RSMC BEIJING
USER'S INTERPRETATION GUIDELINES
ATMOSPHERIC TRANSPORT MODEL OUTPUTS

（Version 5.0）

(March 2016)

1. Introduction

Since the 1st November 1996, the National Meteorological Centre (NMC) in Beijing has been a Regional Specialized Meteorological Centre (RSMC) for Environmental Emergency Response (EER), with responsibility for the Regional Association II area. As part of its responsibility, RSMC Beijing is required to provide advice, in the form of a basic set of products, on the atmospheric transport of pollutants resulting from nuclear disasters, forest fires, chemical incidents and, perhaps, other causes. This document provides a description of RSMC Beijing's products.

2. NATIONAL METEOROLOGICAL CENTRE (NMC)

National Meteorological Centre, the national centre for weather operations and relevant research, is part of the China Meteorology Administration (CMA). NMC operates 24/7 around the clock. The NMC serves as a centralized operational centre, maintaining a round-the-clock nationwide weather watch and providing guidance products to the Regional Forecasting Centers. In addition to its responsibility as an RSMC for Environmental Emergency Response, the NMC also performs international functions as a Regional Specialized Meteorological Centre (RSMC).

NMC provides a variety of essential numerical weather prediction (NWP) products and services to national and international users. At NMC, the operational numerical weather prediction (NWP) systems include Global medium-range NWP system T639L60/GRAPES_GFS, Meso-scale NWP system GRAPES_MESO, Typhoon track NWP system, Medium-range ensemble prediction system and other environmental meteorological forecasting systems. Now, the NWP system Global/Regional Assimilation and Prediction System (GRAPES) all are put into operational use. Experienced meteorologists, computer specialists, and technical staff perform operational duties around the clock to monitor and control the NWP forecast production and dissemination systems. Other specialists are on call on a 24/7 basis to lend additional support such as in the event of an environmental emergency.

The Environmental Emergency Response (EER) system, in RSMC Beijing, is currently based around the Hybrid Single-Particle Lagrangian Integrated Trajectories (HYSPLIT), Version 4.9, Atmospheric Transport Model (referred to as HYSPLIT4 below) developed by Roland Draxler at NOAA's Air Resources Laboratory. HYSPLIT4 is driven by meteorological input resulting from the operational Numerical Weather Prediction (NWP) systems T639L60 global model in RSMC Beijing. Meteorological output fields either from a 00UTC or 12UTC NWP model run are used to drive the HYSPLIT4 model. Additionally, the meso_scale NWP system GRAPES_MESO model is also used to forcing the HYSPLIT4.9 for meeting the needs of national EER.

3. Emergency Response Model (HYSPLIT)

HYSPLIT4 model is used in RSMC Beijing. The equations used in the calculation of pollutant transport and dispersion are a hybrid between Eulerian and Lagrangian approaches. A single pollutant particle represents the initial source. Advection and diffusion calculations are made in a Lagrangian framework using the meteorological gridded analysis and forecast fields. As the dispersion of the initial particle, it spreads into regions of different wind direction or speed, the single particle, represented by a "puff", is divided into multiple particles. The rate of horizontal dispersion is linearly proportional to time and the rate of vertical dispersion is proportional to the square root of the vertical mixing coefficient. Vertical mixing coefficients are computed from a bulk Richardson number. 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 consideration of complex emissions from several sources.

Dry deposition is treated with the deposition velocity concept. Additional gravitational settling is included for particles. Wet deposition is divided into two processes: a scavenging ratio (concentration in air to concentration in water) for pollutants located within a cloud layer and a scavenging coefficient (removal rate) for pollutant removal in rain below a cloud layer. Radiological decay is also included when necessary.

4. Description of the HYSPLIT output maps for the default scenario

As defined by WMO, an initial response of an RSMC will be to provide a set of forecast products based on a “default scenario” unless details about the emergency are known at the time of the model run. The default products consist of a cover sheet with details on the scenario, a 3-level trajectory forecast, three 24-houly average exposure maps, and three 24-hourly accumulated surface deposition maps. Figures 1-8 present a typical product suite from HYSPLIT4 using the default scenario. For these maps the following items are identical:

(1) The source location is Mochovce, Slovak Republic.

(2) It is located at latitude 48.2605^{o}N and at longitude 18.4579^{o}E.

(3) The start time of release is 1200UTC on 28 October 2015 and the duration is 72 hours.

Figure 1 shows the cover sheet which provides details about the model scenario. Including is the RSMC center providing the results and the time the products were produced.

