



ILMATIETEEN LAITOS  
METEOROLOGISKA INSTITUTET  
FINNISH METEOROLOGICAL INSTITUTE

# **Hands on SILAM: applications implementation 1<sup>st</sup> run**



# SILAM v.5: outlook

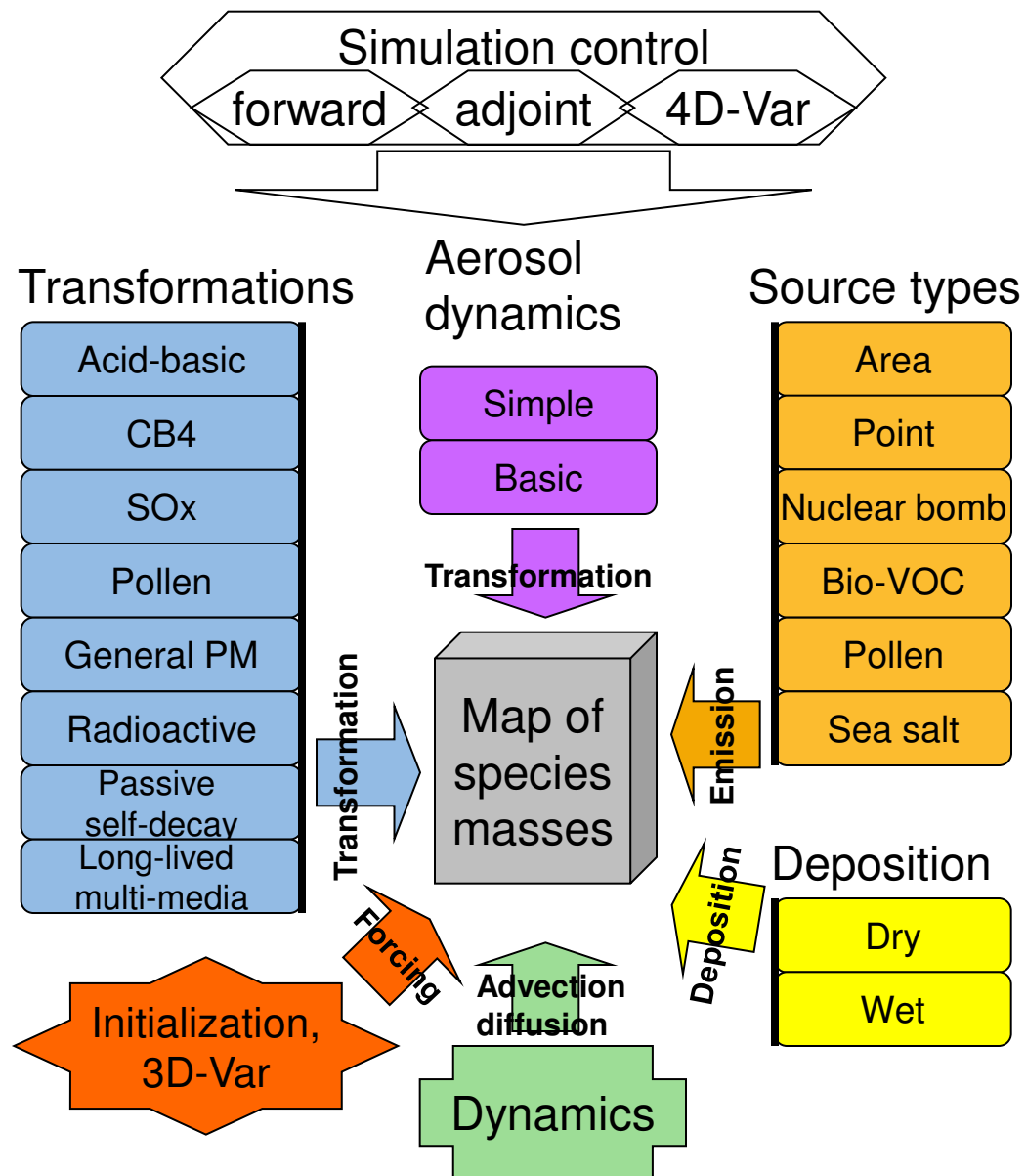


- Modules

- 8 chemical and physical transformation modules
- 6 source terms
- 2 aerosol dynamics
- 3D- and 4D- Var

- Meteo input:

