ABmerit

NUCLEAR SCIENCE AND SOFTWARE

Time of Cloud Arrival Predicted for Emergency Response

Authors:
ABmerit
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Twentieth Annual George Mason University Conference on Atmospheric Transport and Dispersion Modeling

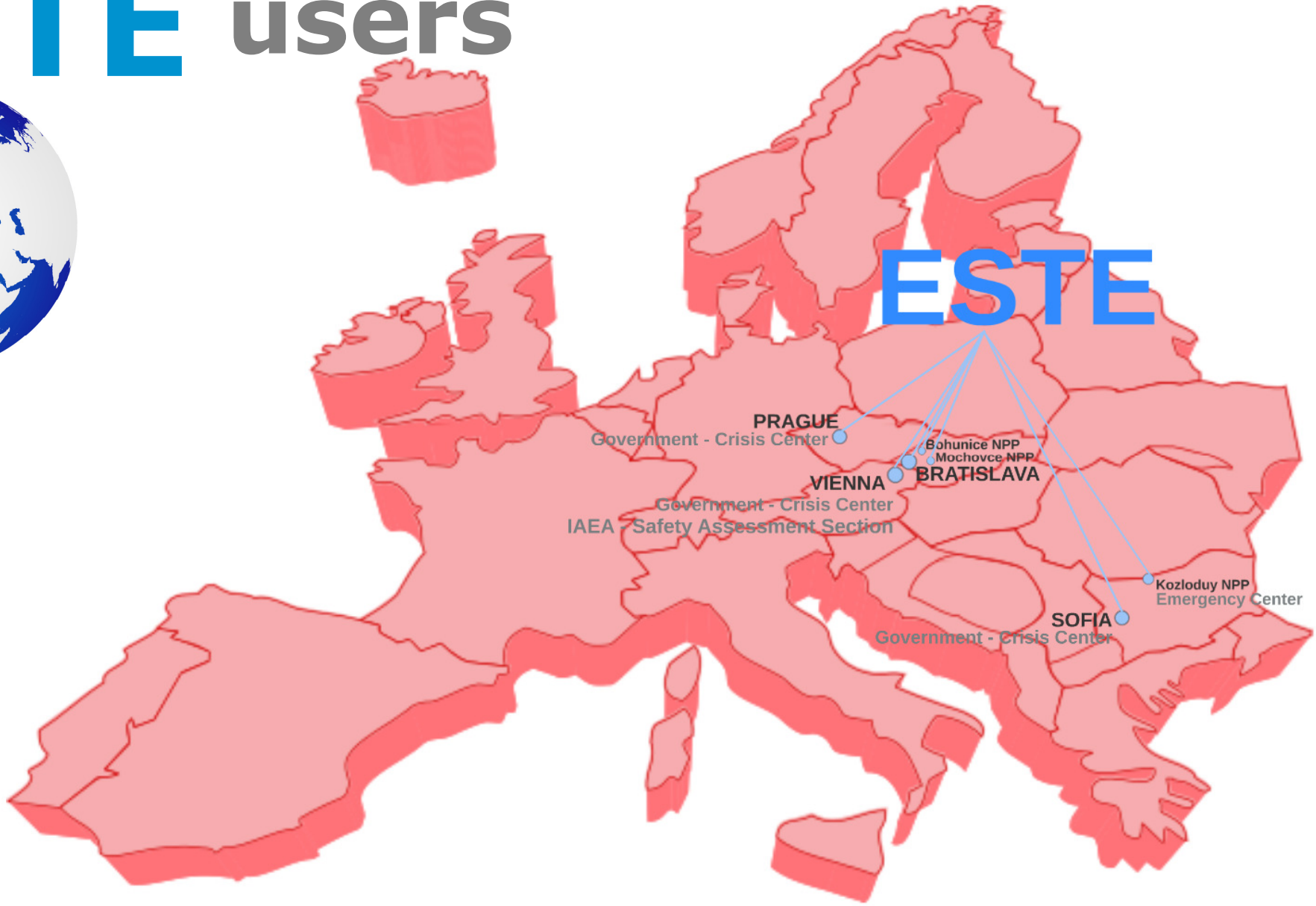
Fairfax, VA, George Mason University, June 14–16, 2016

About ABmerit

- Authors of **ESTE** = **Decision support system for nuclear emergencies**
- Technical Support Organization for nuclear power plants and emergency crisis centers
- Experts in nuclear emergency preparedness and Environmental Impacts Assessment

ESTE users




ESTE
PRAGUE
Government - Crisis Center
Bohunice NPP
Mochovce NPP
BRATISLAVA
VIENNA
Government - Crisis Center
IAEA - Safety Assessment Section
Kozloduy NPP
Emergency Center
SOFIA
Government - Crisis Center

ESTE

Decision support system in case of nuclear accidents

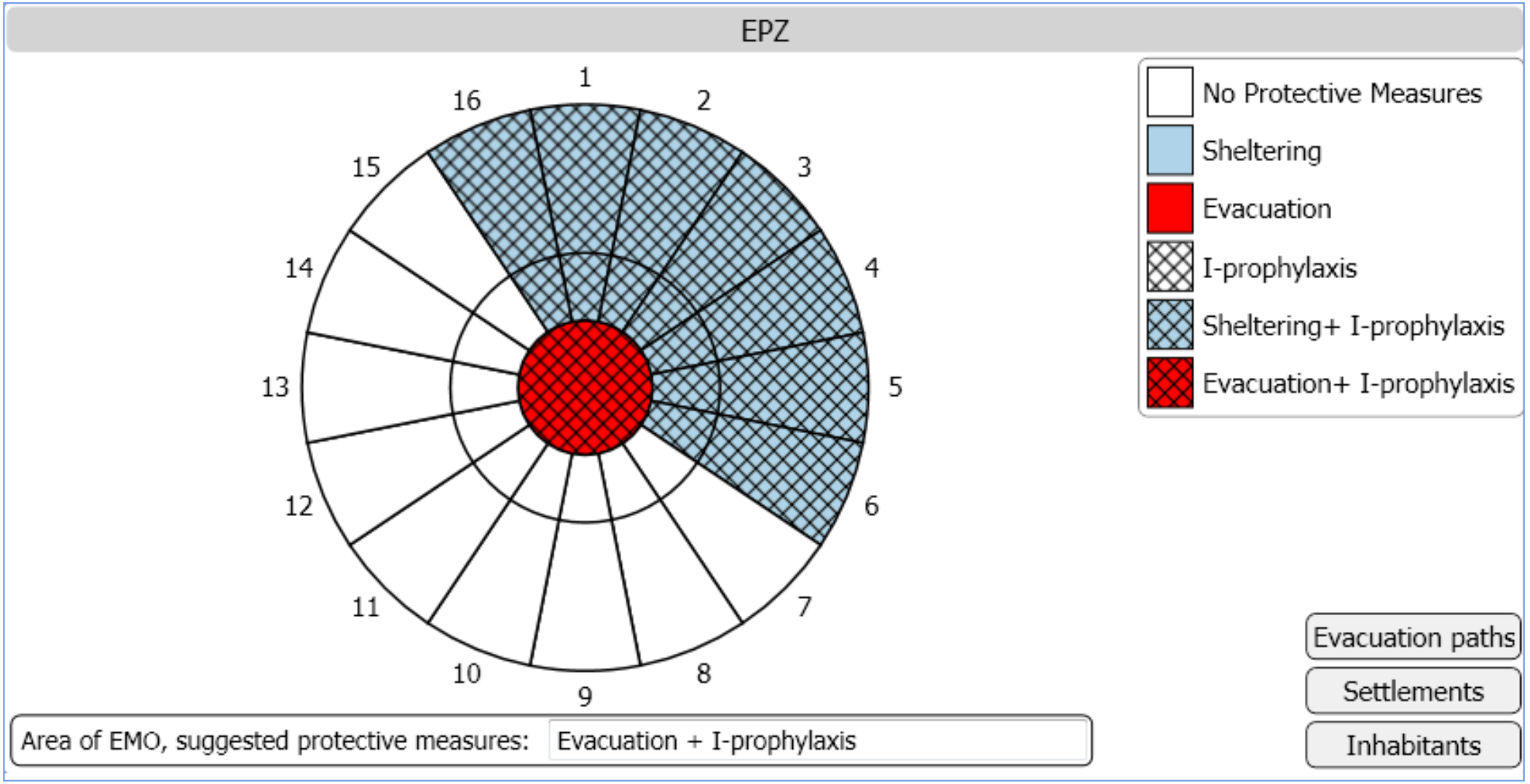
- **Forecast** of radioactive release based **strictly on the state of reactor and state of the fuel** (initiating event – release pathway – state of the core – state of containment)
- Dispersion: PTM and LPM
- Prediction of radiological impacts

ESTE

Decision support system in case of nuclear accidents

- Fast outputs – Fast recommendation of protective measures inside the EPZ available, circle 10 to 30 km from the site (sheltering, evacuation, iodine prophylaxis)
- Data assimilation: containment monitors, stack monitors, monitors inside the NPP area (at the fence), monitor in the EPZ
- Result of data assimilation: “Real source term” = Predicted source term recalculated to comply more with actually monitored radiological parameters.

