



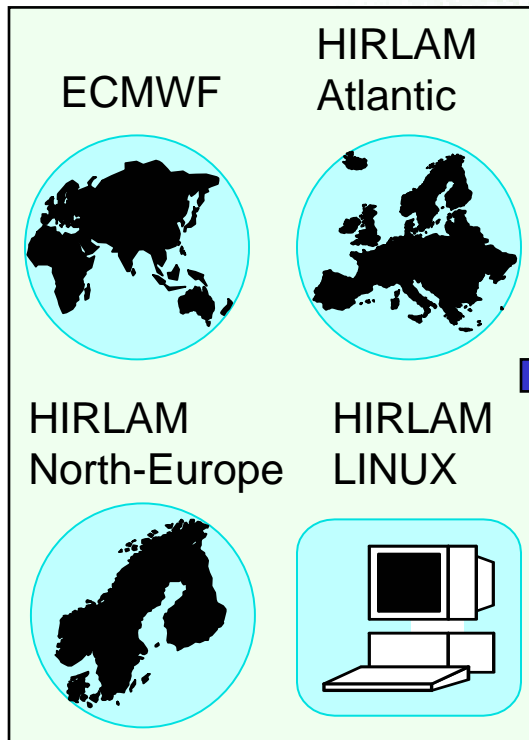
ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

