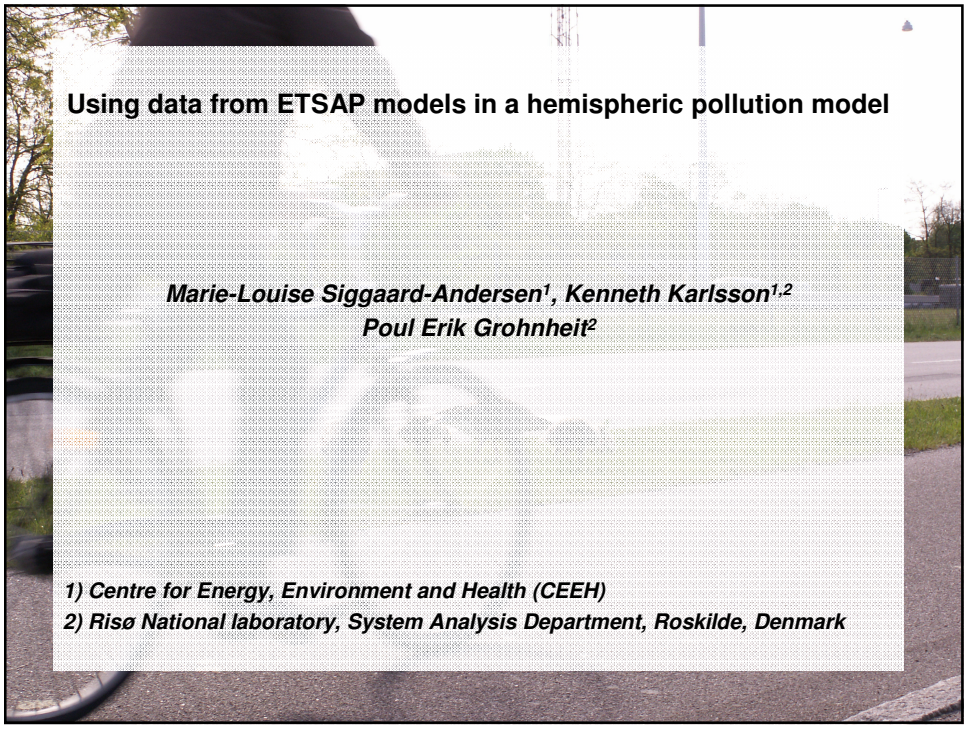

Using data from ETSAP models in a hemispheric pollution model

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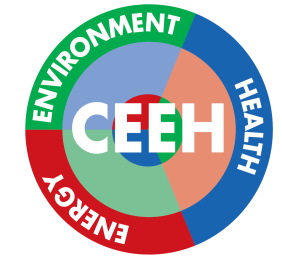

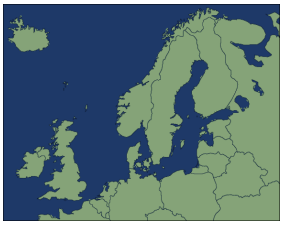

A new Danish research center

Establishing an interdisciplinary based system to support optimal future planning of energy production and usage in Denmark

Including costs related to the natural environment and human health

Focusing on Denmark and the Nordic countries

Centre for Energy, Environment and Health

Centre Partners – 7 different Danish institutes

Earth and Planetary physics (Niels Bohr Institute, University of Copenhagen)
Danish Meteorological Institute (DMI)
National Environment Research Institute (NERI) (University of Aarhus)
National Institute of Public Health (NIPH) (University of Southern Denmark)
Risø National Laboratory (Technical University of Denmark)
Centre for Applied Health Services Research and Technology Assessment (CAST) (University of Southern Denmark)
Institute for Public Health (University of Aarhus)

Disciplines

Systemanalysis science	**Medical science**	**Statistics**	**Meteorology (physics, chemistry)**

Centre for Energy, Environment and Health

Collaboration partners

Dong Energy (Denmark)
University of Queensland (Australia)
Freie Universität Berlin (Germany)
Finnish Meteorological Institute
International Institute for Applied Systems Analysis (Laxenburg, Austria)
CEREA (Marne la Vallét, France)
Los Alamos Laboratory (New Mexico, USA)
University of Cologne (Germany)
Energy Research Centre of the Netherlands
University of Leicester (UK)
VITO (Boeretang, Belgium)
ENEA (Rome, Italy)
ICMMG (Novosibirsk, Russia)
Vienna University of Technology (Austria)
RIVM (Bilthoven, Netherlands)
Institute of North Ecology problems (Russia)
University Medical Centre, ERASMUS MC, (Netherlands)

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Components

Energy-system models

(e.g. Balmorel and MARKAL-TIMES / TIAM)

Danish Atmospheric Chemical Transport models

(DEHM, Enviro-Hirlam, and more)

Physiological relationships (dose-response functions)

Statistical models

(exposure vs frequency of decease and environmental effects)

Health cost models (e.g. prizes for one life-year)

Modelsystems (e.g. EVA = Economic Value of Air pollution)