Example: Suggested protective measures in the EPZ



ESTE

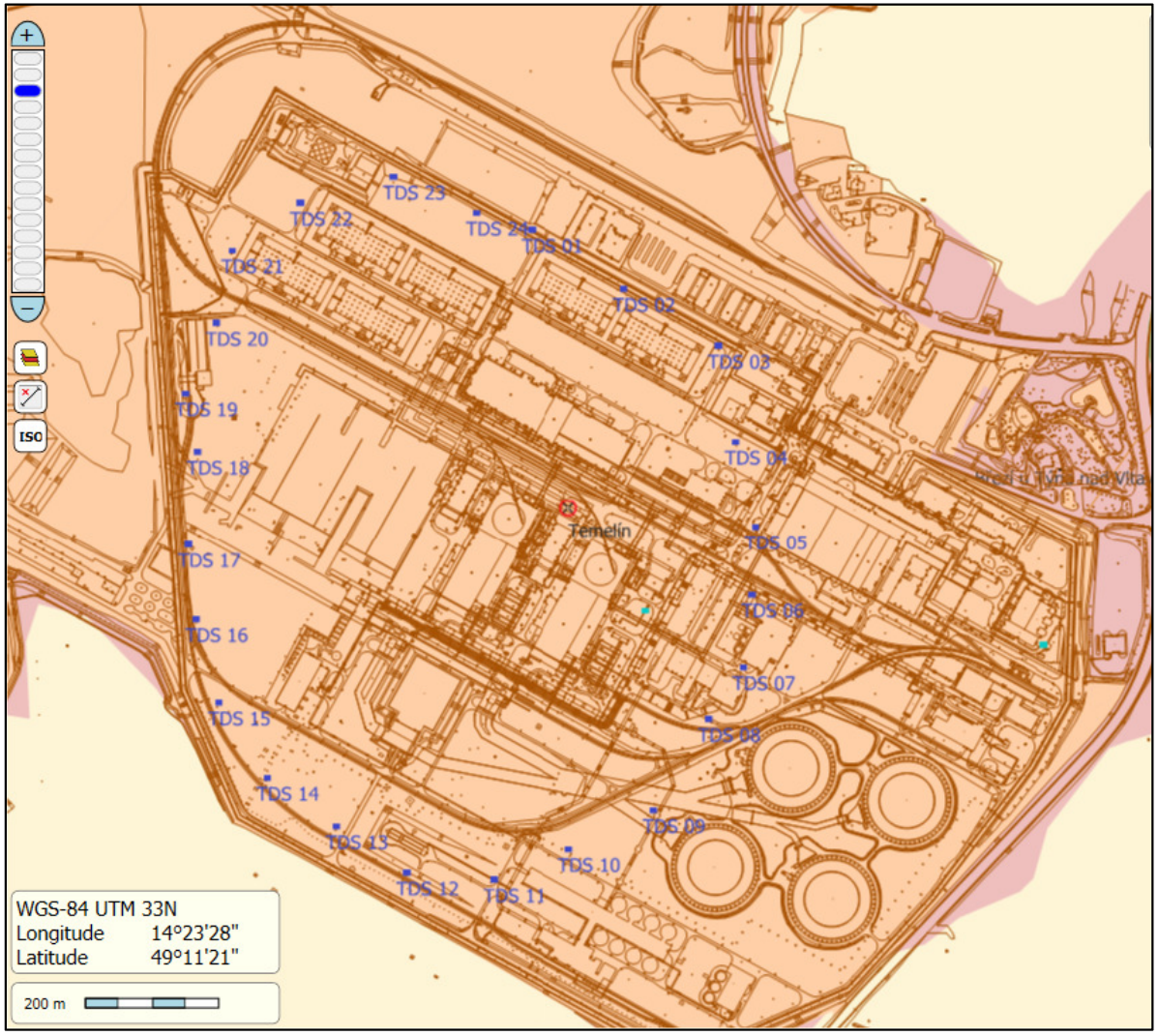
Decision support system in case of nuclear accidents

- "Real source term" is applied for management of protective measures (evacuation routes), management of monitoring teams or management of rescue teams routes:

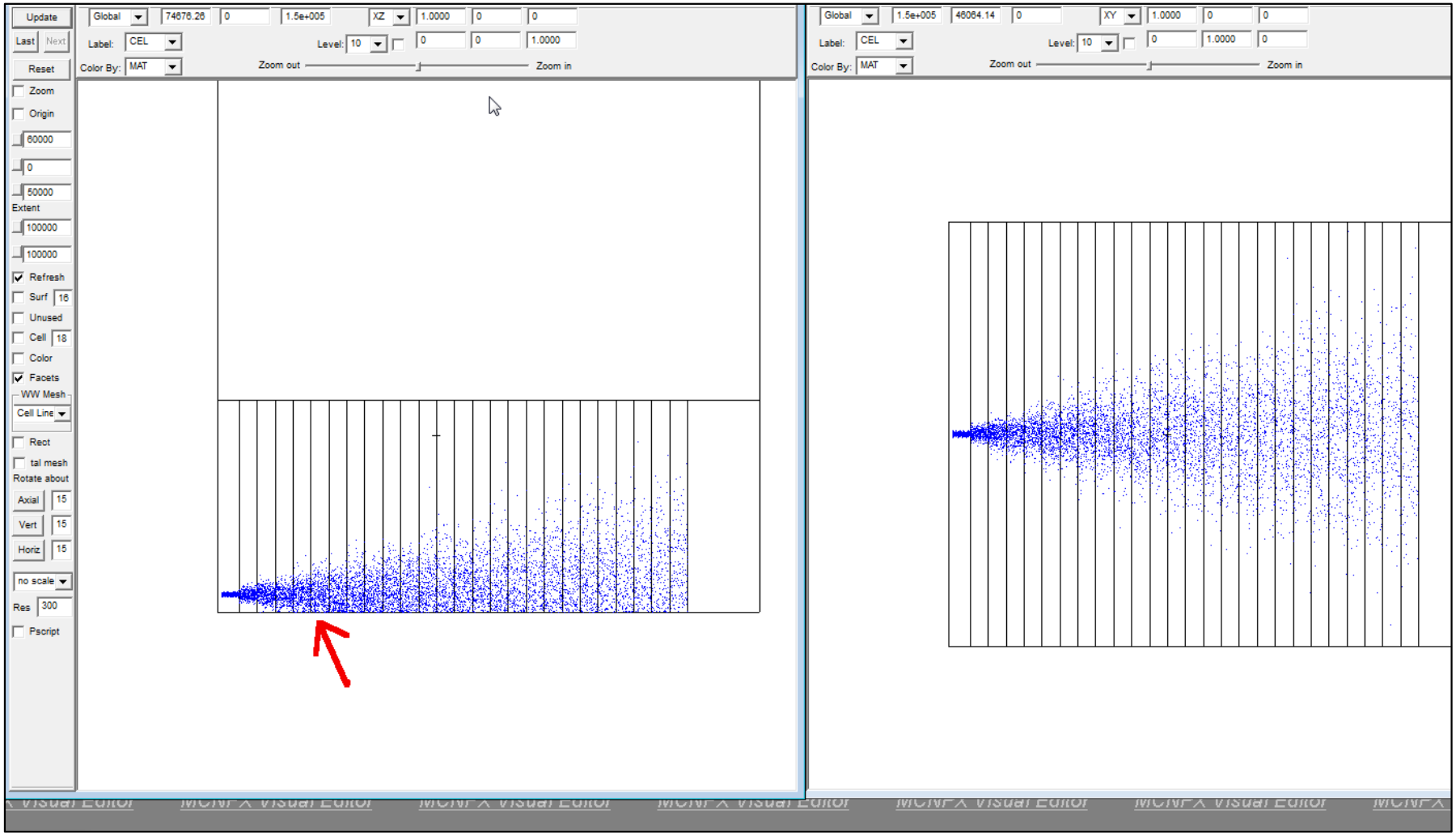
Predicted time of cloud arrival is one important helpful information in such situation.

Estimation of the observed release

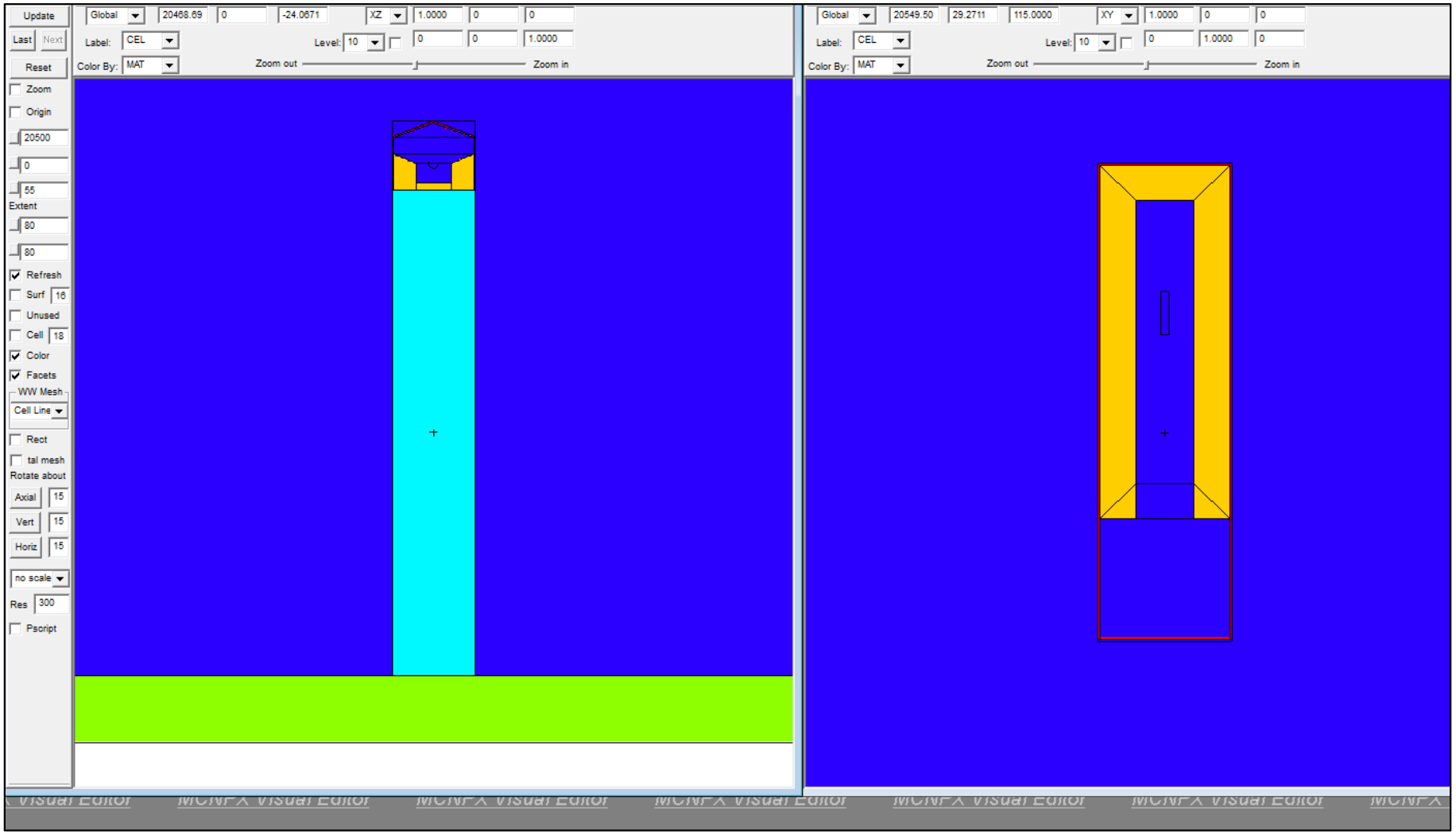
- TDS - System for measuring dose rate within the area of NPP caused by gamma radiation of released/dispersed radioactive material in the atmosphere.
- A pre-calculated library of response of the detectors is utilized (modelled by MCNP).



