Baltic Sea Region
Programme 2007-2013
Part-financed by the European Union
(European Regional Development Fund)

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Weather radar data information in support of nuclear accident scenarios

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STUK's role in nuclear emergencies (with respect to environmental consequences):

- To create and maintain an overview of the radiation situation. (Of course, this is one of the main tasks also during routine conditions.)
- To analyse the situation and to prepare recommendations on possible countermeasures.

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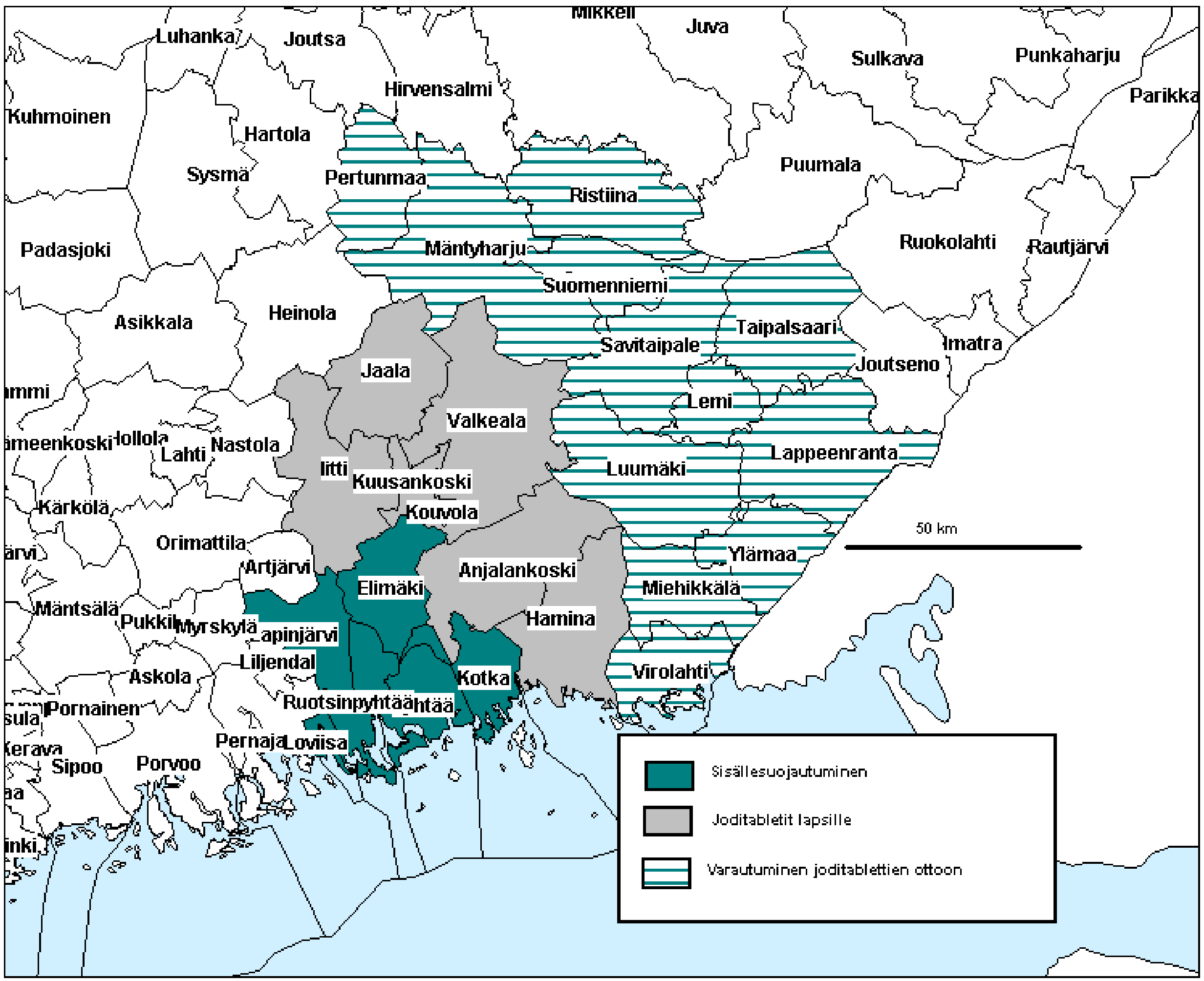
Example of the “output” of STUK in emergencies:



A map showing administrative areas where certain countermeasures should be taken (hypothetical scenario).

