JRODOS:

Implementation in Switzerland

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ENSI

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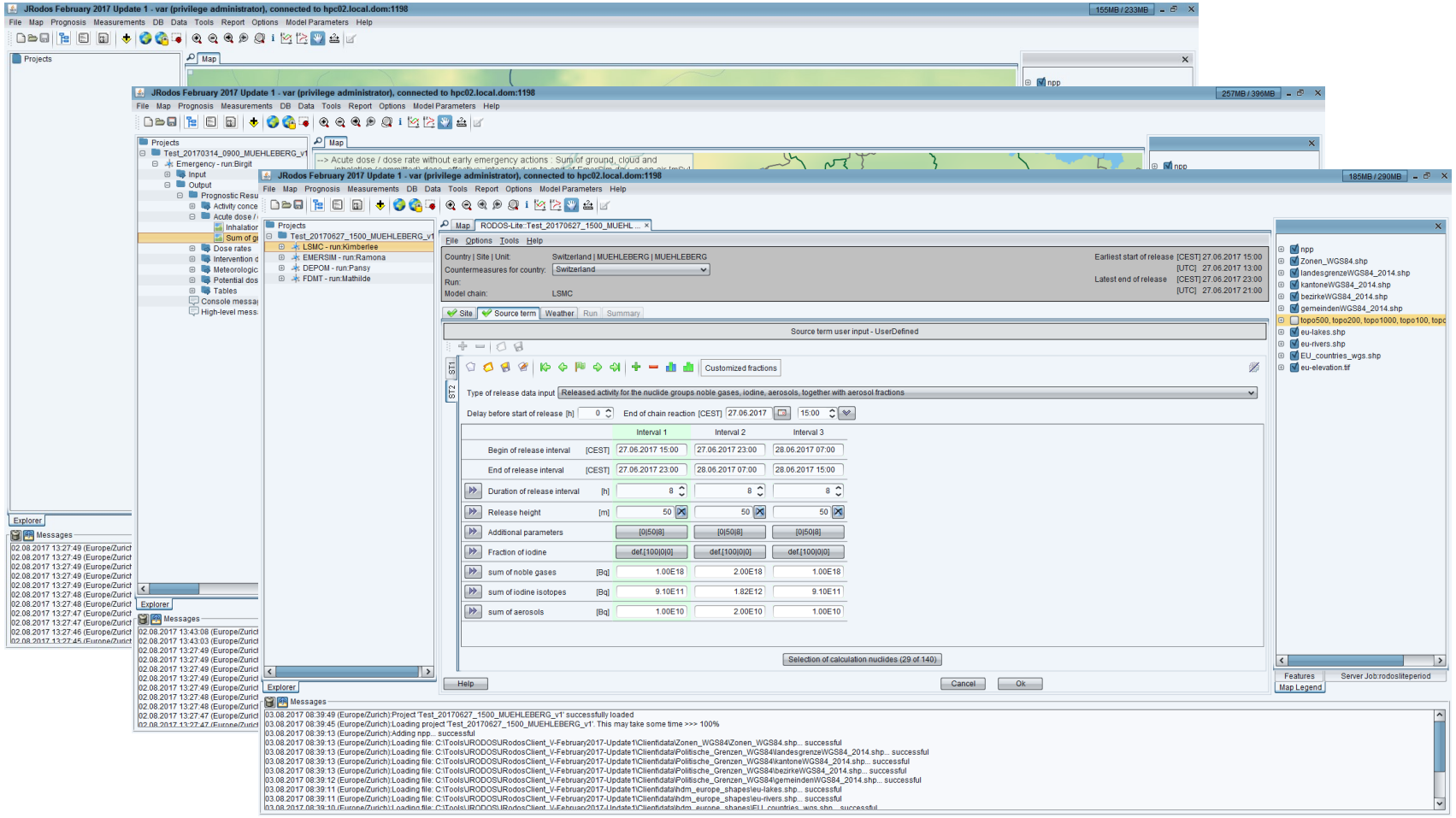
1. Introduction to JRODOS

What is JRODOS?

