ZAMG
Zentralanstalt für Meteorologie und Geodynamik

Accident in the Japanese NPP Fukushima: Spread of Radioactivity / Weather today not favourable/ by comparison with CTBTO radioactivity data, ZAMG estimates high emissions of Iodine and Caesium during the first accident week / Measurements show Hemispheric-scale spread of radioactivity (Update: 1. April 2011 12:00)

Weather in the crisis region

Until Sunday, the crisis region is under the influence of a north-westerly circulation. Disturbances are passing the region. Nevertheless, it stays dry most of the time.

Today, a cold front is passing by, without much rain. The surface wind currently comes from the south, meaning that radioactivity could be transported to inland areas north of the reactor. By 2100 UTC, the wind will shift to westerly direction, transporting material mainly to the Pacific.

On Saturday, a surface low is forming on the lee side of the mountain range. This low pressure system will trigger northerly to north-easterly winds in the Tokyo region, but mainly westerly to northerly winds at the accident location. There may be a few rain showers.

On Saturday, the region comes under the influence of a high-pressure system. Winds come mostly from north-westerly to northerly directions. The weather is cool but dry.

The reference time for this weather forecast is Coordinated Universal Time (UTC); please mind the time difference of plus 9 hours between UTC and the local time in Japan

Dispersion Modeling

According to our dispersion model forecast, a potential radioactive cloud could be transported to inland areas north of the reactor today. Tomorrow and on Sunday, the dominating north-westerly circulation will transport radiation towards the Pacific. An unfavourable influence of unresolved local wind systems can, however, not be excluded for tomorrow, depending on the exact position and strength of the surface low.

The colour scale shows a total of five colours. „Area A“ (violet) is meant to mark an area with maximum dose rate of 0,3 µSv/h, which corresponds to the amount of the natural background radiation dose. “Area B” (blue) marks a region with 3 Micro-Sievert per hour. Finally, one arrives in ”Area E” with a maximum dose rate of 3 Milli-Sievert per hour. This dose rate is currently certainly not exceeded in the regional area (25x25 km^2 box) around the NPP. Irrespective of the assumed emissions, the maximum value of the model is always used to determine “Area E”. In case the situation around the NPP is changing to the worse, the scale would be adapted.