Estimation of the observed release



Estimation of the observed release



Aims for prediction of cloud arrival:

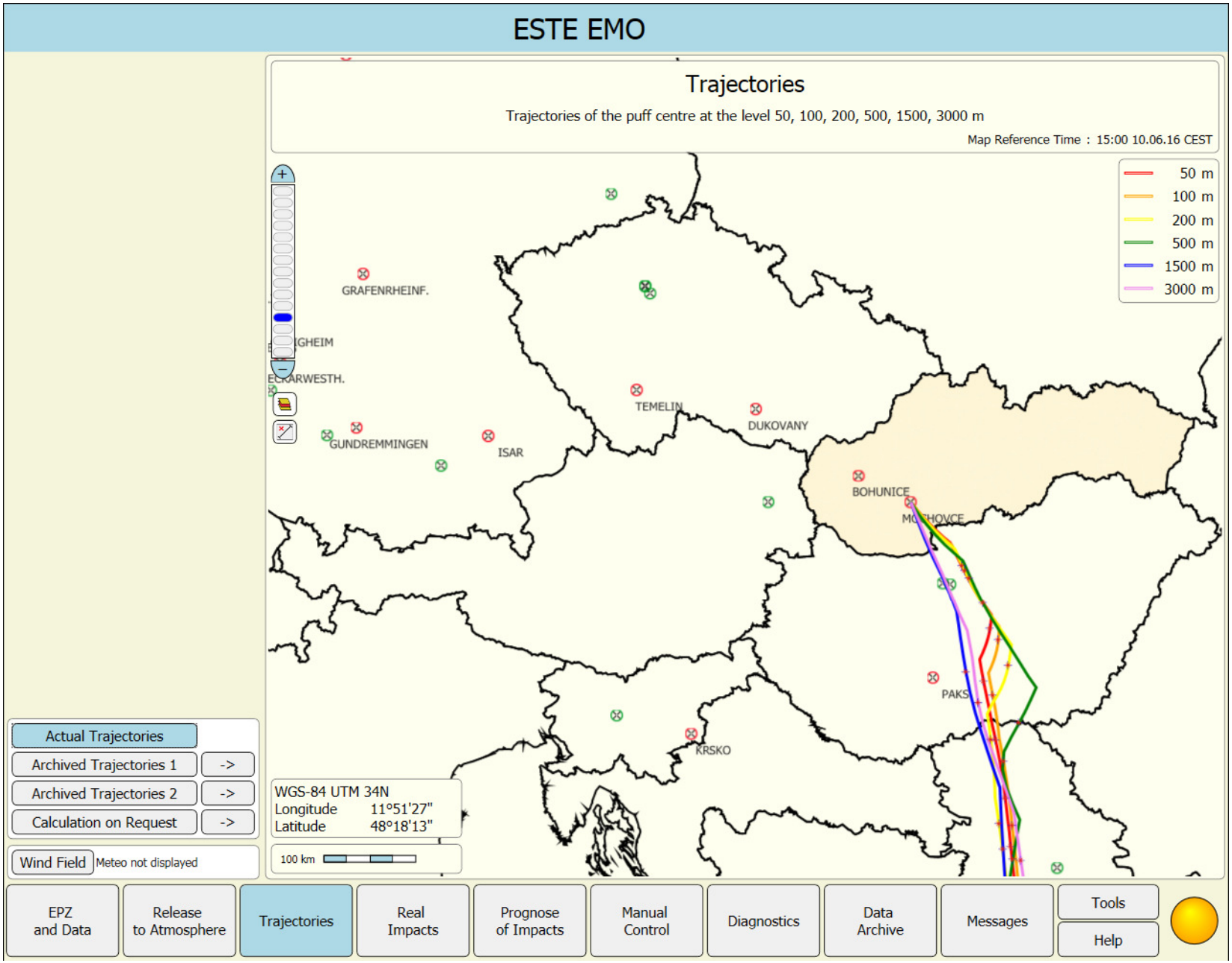
- Recommendation about protective measures could go along with information about time which is available. It could enable us to implement measures more effectively.
- Could enable the crisis staff to prepare/to plan the routes and monitoring better.
- Could enable the crisis staff members to plan/to identify their own routes to the crisis centre in case of alert.

Time of Cloud Arrival Predicted for Emergency Response

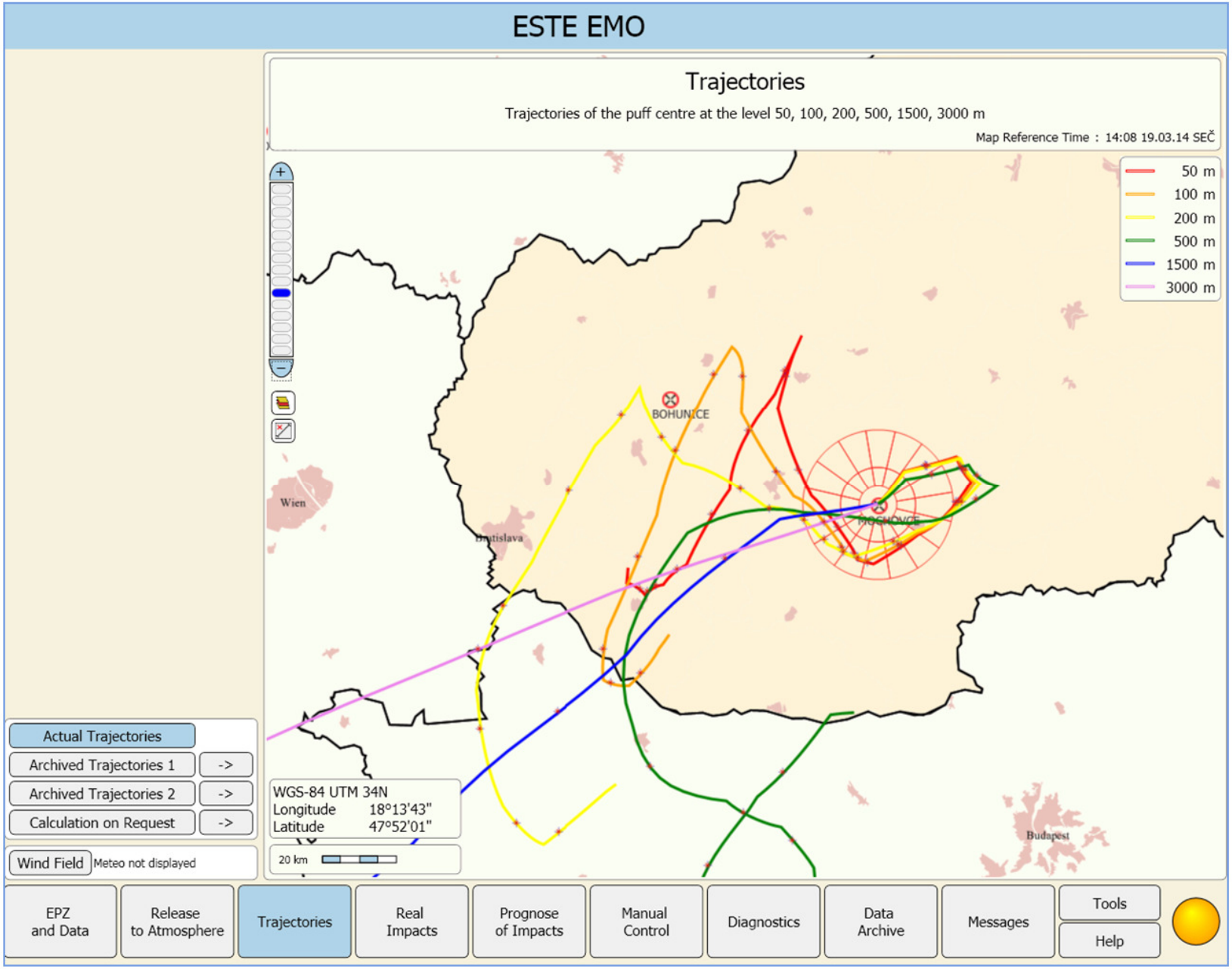
Simple meteo conditions at the NPP site in Slovakia:

Trajectories based on known numerical weather prediction data

(up to 48 days, updated 2-4 times a day)



The same site, but complex meteo conditions:

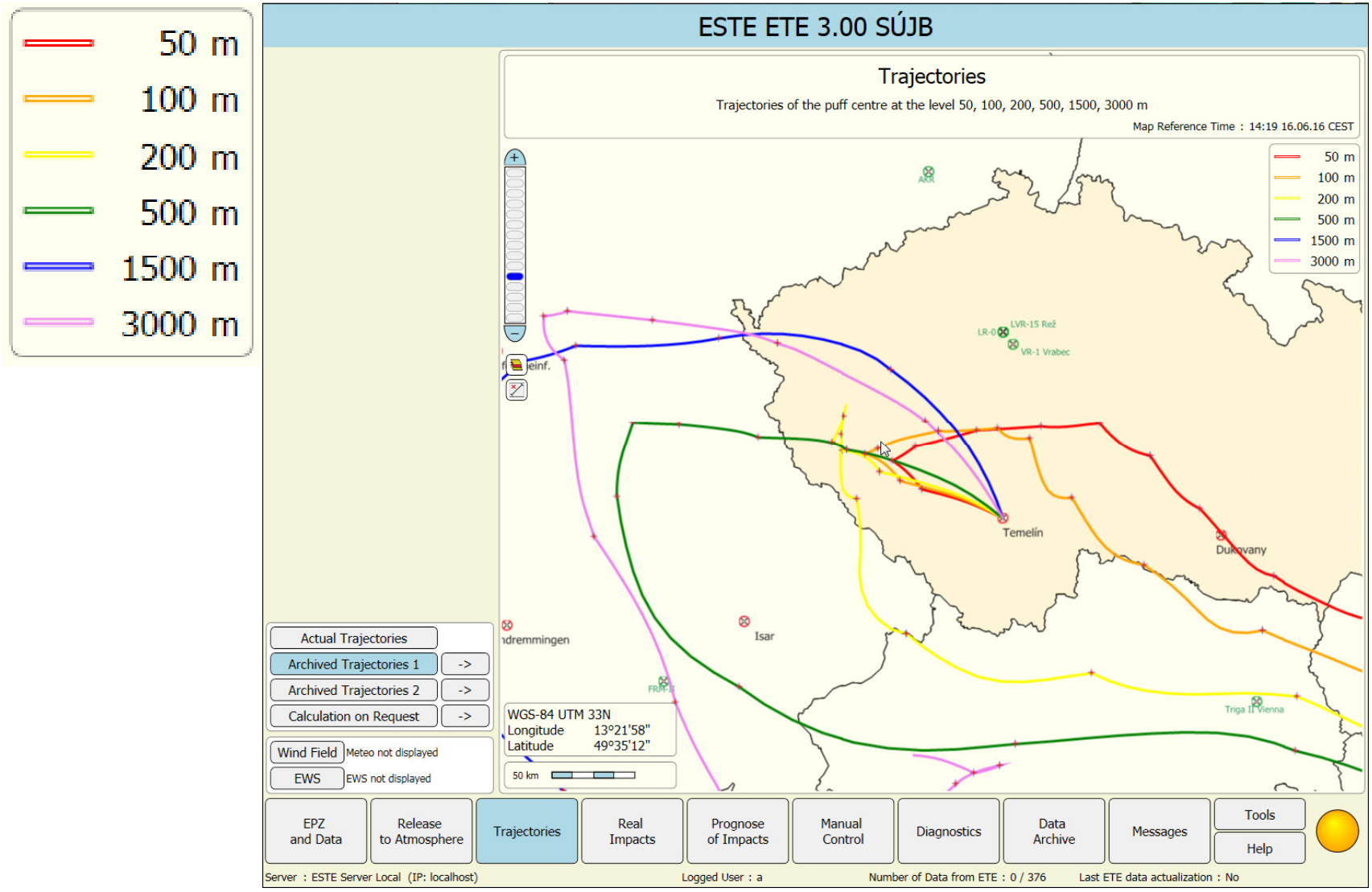


Examples of possible set up of "time of cloud arrival" criteria:

- Dose rate (cloud+depo+inhalation) ... 10 μSv/h
- Dose from the beginning of release (cloud+depo+inhalation) (in open air) ... 10 μSv
- Dose from the beginning of release (cloud+depo+inhalation) (in building) ... 10 μSv
- Committed dose to thyroid, adult or child ... 10 μSv
- TIC of I-131 ... 1E+04 Bq*s/m3

Example: hypothetical release for illustration of the method.

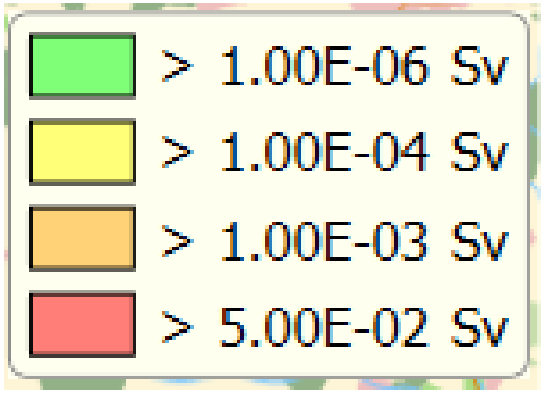
Time of the cloud arrival, trajectories

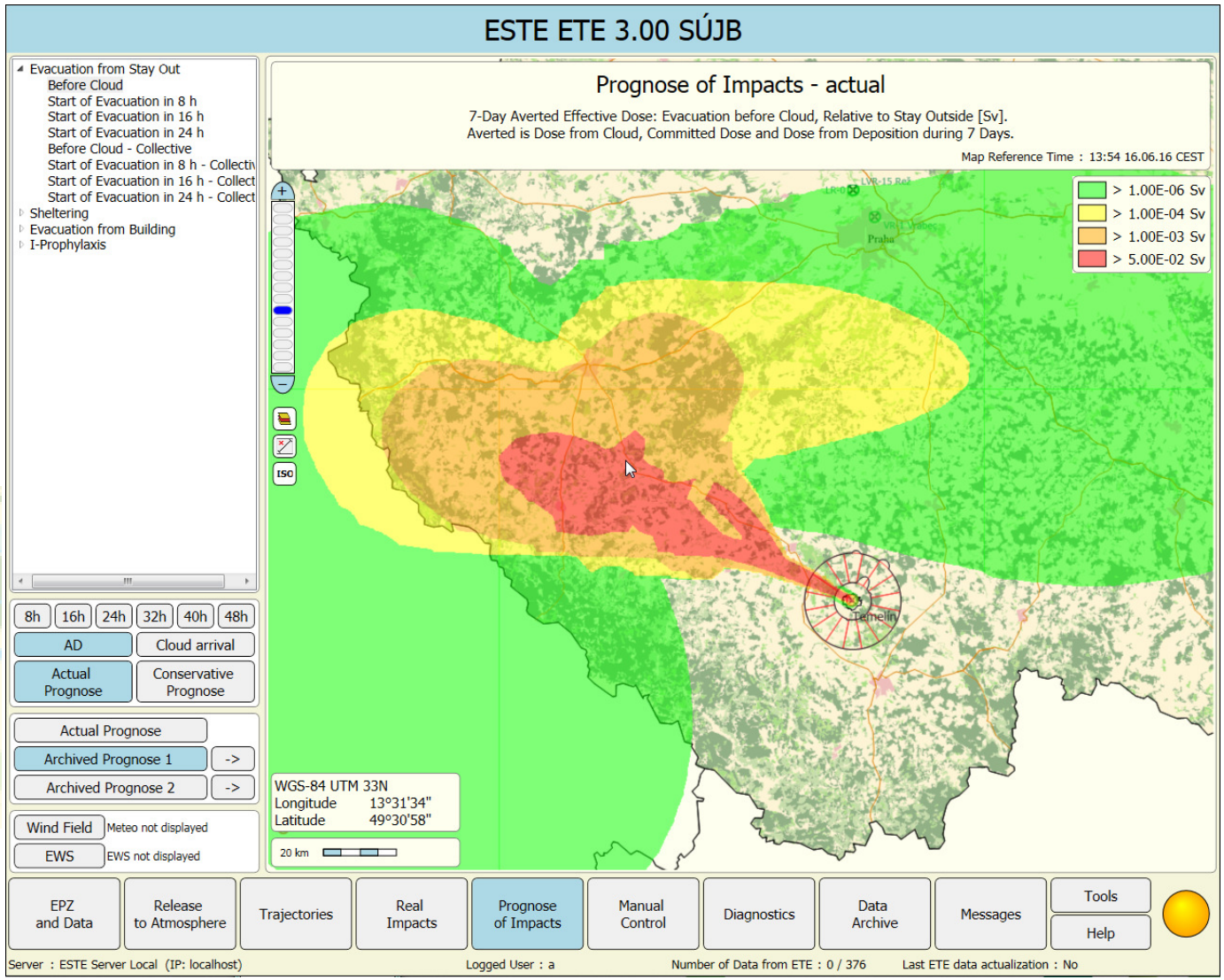


Example: hypothetical release for illustration of the method.

Time of the cloud arrival, prognosis of impacts

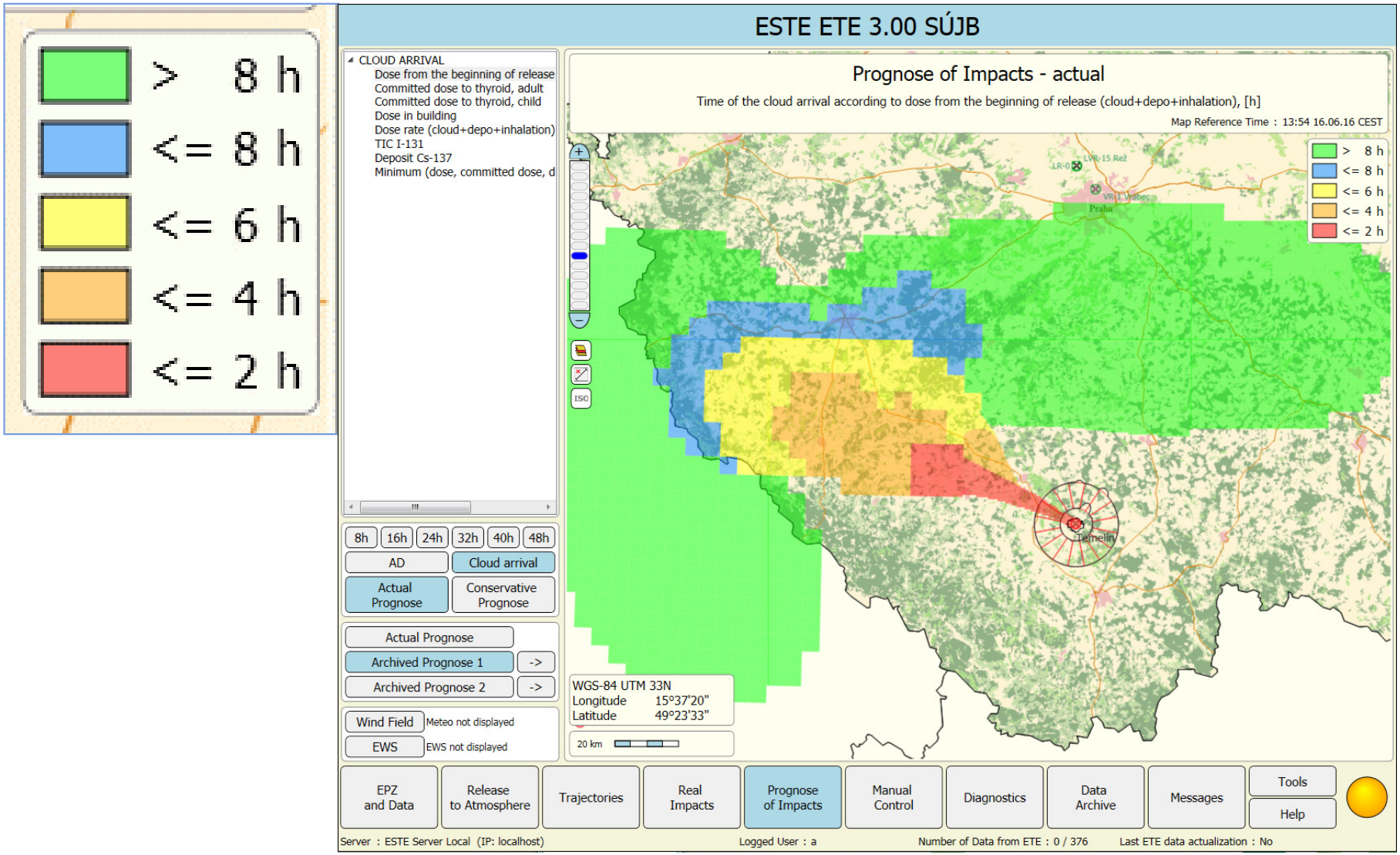
7-Day Averted Effective Dose (evacuation before Cloud, relative to Stay Outside)