In order to succeed in preparing justified and sound recommendations STUK has to have access to various data (including weather-related observations and forecasts).

Weather data is very important in major emergencies because 1(2):

- Wind field determines the transport of radioactive substances released to the atmosphere.
- State of the atmosphere (turbulence or stability) determines the dilution characteristics and spread of releases.
- Poor weather - heavy rain, strong wind - may prevent certain types of radiation measurements (e.g. those performed with airborne platforms).

Weather data is very important in major emergencies because 2(2):

- Weather conditions - especially rain - affect the deposition of airborne substances to the ground. Rain info is needed to indicate possible geographical areas of high deposition levels. This information is important both in planning/ executing countermeasures for protecting people and in guiding measurement activities.
  - Rain data is useful also in routine situations because it helps to interpret higher-than-normal background radiation levels. Rain (washout and/or rainout) brings naturally occurring radionuclides (^{7}Be, radon’s progenies) close to the ground and may thus increase measured dose rates.

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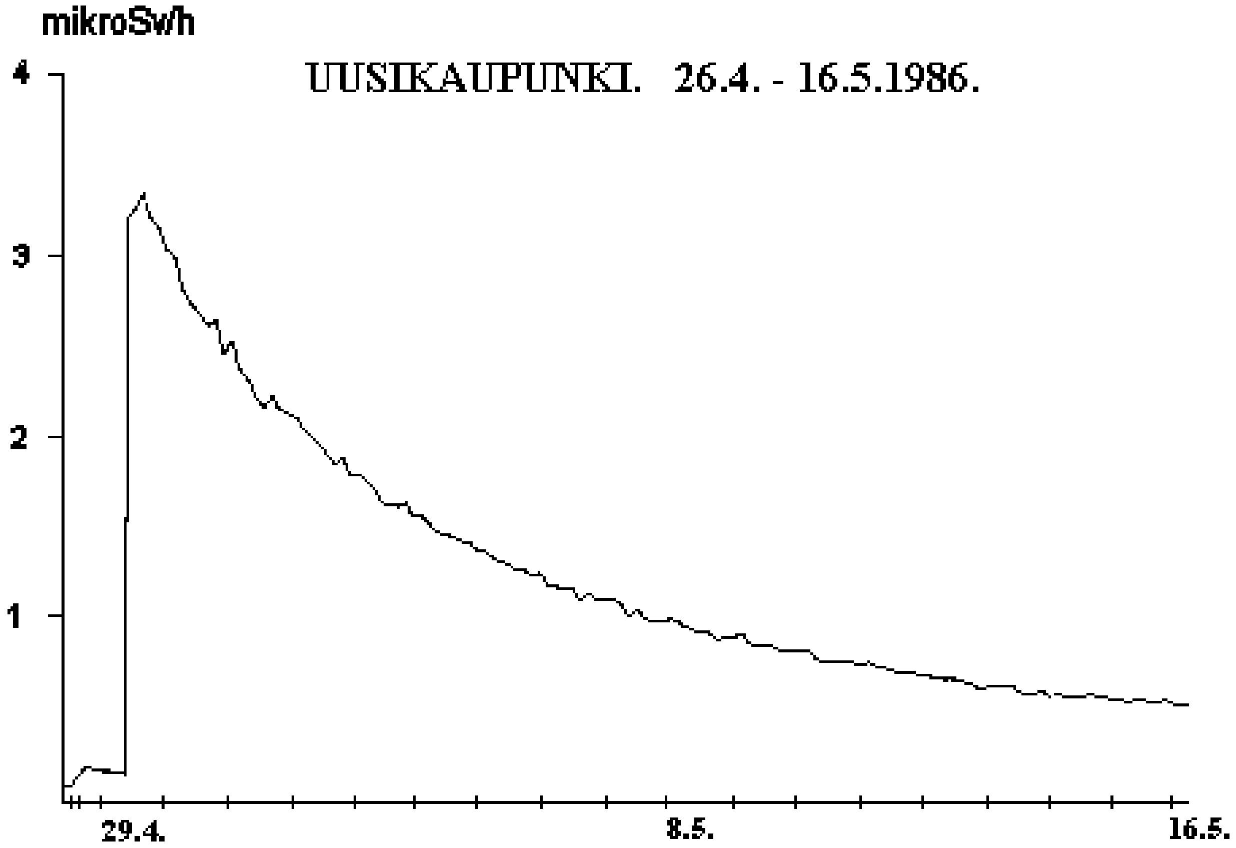
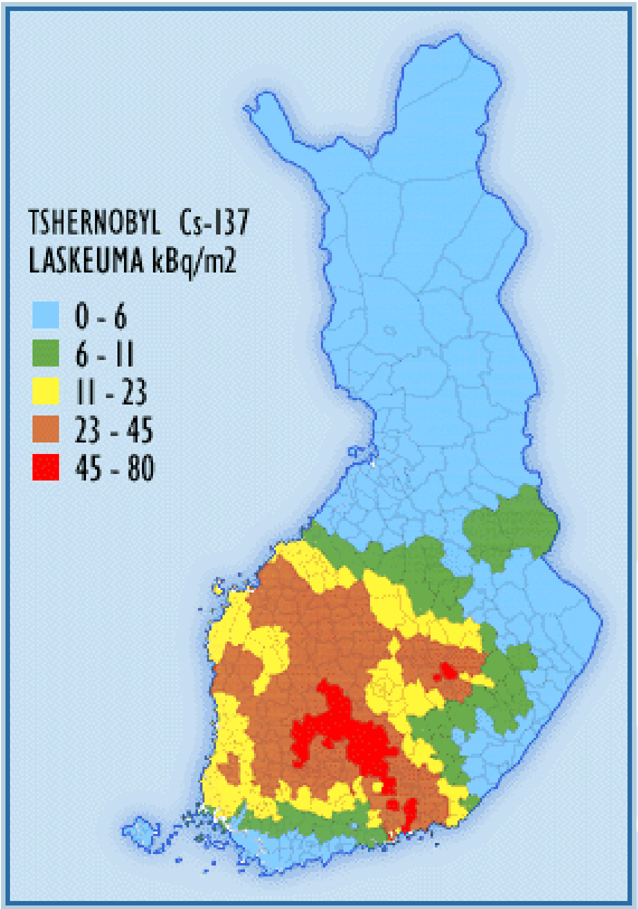
Effect of rain:

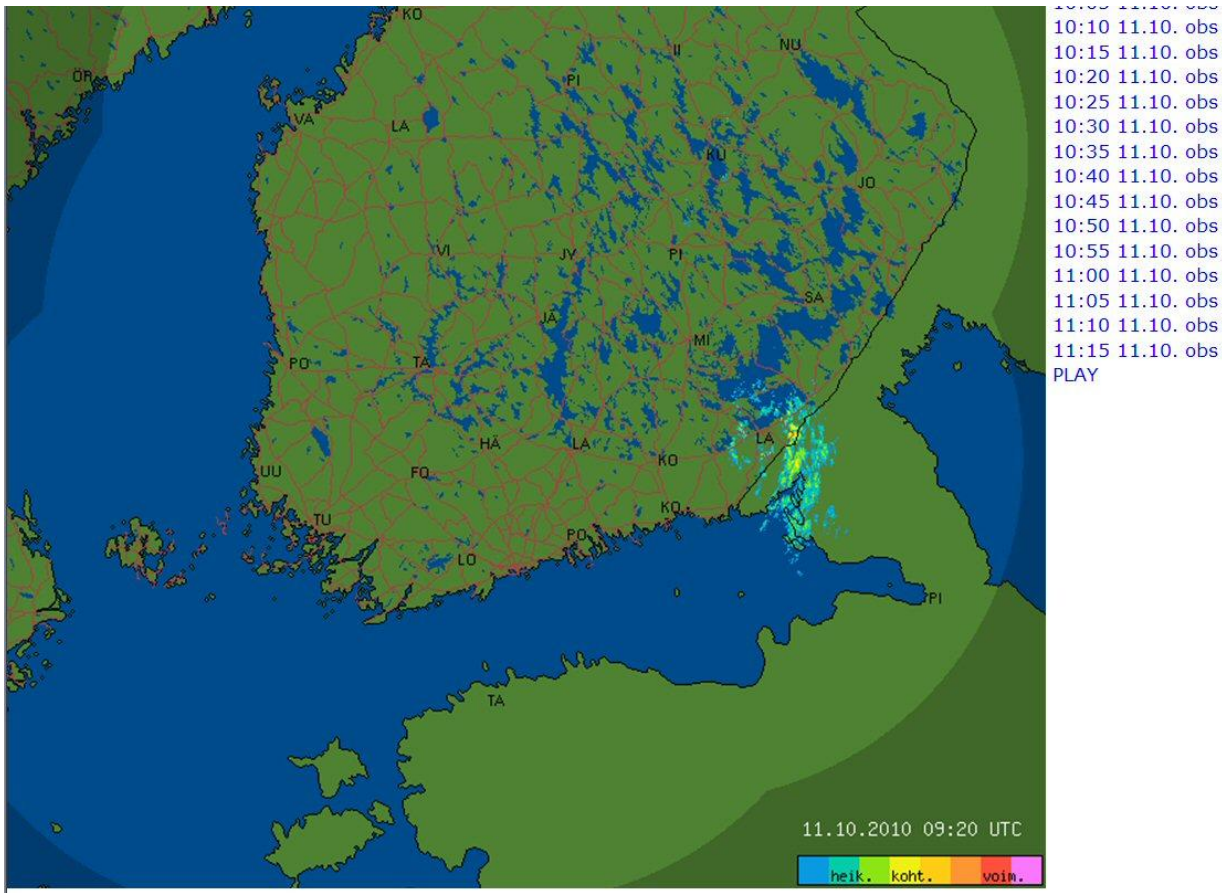




Increased external dose rates

Patchy deposition pattern

Currently STUK can access:



1. FMI's web site dedicated to STUK (left).

2. A SmartMet workstation connected to the data network of FMI.

3. Radar data sent (every ten minutes) by FMI to the USVA system managing the nation-wide automatic dose-rate measuring network ULJAS.

At present: Graphical images and/or numerical data in desibels or given in the scale from “weak” to “strong”.

STUK’s main wishes concerning BALTRAD 1(4):

1. STUK communicates only with FMI, using the request-response principle.

2. FMI should establish a service that STUK can access and retrieve from it data to be displayed in STUK’s systems.

STUK's main wishes concerning BALTRAD 2(4):

3. All data should represent user-friendly quantities (not echo intensities).

4. STUK is primarily interested in precipitation-related ground data (precipitation rate, accumulated precipitation, precipitation type) although the other available quantities may also be of use in some situations.

STUK’s main wishes concerning BALTRAD 3(4):

5. A service to access pure numeric data (like rain intensities given in spatial grid cells) would also be valuable.

Numeric data can be used to determine precipitation scavenging (or washout) coefficients that can be applied directly in many simple and also in some more “advanced” models. In real emergencies the usefulness of this, however, depends on the duration of the event. If it is short, the data would be used only for the re-analysis of the past and not for forecasts.