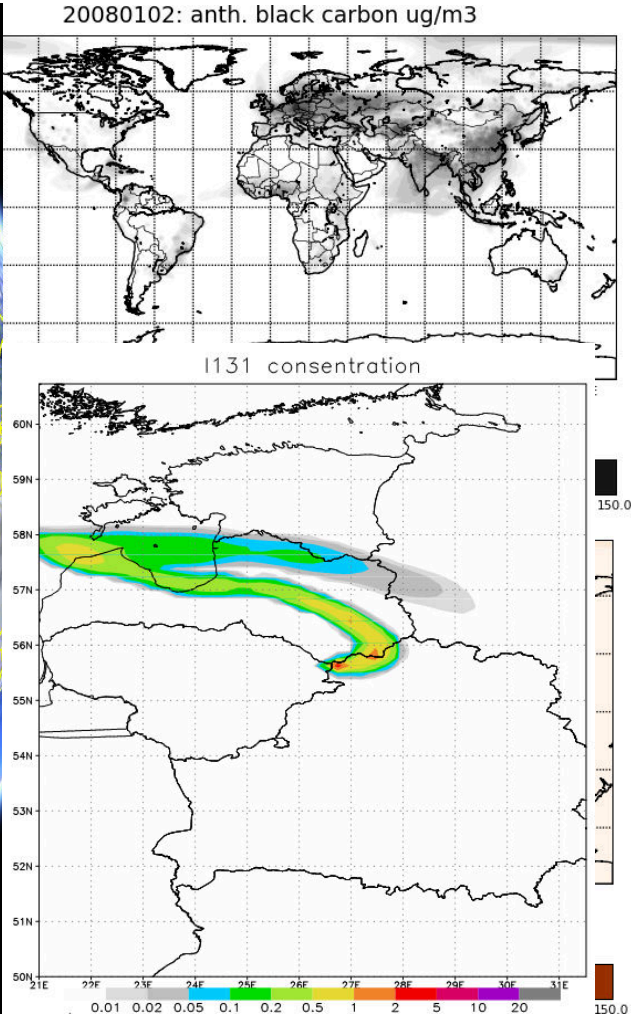
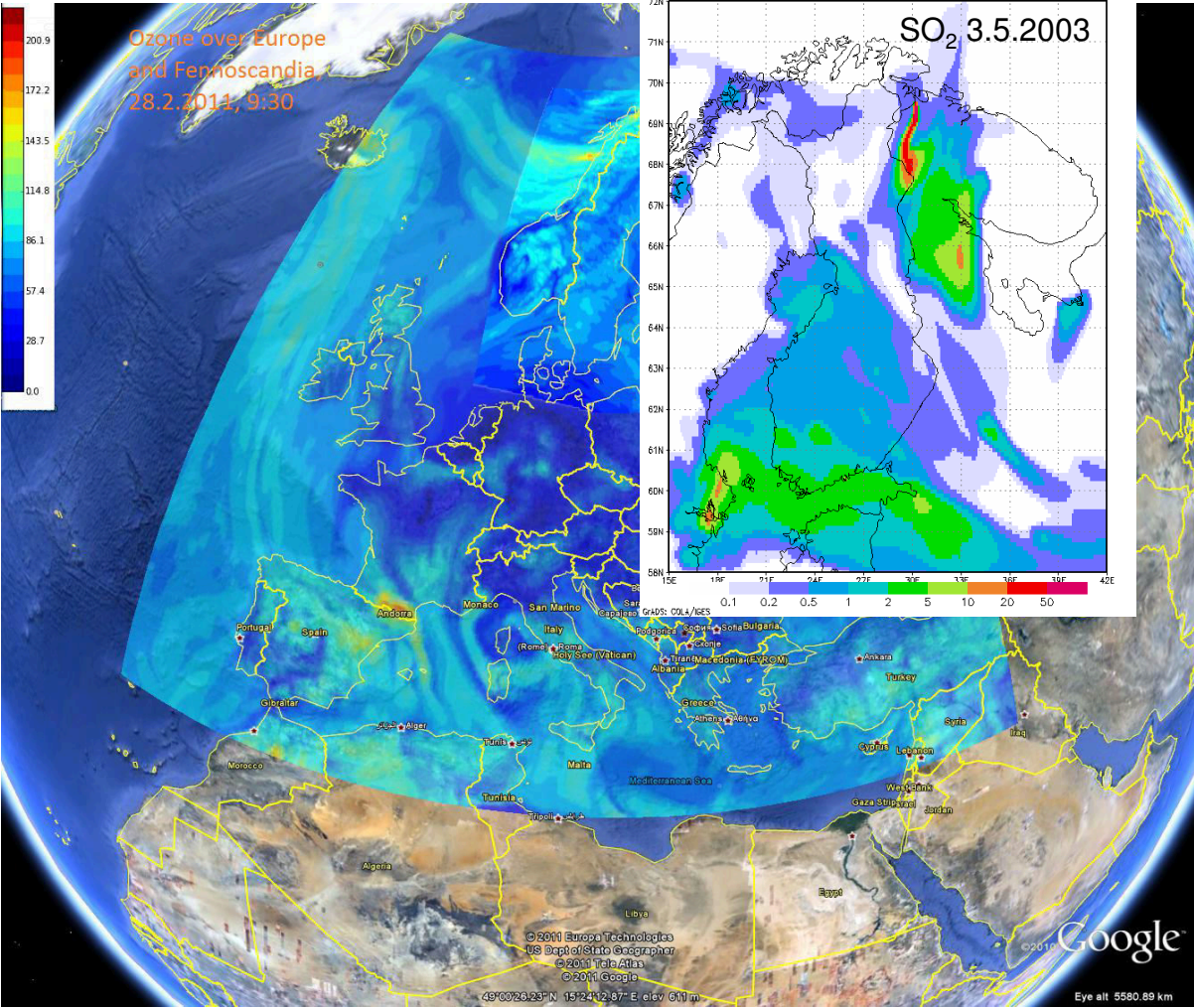
- ECMWF
- HIRLAM, AROME, HIRHAM, ECHAM, and any other who can write GRIB-1 or GRIB-2
- WRF



# SILAM scales



The SILAM model is a chemical transport model, suitable for global, regional (several thousand kilometres) and meso-scale (50-200 Km) simulations