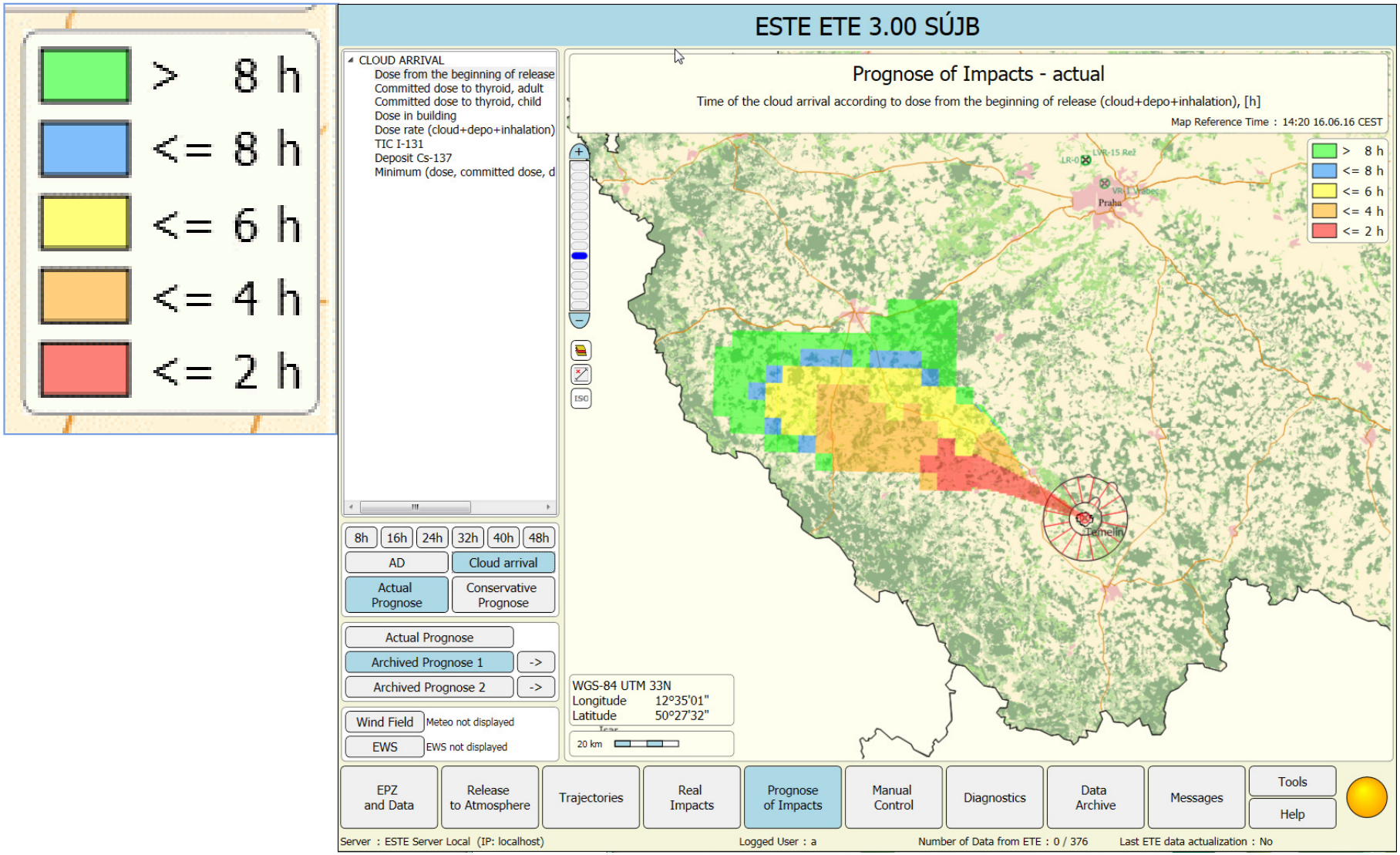
Example: hypothetical release for illustration of the method.

Time of the cloud arrival, prognosis of impacts, 10 microSv



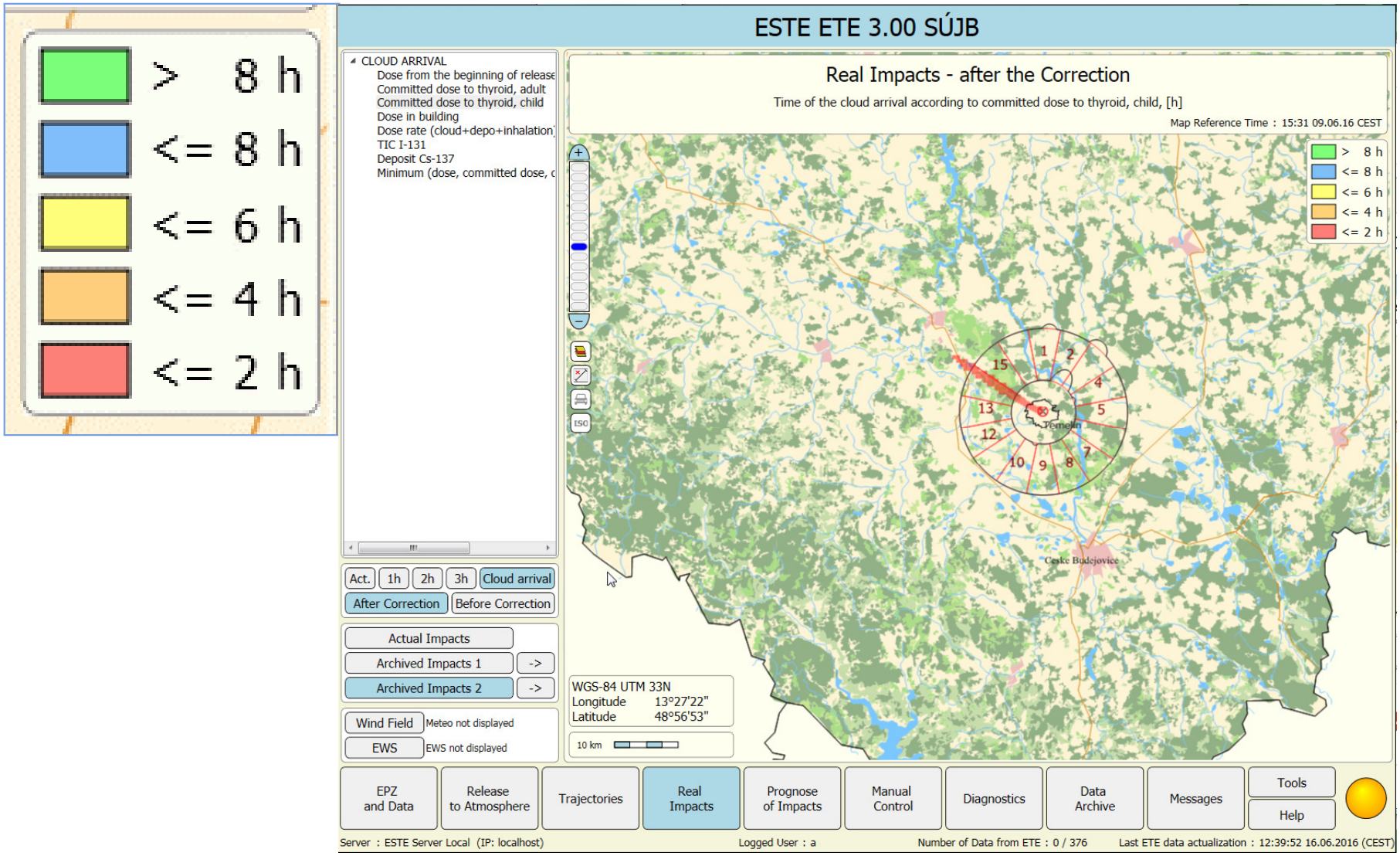
Example: hypothetical release for illustration of the method.