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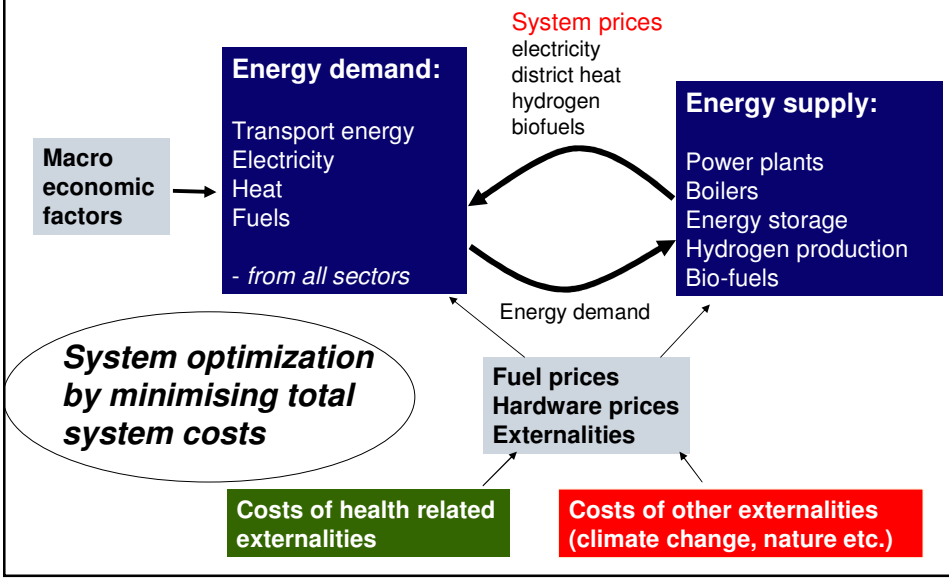
Energy System Modelling – 2005 to 2050



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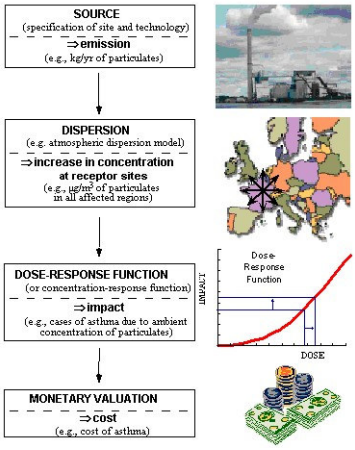
Assessments of air pollution related damages on human health - and the subsequent costs

Based on ExternE

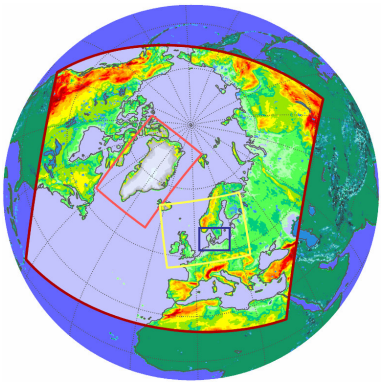


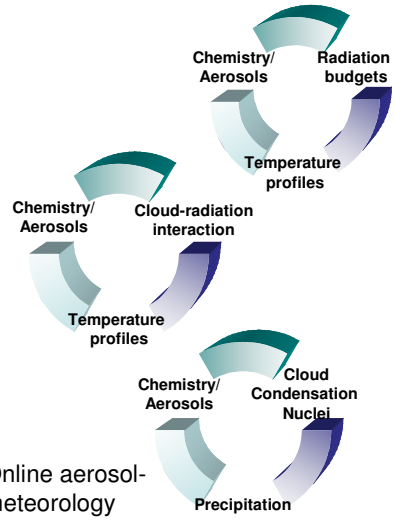
In CEEH

- Geographical distributions of all emissions including traffic
- Using advanced Atmospheric Chemical Transport models
- Quantifying toxicological effects
- Using registers of the population and health
- Quantifying the health impact of pollutants on a macro-scale level to set up health cost functions

Enviro – HIRLAM air pollution modelling

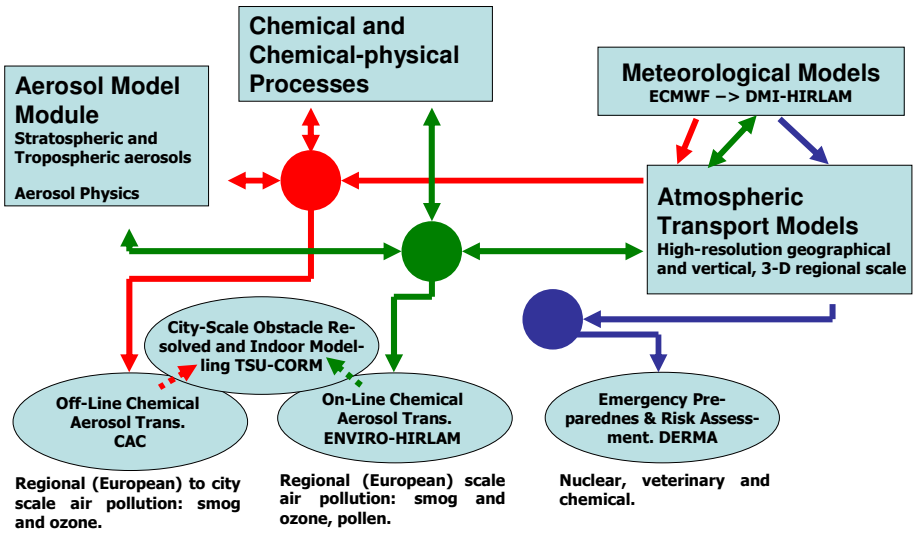
Operational areas covered by the Enviro – HIRLAM system today:
50x50km horizontal down to 1.4x1.4km for Denmark.
Vertically it goes into the stratosphere