FMI dispersion modelling systems

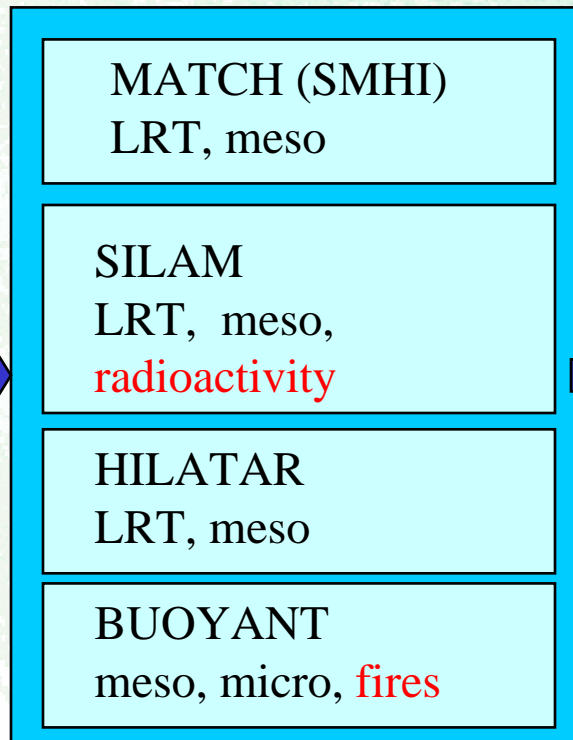
Air Quality Research

Modelling system - FMI

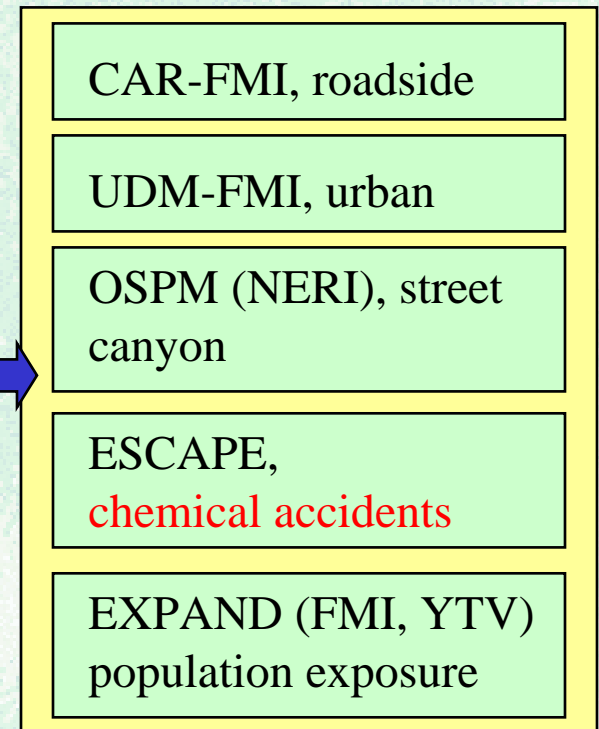
Weather prediction models



Dispersion models - long-range, regional



Dispersion and effects models – urban, local



Process models

MONO32 (U Helsinki, Stadia)
aerosol processes



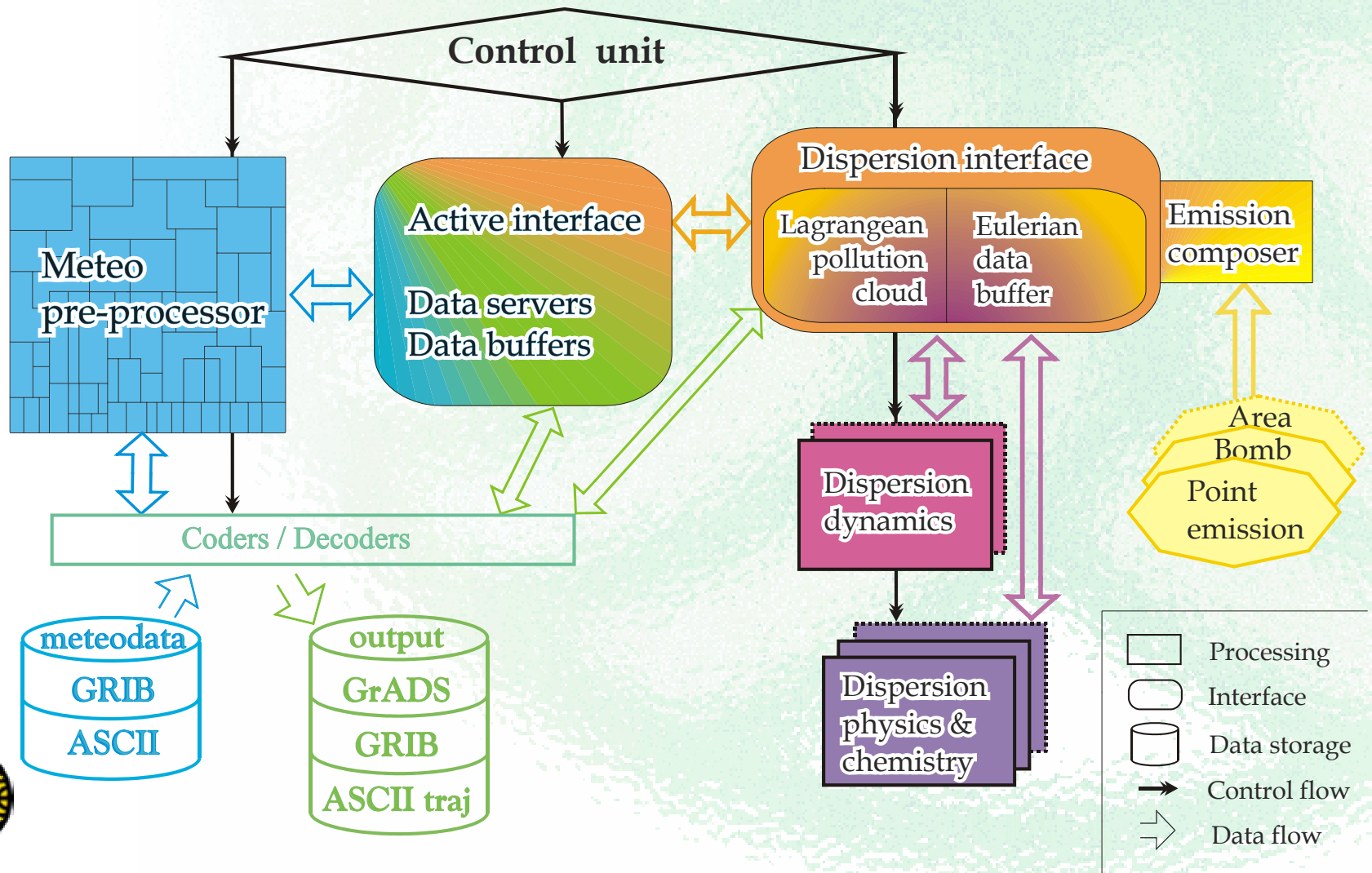
Regional and large-scale models

- SILAM (Sofiev *et al.*, submitted)
 - Regional; Lagrangian; PM, ~500 radioactive nuclides, pollen, probability
- MATCH (SMHI) (Robertson, *et al.*, 1999)
 - Regional; Eulerian & Lagrangian; SO_x, NO_x, NH_x, O₃, VOC, PM
- HILATAR (Hongisto *et al.*, 2004)
 - Regional-to-hemispheric; Eulerian; SO_x, NO_x, NH_x O₃ (crude), PM, aerosol-based and long-living toxic metals and organics
- DMAT
 - Regional-to-hemispheric; Eulerian; SO_x, NO_x, NH_x O₃ (crude), PM, aerosol-based and long-living toxic metals and organics



Meso-to-regional modelling system

SILAM



Evaluation of SILAM against data

- ETEX experiment,
- ENSEMBLE & NKS model inter-comparisons,
- mid-term PM deposition from Estonia (on-going)