# SILAM application types

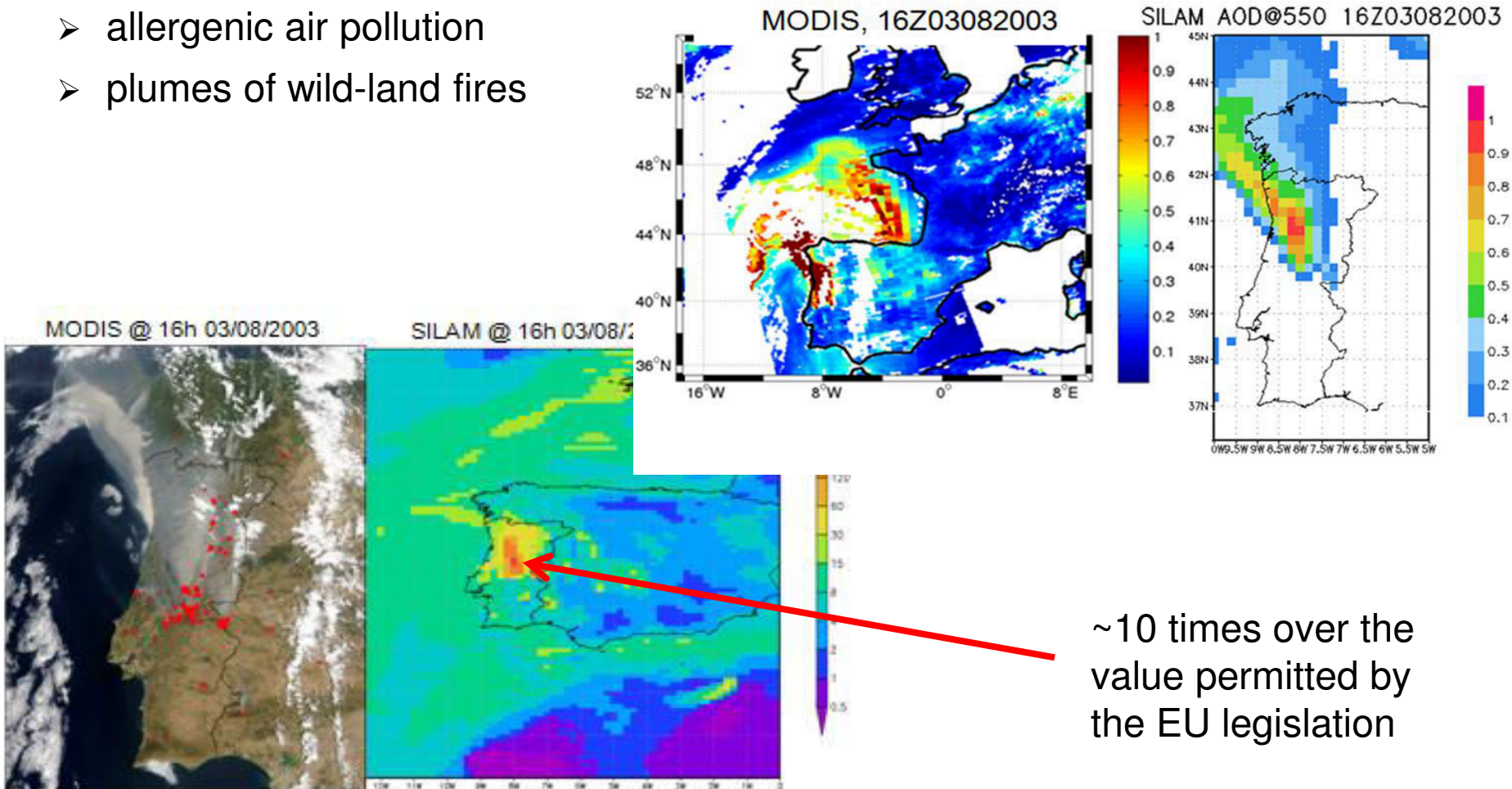


- Short-term forecasting and re-analysis
  - atmospheric chemical composition
  - allergenic air pollution
  - plumes of wild-land fires
- Emergency preparedness
  - nuclear
  - volcanic
- Observational campaign analysis
- Source apportionment studies
  - anthropogenic sources
  - natural sources: allergenic pollen, volcanoes, fires
- Risk assessment
  - chemical
  - nuclear
- Climate change forcing and impact



# SILAM application types

- Short-term forecasting and re-analysis
  - atmospheric chemical composition
  - allergenic air pollution
  - plumes of wild-land fires



# SILAM application types

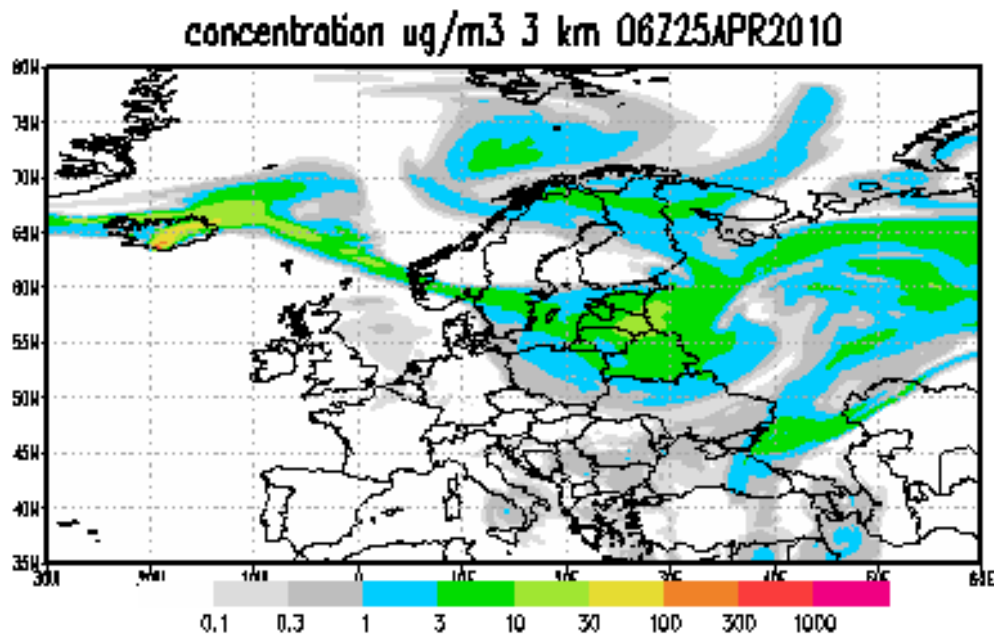


- Emergency preparedness

- nuclear

[http://silam.fmi.fi/internal/russian\\_exercise\\_200706/animations/Loviisa20070613\\_EC\\_Eulerian.html](http://silam.fmi.fi/internal/russian_exercise_200706/animations/Loviisa20070613_EC_Eulerian.html)

