

A successful partnership in Atmospheric Transport Modelling

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On behalf of the World Meteorological Organization (WMO), I wish to thank the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) for the kind invitation to contribute to *Spectrum*. This also provides WMO with a welcome opportunity to acknowledge the outstanding collaboration which, over a remarkably short time, has evolved into a solid operational partnership.

A joint response system between WMO and the CTBTO has been in provisional operation since 2008 and it successfully underwent a major test in March 2011 in the context of the dramatic events in Japan. From the WMO perspective it was, in fact, a quadruple disaster, consisting of a major earthquake, a devastating tsunami, the atmospheric – and oceanic – release of radioactive substances and the impact of very cold weather on the rescue operations, which further augmented the distress of the affected population. Indeed, only the fact that Japan has a very well prepared and resilient society in the face of natural hazards prevented the magnitude of the tragedy from mounting higher still.

WMO AND CTBTO OBSERVING SYSTEMS HAVE A CROSS-BOUNDARY SCOPE

Over 2,000 nuclear tests were conducted from 1945 to 1996, which clearly justifies the need for an International Monitoring System (IMS) like the one the CTBTO is currently developing. Notably, the cross-boundary scope of our respective observing systems is another feature which our two organizations have in common.

In WMO's case, however, although by the mid-17th century some scientific societies were already collecting data more or less systematically in search of weather patterns, the concept of internationally coordinated observations took considerably longer to develop, in particular due to early technological constraints.

A SERIES OF METEOROLOGICAL MILESTONES SINCE 1654

The first international meteorological network was established in 1654 by Ferdinand II of Tuscany. Seven stations were established in northern Italy and four more in Warsaw, Paris, Innsbruck and Osnabrück. The next major milestone came in 1780, in the form of a network of 39 stations, including two in North America, managed by the Societas Meteorologica Palatina, which was another name for the Meteorological Society of Mannheim. Although this network lasted only 12 years, it was a key step forward since all weather observations were performed according to standardized practices and using calibrated instruments.

However, it would still take several decades for the first International Meteorological Conference (Brussels, 1853) and the First International Meteorological Congress (Vienna, 1873) to provide the executive structure needed to successfully re-launch the concept, through the foundation of the International Meteorological Organization (IMO), our predecessor, which became WMO in 1950 and only one year later was already part of the UN System. Today, with 189 Members and a mandate in weather, climate and water, WMO focuses its scientific and technical programmes on providing optimal services to all WMO Members, especially in support of their safety and well-being, through their respective National Meteorological and Hydrological Services (NMHSs).

In the late 1950s, artificial satellites began to orbit our planet and soon became our eyes in the sky, providing us with vital additional information of a truly global nature. Independently but almost simultaneously, super-computers reached a sufficient degree of power to render feasible the numerical weather prediction methods proposed several decades earlier.

The importance of these two autonomous developments was readily recognized by the international community through the 1961 UN General Assembly Resolution 1721/XVI on the Peaceful Uses of Outer Space, requesting WMO to meet the challenge of harnessing the new opportunities. Established in 1963, the World Weather Watch (WWW) – the core of WMO Programmes – combines observing systems, telecommunication facilities and data-processing and forecasting centres – operated by WMO Members – to make available the meteorological and related environmental information needed to provide efficient services in all countries. In particular, the modern WWW encompasses the WMO Emergency Response Activities (ERA) Programme, supporting the application of specialized atmospheric dispersion-modelling techniques to track and to forecast the global spread of various airborne particulates during environmental



Eruption of Eyjafjallajökull volcano, Iceland, April 2010.

emergencies, based on the operational infrastructure of numerical weather prediction systems operated by various WMO Regional Specialized Meteorological Centres (RSMCs) throughout the world.

Spectrum readers may be professionally inclined to think of these particulates as radioactive substances, but the potential of such methods is broader since, with appropriate adjustments, similar models can also be applied to volcanic ash, biohazards, chemical substances from industrial accidents, sand and dust storms, smoke from large fires, locusts and other insect infestations, among other issues.

Of course, the respective concentration measuring sensors differ considerably from one application to another, as do the initial conditions. For example, the 1986 Chernobyl disaster injected a very large number of particles high into the atmosphere, where they remained for a rather long time. By contrast, the Fukushima Daiichi accident was markedly different, as was the prevailing meteorological situation.