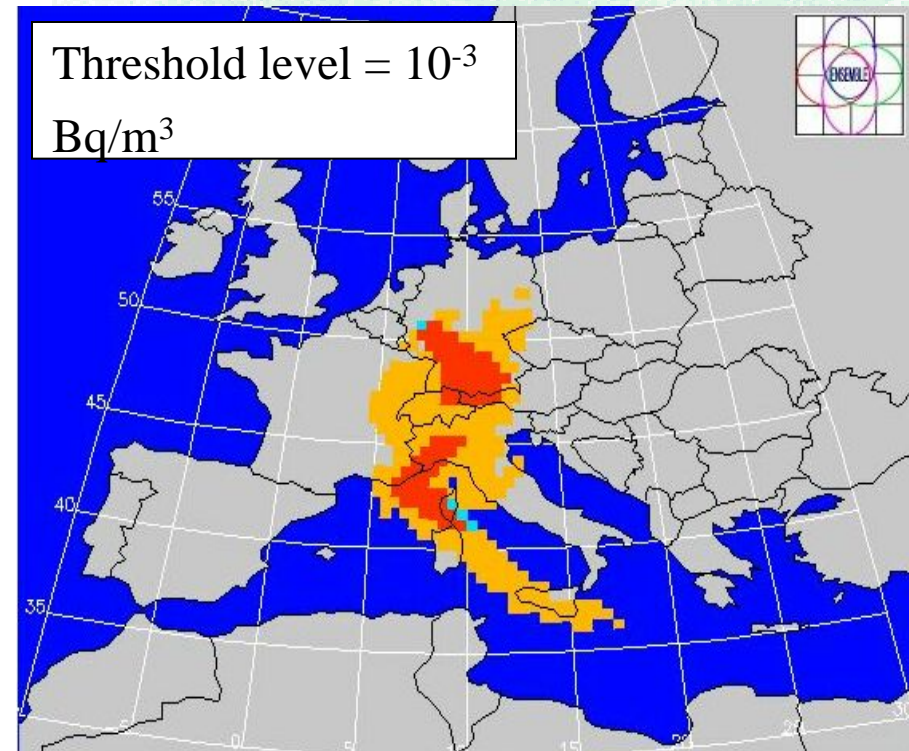
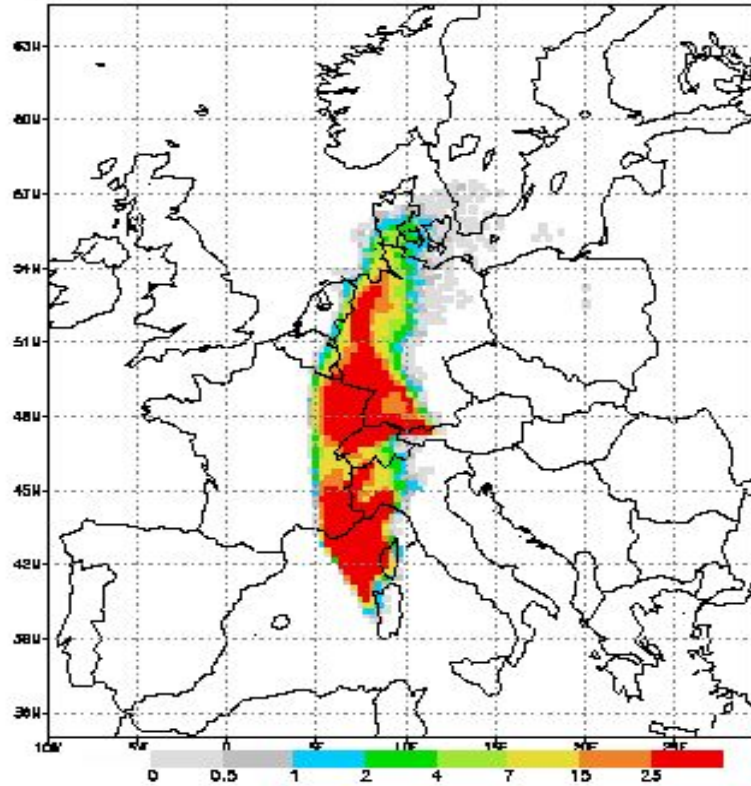
On-going or planned applications

- emergency applications
- PM transport over Europe and Finland
- biomass emission and transport (pollen)
- biomass burning (forest fires)
- data assimilation, inverse studies (source apportionment)
- dispersion and deposition of PM from Estonian power plants



