RTH/RSMC Offenbach (DWD) report of activities for 2011

Executive Summary

This report mainly comprises the responses and experiences of RTH/RSMC Offenbach in relation to the Fukushima Daiichi NPP accident, triggered by the great East-Japan earthquake and tsunami of 11 March 2011. Other activities in 2011 consisted of the RTH Offenbach monthly communication tests with the IAEA and quarterly IAEA/RTH/RSMC tests including CONVEX exercises conducted for different scenarios and accident countries. Additionally, incremental updates and improvements were made to the DWD's dispersion model software, and to the response procedures, which are used for communicating transport model products to the German radiation protection agencies. In the framework of the CTBTO/WMO commitment, numerous backtracking calculations were performed on request for level-5-events, mostly in the context of the Fukushima Daiichi accident.

1. Introduction

The RTH Offenbach is one of the 18 major Regional Telecommunication Hubs within the Main Telecommunication Network (MTN) of the Global Telecommunication System (GTS). RTH Offenbach is the operational counterpart of the Incident and Emergency Centre (IEC) of the IAEA with respect to the distribution of the notification of an accident and additional information. In the framework of the IAEA Convention on Early Notification and Assistance RTH Offenbach has to make sure that the NHMSs are informed as fast as possible of a nuclear accident. Additionally, in the context of the CTBTO/WMO backtracking arrangements Offenbach is one of the WMO-RSMCs for atmospheric dispersion modelling/backtracking.

2. Operational Contact Information

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3. Standing operational procedures

According to the regional and global arrangements for the provision of transport model products in the case of a nuclear environmental emergency, the RTH Offenbach is in charge of the global dissemination of emergency messages*:*

In the framework of the Convention on Early Notification of nuclear accidents, the IAEA informs the WMO Secretariat and the RTH Offenbach (Germany) of the status of the emergency. If needed, the IAEA will request support from the WMO RSMCs. Beginning with a site area emergency, RTH Offenbach will disseminate the EMERCON message on the GTS in the form of an alphanumeric bulletin in plain-text English language under the abbreviated heading WNXX01 IAEA for global distribution to the NMCs and RSMCs. (See also the WMO Manual on the Global Telecommunications System, WMO Publication-No. 386).

When the IAEA no longer requires WMO RSMC support, the IAEA will send an EMERCON termination message to the RSMCs, WMO Secretariat and RTH Offenbach. RTH Offenbach will disseminate the ERMERCON termination message on the GTS in the form of an alphanumeric bulletin in plain-text English language under the abbreviated heading WNXX01 IAEA for global distribution to the NMCs and RSMCs.

Therefore, in case of an accident occurrence and/or whether emergency meteorological support is required. RTH Offenbach will

(a) receive a message from IAEA (as an email and as a fax),

(b) verify its content by a phone call to the IEC of the IAEA,

(c) put the EMERCON message on the GTS in the form of an alphanumeric bulletin in plain-text English language under the abbreviated heading WNXX01 IAEA for global distribution to the NMCs and RSMCs,

(d) check that the Lead-RSMCs have received the same information (email/fax) and

(e) forward the email (fax) with the notification or additional information to the Lead-RSMCs if they did not get it directly from the IAEA.

The communication between IAEA and RTH Offenbach is normally tested every month. According to the current active procedures the tests are performed each third Thursday of a month except from one unannounced test per year. Once every quarter RSMCs and the delivery (but not the distribution) of products are included. The GTS link can be tested at every quarterly exercise. Additionally, GTS messages are distributed in the framework of full scale tests like ConvEx-3 exercises

4. Activities during the release phase and after the Fukushima-Daiichi accident

In response of the accident at the Fukushima-Daiichi nuclear power plant on March 11, RTH Offenbach started to operate according to the standing WMO/IAEA emergency response procedures.

Based on the information received from IAEA the messages and reports were checked and forwarded to the LEAD-RSMCs (Tokyo, Obninsk, Beijing).

Additionally, during the release phase of the accident a total number of 6 EMERCON messages were transferred into the GTS, in each case after consultations with IAEA officers. The first GTS-message was issued at March 14 declaring the general emergency status. In following GTS-message (numbers 2-5) detailed information on the occurrence of actual releases periods were provided. The last GTS Message (preliminary termination of requests for dispersion products) was uploaded on May 24.