STUK's main wishes concerning BALTRAD 4(4):

6. Some easily understandable measures of uncertainty (or quality indices) are needed.

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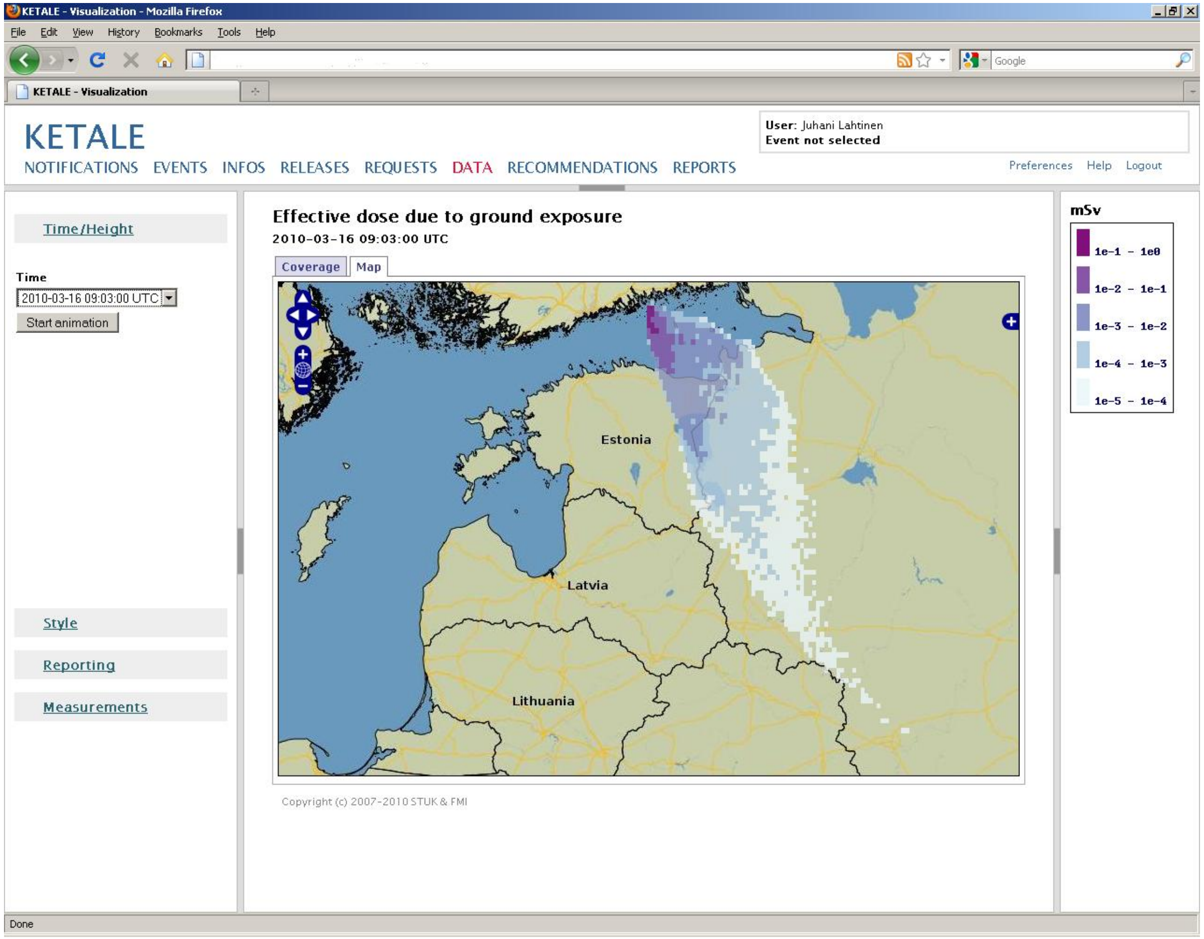
About STUK's end-user applications 1(4):



KETALE system is the platform for the management of dispersion/dose calculation results and meteorological data in nuclear or major radiological emergencies (developed by STUK and FMI).