SILAM

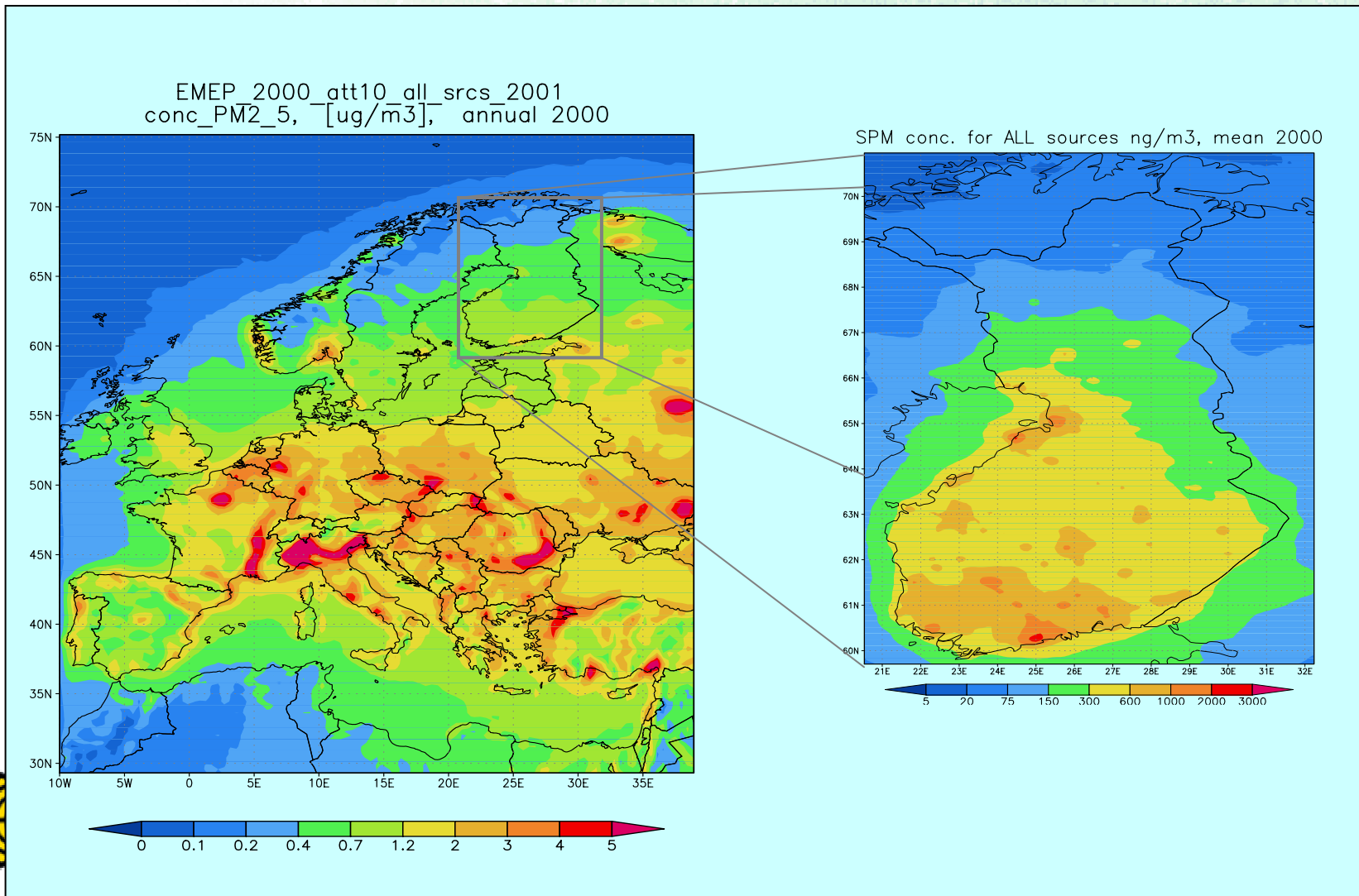
Areas of risk part/100km², time 12Z05DEC20D2