Time of the cloud arrival, prognosis of impacts, 1 mSv



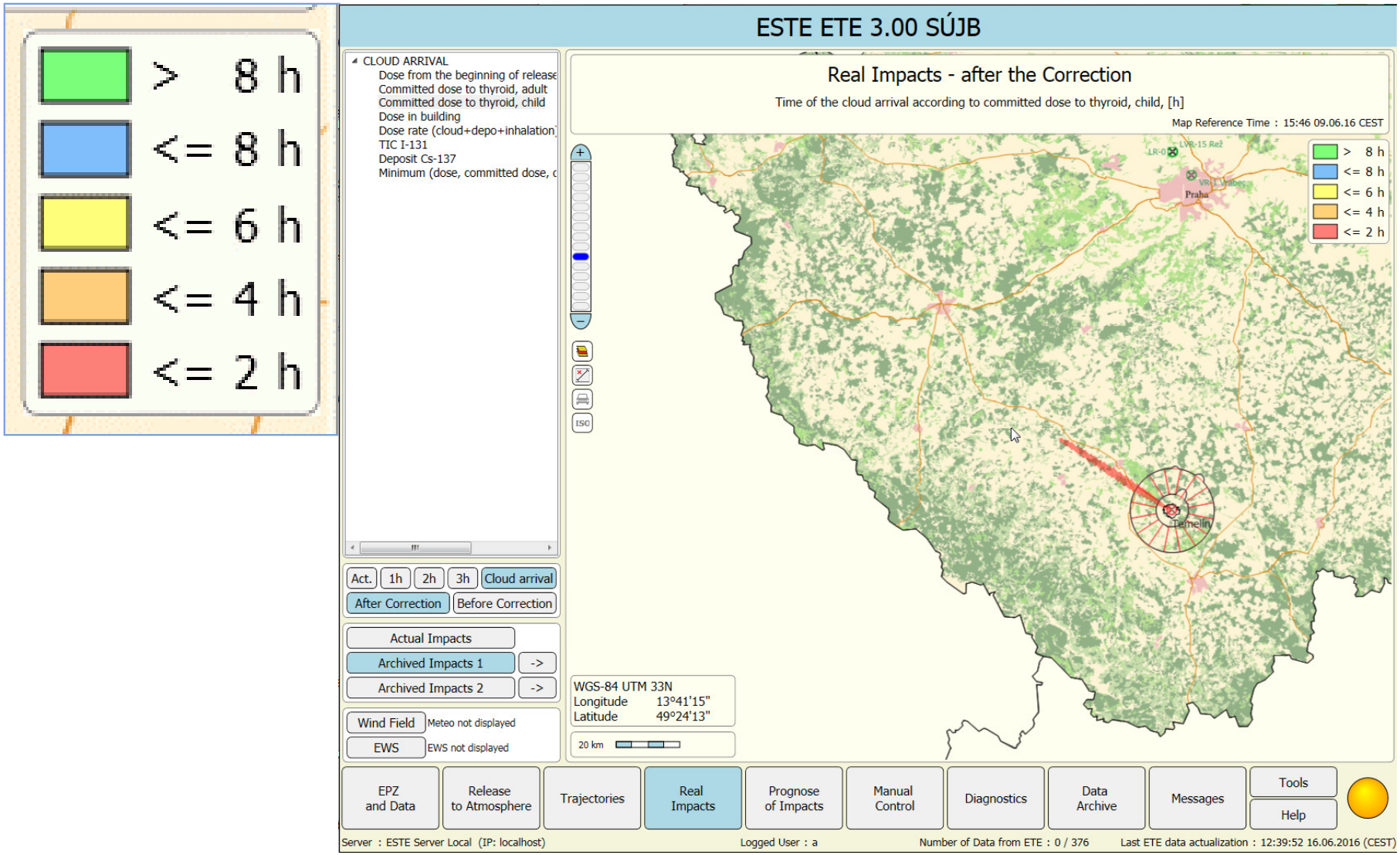
Example: hypothetical release for illustration of the method.

Time of the cloud arrival, real release



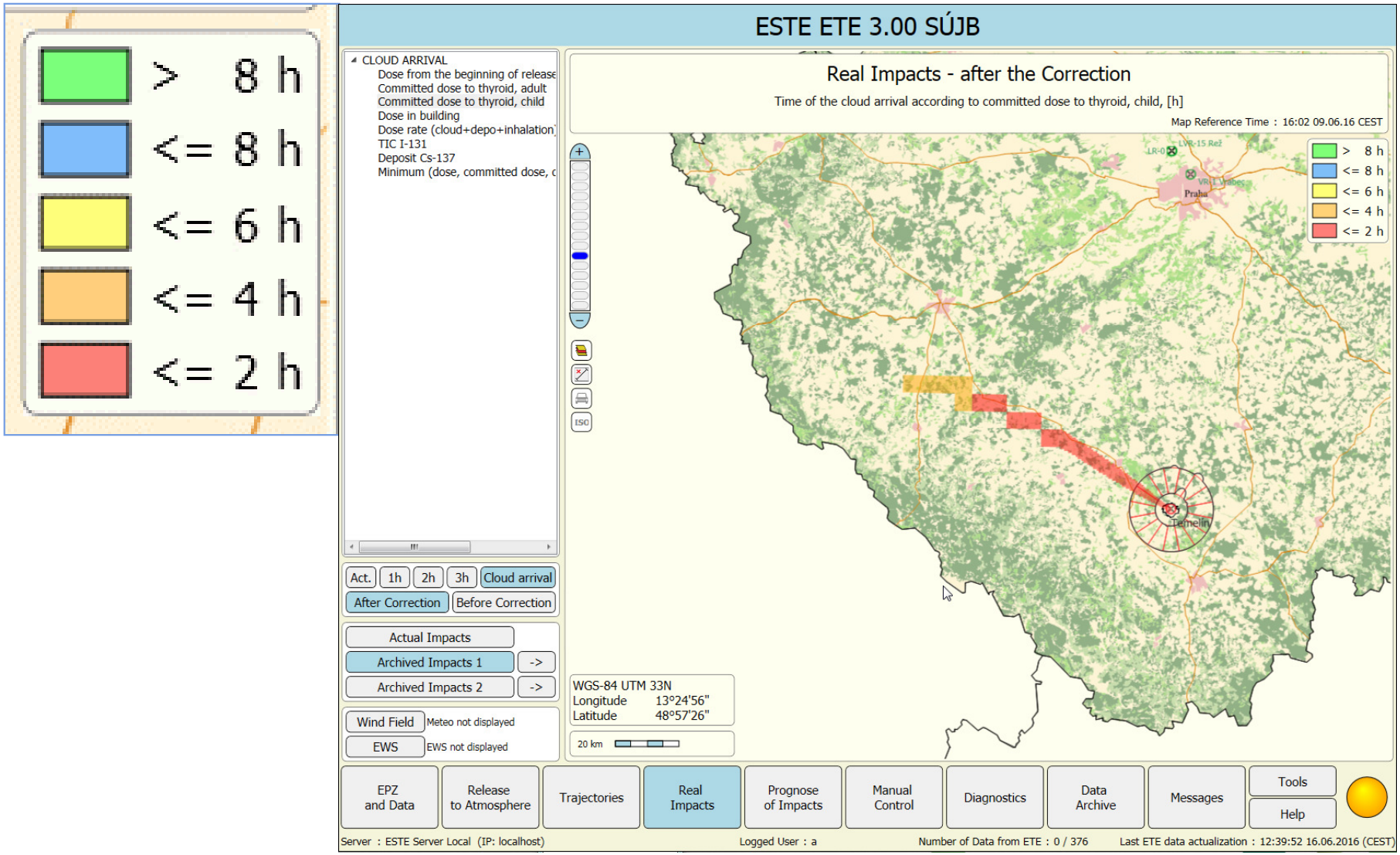
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Time of the cloud arrival, real release



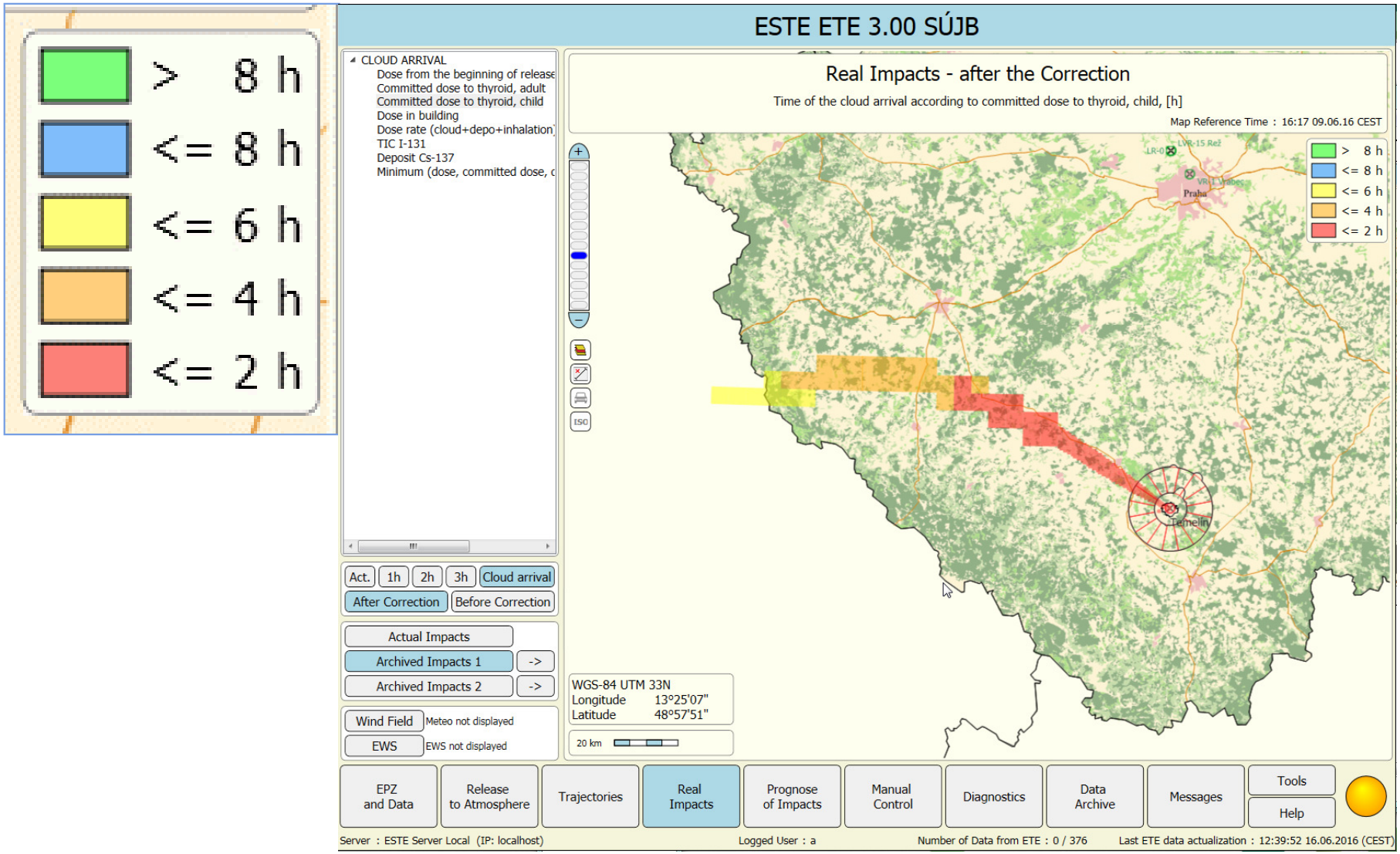
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Time of the cloud arrival, real release



