

RSMC EXETER
USERS' INTERPRETATION GUIDELINES
ATMOSPHERIC TRANSPORT MODEL OUTPUTS April 2011

1. Introduction

The United Kingdom Meteorological Office (UKMO) became a WMO-designated RSMC following the International Workshop on Users' Requirements for the provision of Atmospheric Transport Model Products for Environmental Emergency Response held in Montreal in September 1993. Together with Meteo-France, Exeter has responsibility for Regions I and VI. This article gives a description of the Met Office emergency response operation and the dispersion model products.

2. The United Kingdom Meteorological Office (UKMO).

The Met Office, which became a Ministry of Defence agency in 1990, and started operating as a Ministry of Defence owned trading fund on 1st April 1996, is the UK National Meteorological Service, observing the weather and providing forecast services to a wide range of customers. The main operations room is the Operations Centre (Ops Centre) in Exeter, Devon, which is continuously staffed and operational. The Ops Centre has responsibility for the RSMC operation, which since 1999 has, with a wide range of other emergency response duties, been carried out by an emergency cell, EMARC (see below).

The weather forecasting service is underpinned by the UK numerical weather prediction model, the Unified Model. This has global and mesoscale versions carrying out forecasts to 6 days and 48 hours respectively. The Unified Model is also used as a source of winds and meteorology for the UK dispersion model, the 'NAME' model.

Research and development in numerical weather prediction and atmospheric processes (including atmospheric dispersion) is carried out at the main office in Exeter. Research is currently organised under three divisions, Numerical Weather Prediction, Climate Research and Atmospheric Processes Research. Research into atmospheric dispersion is done by the Atmospheric Dispersion Group.

The methods used to predict the movement of airborne pollutants have become increasingly rigorous, the Chernobyl disaster of 1986 giving long range transport and dispersion studies a new impetus. In January 1988, the UK Government unveiled its National Response Plan which included RIMNET (the Radioactive Incident Monitoring Network, many of whose sensors are positioned at regional met. observing sites) and the development by the UKMO of an advanced plume dispersion model, the **Numerical Atmospheric-dispersion Modelling Environment (NAME-III)**.

3. The Met Office Emergency Response Model 'NAME'

The Met Office's Numerical Atmospheric-dispersion Modelling Environment, NAME, 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 radionuclides, 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.

4. The Emergency Monitoring and Response Centre, EMARC

During 1999, the UKMO established a fully operational, 24 hours per day, 7 days per week, specialised national environmental emergency monitoring and response centre within the Ops Centre. It is staffed by forecasters with specialised training and handles all UK MO operational atmospheric dispersion products, including national nuclear and chemical incidents, airborne animal diseases, smoke from large oil fires, and all international ERA, such as RSMC for nuclear emergency and London VAAC, for volcanic ash. The EMARC bench also provides support to the Maritime and Coastguard Agency (MCA) for support in marine pollution incidents.

5. Description of the NAME output charts for the default scenario.

An example of NAME RSMC output is given in figures 1 to 5. The default release scenario is used for a notional release at UK MO headquarters in Exeter.

The numbered comments are:

1. Identification of output---Dosage between the surface and 500m.
2. Valid Time.
3. The maximum computed Dosage. The position is not given but can be identified from the contour pattern.
4. Legend showing the number and value of the contours. The unit is Bqsm-3, i.e. Bq seconds per cubic metre.
5. Simulation Description
 - a. Start time of the release
 - b. End time of the release, 6 hr after the start for the default scenario.
 - c. Release rate of 1 Bq over the 6 hr, i.e. $4.6305558E-5$ Bqhs-1.
 - d. Source location in degrees latitude and longitude, expressed to 4 decimal places
 - e. The release height, 250m above ground level, i.e. the half way point between surface to 500m above ground level as prescribed by the default scenario
 - f. Identification of the isotope simulated.
 - g. The source of the winds and meteorology used in the integration: in this case the global version of the Unified Model
 - h. The time and date of the model run
6. The originating centre, the UK Met Office.