- volcanic



# SILAM application types

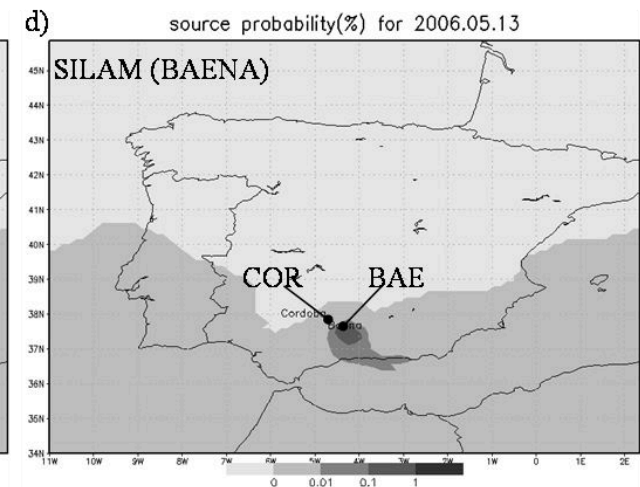
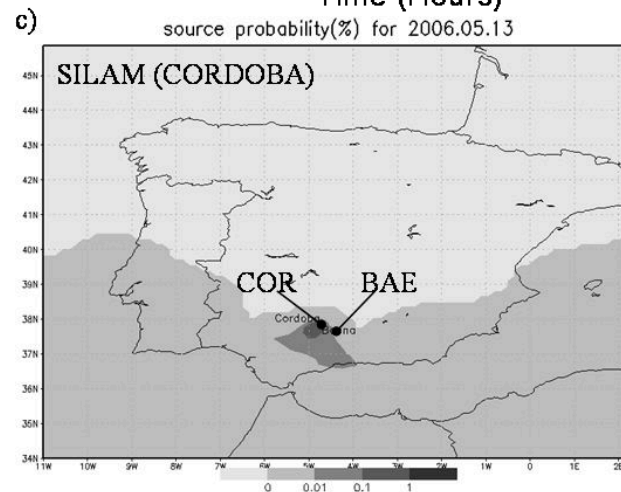
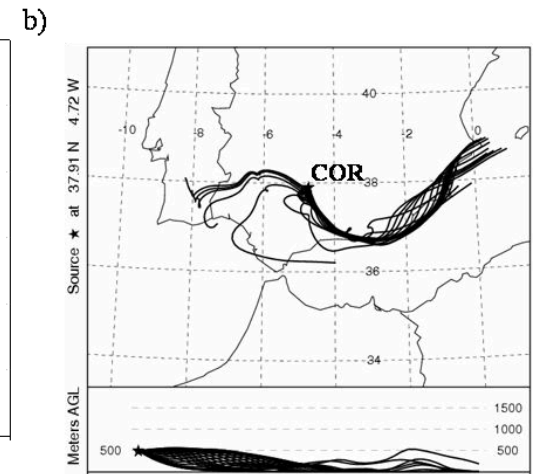
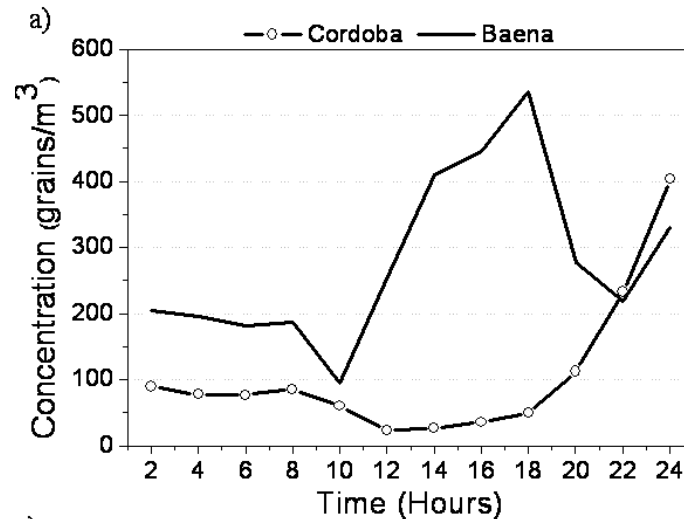


- Observational campaign analysis  
[http://silam.fmi.fi/AQ\\_forecasts/verification/verify\\_PM10.kml](http://silam.fmi.fi/AQ_forecasts/verification/verify_PM10.kml)



# SILAM application types

- Source apportionment studies
  - anthropogenic sources
  - natural sources: allergenic pollen, volcanoes, fires