Figure 2 shows forecast air parcel trajectories starting at 500 (red triangles), 1500 (blue squares), and 3000 meters (green circles) above model ground level on a map. Trajectories are labeled every 6 hours by a filled symbol. The vertical projection of the trajectories with time is shown in the panel below the map.

Figures 3-5 show 24-hour average surface to 500 meter time integrated concentration (exposure) from the start of the release to the nearest even 12 hour synoptic period, which results in a time integration of greater than 12 hours. Figure 3 has been marked with red coded letters in this document only to explain the meaning of each section. Here is a description of what it contains:

1: Identification of the products of RSMC Beijing.

2: Indicates that the air concentration or exposure output units are averaged from the ground to 500 meters above the model ground level and the units are Becquerel-seconds per cubic meter (default units). Unless the source release rate is known at the time of the model run, the default emission rate is one Bq over six hours. Output units can easily be scaled to any multiple of the default emission rate. Ground-level deposition maps are identified on this line with units of Becquerel per square meter.

3: The integration period over which the time-integrated air concentrations are computed. All times are in UTC (Universal Time Coordinate) and are indicated by the start and end of the integration period.

4: The 4-letter ID used to denote the pollutant and the UTC time that the release started. The default scenario would be a release of six hours starting at this time.

5: The latitude and longitude of the release location in degree, and the height of the release in meters above model ground level. Single letter abbreviations are used for East, West, North and South.

6: Colors used for plotting the four concentration contour intervals and their corresponding values. If the range of values on the map is less than eight orders of magnitude then the contour intervals are at factors of 10. If the range is greater, then the contour intervals are at factors of 100.

7: The maximum exposure (or deposition) value is indicated by a solid red square (the size of the grid cell) on the map and its value is indicated on this line along with the minimum concentration value on the map (not plotted).

8: The time at which the forecast model was initialized and an abbreviated name for the meteorological model: CMAG (CMA global) forecast model T639L60.

9: The contents of this section will vary with the product being displayed; concentration, deposition, or trajectories. The following is a list of possible contents.

The nature of emergency is indicated that a real nuclear accident has happened. However, the actual amount of release may be unknown.

The name, latitude and longitude of the location of the release site are repeated on this line.

The meteorological model name: GT639.

Describes the emission scenario used for the concentration (exposure) simulations, including the species type, the rate of release and its duration. The indication of species type is used only in the definition of specific internal model parameters for decay and deposition.

The distribution of the concentration (exposure) output maps is indicated to be a layer average between the surface and 500 meters above the model ground level.

The deposition computations include both wet and dry deposition using a deposition velocity for the dry component of the removal process and in-cloud and below-cloud removal rates for the wet deposition.

Additional notes indicate that the contour intervals may change from map to map as the interval depends upon the concentration range on each map.

The results for this simulation are based upon the default scenario, since no additional information was available at the time of the model run.

Figure 6-8 shows the 24-hourly surface accumulated deposition for three simulation periods of 1200 UTC 28-29 October, 1200 UTC 29-30 October, and 1200UTC 30-31 October. Note that output units are Bq per square meter.

5. Other products available from RSMC Beijing and contact for additional information

Additional products can be produced by RSMC Beijing if the situation requires it. These products go beyond the scope of the document and will not be described here. For additional information contact the RSMC directly.

RSMC Beijing - China Meteorological Administration

EXERCISE! EXERCISE! EXERCISE! EXERCISE

Location: Mochovce,Slovak Republic (48.2605 N 18.4579 E)
Month/Day: 10-28
Time(UTC): 12:00:00
Meteorology: GT639
Trajectories: 500,1500,3000(meters AGL)
Emission: 3.70E+13 Unit I131 over 3 hr
Distribution: Uniform between 0 - 500 m agl
Deposition: Wet and Dry (0.020000 m/s)
Notes: Contours may change from map to map
Results based on default values

****
Product time :Wed Oct 28 23:56:11 UTC 2015
****

Figure 1. Cover sheet with details on the model scenario.

