RSMC Washington report of activities for 2012

Executive Summary

RSMC Washington did not receive any requests for support for real events. Other RSMC-related activities for 2012 consisted of Region 3, 4, and 5 monthly tests, conducted for scenarios over Canada, the United States, and Australia and one IAEA exercise with RSMC Washington and Montreal as Lead RSMCs in February. 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 between RSMCs.

1. Introduction

The National Oceanic and Atmospheric Administration's (NOAA) Air Resources Laboratory (ARL) together with NOAA's National Centers for Environmental Prediction (NCEP) are designated by the WMO as the Washington Regional Specialized Meteorological Centre (RSMC) with the specialization to provide atmospheric transport model products for environmental emergency response. The primary regions of responsibility are WMO Regional Associations (RA) III & IV, which encompass Canada, United-States, Mexico, Central and South America.

2. Operational Contact Information

RSMC Washington
National Oceanic and Atmospheric Administration (NOAA)
National Weather Service
NCEP Center for Weather and Climate Prediction
Suite 4600, W/NP
College Park, MD 20740
United States of America

Business contact: Mr Jeffery McQueen
Tel : 1 301 683 3736
Fax : 1 301 683 3703
Email : jeff.mcqueen@noaa.gov

Operational contact (24 hours): Senior Duty Meteorologist
Tel : 1 301 683 1500
Fax : 1 301 683 1501
Email : SDM@noaa.gov

3. Emergency operations

RSMC Washington did not respond to an emergency in 2012.

4. Routine operations

Monthly Test:

RSMCs Montréal, Washington, and Melbourne generally hold a joint exercise on the second Thursday of every month and invite other RSMCs to participate. In addition, RSMC Washington participated in two IAEA-initiated exercises during the year, one of which RSMC Montréal and RSMC Washington were designated as Lead RSMCs. Table 1 shows the breakdown of the details for the exercises in 2012.

Month	Source location
Jan 12	Port Adelaide, Australia
Feb 16	Pickering, ON, Canada (IAEA request)
Mar 8	Laguna Verde, Mexico
Apr 12	Point LePreau, ON, Canada
Jun 14	Lucas Heights, Australia
Sep 13	Donald Cook, MI, USA
Oct 11	Pickering, ON, Canada
Nov 15	Bushehr, Iran (IAEA request)
Dec 13	Fort Calhoun, NE, USA

Table 1: RSMC Washington monthly tests for 2012

Once the model products are posted to the common web pages, an email is sent in both Spanish and English to those NMHS contact points with valid email addresses in WMO RA III and IV, the IAEA and WMO. The email contains login information to retrieve the RSMC products from the common web pages.

Common web pages:

RSMC Washington (ARL) continues to maintain and update, as needed, the common web page code. RSMC Washington is responsible for maintaining and distributing the web page code to all RSMCs and to make changes to the code based on lessons learned and RSMC technical meeting suggestions from other RSMCs. In 2012, RSMC Washington was able to post its results to the common web sites at all other RSMCs except Exeter, greatly enhancing the redundant capability of access to RSMC model products. In addition, most RSMCs regularly post their results to the RSMC Washington common web page for IAEA and Region III/IV exercises. The goal is for all RSMCs to post their products on all common web pages whenever possible.

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

- In July and August, RSMC Washington's two components, the Air Resources Laboratory (ARL) and the National Centers for Environmental Prediction (NCEP), collocated to a new facility in College Park, MD. The new facility, called the NOAA Center for Weather and Climate Prediction, is located on a 50-acre section of the University of Maryland's M-Square Research and Technology Park. Tenants include approximately 800 employees of NOAA's National Weather Service (NWS), National Environmental Satellite, Data and Information Service (NESDIS), and the Office of Oceanic and Atmospheric Research (OAR). During the move transition in July and August RSMC Montreal was alerted to the fact that RSMC Washington may not be fully functional. Being collocated will facilitate better collaboration and communication between the research and operations of RSMC Washington.

6. Additional operational issues and challenges:

RSMC Washington continues to have difficulty with invalid email addresses for NMS contacts who receive email notices of updated model products. Guidance from WMO on how the proper procedure to remove bad email addresses from our system would be helpful.

7. Summary and status of the operational atmospheric transport and dispersion models

i. The HYbrid Single-Particle Lagrangian Integrated Trajectory Model (HYSPLIT)

RSMC Washington's operational atmospheric transport and dispersion model is HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectories) model, developed at the NOAA Air Resources Laboratory. HYSPLIT is driven by meteorological forecast data from the operational Global Forecast System (GFS) model (T574, approximately 22 km, converted to a 1 degree latitude-longitude grid) and the North American Meso (NAM) Non-hydrostatic Multi-scale Model on a 12 km grid (NMM). The system is available for running on demand and can produce forecast trajectories, concentrations (or exposures) and depositions for nuclear accidents, volcanic eruptions, smoke episodes and other related atmospheric pollutant releases.

HYSPLIT can be used for modeling atmospheric transport and dispersion of pollutants over a broad range of distances; from local to global scales. The equations used in the calculation of pollutant transport and dispersion are a hybrid between Eulerian and Lagrangian approaches. Advection and diffusion calculations are made in a Lagrangian framework using the gridded meteorological analysis and forecast fields. Air concentrations are calculated on a fixed three dimensional grid by integrating all particle masses over a pre-set averaging period. Routine calculations may consist of simple trajectories from a single source to complex emissions from several sources. Dry deposition is treated with a deposition velocity. Wet deposition is divided into two processes: a scavenging ratio for pollutants located within a cloud layer and a scavenging coefficient for pollutant removal in rain below a cloud layer. Radiological decay is also included when necessary.