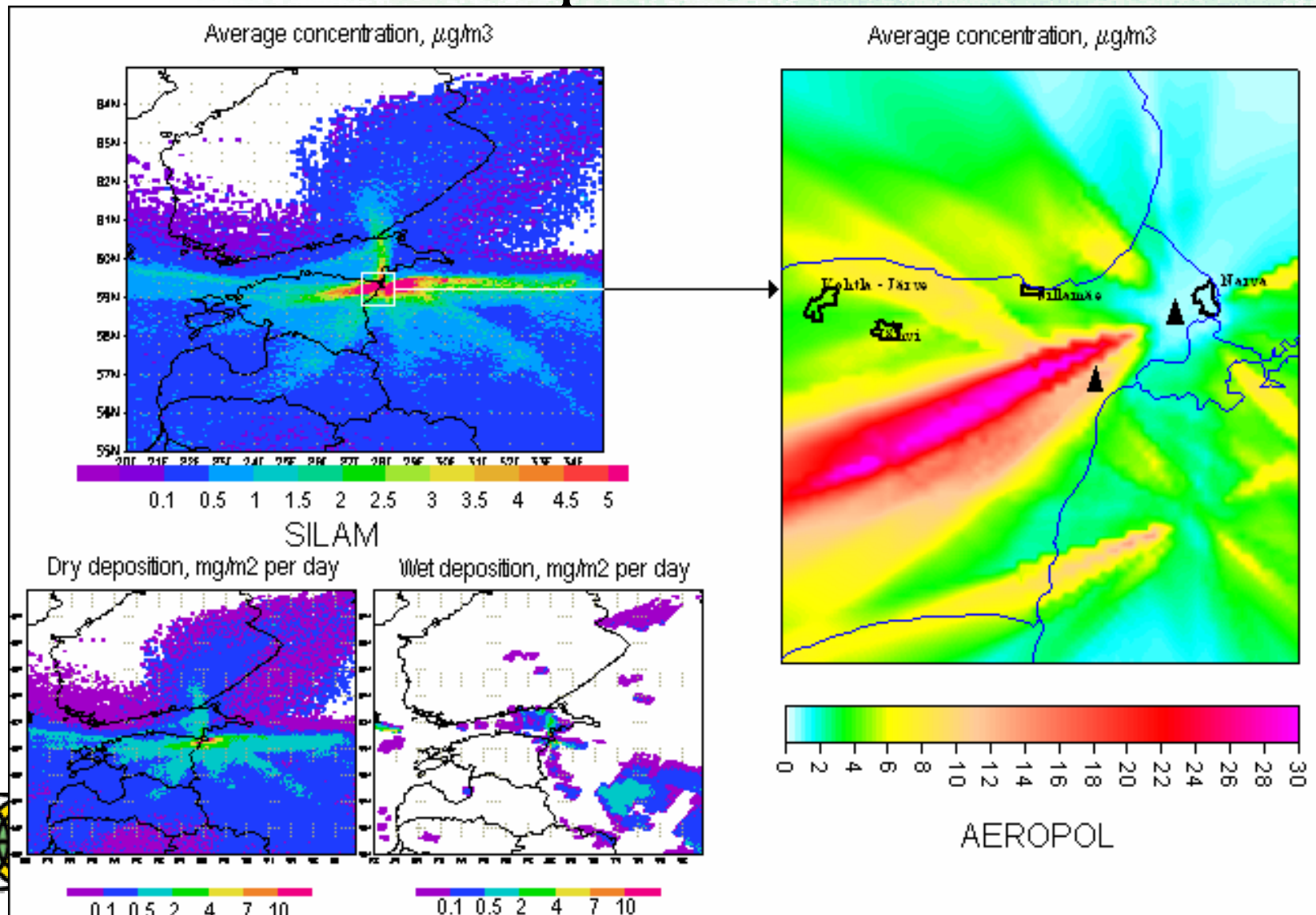
Oletetun onnettomuustilanteen simulaatio SILAM mallilla (vasen kuva), verrattuna Ruotsin, Norjan, Tanskan ja Englannin ilmatieteen laitosten mallien vastaaviin ennusteisiin (oikea kuva).



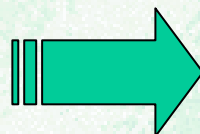
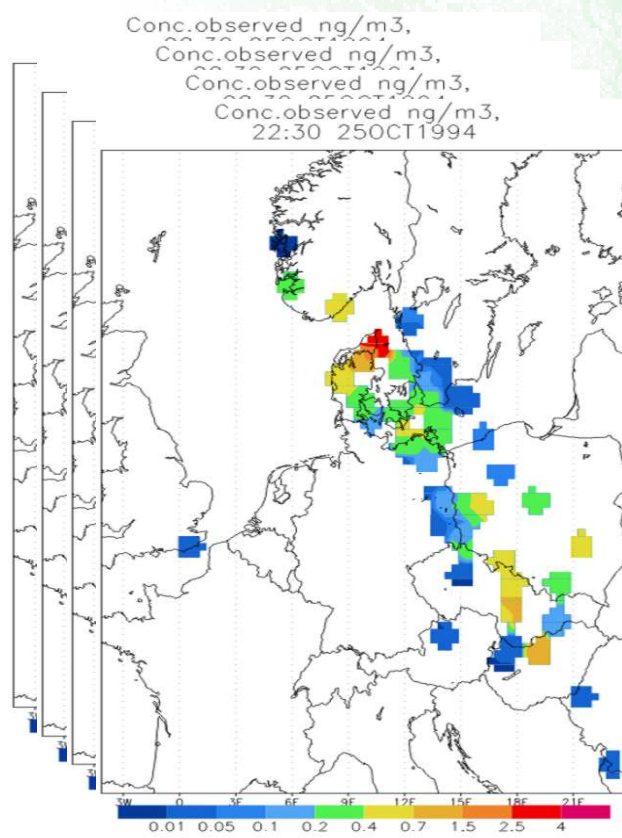
PM 2.5 from European and Finnish sources, mean 2000