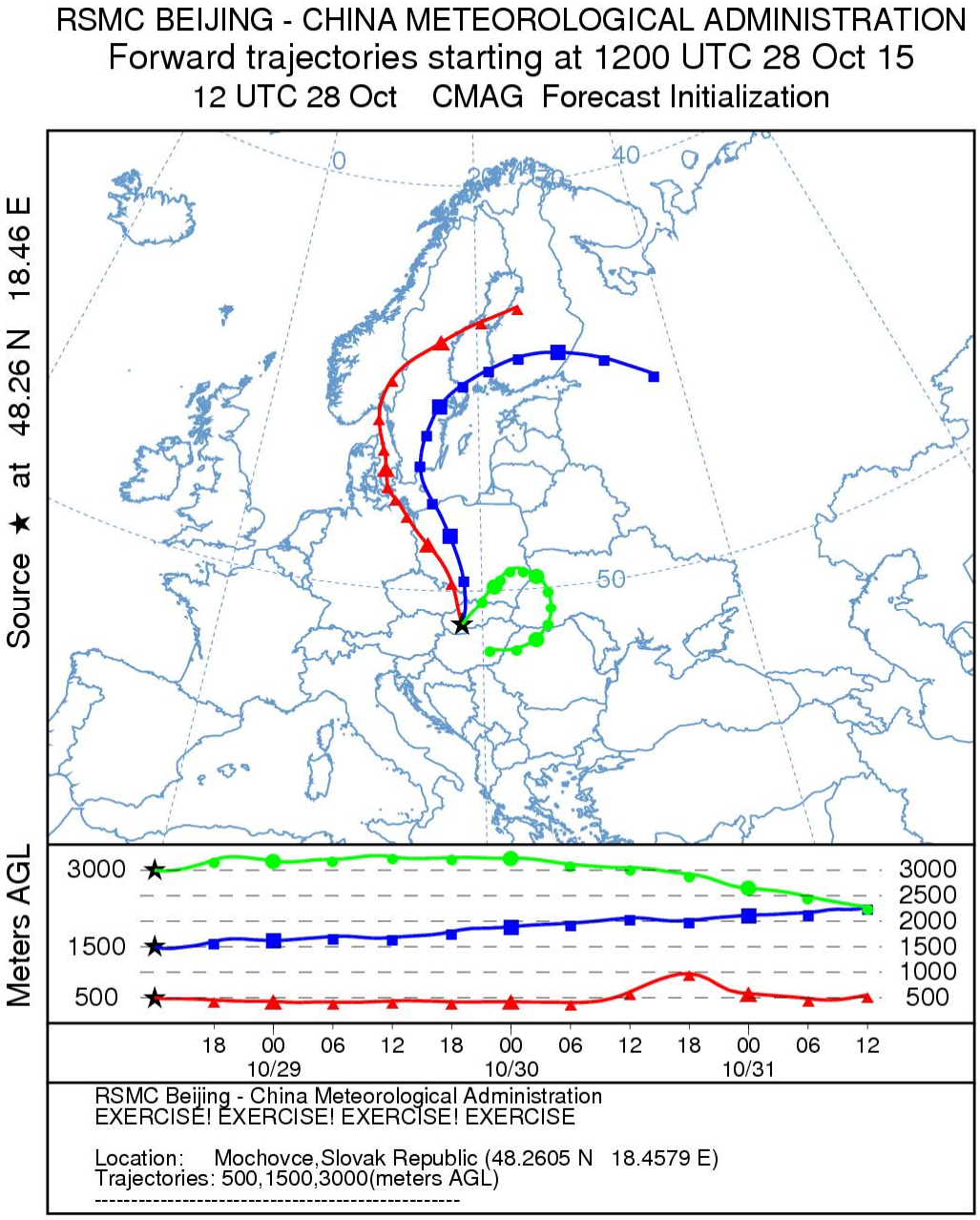

Figure 2. Horizontal and vertical projection of the 500, 1500, and 3000 meter above ground level forecast air parcel trajectories.