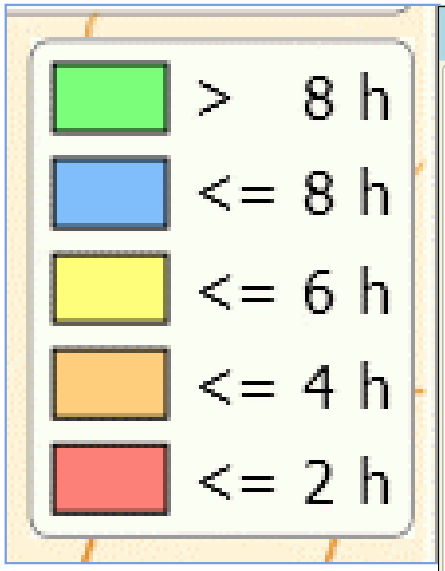
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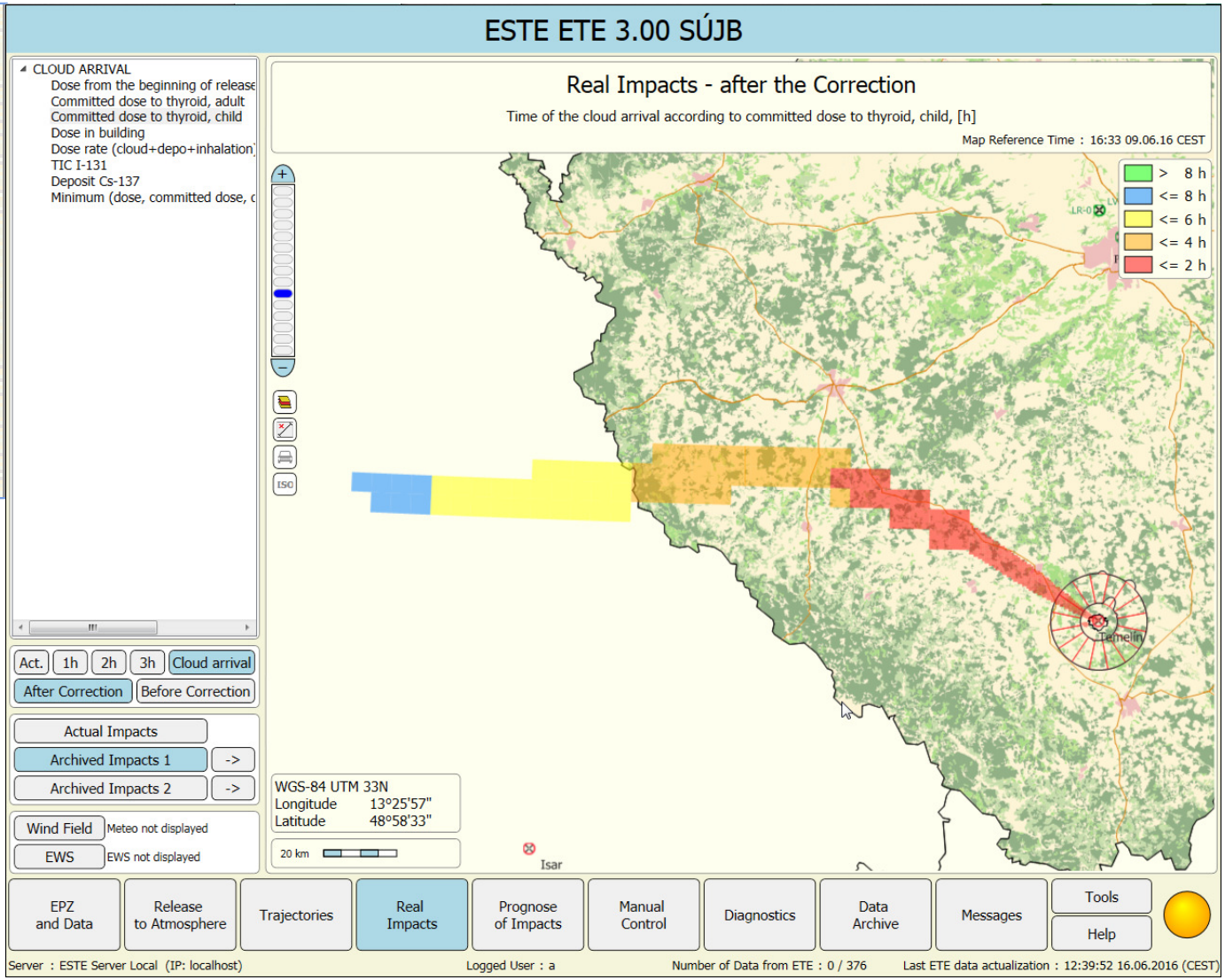
Time of the cloud arrival, real release



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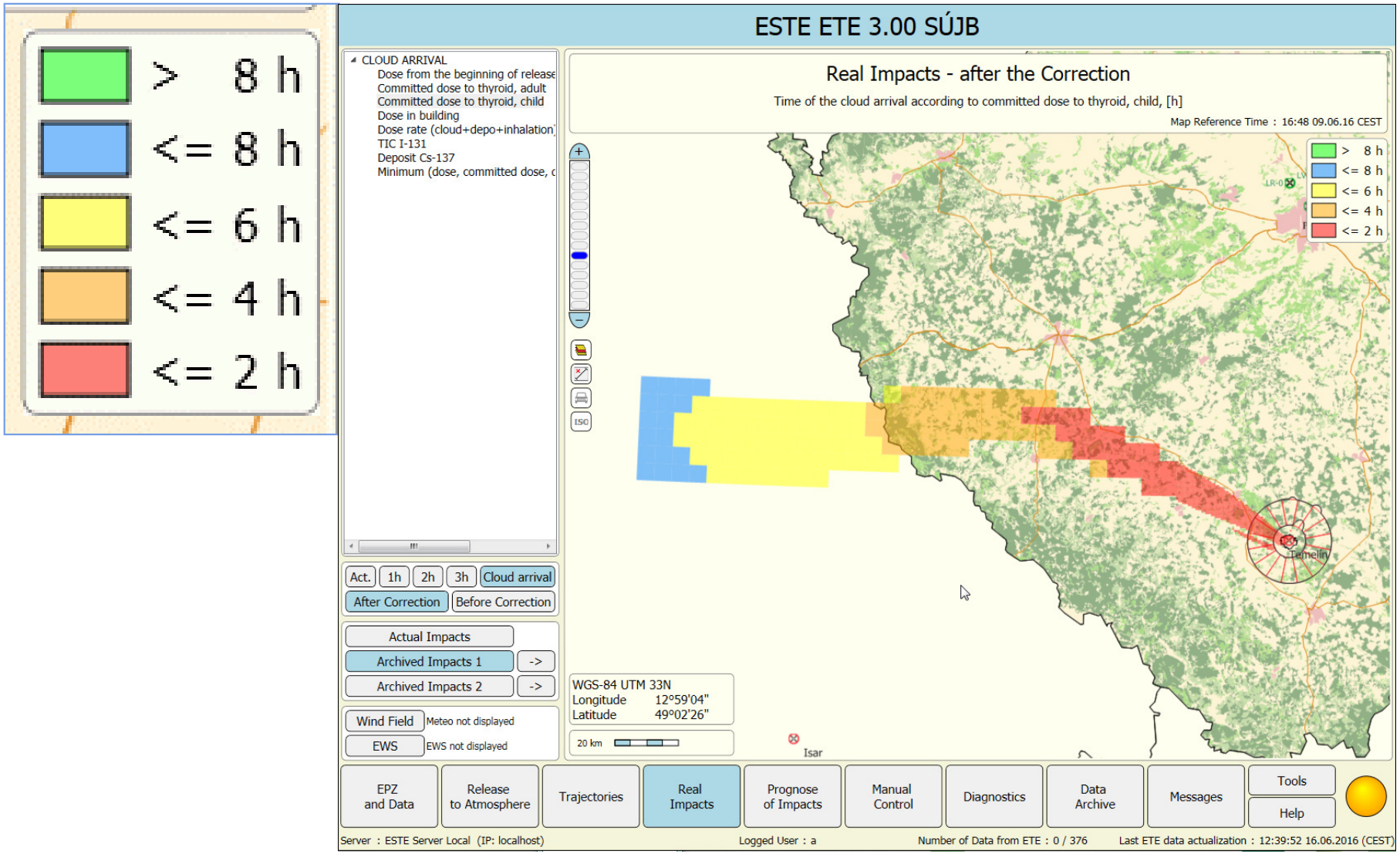
Time of the cloud arrival, real release