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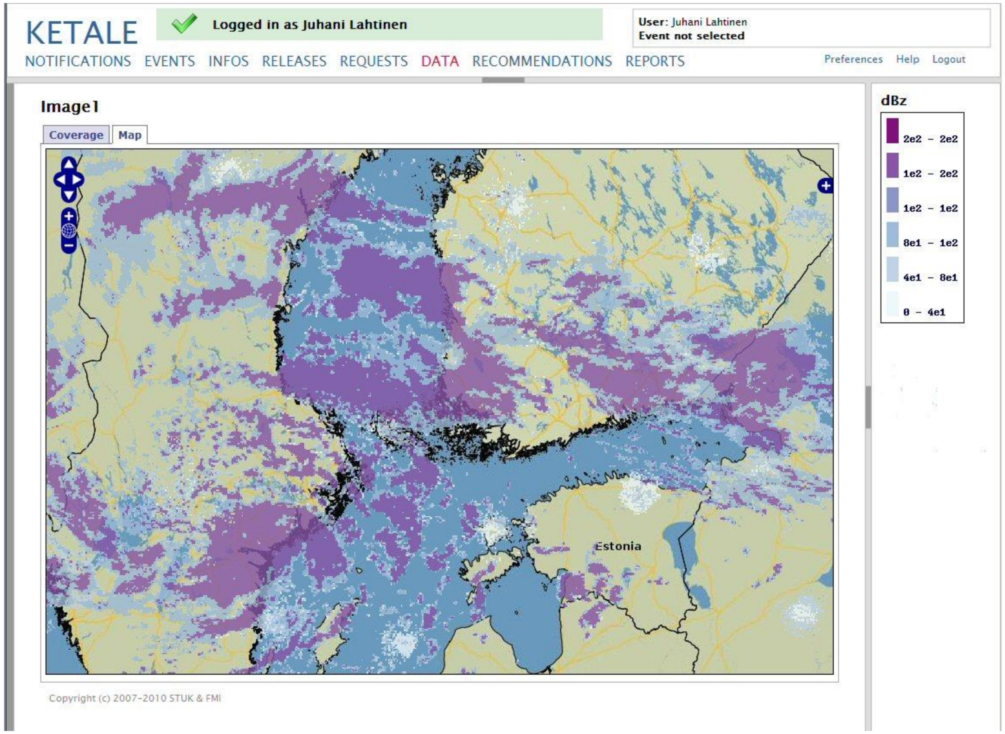
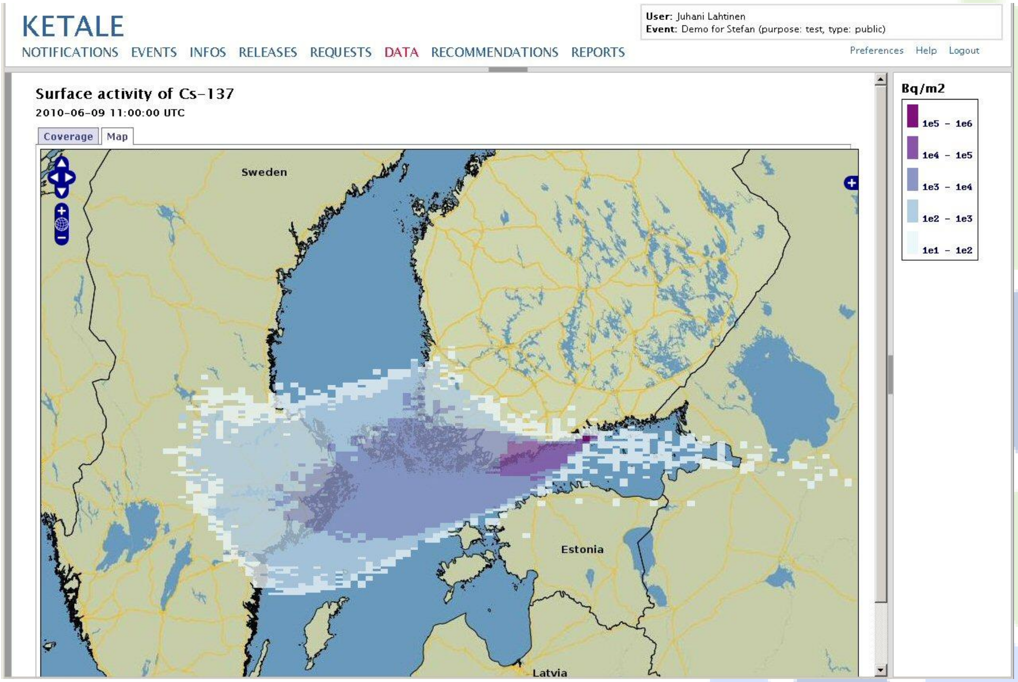
About STUK's end-user applications 2(4):