- Decision support system for nuclear emergencies with Java-based user interface
  → easy to use yet permit a broad range of applications
- Calculation kernel is modular (~ 25 modules): atmospheric dispersion modelling, nuclide deposition, food contamination and dose calculation, effect of emergency protection measures, etc. Combination of modules into ‘model chains’.
- Server-client architecture
- Used in > 15 countries
- Operational system for emergency protection in AT, DE, FI, NL, SK and CH
- Mainly developed by Karlsruhe Institute of Technology (KIT)
- Yearly RODOS User Group (RUG) meeting defines development goals

1. Introduction to JRODOS

Client user interface



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2. Features of the release ‘2017FebruaryUpdate1’

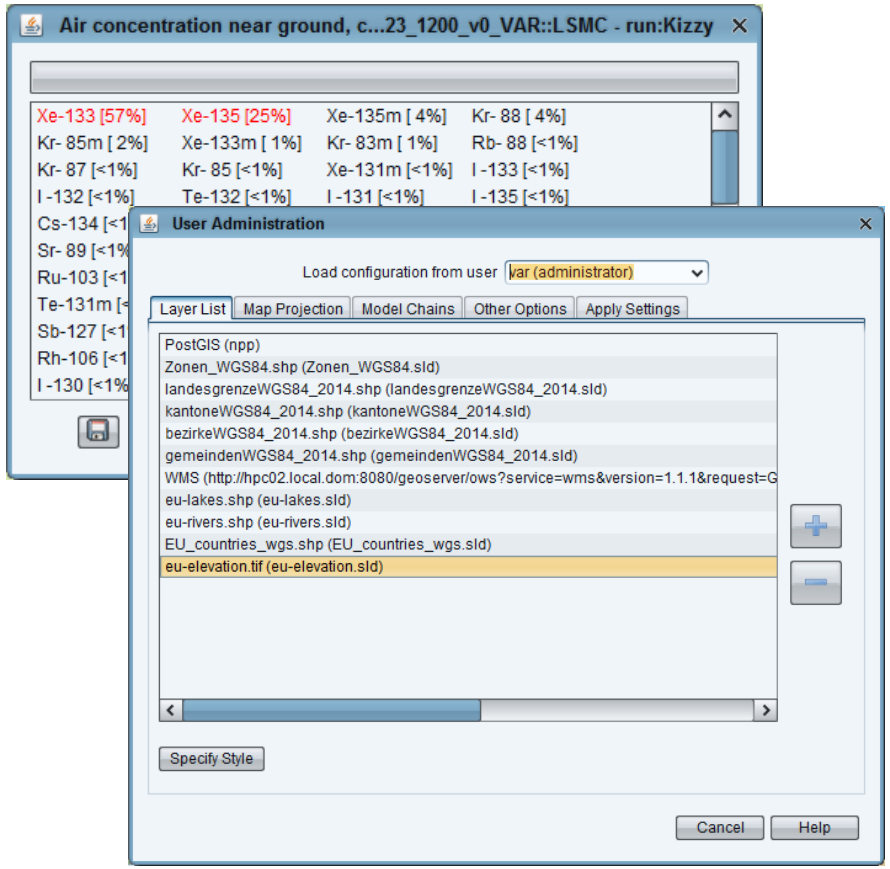
Main new features of Server

- New dose conversion factors: ICRP 109 (Database vol. 3.0) and Petoussi-Henss et.al., Phys Med Biol. 2012; 57: 5679-5713
- Separate treatment of chemical forms of Iodine for dose calculation (previously only aerosol)
- Mother/daughter build-up in air concentration and ground deposition inside ADM
- Eight important mother-daughter pairs forcibly calculated if mother/daughter present in ST
- Improvements to meteo pre-processor (faster GRIB parsing, wind field, rain)
- Early emergency action simulation possible over 48 hours (module ‘EmerSim’)
- Particle size distribution can be modified (ADMs RIMPUFF, DIPCOT, LASAT)
- Up to 25 radio-ecological regions in model FDMT
- Up to 1008 time intervals (7 days * 24 hrs * 6 ten-minute intervals)

2. Features of the release ‘2017FebruaryUpdate1’

Main new features of Client user interface

- Compact result listing for nuclide-specific results
- User groups
- Transfer of user-specific Client start-up settings to other users
- Many small changes/improvements



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3. Implementation in Switzerland