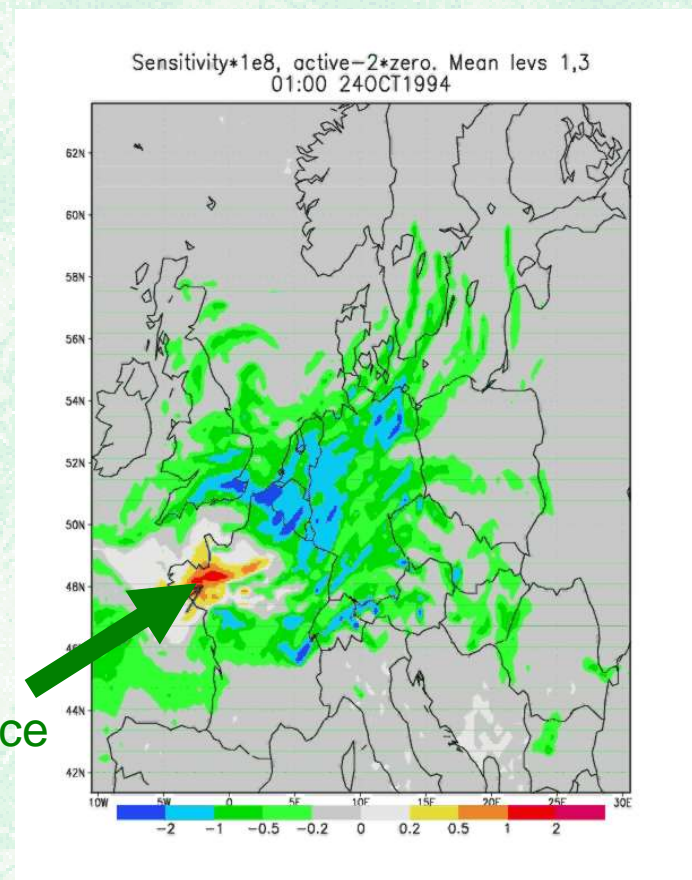
Alcaline dust from Estonian power plants



Inverse problem solution with SILAM



True source
place

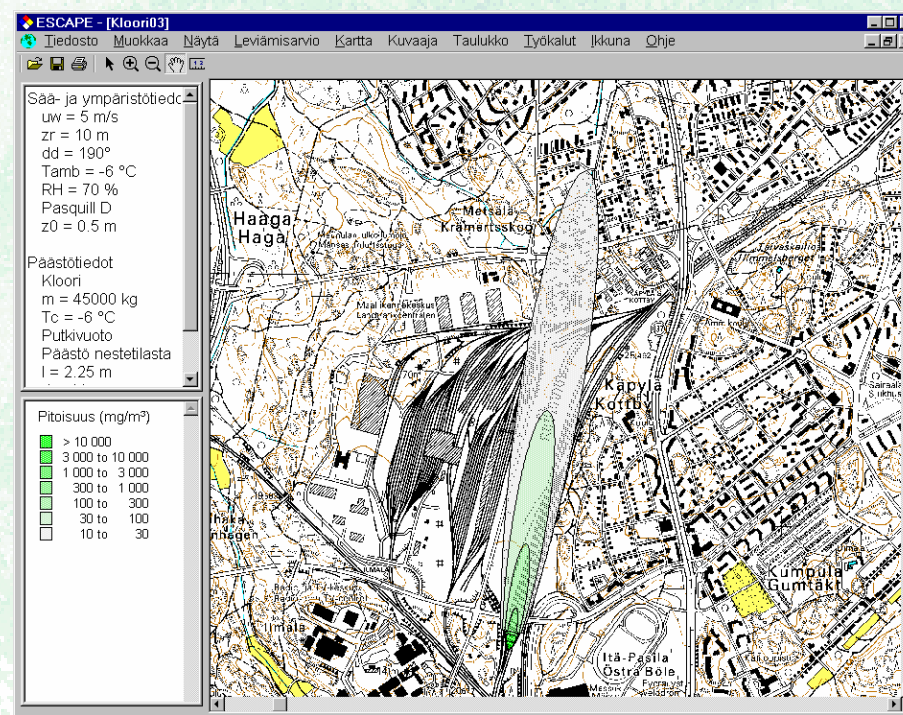
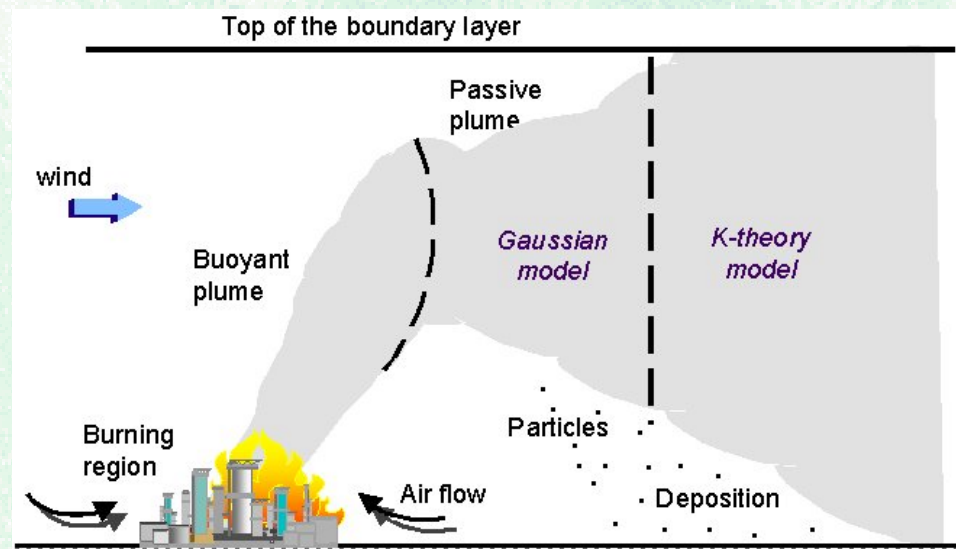