Flexible visual comparison of calculated doses and concentrations with rain data in order to identify regions of special interest (from the point of view of measurement activities or protection of population).
Presentation of numeric BALTRAD radar data (converted at STUK from HDF5 format to NetCDF) in KETALE has been tested.





About STUK’s end-user applications 3(4):

```
#Old trajectory output(TRADOS style) written by SILAM v.2
#Case name: testitesti
# add. quantity:  1: boundary layer height from gound [m]
# add. quantity:   2: scavenging coefficient [1/s]
# add. quantity:   3: pasquill stability class
   5000 trajectories
************  Trajectory number    1 ********************
   39 steps: step, time(6)UTC, lat,    lon,  pre(HPa), height(m), extra
   1 2007  8  8  9 35 30.0   59.900   29.083   1019.     20.  864.387  0.000E+00  4
   2 2007  8  8 10 35 30.0   59.892   28.592   1009.    109.  304.686  0.000E+00  4
   3 2007  8  8 11 35 30.0   59.889   27.973   1015.     59.   91.264  0.000E+00  4
   4 2007  8  8 12 35 30.0   59.828   27.405   1017.     42.   58.111  0.000E+00  4
   5 2007  8  8 13 35 30.0   59.758   26.882   1013.     68.   60.771  0.000E+00  4
   6 2007  8  8 14 35 30.0   59.706   26.240   1019.     10.  123.012  0.000E+00  4
   7 2007  8  8 15 35 30.0   59.616   25.767   1004.    117.  467.172  0.000E+00  4
   8 2007  8  8 16 35 30.0   59.616   25.183   1009.     84.  127.075  0.000E+00  4
   9 2007  8  8 17 35 30.0   59.599   24.614   1014.     42.   59.913  0.000E+00  4
  10 2007  8  8 18 35 30.0   59.565   24.058   1008.     91.   60.039  0.000E+00  4
  11 2007  8  8 19 35 30.0   59.557   23.344    977.    356.   65.911  0.000E+00  4
  12 2007  8  8 20 35 30.0   59.757   22.705    916.    915.   76.356  0.000E+00  4
  13 2007  8  8 21 35 30.0   60.048   22.226    865.   1388.   93.517  0.000E+00  4
  14 2007  8  8 22 35 30.0   60.267   21.978    941.    679.  108.303  0.000E+00  4
  15 2007  8  8 23 35 30.0   60.601   21.624    995.    192.  175.290  0.000E+00  4
  16 2007  8  9  0 35 30.0   60.824   21.093   1010.     71.   64.483  0.000E+00  4
  17 2007  8  9  1 35 30.0   60.975   20.666    939.    693.   59.476  0.358E-05  4
  18 2007  8  9  2 35 30.0   61.293   20.593    963.    484.   58.392  0.109E-04  4
  19 2007  8  9  3 35 30.0   61.630   20.603    978.    345.   57.780  0.647E-05  4
  20 2007  8  9  4 35 30.0   61.946   20.599    986.    275.   67.310  0.000E+00  4
  21 2007  8  9  5 35 30.0   62.233   20.546    953.    565.   65.239  0.103E-05  4
  22 2007  8  9  6 35 30.0   62.470   20.679    930.    776.   59.013  0.699E-06  4
  23 2007  8  9  7 35 30.0   62.719   20.763    950.    594.   63.278  0.000E+00  4
```