Figures 2 and 3 are similar charts for two succeeding 24 hr periods. In figures 4, 5 and 6 the charts show total (wet and dry) deposition to the surface over periods T+24, T+48 and T+72 respectively. The details are analogous to those for the Dosage fields, the units in Bqm-2.

Figure 7 shows corresponding 3-dimensional trajectories at 500, 1500 and 3000m above ground released at 12UTC on 13/07/2010 and continued for 3 days. The paths are labelled at 12 and 00UTC each day. Also shown in a panel below the chart is the vertical projection of the trajectories in metres above ground level plotted against date and time.

6. Other services provided by the UKMO Operations Centre.

The Ops Centre acts as a control and co-ordination centre for all UK meteorological forecasts, both local and overseas, and both military and civil. It offers a wide range of forecasts, from very short range up to the medium range for military, public, media and commercial customers, including international and national aviation, local and global shipping.

The Operations Centre also hosts one of only two World Area Forecast Centres (WAFC) on behalf of ICAO.

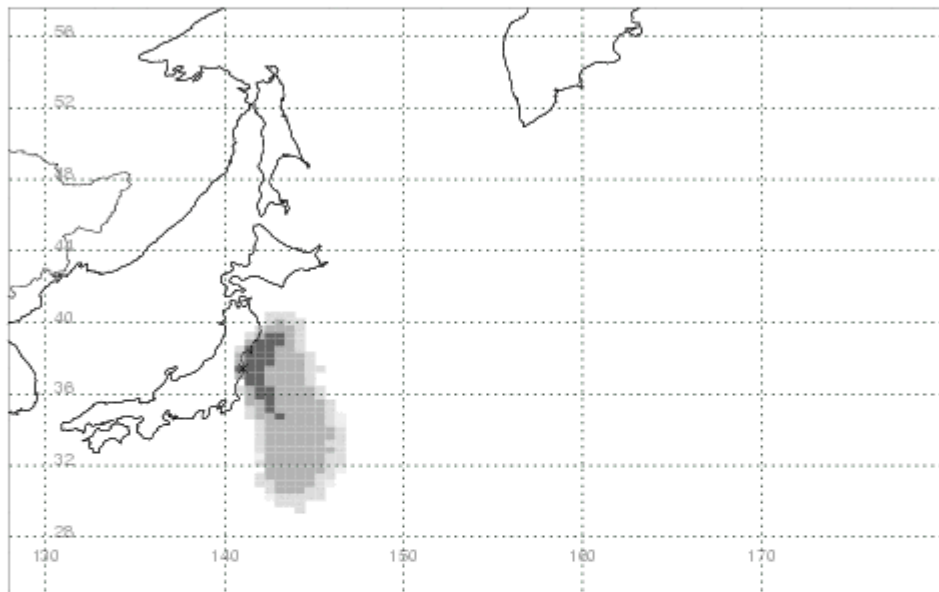
North Atlantic marine forecasts are also issued to support the Global Maritime Distress and Safety System (GMDSS) and Safety of Life at Sea (SOLAS).

1 024 hr time integrated Air Concentration

From 0 - 500m agl



2 Valid at 0000UTC 13/04/2011



3 Maximum value = 2.21×10^{-9} Bqs/m³



Simulation Description

5 Start of release: 0200UTC 12/04/2011 Pollutant: IODINE-131
End of release: 0200UTC 13/04/2011 Met data: NWP Flow: Global_PT1_flow; NWP Flow. C
Release rate: 1.1583334×10^{-5} Bq/s Run time: 0215UTC 12/04/2011
Release location: 141.0329E 37.4206N
Release height: 20.000 to 500.000m agl