# SILAM application types

- Risk assessment

- nuclear

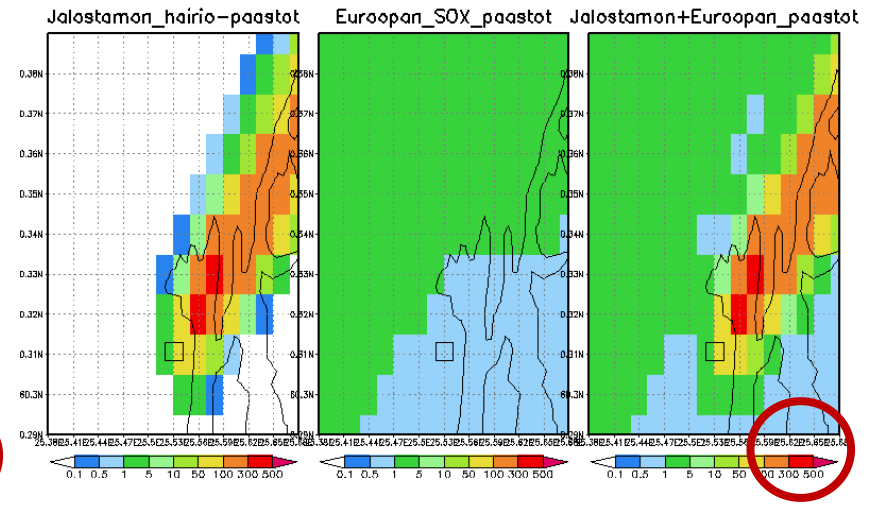
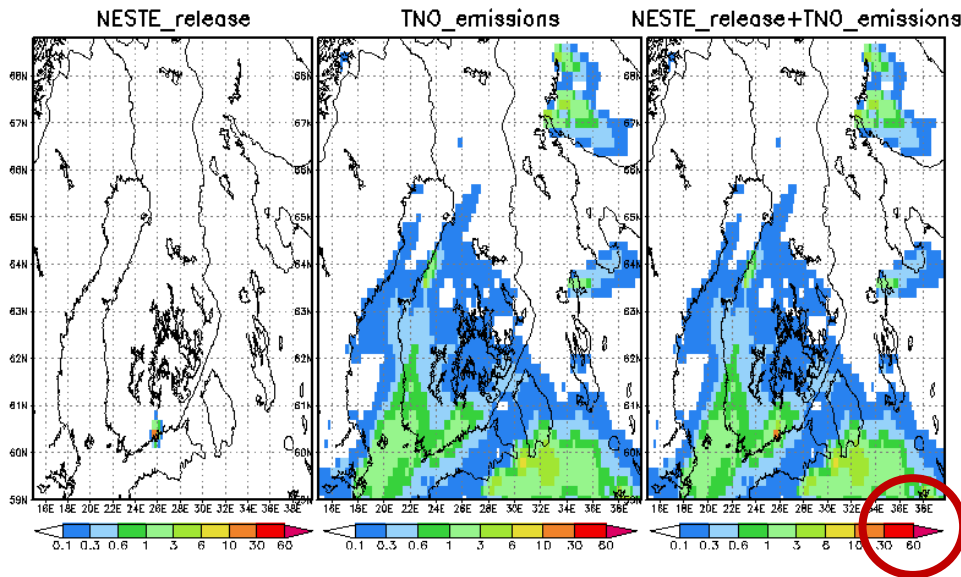
<http://en.ilmatieteenlaitos.fi/japan>

- chemical

Impact of an uncontrolled release on the surroundings of the stack:  
consequence of data resolution on the assessment - 20km vs. 2km