Software

‘2017FebruaryUpdate1’ since 1 June 2017

Configuration of JRODOS includes

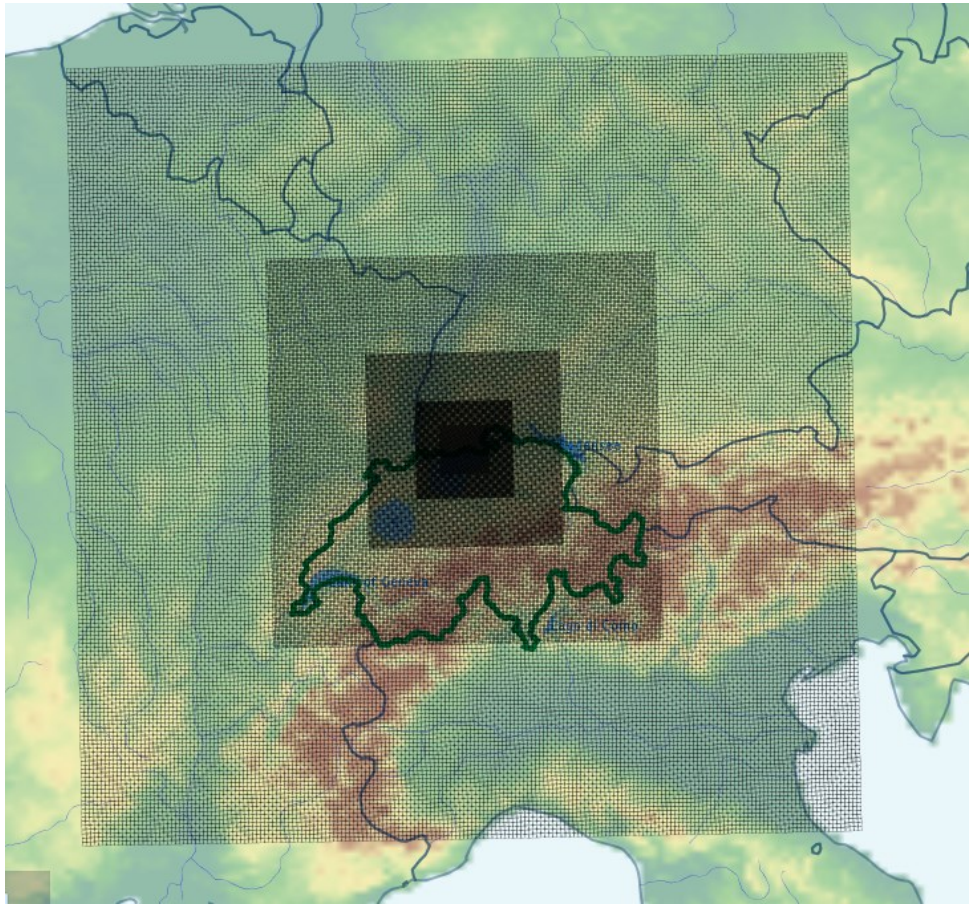
- Swiss coordinates
- country maps of various resolutions
- use of COSMO-1 NWP data from MeteoSwiss (1 km spatial resolution, 10 min time resolution, 24 hrs prediction time)
- LASAT dispersion model
- ENSI grid with 5 rings (~35’000 cells each)