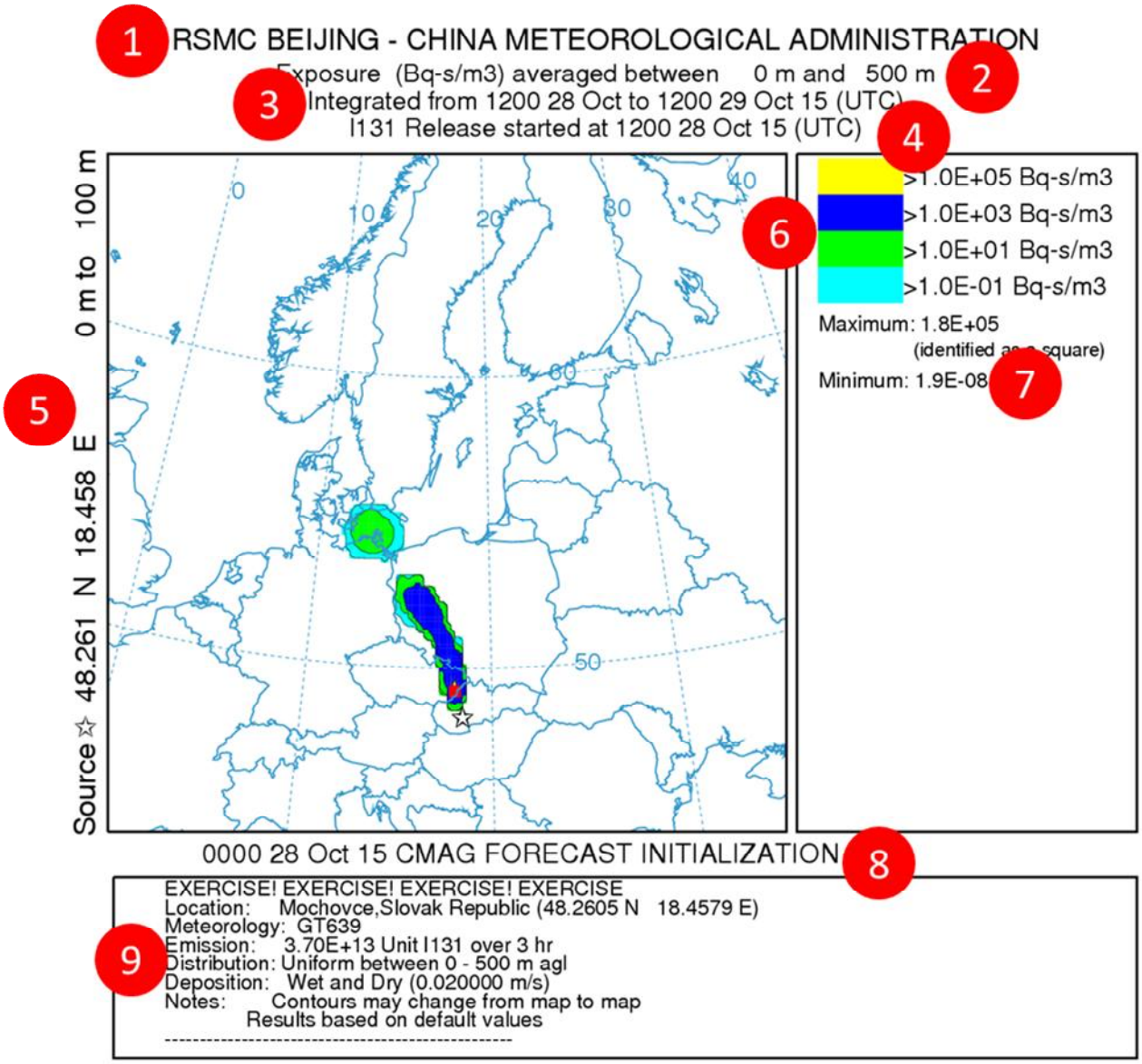

Figure 3. First 24-hour average exposure forecast for NPP at Mochovce, Slovak Republic. The red circled numbers are for reference in this document only and do not appear on the forecast products.