cnc\_so2, ugS/m3, 07Z15JUL2009

pitoisuus\_so2, ugS/m3, 07Z15JUL2009



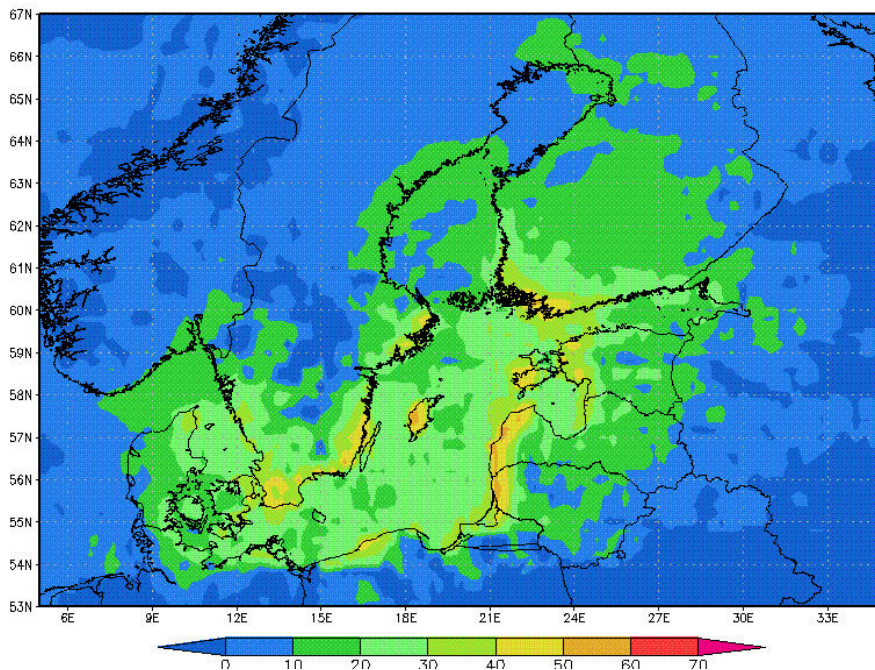


# SILAM application types

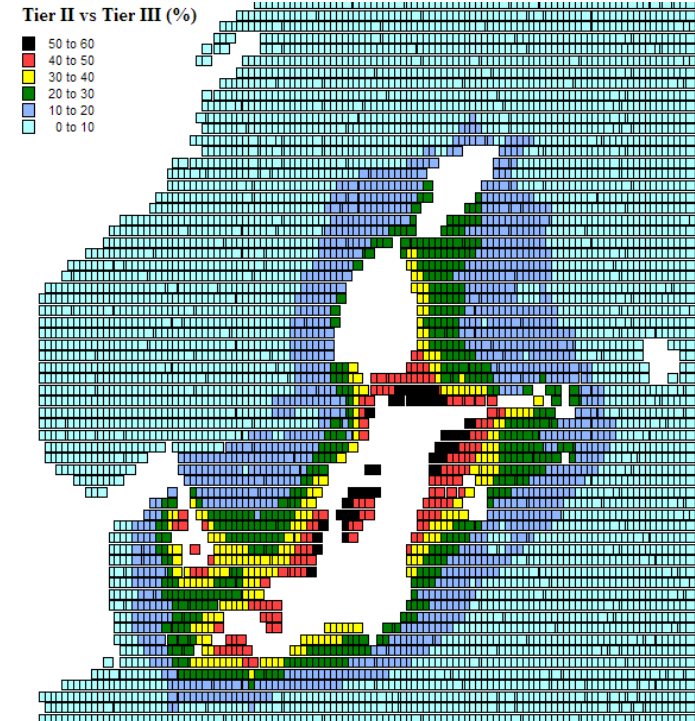
- Climate change forcing and impact

Tier II vs. Tier III

Impact on  
ecosystems  
(N deposition)



Impact on  
human health  
(N concentration)



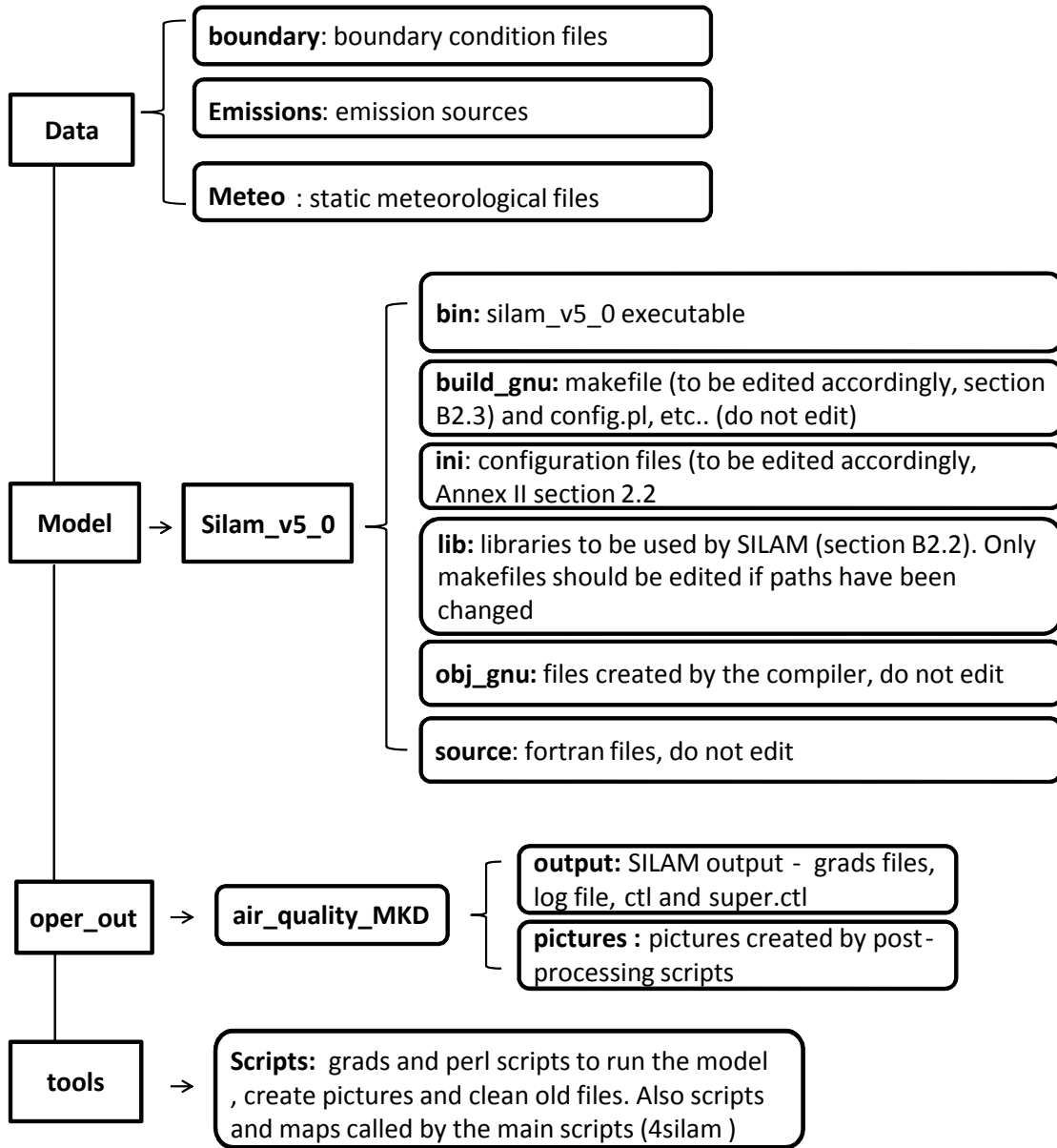
# FMI regional AQ assessment and forecasting platform