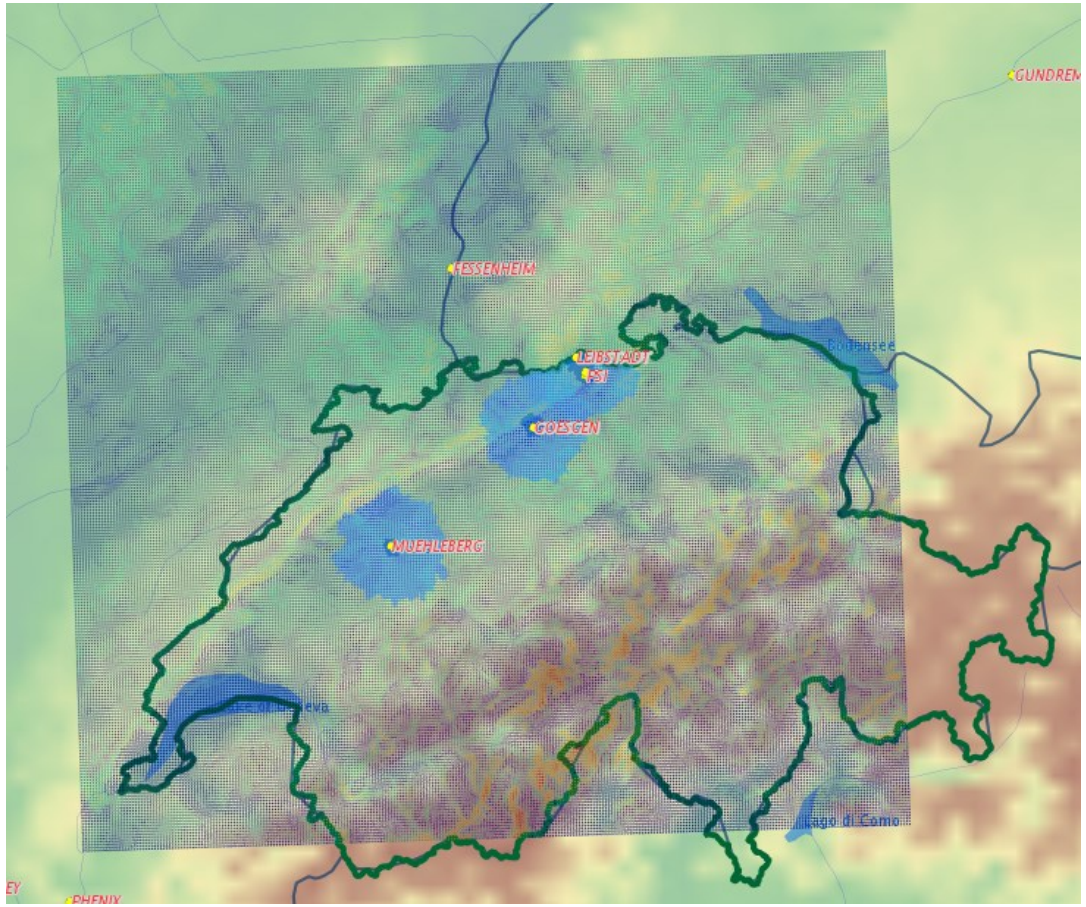
Implementation in ERO:

- Hourly dispersion simulation for all nuclear installation locations with unit source
- Import of XML from ST estimation program ADAM STEP (based on level 2 PSA)
- Export of results to measurement rings’ software MADUK and from there to EP partners

3. Implementation in Switzerland

Calculation domain and NWP data range





3. Implementation in Switzerland

Hardware

System structure:

- 3 server systems
  (2 operational and 1 test systems)
- 4 client systems
  (3 operational and 1 training systems)
- 2 NWP data handling systems
  (incl. virtual SFTP servers and failover provisions)

New hardware per 1 June 2017 :

Lenovo x3850 X6 Server with 4 Intel Xeon E7-8890 v3 sockets with 18 cores @ 2.5 GHz each, 256 GB RAM, ca. 4 TB memory

Multiple LASAT (ADM) calls distributed over available cores $\Rightarrow$ up to 12 parallel simulations without significant overhead

3. Implementation in Switzerland

Performance figures

Benchmark case

- 24 hrs simulation with 10 min time step
- ENSI grid with 1 ring and 250 m horizontal resolution
- ST with two parallel emission of 2 hrs each, 140 nuclides each

⇒ 50 min runtime

«Typical simulation» (i.e. emergency case)

- 8 hrs simulation with 10 min time step
- ENSI grid with 1 ring and 250 m horizontal resolution
- ST with two parallel emissions of 2 hrs, 29 nuclides

⇒ 5 min runtime

Using 29 nuclides only: 15 min runtime

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4. Conclusion and Outlook

Verdict: With the release ‘February 2017 Update 1’ JRODOS has reached a stable and mature state, permitting use in emergency protection context and satisfying high availability requirements.

ENSI envisions further developments:

- Further optimisation of parallelisation of LASAT in JRODOS
- Pre-processing of NWP data for most common calculation grid configurations
- Export functionality of project into file to permit restrictions on exported quantities

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Thank you for your attention!