6 Met Office Crown copyright

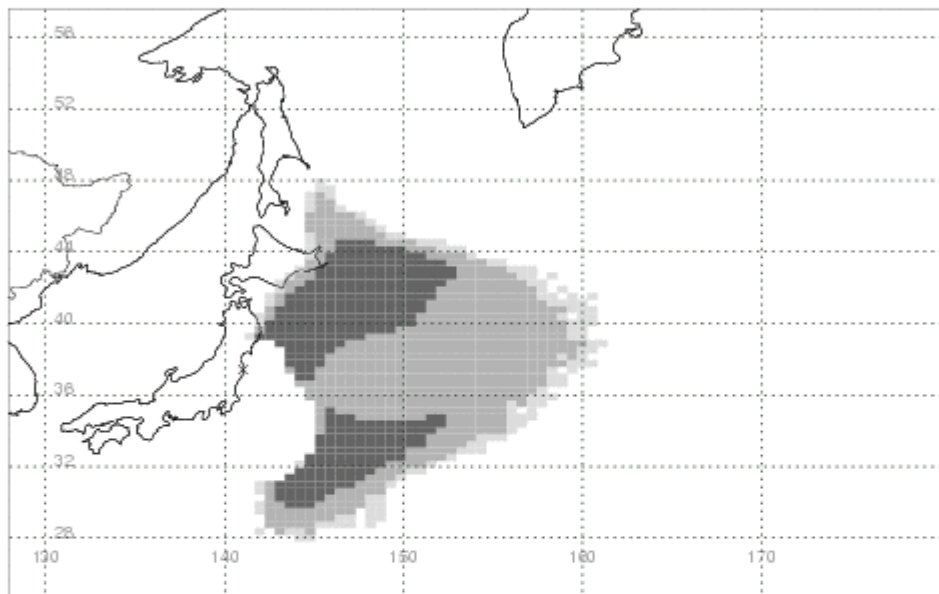
Figure 1

Figure 2

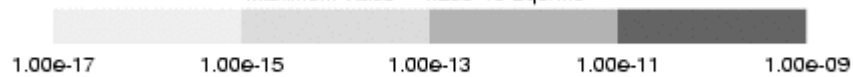
024 hr time integrated Air Concentration

From 0 - 500m agl

Valid at 0000UTC 14/04/2011



Maximum value = 4.25×10^{-10} Bqs/m³



Simulation Description

Start of release: 0200UTC 12/04/2011

End of release: 0200UTC 13/04/2011

Release rate: $1.1583334 \times 10^{-05}$ Bq/s

Release location: 141.0329E 37.4206N

Release height: 20.000 to 500.000m agl

Pollutant: IODINE-131

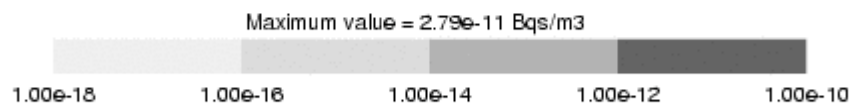
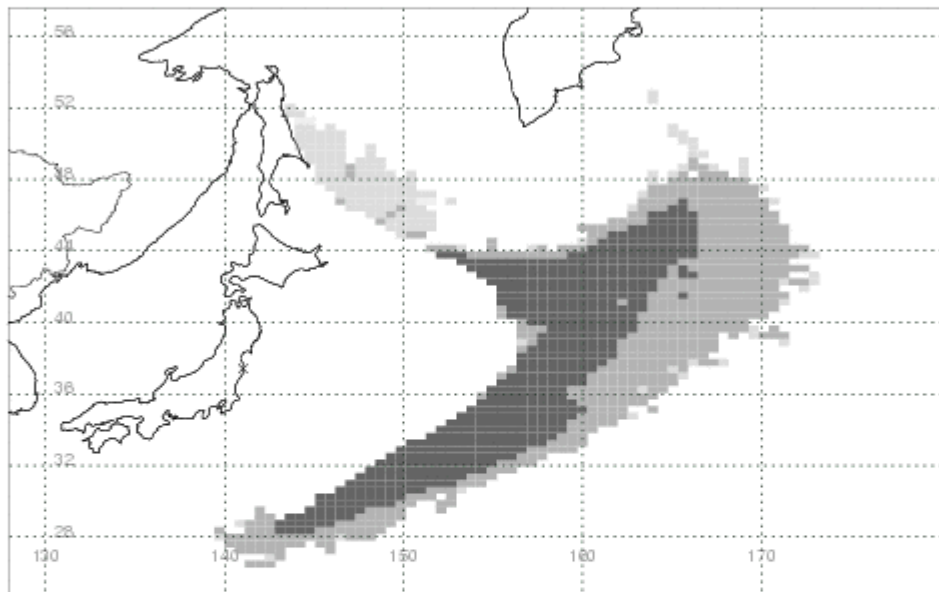
Met data: NWP Flow. Global_PT1_flow; NWP Flow. C