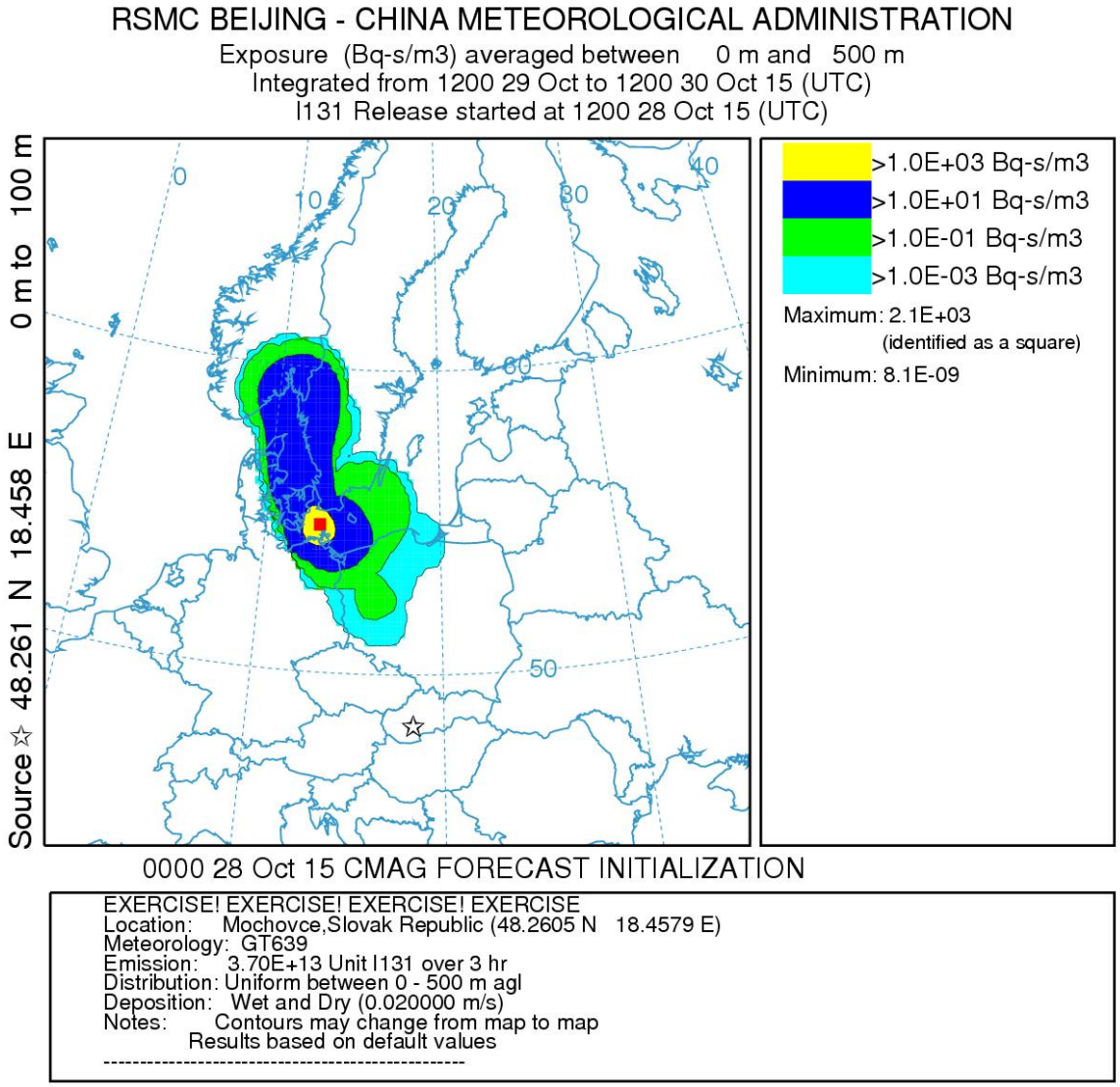

Figure 4. Second 24-hour average exposure forecast for NPP at Mochovce, Slovak Republic.