European Tracer Experiment ETEX-1. Left panel: observations [ng m^{-3}];
right panel: probability density for the source location [m^{-2}]



BUO-FMI –malli (Dispersion from Strongly Buoyant Sources – Finnish Meteorological Institute)

- Arvioi paloissa syntyvien savukaasujen ja hiukkasten leviämistä.
- Liitetty savukaasujen nousulisää kuvaava virtausmalli.
- Tuloksina saadaan mm. pitoisuudet kartalla
- Voitaisiin käyttää yhdessä myös SILAM:in kanssa.



Scope of the BUO-FMI model

- local scale ($\sim 20 - 30$ km)
- continuous, steady-state release
- homogeneous terrain
- no wet deposition



Laskentaohjelmisto
kemikaalionnettomuuksien seurausten
arvioimiseksi

ESCAPE

An Expert System for Consequence
Analysis using a Personal Computer

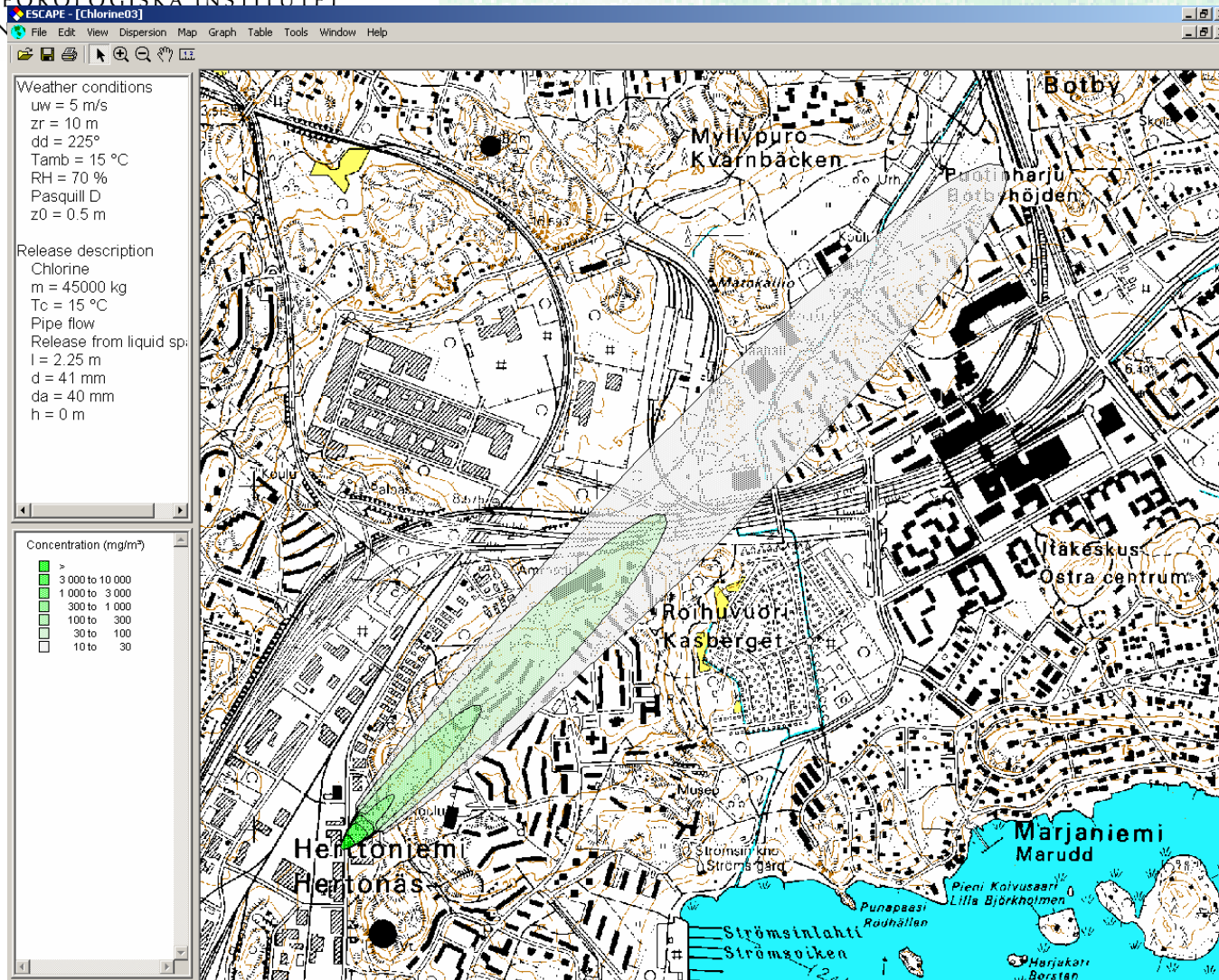


ESCAPE –ohjelmisto sisältää fysikaalis-kemialliset ominaisuudet seuraaville aineille (32 kpl)

Akrylonitriili	Fosgeeni	Pentaani
Akryylihapo	Freon 12	Propaani
Ammoniakki	Heksaani	Propyleenioksidi
Asetoni	Hiilidisulfidi	Rikkidioksidi
Asetonitriili	Hiilitetrakloridi	Rikkivety
Bentseeni	Isobutaani	Rikkiatrioksidi
Bromi	Kloori	Tolueeni
Butaani	Kloorivety	Vetyfluoridi
Butadieeni	Kumeeni	Vetysyanidi