Run time: 0215UTC 12/04/2011

024 hr time integrated Air Concentration

From 0 - 500m agl

Valid at 0000UTC 15/04/2011



Simulation Description

Start of release: 0200UTC 12/04/2011

End of release: 0200UTC 13/04/2011

Release rate: 1.1583334×10^{-5} Bq/s

Release location: 141.0329E 37.4206N

Release height: 20.000 to 500.000m agl

Pollutant: IODINE-131

Met data: NWP Flow: Global_PT1_flow; NWP Flow. (

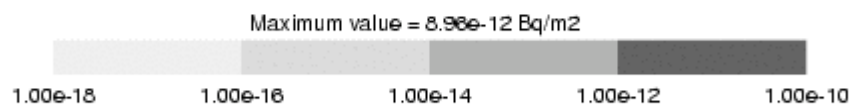
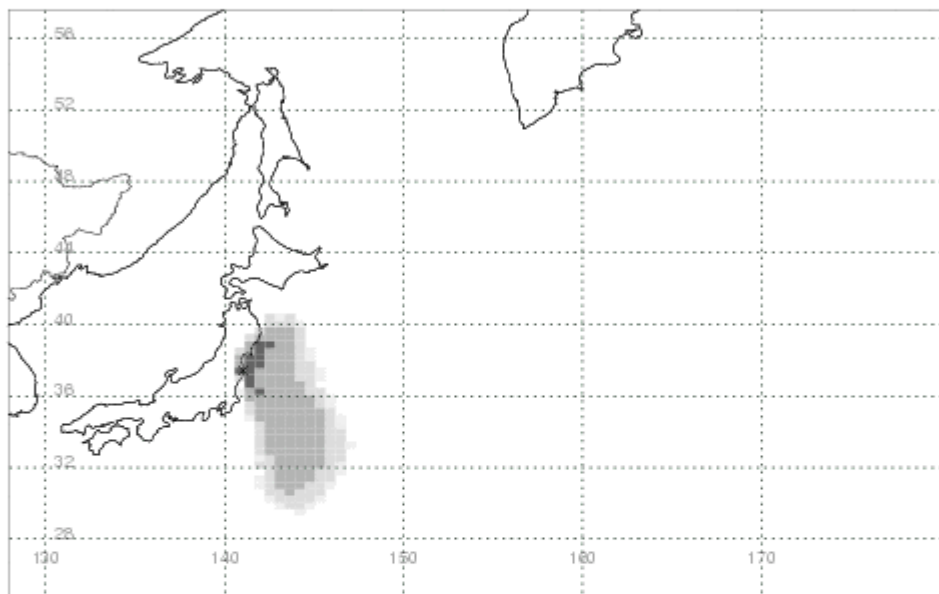
Run time: 0215UTC 12/04/2011

