T1.3-P6 Comparison of Atmospheric Transport Models (ATM) Used in Decision Support in the Framework of the Austrian Radiological Emergency Response Preparedness

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Zentralanstalt für Meteorologie und Geodynamik

1. Abstract

The ZAMG is designated by the World Meteorological Organization (WMO) as Regional Specialized Meteorological Centre (RSMC) Vienna for backtracking and supports the CTBTO verification system with inverse atmospheric modeling activities on a global scale since its entry into operations. Besides, ZAMG supports the federal authorities with meteorological expertise, provides input data for other dispersion models and performs preliminary assessments of radiological dispersion in cases of a disaster event. In such a case, the Austrian Federal Crisis and Disaster Management (SKKM), which subordinates under the Austrian Ministry of the Interior, possesses the results of several atmospheric dispersion models as a profound basis for decision-making. In a recent study, different scenarios have been set-up and evaluated, using identical meteorological forcing for the atmospheric dispersion models, which are available during a radiological incident to the Federal Crisis and Disaster Management.

2. Description

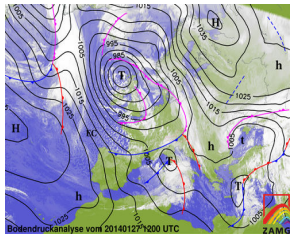
The study uses simulation results provided by the following dispersion models:

- TAMOS — A dispersion model developed by ZAMG, using the Lagrangian particle diffusion model FLEXPART.
- ESTE — (Emergency Source Term Evaluation Code) Lagrangian model developed by ABmerit
- Rodos: (Real-time On-line DecisiOn Support) Institute of Technology Karlsruhe
  - DIPCOT — (DIsPersion over COmplex Terrain) comparable to FLEXPART
  - ATSTEP, RIMPUFF — Gaussian puff models, using homogeneous, stationary flow fields as approximation

The idea behind this study was the comparison of the two different modeling systems, i.e. Gaussian and Lagrangian dispersion models as well as screening the comparability of the Lagrangian models TAMOS, ESTE and DIPCOT. On behalf of this study, 56 scenarios for medium and heavy accidents at the Nuclear Power Plants Dukovany, Krsko and Leibstadt were selected and EZMW meteorological forecast data were provided for 5 weather periods between July 2013 and January 2014.

3. Model Scenario

For presentation purpose the scenario of a medium accident on January the 27th 2014 at Krsko has been chosen. The EZMW forecast data showed a frontal system crossing Austria separating the colder continental air mass in Eastern Europa and a relatively warm air mass in Western Europe.



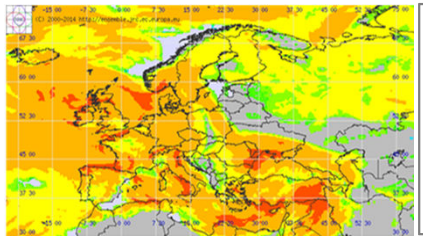


Figure 1:
Weather conditions on 27.1.2014 12 UTC – left: Surface pressure analysis, right: 24-hourly sum of precipitation from EZMW (red: up to 10mm/24h, orange: up to 1mm/24h)

4. Results

Using these data leads to significantly different results provided by the simulation models, with respect to the calculation method. The three Lagrangian dispersion models (i.e. TAMOS, ESTE and Rodos/DIPCOT) show a good internal agreement of the modeled air concentrations near the ground, but also presenting definitely contrary results according to the Gaussian models ATSTEP and RIMPUFF, also implemented in Rodos.

