

RSMC Exeter report of activities for 2017

Executive Summary

RSMC Exeter did not receive any requests for support for real events in 2017. Other RSMC-related activities for 2017 consisted of participation in monthly tests, led by RSMCs Washington, Montreal and Melbourne, as well as a major IAEA exercises in June 2017 (ConvEx-3) for which Exeter and Toulouse were lead RSMCs. Response procedures, software, and joint RSMC secure common web pages and numerical models were improved. The joint web pages are used for communicating transport model products to National Meteorological and Hydrological Services (NMHS) and between RSMCs and IAEA.

1. Introduction

The UK Met Office is designated by the WMO as the Regional Specialized Meteorological Centre (RSMC) for the provision of atmospheric transport modelling in case of an environmental Emergency Response. The regions of responsibility are WMO Regional Associations (RA) I & VI, which encompasses Europe, Ukraine, the Russian Federation and Africa. In the case of an event, e.g. an accident at a Nuclear Power Plant (NPP) RSMC Exeter would respond jointly with RSMC Toulouse. In addition to emergency response, RSMC Exeter contributes global inverse modelling support to the CTBTO verification system

2. Operational Contact Information

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3. Responses and information on dissemination of products

i. Participation in international inverse dispersion modeling events and exercises with CTBTO

During 2017 RSMC Exeter received three requests from the Provisional Technical Secretariat of the Comprehensive Test Ban Treaty Organisation (PTS of the CTBTO). The requests were made on 20th February, 4th October and 27th October and were all responded to within the expected timescale. This compares to four requests made by the PTS of the CTBTO in 2016.

ii. Dissemination of Products

Transport model graphical products and joint statements are posted to secure joint web pages maintained by all RSMCs for ATDM. When requested by the International Atomic Energy Agency (IAEA) these products are also faxed/e-mailed to relevant RSMCs and National Meteorological and Hydrological Services (NMHS). For examples of the graphical products, see WMO technical document no. 778 section 4. (<http://www.wmo.int/pages/prog/www/DPFSERA/td778.html>)

Throughout 2017, monitoring of RSMC mirror web pages continued, to ensure that they remained congruent.

4. Routine operations

RSMC Exeter participates in the monthly testing regime led by RSMCs Washington, Montreal and Melbourne. This participation is limited to running the dispersion model (NAME) for the advertised release and then posting results on to the RSMC mirrored websites. These actions help to regularly monitor the performance of the mirrored websites, ensuring that any issues can be addressed in near real time.

In June 2017, RSMC Exeter took part in a major nuclear accident exercise (ConvEx-3 2017). This coincided with the quarterly testing regime of the RSMCs, with Exeter and Toulouse acting as lead RSMC for the exercise. The exercise itself was based on a theoretical accidental release of radiation from the Paks Nuclear Power Plant (NPP) in Hungary. Real weather was used for this exercise, ensuring that all RSMCs could take part in real (or near real) time. Graphics (standard products) were posted to all the RSMC mirrored websites, as well as to the IAEA and to NMSs within RA I and RA VI

As well as the standard RSMC products (see examples referenced in the link to WMO technical document no. 778, section 4, above) most of the RSMCs also exercised the production of a new product – the Time of Arrival (ToA) chart. This chart provides users with an understating on the position of the leading edge of a radioactive cloud following a NPP release, in six-hour segments, up to 72 hours ahead. Generally speaking the ToA products were only shared amongst the other RSMCs (i.e. were not disseminated to NHMSs, since they are not standard RSMC products). However, RSMC Exeter and RSMC Toulouse, as leads for the exercise, did pass their ToA products to the IAEA so that their use could be evaluated by an “intelligent” customer. These charts were well received. Separately, RSMC Tokyo conducted a review of the ToA charts from all participating RSMCs.

Further, following another request from the IAEA ahead of the exercise, RSMC Exeter and RSMC Toulouse also made available to the IAEA some short-range modelling products, showing plumes extending a few hundred kilometres from the Paks NPP. These charts were intended to provide a better level of detail to the IAEA and were used as an exercise to assess the viability of short-range ATDM modelling for that customer.