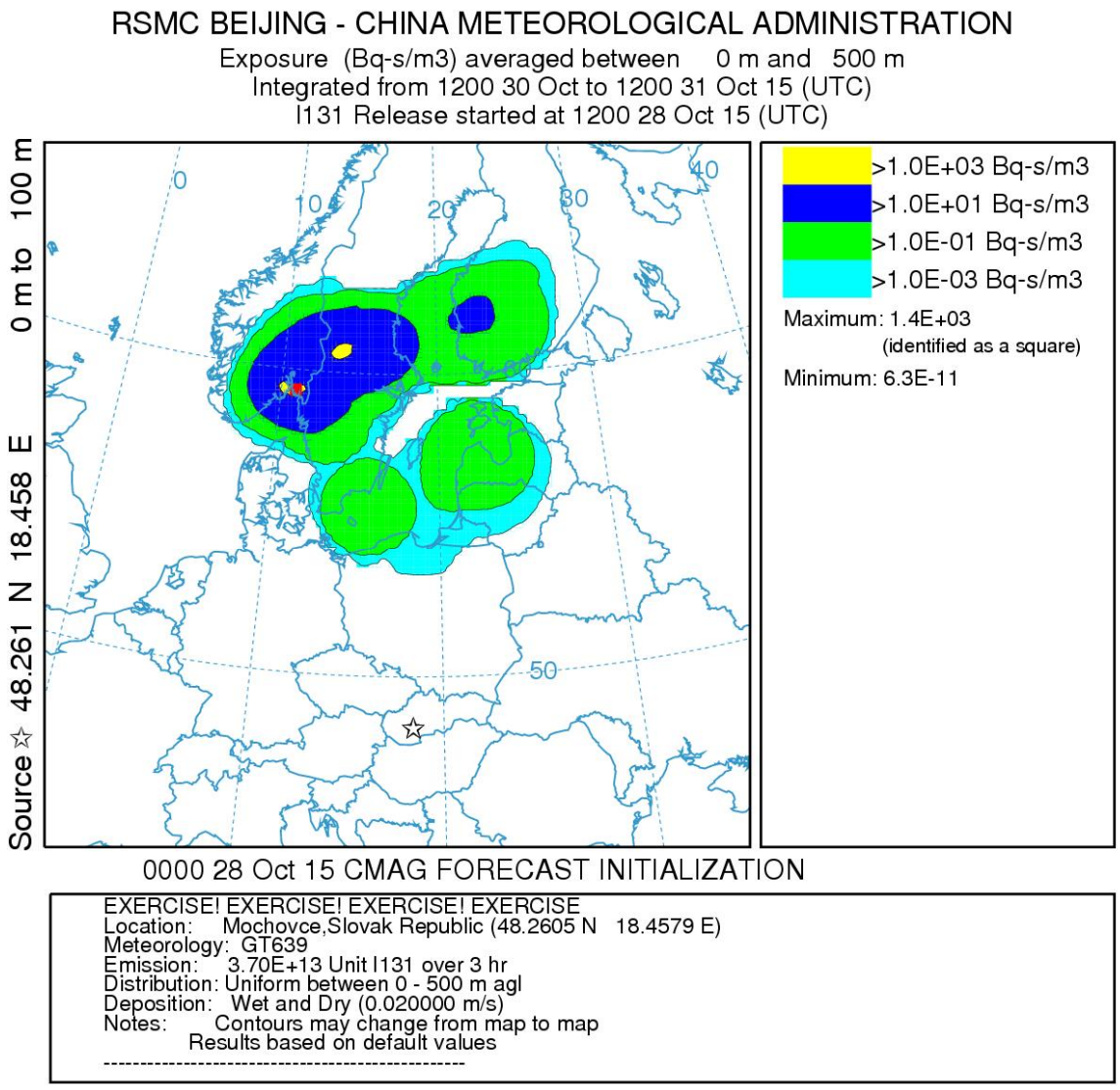

Figure 5. Third 24-hour average exposure forecast for NPP at Mochovce, Slovak Republic.