Met Office Crown copyright

Figure 3

Figure 4

Total deposition
Boundary layer
Valid at 0000UTC 13/04/2011



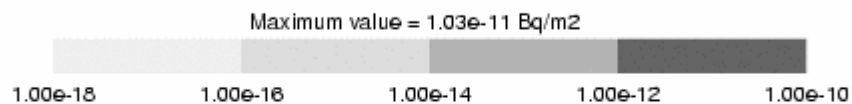
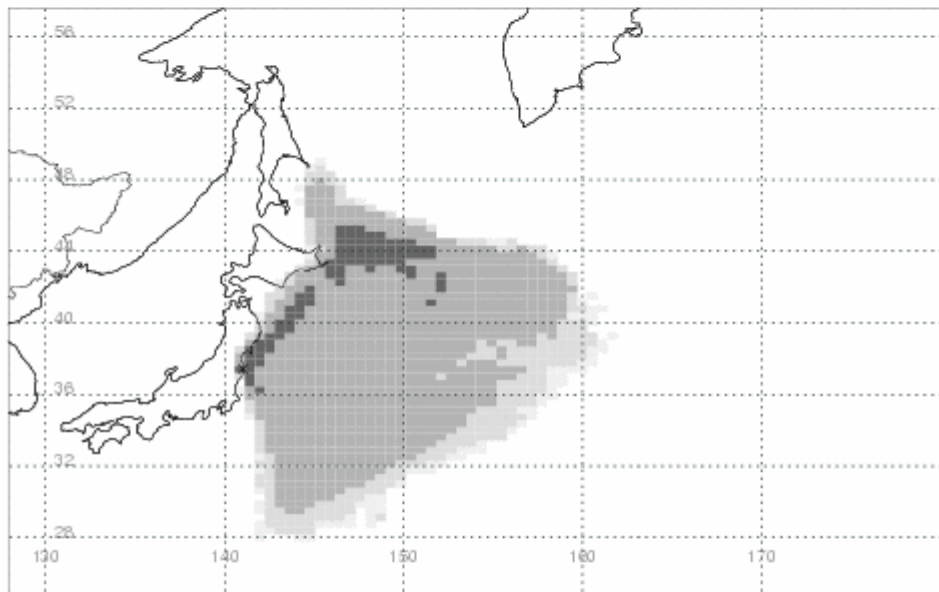
Simulation Description

Start of release: 0200UTC 12/04/2011
End of release: 0200UTC 13/04/2011
Release rate: $1.1583334\text{E-}05$ Bq/s
Release location: 141.0329E 37.4206N
Release height: 20.000 to 500.000m agl

Pollutant: IODINE-131
Met data: NWP Flow.Global_PT1_flow; NWP Flow.C
Run time: 0215UTC 12/04/2011

Figure 5

Total deposition
Boundary layer
Valid at 0000UTC 14/04/2011



Simulation Description

Start of release: 0200UTC 12/04/2011

End of release: 0200UTC 13/04/2011

Release rate: $1.1583334E-05$ Bq/s

Release location: 141.0329E 37.4206N

Release height: 20.000 to 500.000m agl

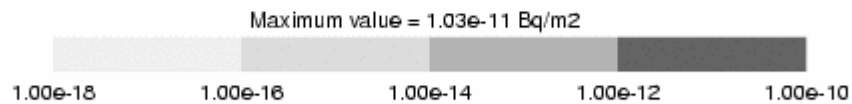
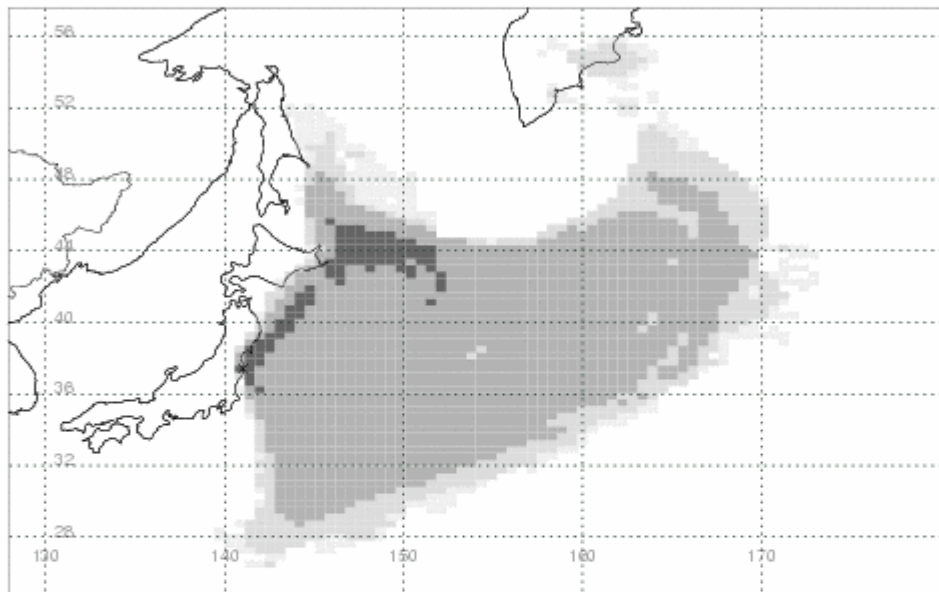
Pollutant: IODINE-131