5. Lessons learned from recent experiences and significant operational and technical changes:

- i. All requests for RSMC support during 2017 were carried out in a timely fashion.
- ii. Various incremental changes continue to be made to NAME III to improve the capability of this model.
- iii. During 2017, the dispersion model used by RSMC Exeter (NAME) was migrated from standalone servers to the High Performance Computing (HPC) system at the Met Office. One of the principle reasons for this move was that changes to the driving atmospheric model, used by the Met Office, had resulted in a major increase in the data volumes generated in the course of a routine prediction run. These vastly increased data volumes meant that it was not viable to transfer the data to the standalone servers, where NAME had previously been housed, in a timely fashion. A benefit of the move of NAME to the HPC is that data from the driving atmospheric models are now available to NAME at a much earlier time (1-2 hours) compared to the original availability when on the standalone servers.

6. Operational issues and challenges:

There is a continued need to ensure that all operational staff are regularly exercised and tested in their execution of all aspects of Emergency Response. The initiation of the dispersion model (NAME) runs is a straightforward task, since the process is well-documented and performed frequently by the team. However, the writing of the Joint Statement is somewhat more involved and it is this aspect that has been focussed on. To ensure that all team members are up to date, specific “training” days continue to be rostered to allow the EMARC (RSMC) meteorologists dedicated time away from operational duties in which to continually practice these (and other) Emergency Response activities. Additionally, the regular completion of this aspect of the RSMC response has been included in the Performance Review targets of the meteorologists to ensure that they are up to date with the activity.

7. RSMC representation at ad-hoc meetings:

The representative for RSMC Exeter attended the Third Planning Meeting in Budapest, Hungary, 26-27 February 2017 in order to discuss and plan the upcoming Convention Exercise (ConvEx-3) planned for June 2017.

8. Summary and status of operational atmospheric transport and dispersion models

The Met Office’s Numerical Atmospheric-dispersion Modelling Environment, NAME III (v. 6.5 is the current version) is a Lagrangian particle-trajectory model designed to predict the atmospheric dispersion and deposition of gases and particulates. A large number of particles are used to represent releases from pollution sources. Each model particle can

have its own characteristics, represent different compounds or chemicals and represent real particulate sizes. These particles are advected by the temporally varying, three-dimensional model winds and dispersed using random walk techniques that take into account the atmospheric turbulent velocity structures.

Several deposition processes remove particles from the atmosphere; i) impaction with the surface, ii) washout where particles are 'swept out' by falling precipitation, iii) rainout where particles are absorbed directly into cloud droplets as they form and, iv) fall out due to gravity.

A modular code design offers the user flexibility in configuring model runs and provides an infrastructure onto which extra modules could be added. NAME is capable of utilising meteorological data from a variety of sources: fields from a numerical weather prediction model, radar rainfall estimates, and single-site observations, with the available data used in a nested sense.

Other effects, such as plume-rise (for buoyant or momentum-driven releases), radioactive decay of radio nuclides, and chemical transformations, can also be included. At short ranges, NAME functionality includes modelling of short-period concentration fluctuations and the effects of small-scale terrain or isolated buildings on dispersion.

Prior to 2017 an upgrade to version 6.5 of NAME was made. The main improvements in NAME 6.5 are to the representation of mesoscale motions (larger than turbulence, but smaller than the motions which can be represented at the resolution of each meteorological model), the ability to use UKPP and EuroPP precipitation fields with NAME and improved particle trajectories close to the poles.

The option to add the ability to use ECMWF data with NAME was also included in the 6.5 release.

Also included in the 6.5 release were some minor improvements to the RSMC products – the addition of Exercise (or Real) in the titles of the graphics and the increased visibility of the source term symbol, as well as a set of instructions for the "Manually Enter Observations" tab on the CHEMET and PACRAM interfaces.

As described in section 5 (iii) above, NAME was migrated from standalone servers to the High Performance Computing (HPC) facility in 2017.

In September 2017 the Met Office Global Model (which is used to "drive" NAME for releases outside of the UK) was upgraded; one important aspect of this was an increase in grid point resolution from 17km to approx. 10km, allowing for better modelling.

9. Plans for 2018:

The schedule of routine quarterly tests for 2018 has been set up in collaboration with IAEA. The test plan is as follows:

20 February: Lead RSMC: Melbourne

23 May: Lead RSMCs: Montreal and Washington

21 August: Lead RSMCs: Obninsk, Beijing and Tokyo

20 November: Lead RSMCs: Exeter and Toulouse

The expectation is that all RSMCs will participate in the next scheduled WMO Expert Team for Emergency Response Activities (ET-ERA) meeting. This is most likely to take place in Vienna in October 2018.