Date and time of the GTS-messages:

1. WNXX01 IAEA 141840 (14.03.2011, 18:40 UTC)
2. WNXX01 IAEA 161035 (16.03.2011, 10:35 UTC)
3. WNXX01 IAEA 200945 (20.03.2011, 09:45 UTC)
4. WNXX01 IAEA 261954 (26.03.2011, 19:54 UTC)
5. WNXX01 IAEA 030101 (03.04.2011, 01:01 UTC)
6. WNXX01 IAEA 241600 (24.05.2011, 16:00 UTC)

Beginning with May 10, the fax dissemination of the Fukushima status reports to the Lead-RSMCs was substituted by an email forwarding of these reports, due to the increasing amount of pages of the status reports. Additionally, the corresponding link address at the ENAC-website (since June 29: USIE-website) of the IAEA was sent by email.

On June 14 the emergency status of the RTH staff was lowered to a basic response mode, which still included the dissemination of the reports and messages provided by the IAEA to the Lead-RSMCs.

At the end of June a total amount of more than 800 reports and other messages were received from IAEA associated with the Fukushima accident.

On July 1st the external forwarding of the Fukushima reports was stopped, and since then the IAEA reports and messages were disseminated for domestic purposes only.

5. Evaluation of the accident response activities and lessons learned

RTH Offenbach and the IAEA-IEC were in communication contact since the beginning of the Fukushima-Daiichi emergency response action on March 11. These activities include the important aspect of globally distributing messages via the GTS gateway in Offenbach, which could provide real-time information from IAEA to all of the NMCs.

With respect to the distribution of alarm messages, additional confirmation cross-checks were done by RTH Offenbach. They were useful activities and were important backup features in this emergency response communication context. Fortunately, no major problems or deviations from the agreed WMO emergency response procedures occurred during this crucial period.

Due to the increasing amount of information provided e.g. by the status reports it seems to be obvious to change the distribution procedures from fax to email based dissemination by maintaining the fax mode as backup feature only. As an additional option the corresponding link (URL-address) to the IAEA emergency web-site (USIE) could be forwarded by email.

It can be concluded that the established cooperation between IAEA and RTH Offenbach during the Fukushima-Daiichi nuclear accident can be regarded as very successful.

6. The national role of the DWD and its operational atmospheric transport and dispersion forecasts after the explosions at the nuclear power plant at Fukushima

Besides the official RTH/RSMC functionality for the distribution of emergency response messages according to the existing IAEA/WMO conventions (e.g. EMERCON messages) and the WMO/CTBTO backtracking commitment, DWD is a national contact point regarding the IAEA communication in Germany. Particularly, the DWD is also by federal law responsible for the surveillance of radioactivity in the atmosphere and for providing dispersion forecasts in the case of radioactive events.

In this context the DWD calculated special forecasts (trajectories and dispersion simulations) for the federal radiation protection agency BfS ("Bundesamt fuer Strahlenschutz") in the frame of the German radioactive emergency systems IMIS/RODOS during the release phase of the Fukushima accident (March/April 2011).

In agreement with the BfS and the federal government (BMU, Ministry for Environment), the public was also informed via the DWD's internet web sites by 12 hourly updated visualized dispersion forecasts for Japan and its surroundings utilizing standard default source terms.

The DWD's radioactivity measurement division was in alert mode during the release phase of the accident. The observations of about 48 radioactivity measurement stations were continuously evaluated and the nuclide-specific results transferred to the BfS and to relevant international institutions.

On request of the Ministry of Foreign Affairs the DWD provided also expertise for German people living in or travelling to Japan and nearby states in southeast Asia.

7. Evaluation of the regular exercises

Due to the enormous work load of the emergency response activities in the context of the Fukushima accident, standard communication test between IAEA and RTH Offenbach were not conducted on a regular schedule.

Nevertheless, in this period some standard ("monthly") communication tests and ConvEx-1a/2a/2c exercises (USIE-web site tests) were performed, testing the email, fax and phone contacts between IAEA and RTH Offenbach.

Additionally, in the first and in the last quarter of 2011 a quarterly exercise was conducted to test the communication procedures and contacts between IAEA, RSMCs and RTH Offenbach. In these exercises accident scenarios in different WMO regions were chosen and only the corresponding Lead RSMCs had to respond according to the distributed messages. The GTS link was utilized during these exercises.