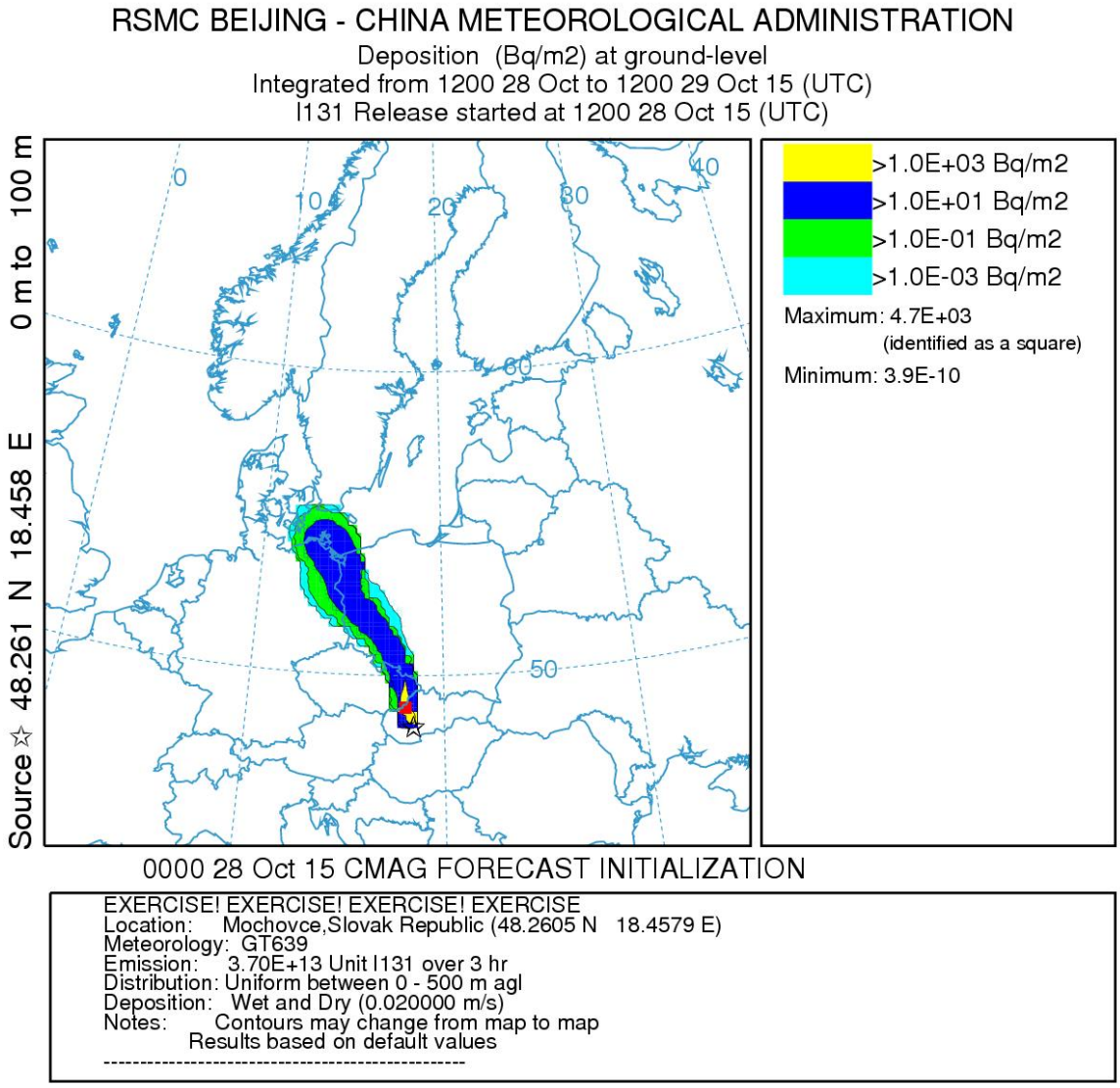

Figure 6. 24 hours surface accumulated deposition forecast for NPP at Mochovce, Slovak Republic.

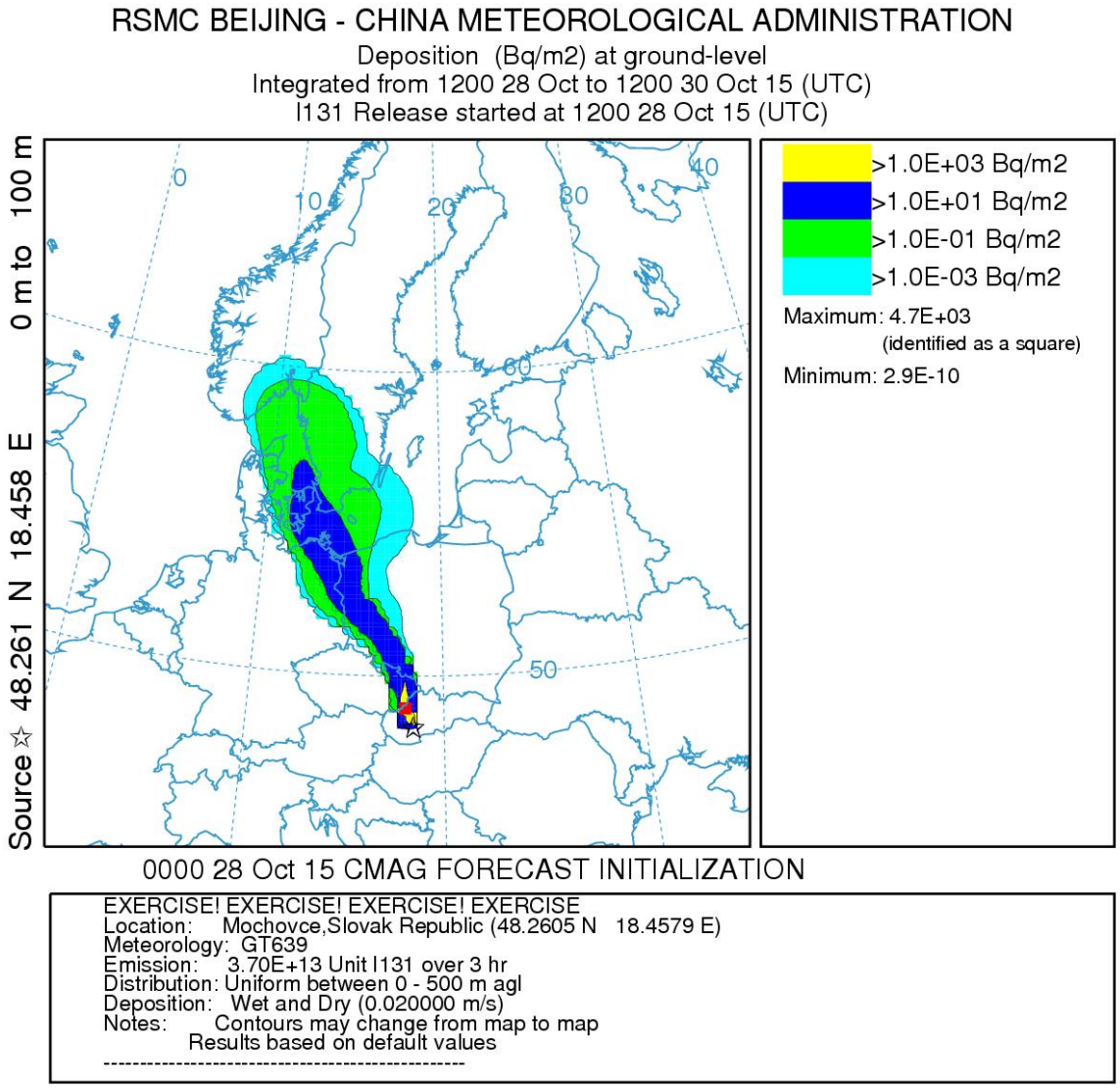

Figure 7. 48 hours surface accumulated deposition forecast for NPP at Mochovce, Slovak Republic.

