ago by solid-Earth geophysicists, and now has some problems in scientific management. The presence of a civilian meteorological organization

could have stimulated a similar institution for the atmospheric sciences.

The involvement of the private sector also has been retarded by the qualitative nature of meteorological information disseminated nationally. The national forecast until the early 1990s was based on the low-resolution products released by ECMWF. Quantitative data became available only after USAM started to use regional models in 1999 (and experimentally for four years before that). Considering the military's monopoly of the atmospheric data and their popularization, this situation may be largely attributed to them. There was no "public intellectual" (as described by Richard C. Lewontin in a recent *New York Review of Books*) for meteorology.

Research in meteorology and atmospheric remote sensing is carried out in only a few universities and a couple of National Research Council (CNR) laboratories. USAM does not manage research laboratories. Except in a few cases, large facilities like computers, airplanes, and radar are only available to research groups connected with the regional programs, such as those affiliated with Regional Operational Centers or Regional Functional Centers. In some regions, the university has prompted the local government to get involved with meteorology. Cooperation with USAM (like for the COSMO program) is limited to data sharing and sometimes computer resources. The research funds for universities are mostly available from the European Community and at the national level from the Italian Space Agency (ASI). ASI does have some operational restrictions, but has a funding program for remote sensing in meteorological research.

The scientific cooperation between USAM and nonmilitary research is limited to one or two regional weather services; USAM does not issue public calls for research. Several opportunities for research in recent years have not been exploited. For instance, USAM is not participating in the National Climate Program, which despite many difficulties is building a computing center in Lecce. INGV is organizing this center (Euromediterranean Center for Climatic Change, or CECC) despite having limited expertise in this field. The funding of the center came from the Ministry of the Environment and the Ministry of the Universities with the recommendation that all the climatic community (including USAM) be involved. However, this did not happen.

Following the university reform in Italy, which created a three-year degree (equivalent to a bachelor's degree), a few universities now offer a bachelor's degree in

meteorology. This could have been a good occasion to start cooperation with universities, but USAM chose to work with only one of the many universities in Italy without stimulating a coordinated national program. This approach is completely different from that used in other countries. The U.S. National Weather Service modernized by enlarging the local partnership with universities and research entities. The goal was, and still is, to exploit and stimulate cooperation among weather forecast offices, river forecast centers, and all involved research communities, obviously in a competitive and highly technological context.

Any choice about the future of the Italian meteorological community is more political than technical. Civilian air traffic control in Italy was also a military matter until relatively recently. Now ENAV is a public joint-stock company. We feel meteorology in Italy needs a similar transition toward a civilian national weather service—to provide greater transparency in management; to advocate more prominently for public needs; and to open its ranks to scientific meteorologists and experienced managers from academic, government, and civilian backgrounds. USAM could continue to pursue its main goal of military flight assistance and mission support. In this respect there are international examples, such as the U.S. Naval Research Laboratory or the U.S. Air Force Weather Agency.

The formation of a National Weather Agency, not necessarily as a private company like ENAV, would provide national forecasts and related products and also take on most of the responsibilities for handling the weather radar network and satellite meteorology facilities. It should fund and stimulate applied research inside and outside the agency itself, opening competition and cooperation among all existing institutions. It should also represent Italy in all major international organizations related to research and applications. Any choice about the future of the Italian meteorological community is more political than technical. The resources that USAM obtains from the national government, under various sources, would easily allow the establishment and management of such a National Weather Agency, one neither narrowly focused on operational duties nor constrained by the military hierarchy.

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