The monthly and quarterly communication exercises were performed without any deviations or only minor ones (see list below) from the agreed procedures.

Some deviations are listed here:

- missing email resp. fax messages (required for back-up)

- incorrect subject information: (e.g. “communication test” instead of “quarterly exercise”)
- missing exercise termination messages
- replication of GTS messages

The regular monthly communication exercises are helpful to keep the procedure in mind and to test the handling of the information. But they are very simple and no significant problems are expected to show up except perhaps a disruption of the email system or similar technical problems.

It is therefore not surprising that the major problems or deviations from the agreed procedures only happened during the quarterly tests because they were the only tests with several steps in predefined accident scenarios which also include the distribution of GTS messages.

8. Participation in the WMO/CTBTO inverse dispersion modeling calculations

Beginning with September 2008, which was the official start of the operational phase of the CTBTO/WMO system, until end of 2011, more than 90 backtracking calculations were performed from RSMC Offenbach on request for level-5-events. In the context of the Fukushima releases about 45 backtracking request were received since March 2011.

WMO and the Provisional Technical Secretariat (PTS) of the Comprehensive Test Ban Treaty Organization (CTBTO) cooperate according to adopted arrangements for the provision of inverse dispersion modeling by the WMO designated Centres to CBTO. At present 9 WMO Centres (RSMCs) are active participants in these backtracking calculations. The 9 WMO Centres were asked on request to provide inverse dispersion modeling as far back as 21 days and for up to 36 stations and to upload (to the CTBTO web-site) their results within 24 to 96 hours of receiving the request. RSMC Offenbach was successful in meeting the requirements. CTBTO then combined the results in various ways to generate ensemble products.

9. Status of the DWD’s operational atmospheric transport and dispersion model (employed for WMO/CTBTO)

As a part of the German radioactive emergency systems IMIS/RODOS a Lagrangian Particle Dispersion Model (LPDM) is employed at the DWD. The LPDM calculates trajectories of a multitude of particles emitted from a point source using the grid-scale winds and turbulence parameters of the NWP-model and a time scale based Markov-chain formulation for the dispersion process. Concentrations are determined by counting the number and mass of particles in a freely eligible grid. Dry deposition parameterisation follows a deposition velocity concept and wet deposition is evaluated using isotope-specific scavenging coefficients. Also included is radioactive decay, a vertical mixing scheme for deep convection processes and optionally particle-size depending sedimentation coefficients. The LPDM was successfully validated using data of the ANATEX and ETEX tracer experiments.

The dispersion model is driven by the DWD's weather forecast models (GME, COSMO-EU/COSMO-DE). In case of emergency the model output will be transmitted to the national 'Integrated Measurement and Information System' (IMIS) and the real-time decision system RODOS in Germany. Additionally, the LPDM

is utilized for the EU-activity "ENSEMBLE" (participants: weather services in Europe and North America), which combines the forecast of different emergency dispersion models to a multi-model ensemble.

The model is also a member of the multi-model backtracking ensemble of the CTBTO (Comprehensive Nuclear-Test-Ban Treaty Organization). The code is optimised for MPP computers (e.g. NEC-SX8/SX9, IBM P5 575) utilising MPI-based parallelisation features. The model is also implemented at MeteoSwiss based on the Swiss COSMO-version running on a CRAY-XT4.