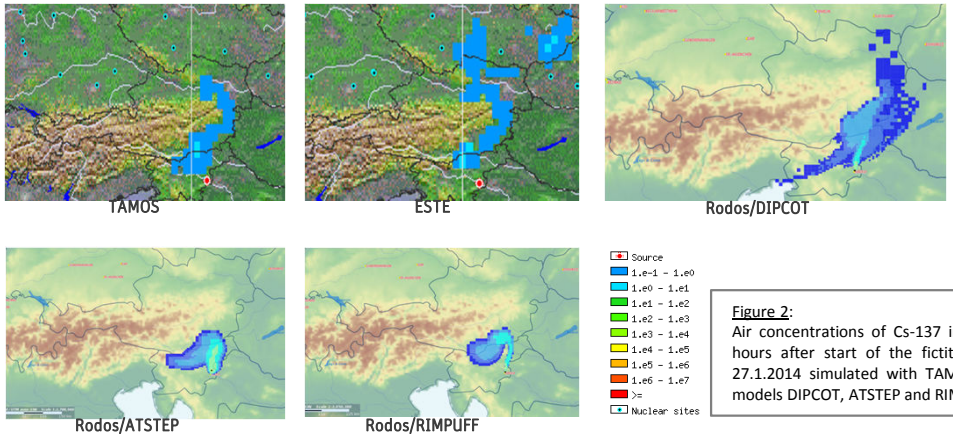


Figure 2:
Air concentrations of Cs-137 integrated for the first 24 hours after start of the fictitious release at Krsko on 27.1.2014 simulated with TAMOS, ESTE and the Rodos models DIPCOT, ATSTEP and RIMPUFF.

Since the calculated deposition of the radioactive plumes strongly differs within these two calculation methods, the same is true for the wet deposition. Both Gaussian models expect the downfall to be strictly localized at the Austrian / Slovenian border, while TAMOS, ESTE and DIPCOT predict a wide spread area from Slovenia along the eastern border of Austria up to the Czech Republic..

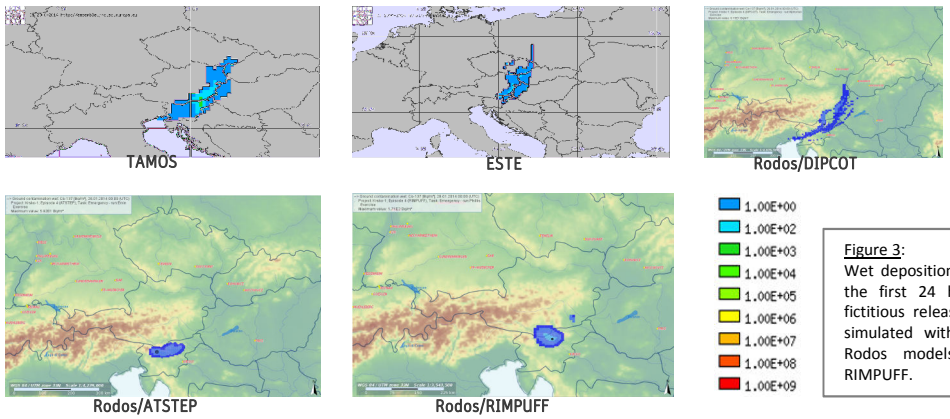


Figure 3:
Wet deposition of Cs-137 integrated for the first 24 hours after start of the fictitious release at Krsko on 27.1.2014 simulated with TAMOS, ESTE and the Rodos models DIPCOT, ATSTEP and RIMPUFF.

With respect to the scenarios considered in this study we may conclude the comparability of the rendered results provided by TAMOS and Rodos/DIPCOT. However, comparisons to real life measurements would be required to judge, which of the parameterizations presented renders more realistic results.

Kontaktinfo: Dr. Kathrin Baumann-Stanzer , Fachabteilung Umwelt, kathrin.baumann-stanzer@zamg.ac.at, Tel. +43 1 360 26 / 2402, www.zamg.ac.at
Mag. Erwin Polreich, Fachabteilung Umwelt, erwin.polreich@zamg.ac.at, Tel. +43 1 360 26 / 2417, www.zamg.ac.at
Mag. Paul Skomorowski, Fachabteilung Umwelt, paul.skomorowski@zamg.ac.at, Tel. +43 1 360 26 / 2419, www.zamg.ac.at
Alexander Hieden, MSc., Fachabteilung Umwelt, alexander.hieden@zamg.ac.at, Tel. +43 1 360 26 / 2408, www.zamg.ac.at