# SILAM's structure and settings

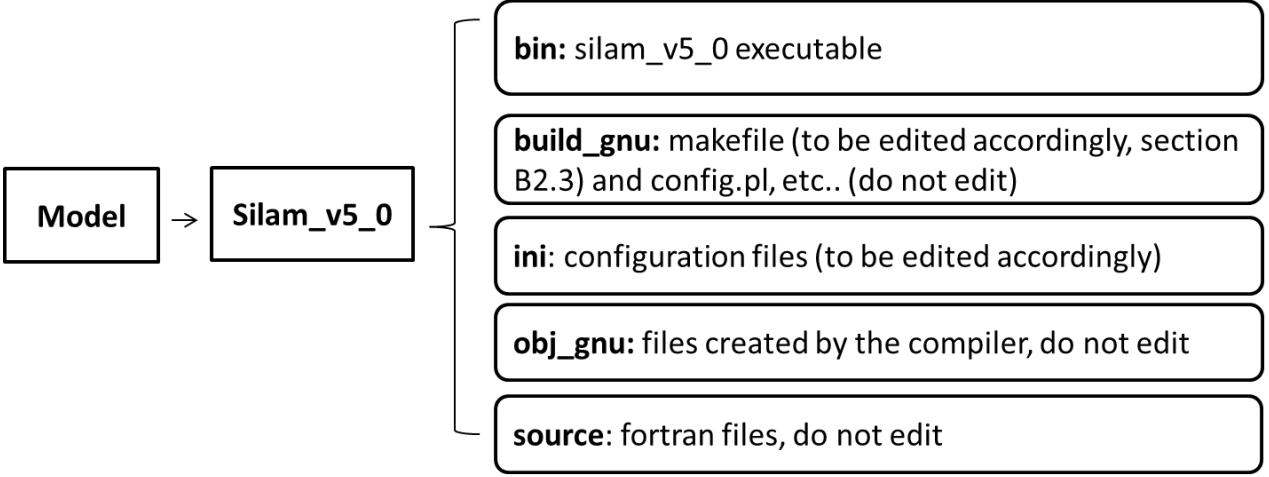


/home/silam/

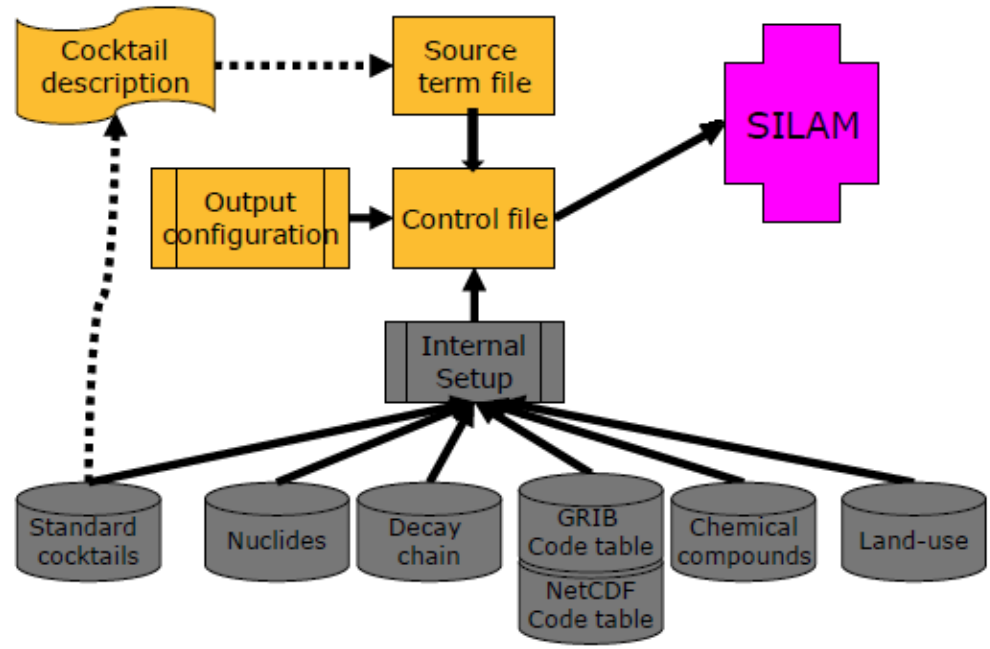




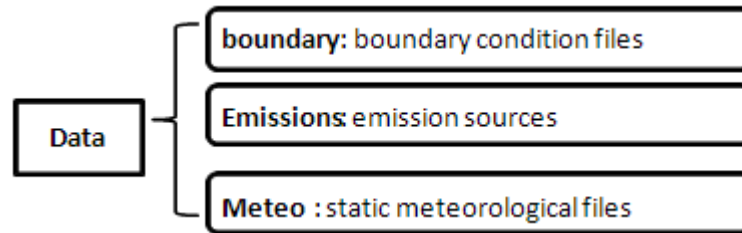
# Model: Configuration files



- Control file
  - Link between the model and all the configuration files
- Source file
- Output configuration
- Internal setup of the model (non-editable)



# SILAM's structure and settings



- **Boundary conditions:**

provides the concentrations at the limits of the domain, so that the edges of the domain have a non-zero concentration (closer to reality)