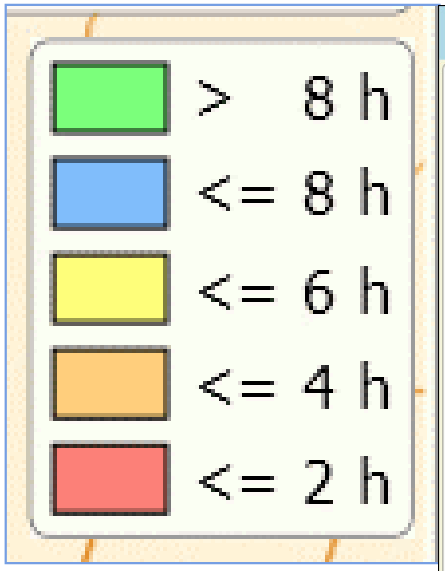
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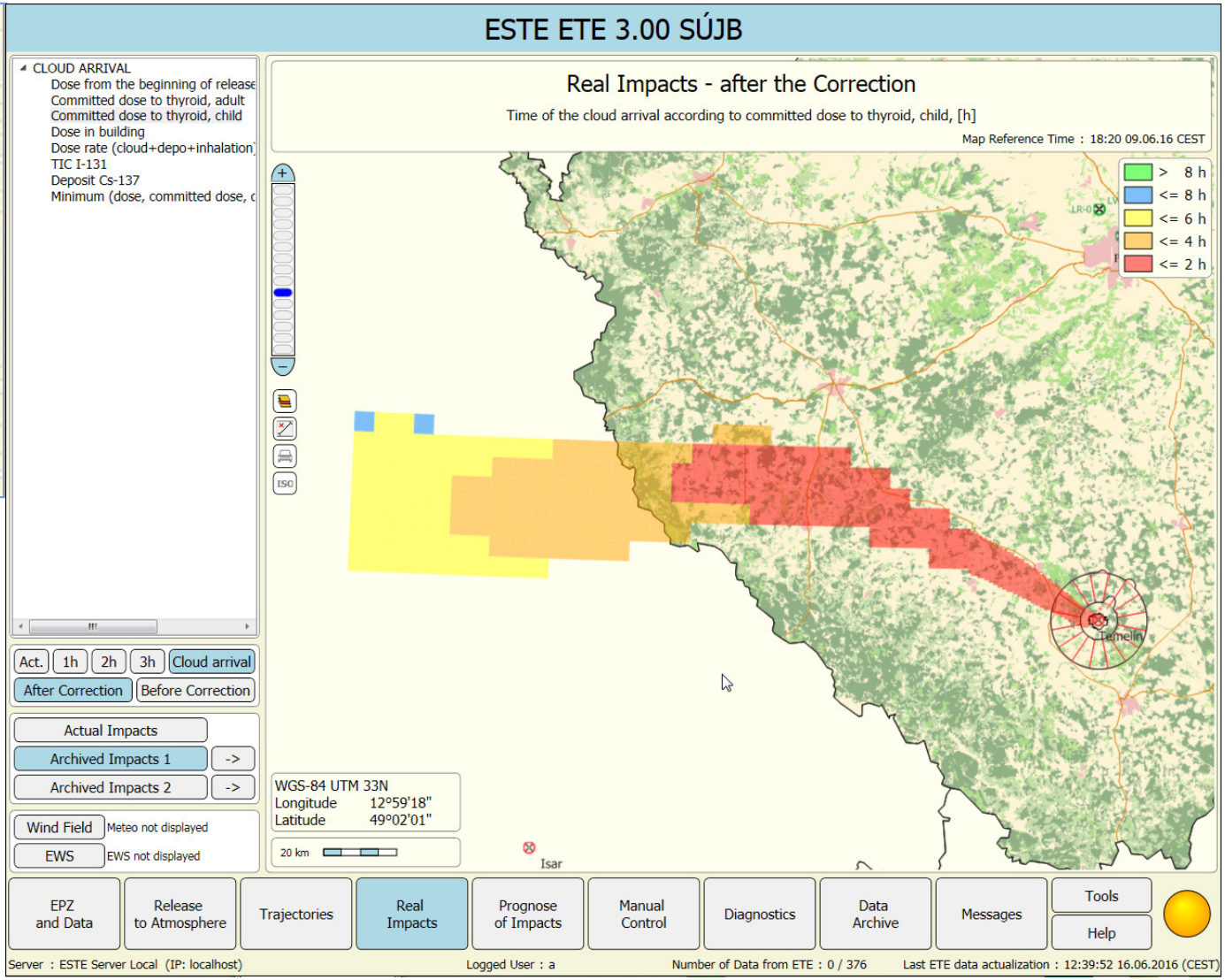
Time of the cloud arrival, real release



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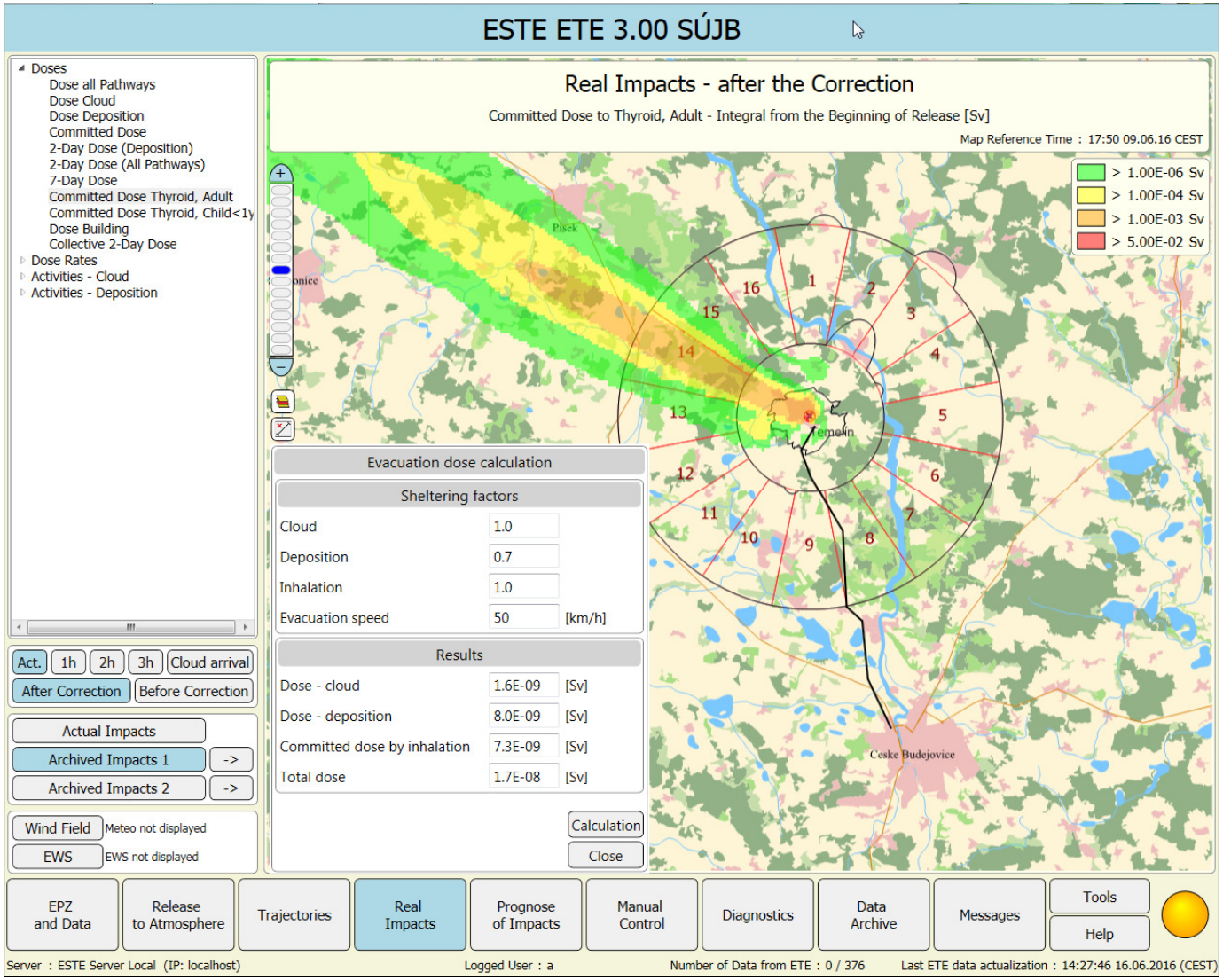
Time of the cloud arrival, real release





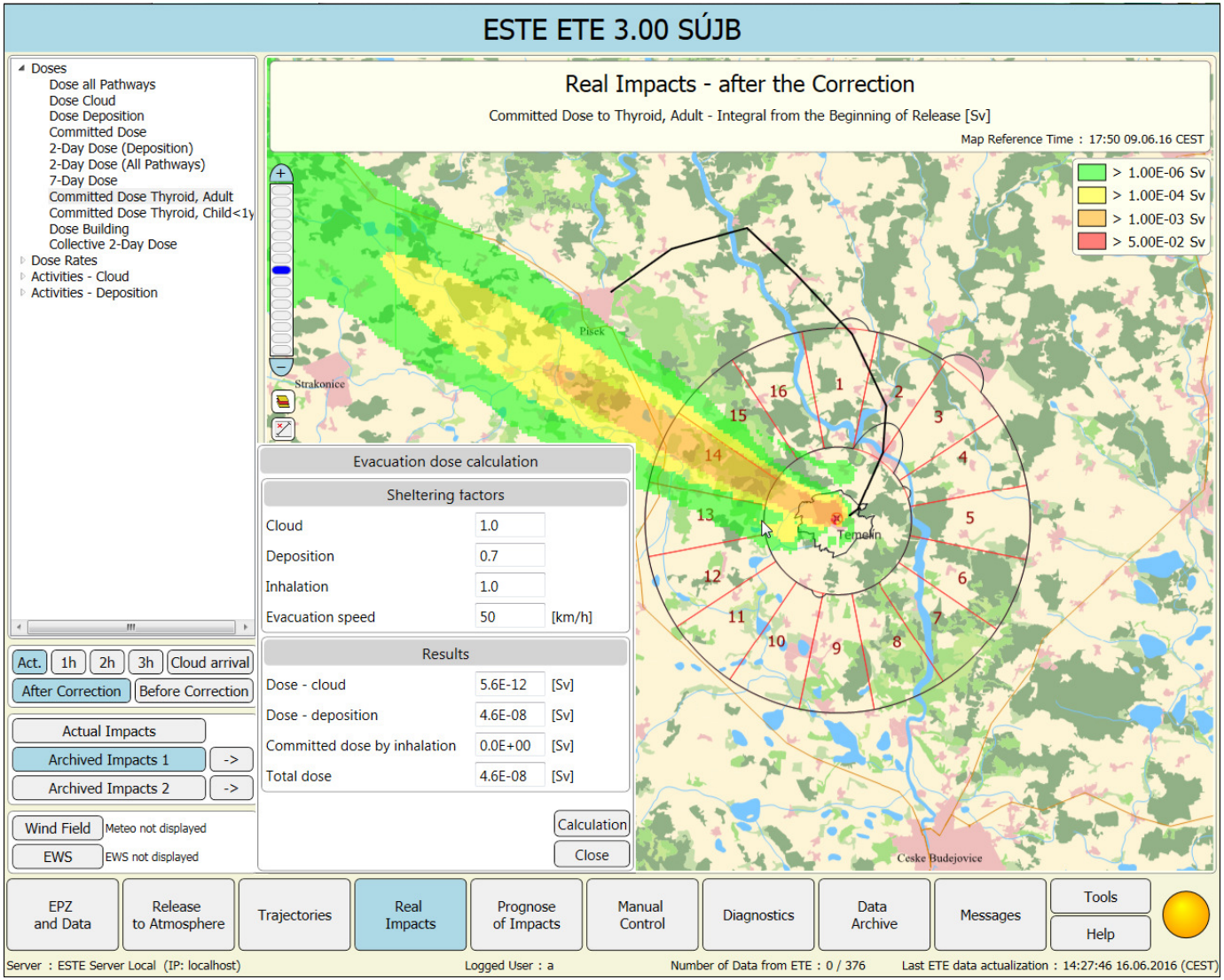
Example: hypothetical release for illustration of the method.

Time of the cloud arrival, definition of routes



Example: hypothetical release for illustration of the method.

Time of the cloud arrival, definition of routes



Example: hypothetical release for illustration of the method.

Thank you for attention

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