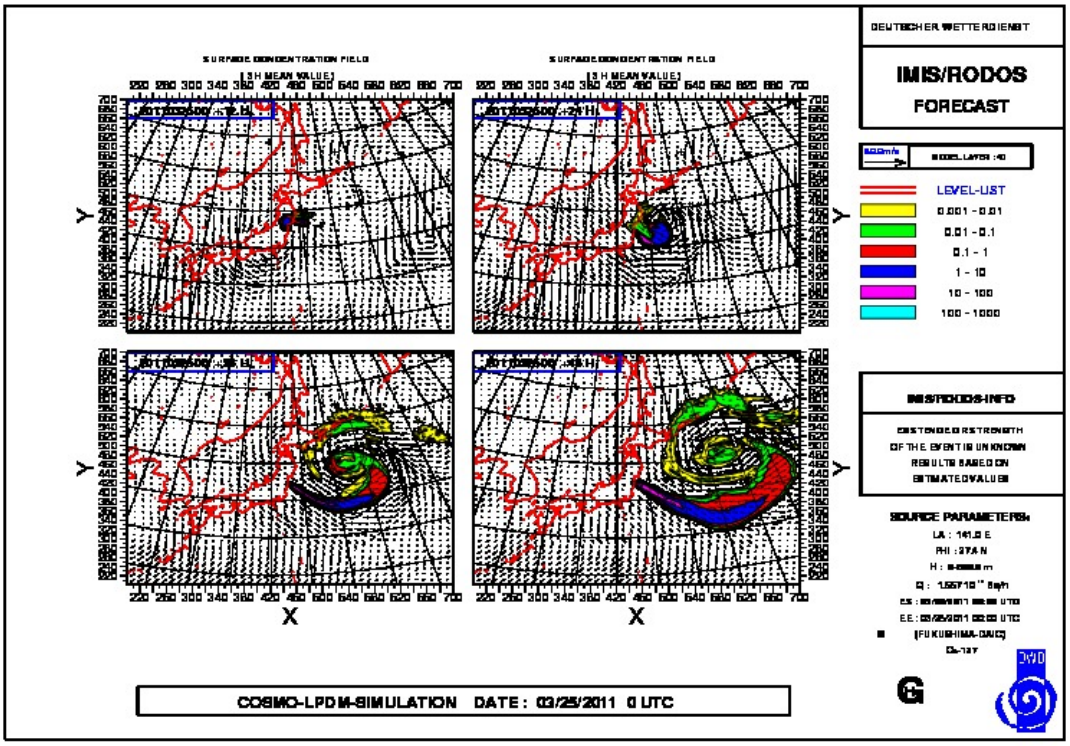
The NWP modelling suite of DWD consists of three models, namely the global icosahedral-hexagonal grid point model **GME** (grid spacing 30 km, i.e. 655362 grid points/layer, 60 layers), the non-hydrostatic regional **COSME-EU** (COSMO model Europe, grid spacing 7 km, 665x657 grid points/layer, 40 layers), and finally the convection permitting **COSMO-DE**, covering Germany and its surroundings with a grid spacing of 2.8 km, 421x461 grid points/layer and 50 layers.

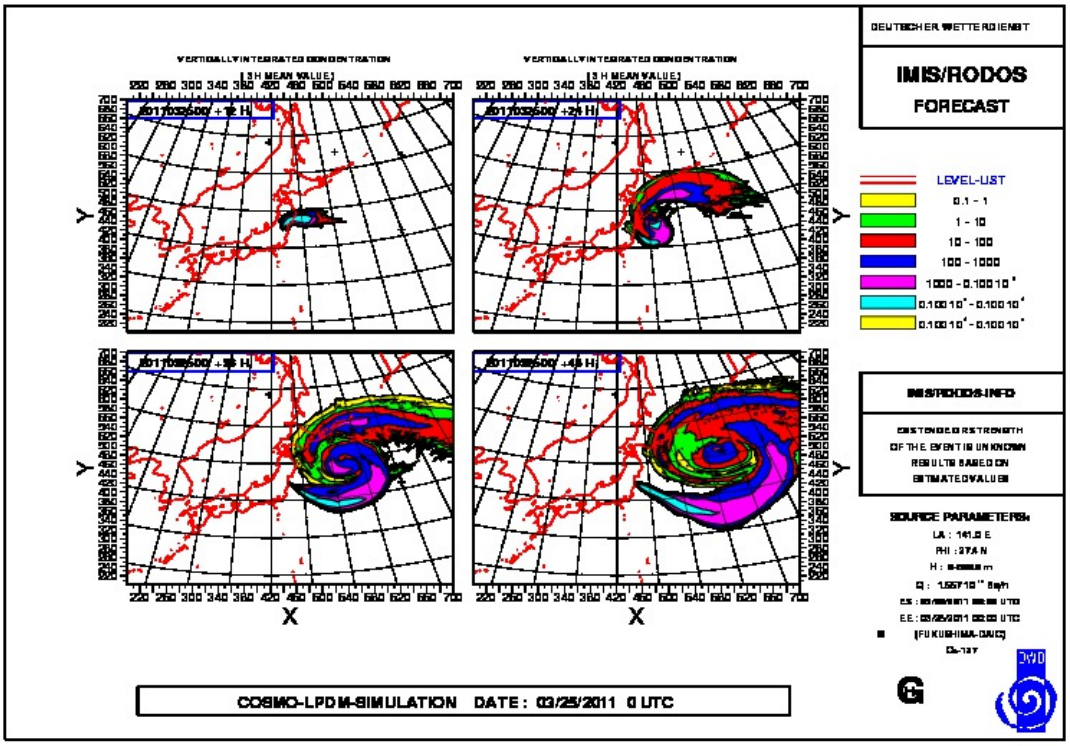
Independent 4 dim. data assimilation suites are performed for all three NWP models, GME, COSMO-EU and COSMO-DE. For GME, analyses are derived for the eight analysis times 00, 03, 06, 09, 12, 15, 18 and 21 UTC based on a three-dimensional variational data assimilation scheme. For COSMO-EU and COSMO-DE, a continuous data assimilation system based on the nudging approach provides analyses at hourly intervals. Analyses and forecasts are currently run on a NEC-SX9.