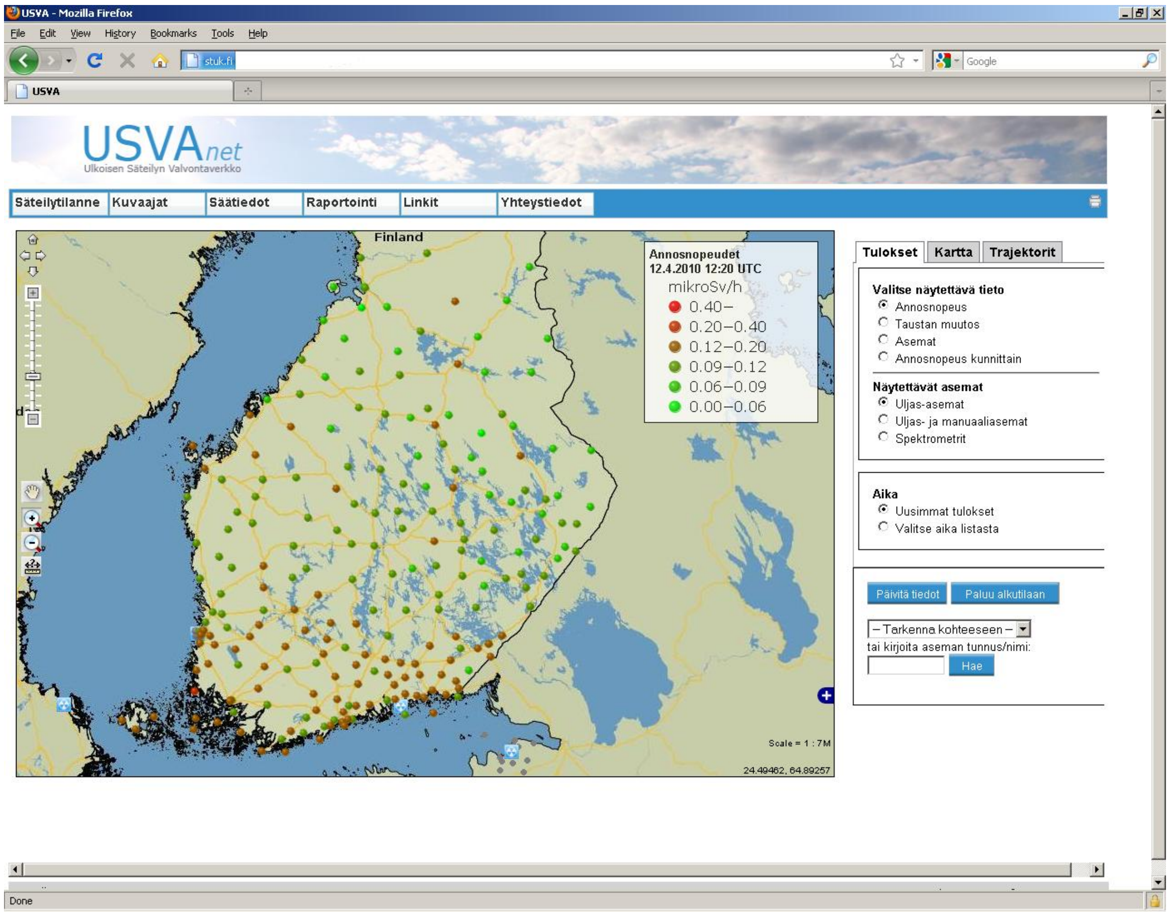
Scavenging coefficient

SILAM uses weather model data that is updated two (ECMWF weather model) or four (HIRLAM) times a day.

<u>Weather radar data is updated much more frequently.</u>

Beginning of a trajectory data file calculated by FMI’s SILAM dispersion model. The file can be input to the VALMA dose calculation model at STUK.

About STUK's end-user applications 4(4):



USVA system:

Both numeric radar data (e.g. rain rates in mm per hour) for the sites of the dose-rate measuring network and a graphical image that can be displayed together with the dose rate map would be useful.

The monitoring stations have also On/Off rain gauges.

USVA system controls the nation-wide automatic dose-rate measuring network ULJAS.

Thank You