- **Emissions:**

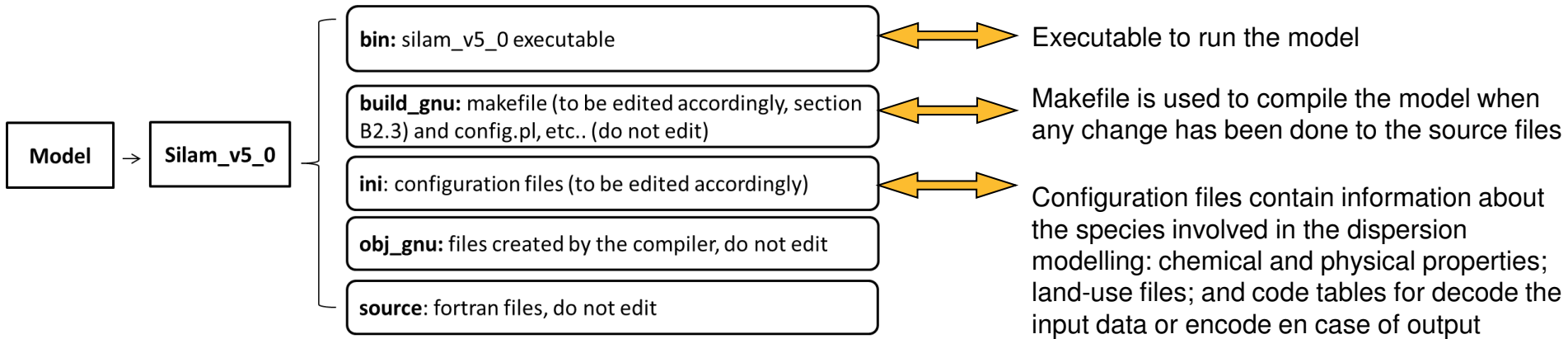
- ASCII files with typical SILAM area (ext: .sa/p.sa) or point source (ext: .p) format for different species (NO<sub>x</sub>, SO<sub>x</sub>, PM, etc)
- Salinity maps for sea salt emissions to be computed and sea-salt mapping is needed

- **Meteorological files:**

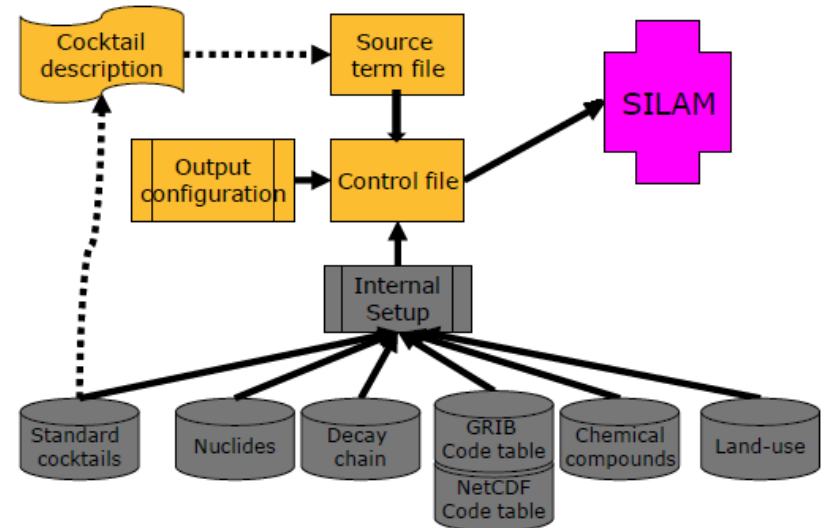
- Static (not time-dependent) files: land-use and geopotential height maps
- Dynamic (time-dependent)



# SILAM's structure and settings



- Control file (created daily by the autorun\_SILAM script)
  - Defines the settings of the run
  - Link between the model and all the needed configuration files and source file
- Typically, the internal set-up file is edited when paths for the files have been changed.
- Files called by the internal set-up are generally not edited. Standard cocktails can be changed if the user requests a different composition of the mixture being dispersed or different distribution of aerosol sizes



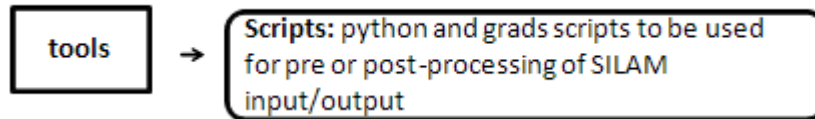
# SILAM's structure and settings: output



- Type of files (defined by control file)
  - grads, log, ctl and super\_ctl files
  - netcdf
- Gases, primary and secondary aerosols (defined by output file)
  - per specie, per vertical layer
  - emissions (kg /s.m<sup>3</sup>)
  - concentrations (particles - Kg/m<sup>3</sup>, gas - mol/m<sup>3</sup>)
  - Deposition: wet and dry deposition (kg/s.m<sup>2</sup>)
- Meteorological parameters: 2D and 3D (defined by output file)



# SILAM's structure and settings: tools



- How to run scripts or executables:
  - ./executable or <script with executable path inside, e.g. script.sh>
  - gradsnc <script.gs>
- Scripts :
  - Data downloading: meteo
  - Running the model: control file generator & set model run (e.g. autorun\_SILAM, autorun\_SILAM\_backup)
  - Sum up of species for total PM: make\_TPM.gs
  - Draw pictures: make\_pictures
  - Clean up old files: meteo and model runs (clean\_silam\_old\_files)

# Scripts (general ideas)



- To make a program executable:
  - `chmod +x <script>`
- How to run scripts or executables
  - `./executable`
  - `./<script with executable path set on the first line of the script - a Unix/Linux request- e.g. #!/script.sh or #!/usr/bin/perl`
  - `perl <script.pl>`
  - `gradsnc <script.gs>`
  - Running the scripts can have many options to control execution of the program (e.g.):
    - `-w` – turns on warnings
    -

# SILAM v.5: outlook



## External input data required:

- Meteorology
- Land-use
- Emissions

## Other requirements:

- Computer and human resources
- Compromise between chemistry and physical processes complexity (no. compounds)
- Refinement of the horizontal and vertical resolution of the dispersion and output grid.
- Compromise between temporal and spatial scales.