During the release phase of the Fukushima accident (March/April 2011) the DWD provided dispersion forecasts for the public mainly based on GME data. Additionally, the COSMO model (7 km grid spacing) was set up and run in an operational mode for the relevant region covering Japan and its surroundings.

The figures display examples of simulated COSMO-LPDM nuclide concentrations near the surface (0 – 500 m, Fig. 1) and in the free atmosphere (vertically integrated from the surface to the model top, Fig. 2) for different forecast times based on default source terms and on the COSMO forecast from 25.03.2011 0 UTC.

Fig. 1: Surface concentration (Bq/m^3) 25.03.2011 +12 h, +24 h, +36 h, +48 h.
Fig. 2 Vertically integrated concentration (Bq/m^2) 25.03.2011 +12 h, +24 h, +36 h, +48 h.


SURFACE CONCENTRATION FIELD
SURFACE CONCENTRATION FIELD
(3 H MEAN VALUE)
(3 H MEAN VALUE)
+12 HR
+24 HR
+36 HR
+48 HR
X
Y
DEUTSCHER WETTERDIENST
IMIS/RODOS
FORECAST
LEVEL-UST
0.001 - 0.01
0.01 - 0.1
0.1 - 1
1 - 10
10 - 100
100 - 1000
IMIS/RODOS-INFO
EXTENDED OR STRENGTH
OF THE EVENT IS UNKNOWN
RESULTS BASED ON
ESTIMATED VALUES
SOURCE PARAMETERS:
LA : 141.0 E
PHI : 37.4 N
Q : 1.55*10^17 Bq/h
(FUKUSHIMA-DAIICI)
COSMO-LPDM-SIMULATION DATE : 03/25/2011 0 UTC


VERTICALLY INTEGRATED CONCENTRATION
VERTICALLY INTEGRATED CONCENTRATION
(3 H MEAN VALUE)
(3 H MEAN VALUE)
+12 HR
+24 HR
+36 HR
+48 HR
X
Y
DEUTSCHER WETTERDIENST
IMIS/RODOS
FORECAST
LEVEL-UST
0.1 - 1
1 - 10
10 - 100
100 - 1000
1000 - 0.100 10^3
0.100 10^3 - 0.100 10^4
0.100 10^4 - 0.100 10^5
IMIS/RODOS-INFO
EXTENDED OR STRENGTH
OF THE EVENT IS UNKNOWN
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Q : 1.55*10^17 Bq/h
(FUKUSHIMA-DAIICI)
COSMO-LPDM-SIMULATION DATE : 03/25/2011 0 UTC

References:

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Majewski, D., D. Liermann, P. Prohl, B. Ritter, M. Buchhold, T. Hanisch, G. Paul, W. Wergen and J. Baumgardner, 2002: The operational global icosahedral-hexagonal grid point model GME: Description and high resolution tests. Mon. Wea. Rev., 130, 319338

10. Plans for 2012:

- The schedule of tests (monthly, quarterly and others) has been set up and defined in cooperation with the IAEA.
- Continuation of the participation in WMO/CTBTO backward ensemble calculations.
- For global applications the dispersion model will be based on a new version of the global NWP model with an enhanced horizontal resolution (GME20L60).
- Participation in the WMO-RSMC-ENSEMBLE-Test