8. Plans for 2013:

- The schedule of routine monthly tests for all of 2013 has been set up in collaboration with RSMCs Montréal and Melbourne.
- Four exercises in 2013 will be initiated by IAEA with the May exercise being designated "Lead" for RSMCs Washington and Montréal.
- Begin development of a web-based model launch capability in NCEP operations.
- Continue to make small modifications to the common web page code as needed based on problems encountered during exercises/events and provide the changes to all RSMCs.
- Implement HYSPLIT repository version 339 (July 2012), which includes the dispersion, trajectory and all HYSPLIT-related programs, Plume Time of Arrival Product, output in GRIB2, option to use NAM output on hybrid levels or NAM fine horizontal resolution "nests", additional few radionuclide species in menu list with option to manually input others, change in default wet deposition constants, change simulation of Iodine from a particle to a 50/50 split of particle/gas. Changes to the HYSPLIT dispersion code and related programs are mostly minor however a new check for precipitation with wet deposition can have an impact for radiological applications.
- For internal NOAA experimental use, implement a prototype radiological advisory product analogous to the Volcanic Ash Advisory. Source term is a default Fukushima source if no source is available. Dose rate is from cloudshine and inhalation. Threshold dose rate is 0.005 mSv/h.

9. **Summary and status of the operational Numerical Weather Prediction (NWP) models**

HYSPLIT dispersion for RSMC response is primarily driven by the NWS/NCEP Global Forecast System (GFS) or the North American Model (NAM). The NAM 12 km Nonhydrostatic Multiscale Meteorological Model on the B grid (NMMB; Janjic and Gall 2012) became NCEP's operational North American Mesoscale model in October 2011, replacing the previous operational model, Weather Research and Forecasting (WRF) NMM (Janjic et al., 2001). Four fixed domain nests (4 km CONUS, 6 km Alaska, 3 km Hawaii and 3 km Puerto Rico) are embedded within the NAM 12 km parent model. Unlike its predecessor, the NMMB model is formulated on the Arakawa B grid using a generalized hybrid vertical coordinate, and it can be applied at global scales. Among all the upgrades in NMMB, the most important change for dispersion predictions is the use of a more recent Land Use Land Cover (LULC) database with more expansive urban areas, based on the Moderate Resolution Imaging Spectroradiometer (MODIS) measurements for the years 2001-2005, which replaced the USGS (U.S. Geological Survey) LULC data based on the Advanced Very High Resolution Radiometer (AVHRR) measurement for the years 1992-1993. Changes in LULC can impact dispersion predictions through a variety of mechanisms, including modulation dry deposition velocities, or by modifying planetary boundary layer (PBL) height and eddy diffusivity coefficients.

In 2012, the primary change to the operational GFS run at T574 (~35 km) horizontal resolution and Global Data Assimilation System (GDAS) was in the analysis system. The major component of the analysis change was the incorporation of a hybrid variational/ensemble assimilation system. In this system, the background error used to project the information in the observations into the analysis is created by a combination of a static background error (as in the prior system) and a new background error produced from a lower resolution (T254) Ensemble Kalman Filter. The inclusion of this change and the other smaller changes produced significant positive impact on forecasts in both the northern and southern hemispheres and in the tropics. In almost all measures, a positive impact was noted; however, during the summer (convective precipitation) season, a small consistent degradation of the rain/no rain line and an increase in the bias was noted. This problem will be addressed through modifications to the convective parameterization in the next global implementation.

In 2013, all NCEP models will be transitioned to the Weather and Climate Operational Supercomputer system (WCOSS). WCOSS is based on the IBM iDataPlex/Intel Sandy Bridge/Linux hardware and software operation system. 10,048 processing cores with 2590 trillion bytes of storage are configured to produce about 208 trillion calculations/sec. WCOSS provides the operational and developmental platform to run HYSPLIT, GFS, NAM as well as the 16 km Short Range Ensemble Forecast, T190 Global Ensemble Forecast, hourly 13 km Rapid Refresh (RAP) and 2.5 km Real-Time Mesoscale Analysis (RTMA) and other customized weather and ocean modeling systems.

References

Janjic, Z. I., Gerrity Jr, J. P., & Nickovic, S. 2001. An alternative approach to nonhydrostatic modeling. *Monthly Weather Review*. 129(5), 1164-1178.

Janjic, Z., Gall, R.L. 2012. Scientific documentation of the NCEP nonhydrostatic multiscale model on the B grid (NMMB). Part 1 Dynamics. http://nldr.library.ucar.edu/repository/collections/TECH-NOTE-000-000-000-857 (full text at http://nldr.library.ucar.edu/repository/assets/technotes/TECH-NOTE-000-000-000-857.pdf)

WMO, 2012: Documentation on RSMC Support for Environmental Emergency Response. *WMO-TD/No.778*. Available online at http://www.wmo.int/pages/prog/www/DPS/WMOTDNO778/documents/WMO_TD778_Washington_April2012.pdf