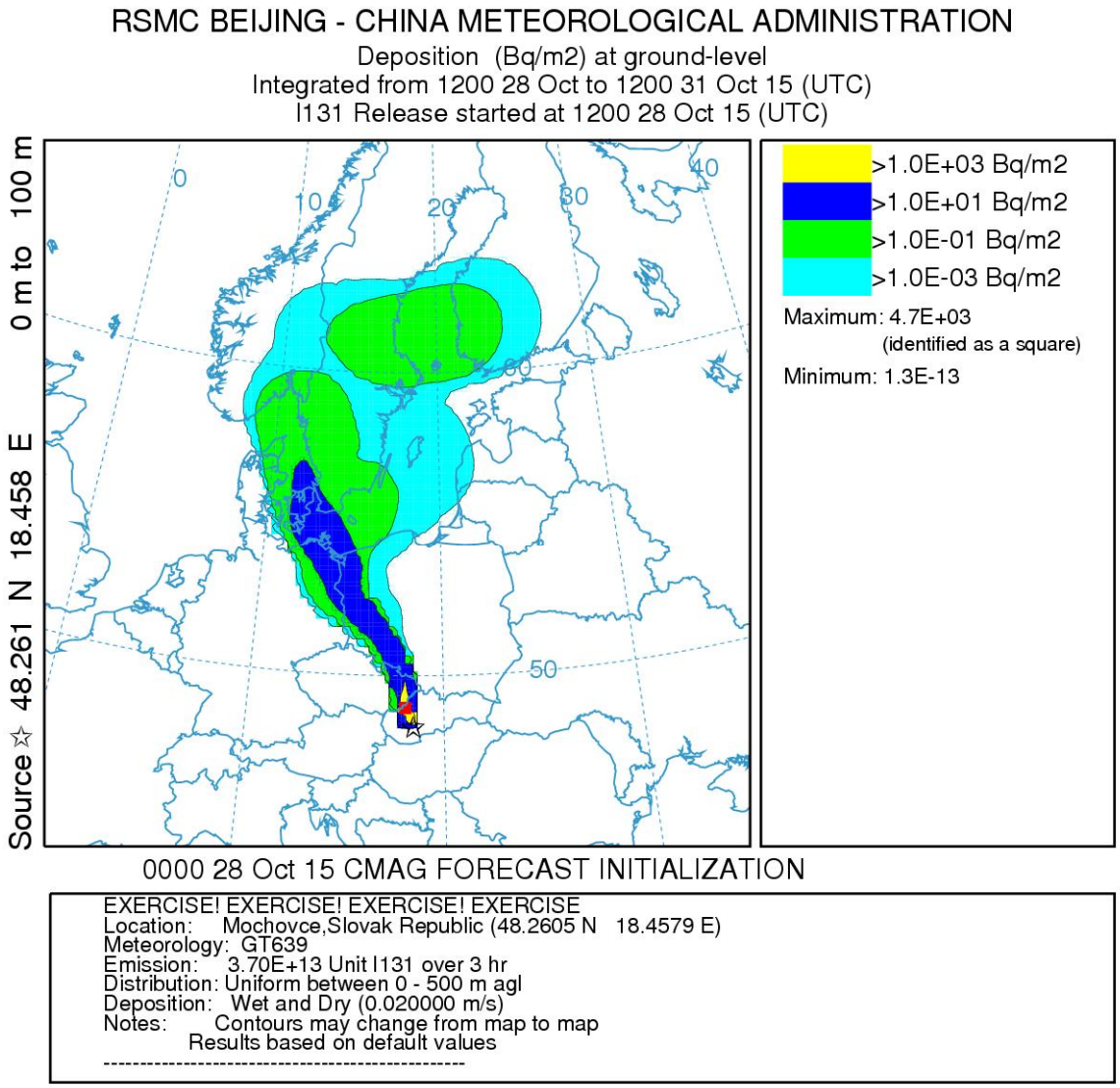

Figure 8. 72 hours surface accumulated deposition forecast for NPP at Mochovce, Slovak Republic.