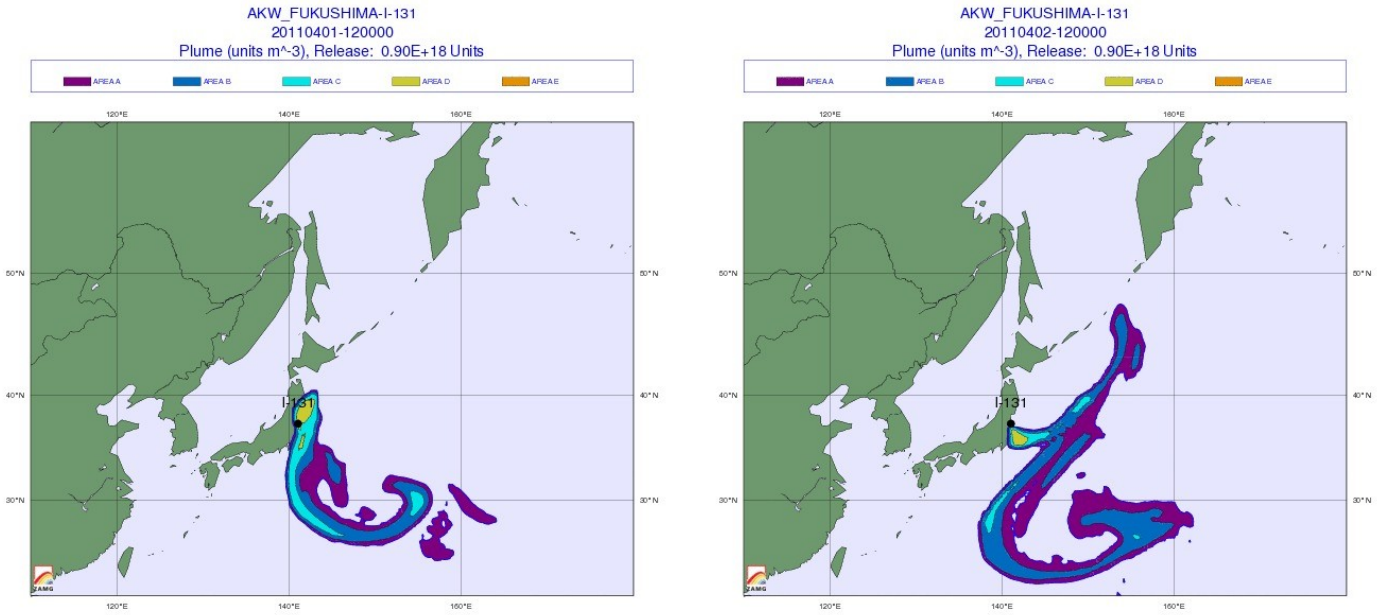

Figure: Spread of Radioactivity over Eastern Asia today and tomorrow 12:00 UTC

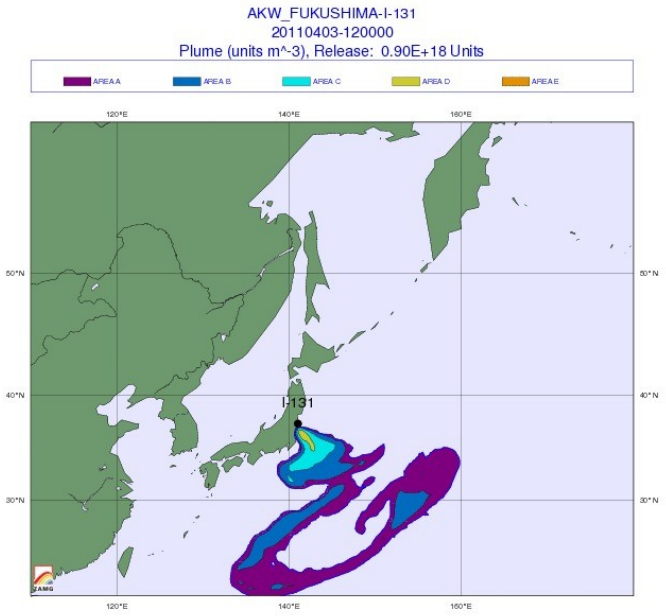

Figure: Spread of Radioactivity over Eastern Asia the day after tomorrow 12:00 UTC

Emission estimates based on CTBTO data

ZAMG published emission estimates of Iodine-131 and Cesium-137 from Fukushima during the first 3 days of the accident (March 12-14). These amounted to 10^{17} Bq per day for Iodine-131 and between 5 10^{15} and 5 10^{16} Bq per day for Cesium-137. Related to Iodine-131, one needs to take into account that CTBTO only measures a part of the total material, namely the Iodine-131 particles. The gas is not sampled within the filter.

The CTBTO measurement network is not dense, and thus it takes, on the average, about 6 days before the first station is reached. During transport, material is deposited and washed out, a process that is subject to significant uncertainties. Only during a few days, material was directly transported from the reactor towards the CTBTO station Takasaki in Japan. During the first week, this happened only once, namely on 15 March. The material sampled there was released late on 14 March (UTC), which was the period with the maximum emissions according to IAEA assessments.

The total uncertainty of the emissions can be estimated as follows:

- Upper emission limit: Estimate of the source strength by modelling that takes into account washout and deposition.
- Lower emission limit: Estimate of the source strength by modelling passive tracer transport

The total uncertainty is estimated as follows:

- If the cloud is directly measured in Takasaki: Factor 10
- If the cloud is measured after 6 days in California/Hawai/Alaska or the Philippines: Factor 1000

The estimate of the emission during the first week can thus be performed as follows:

March 14 Iodine-131 10^{16} to 10^{17} Bq/day

Caesium-137 10^{15} to 10^{16} Bq/day

March 12-13 and 15-19

Iodine-131 10^{14} to 10^{17} Bq/day

Caesium-137 10^{13} to 10^{16} Bq/day

Based on this estimate, the sum of Iodine-131 emitted during the first week in Fukushima is between 10^{16} and 7 10^{17} Bq. The sum of Caesium-137 is between 10^{15} and 7 10^{16} Bq. Since Iodine and Caesium particles are no passive tracers, the lower emission limits are estimated conservatively.

Radioactivity Measurements

The global radionuclide measurements performed in the framework of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) currently show that traces of Iodine and Caesium can be found over most parts of the Northern Hemisphere (status of measurements: 1 April, data are from 29 March). Regarding Europe, the CTBTO stations in Freiburg/Germany and Stockholm/Sweden measured Iodine-131 activity concentrations of 250 and 1700 μBqm^{-3}, respectively. Similar values were reported from there yesterday. The currently measured nuclides were emitted in Fukushima two weeks ago.

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Stabsstelle Daten/Methoden/Modelle

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ZAMG will not answer any questions related to travel in Japan or in other parts of the world, since this is the responsibility of national radiation protection authorities. Travel advisories and warnings are available from your foreign ministry. In Austria, such advisories are available on www.bmeia.gv.at.

This information is updated daily, and whenever the development of the situation requires it.

Videos:

Plume spread from Fukushima/Permanent Release/Iodine-131