TRACKING RADIOACTIVITY DISPERSION IS ESSENTIAL AFTER A NUCLEAR ACCIDENT

Since the Chernobyl accident, WMO has continuously upgraded its operational planning and support for nuclear facility

accidents, as in the aftermath of such situations it is critically important to track radioactive material dispersion effectively. Of relevance as well from the CTBTO perspective, is the fact that the system can also be applied to reverse-track emitting sources.

Today, WMO RSMCs are operational 24 hours a day, seven days a week, covering the entire planet, and providing authorities and decision-makers with the best possible information on winds and trajectories, as well as on any likely precipitation which might contribute to wash down nuclear contamination over cities, cultivated fields, fishing zones and other critical areas.

The system includes a telecommunication gateway at the German National Meteorological Service (DWD) in Offenbach to provide real-time information, in particular, to the Incident and Emergency Centre of the International Atomic Energy Agency (IAEA) in Vienna. Accordingly, specialized products can begin to be made available to the IAEA within less than three hours of their initial request. WMO also coordinates very closely with the International Civil Aviation Organization (ICAO) by helping to prevent commercial airlines from flying into any potentially dangerous areas, and with the International Maritime Organization (IMO) by supporting navigational warnings, establishing



Aerial photo taken by a small unmanned drone of the crippled Fukushima Daiichi nuclear power plant, northern Japan. From left: Unit 1, partially seen; Unit 2, Unit 3 and Unit 4. (Air Photo Service Co. Ltd., Japan)

danger zones and providing meteorological alerts which can be disseminated via the established automated systems.

On 11 March 2011, at the IAEA's request, WMO activated its Environmental Emergency Response mechanism for Asia, consisting of three Regional Specialized Meteorological Centres situated at the Japan Meteorological Agency (Tokyo), in Beijing (China) and Obninsk (Russian Federation). For other regions, the relevant centres are located in Exeter (United Kingdom), Melbourne (Australia), Montreal (Canada), Toulouse (France) and Washington (USA).

The three concerned RSMCs continued to issue forecast charts of the Fukushima Daiichi power plant nuclear material dispersion until these products were no longer required, while the other five centres regularly provided dispersion charts for comparison and validation.

WMO AND CTBTO WORKED CLOSELY THROUGHOUT THE FUKUSHIMA CRISIS

Throughout the emergency, WMO collaborated closely with the CTBTO and simultaneously provided special support to the World Health Organization (WHO) in Geneva. Indeed, since nuclear safety is a global public good serving the interests of all, the Fukushima Daiichi emergency helped to illustrate the importance of

cooperation among all the competent UN System organizations, including in the area of public information.

In concluding I would like to stress that, much as we collectively regret the individual suffering and the massive damage caused by the connected disasters which impacted upon Japan last March, including the Fukushima Daiichi nuclear power plant episode, the potential was there for higher magnitude destruction. Throughout the crisis, the Japan Meteorological Agency provided tsunami and weather warnings efficiently.

I would also like to draw attention to the critical importance of strengthening different kinds of observational programmes at key installations. The CTBTO is currently developing its global verification system to monitor compliance with the Comprehensive Nuclear-Test-Ban Treaty (CTBT), including a network of seismic, hydroacoustic, infrasound and radionuclide stations. This system is primarily being designed to detect nuclear explosions and it could benefit from the installation of co-located automated weather stations (AWSs). Similarly, radionuclide monitoring stations at or close to nuclear installations already equipped with AWSs could also be fitted to measure the composition of the local atmosphere.

In the event of a nuclear accident, a very precise knowledge of the local weather parameters would contribute to the better and quicker monitoring and evaluation of any potential nuclide dispersion.

On behalf of WMO, I look forward to further collaboration with the CTBTO, in this and other key areas, in particular for the protection of life, livelihoods and property; health and well-being; safety on land, at sea and in the air; sustainable economic growth; the protection of natural resources and environmental quality; and especially for natural disaster risk reduction activities and climate change adaptation.

BIOGRAPHICAL NOTE

MICHEL JARRAUD

has been Secretary-General of the World Meteorological Organization (WMO) since 1 January 2004. Before joining WMO as Deputy Secretary-General in January 1995, he held a number of senior positions within the European Centre for Medium-Range Weather Forecasts (ECMWF), including Deputy Director of the Centre from 1991. From 1986 to 1989, he was Director of the Weather Forecasting Department at the French National Meteorological Service..