Etaani	Metaani	Vinyylkloridi
Etyleenioksidi	Metanoli	

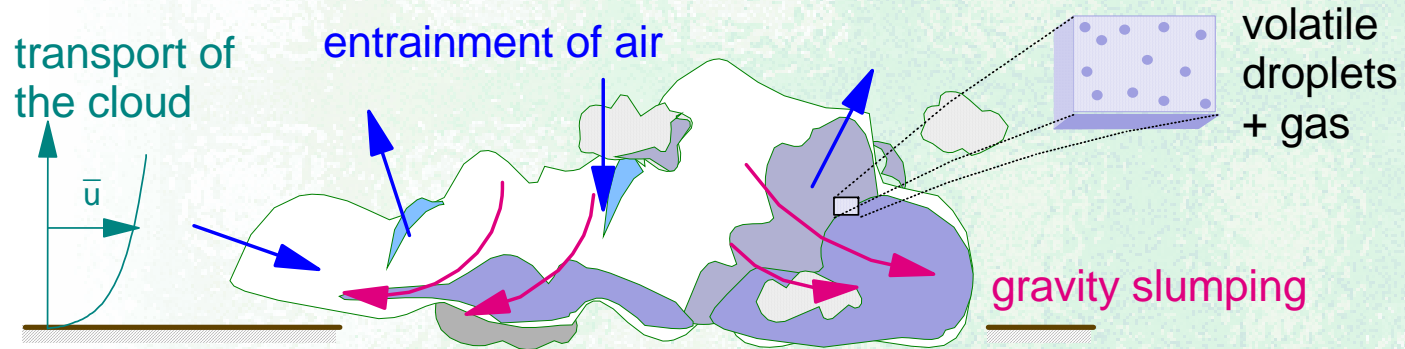
Käyttäjä voi lisätä aineita verrattain helposti ohjelmiston ainetietokantaan (CHEMIC-malli).





Example results of the Windows 95 ESCAPE application: gas plume formed in a conceived release of liquified chlorine from a ruptured pipe (map (©) Karttakeskus).

The model AERCLOUD



- Describes the nonequilibrium thermodynamics of a multicomponent aerosol cloud
- Includes a detailed mathematical description of the mass and heat transfer processes from the droplets into the gas



Atmospheric Dispersion of Chemical Warfare Agents in Accidental Releases from Warehouse Fires

(MATINE)



Seven Declared CW Storage Sites in Russia

Storage site	Percentage of CW stock	VX	Sarin	Soman	Yperite	Lewisite	Yperite/Lewisite mixture	Phosgene
Pochep, Bryansk oblast	18.8	x	x	x				
Maradikovsky, Kirov oblast	17.4	x	x	x			x	
Leonidovka, Penza oblast	17.2	x	x	x				
Shuchye, Kurgan oblast	13.6	x	x	x				x
Kizner, Udmurtia Republic	14.2	x	x	x		x		
Kambarka, Udmurtia Republic	15.9					x		
Gorny, Saratov oblast	2.9				x	x	x	

Source: Russian Federation, Conception: Destruction of Chemical Armament (draft), 1994, p. 5