Met data: NWP Flow.Global_PT1_flow; NWP Flow.C

Run time: 0215UTC 12/04/2011

Figure 6

Total deposition
Boundary layer
Valid at 0000UTC 15/04/2011



Simulation Description

Start of release: 0200UTC 12/04/2011

End of release: 0200UTC 13/04/2011

Release rate: $1.1583334\text{E-}05$ Bq/s

Release location: 141.0329E 37.4206N

Release height: 20.000 to 500.000m agl

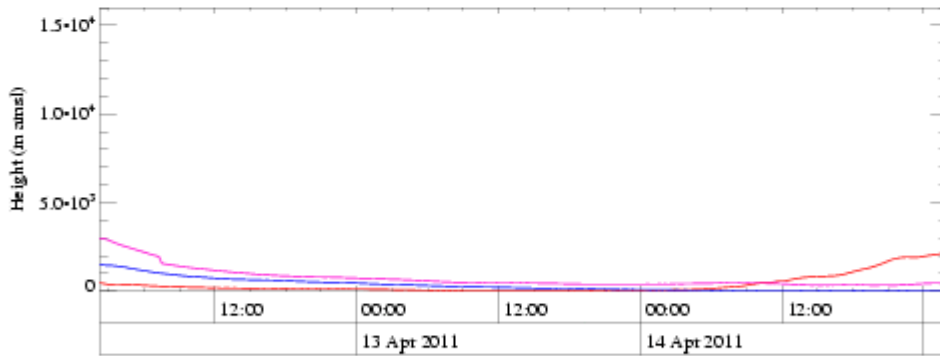
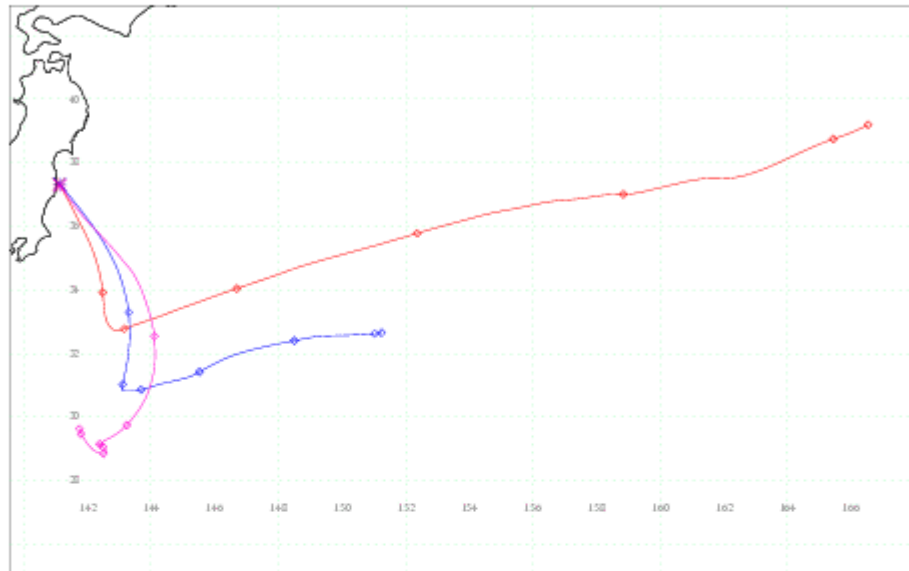
Pollutant: IODINE-131

Met data: NWP Flow.Global_PT1_flow; NWP Flow.C

Run time: 0215UTC 12/04/2011

Figure 7

NAME
Forward trajectories



Simulation Description

Number of trajectories: 3
 Release location: 141.132 37.2782
 Release time: 12/04/2011 02:15
 Name version: NAME III (version 5.4)
 Run name: FUKUSHIMA 12042011 0214