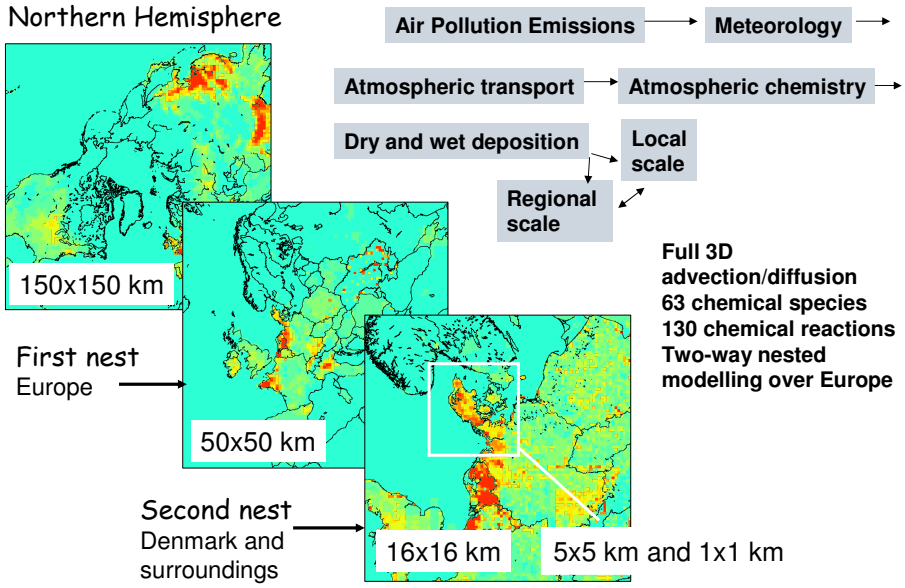


Online aerosol-meteorology interaction

Air Pollution Modeling sceme



Danish Eulerian Hemispheric Model System (DEHM)



Economic Value of Air pollution (EVA)

A new integrated model system
Uses the DEHM air-pollution model on a regional scale
Local modeling based on a smoke-fan model
Estimating local concentrations
Uses meteorological data, population data, dosis response functions, cost functions
Can run with various emission scenarios and for different years
Enables changes/additions of dose-response functions and cost functions without repetition of transport/chemistry modelling

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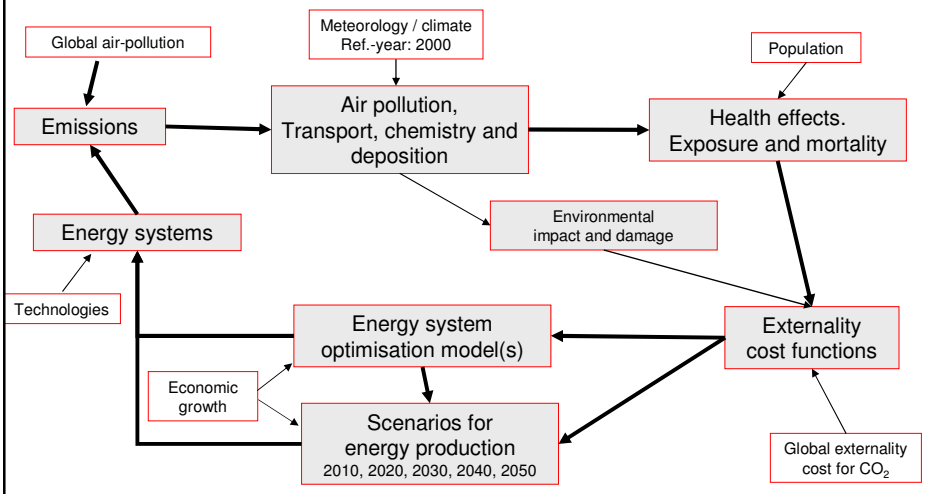
CEEH Model flow diagram



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To summarize

Boundary conditions:

Global scale
- Energy scenario
- Air pollution
- CO_2 costs
- Climate + meteorology

CEEH – Machine:

Energy system models

Advanced air pollution models

Detailed knowledge about effects on human health and related costs

Base-line definition:

Geographical mapping
- Energy systems
- Air pollution (incl. transport)
- Population
- Meteorology

Supporting system for polecymakers to define the optimal danish energysystem

Thank you for listening

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Product

An integrated regional economic model system including components for air pollution chemistry and dispersion down to urban and sub-urban scales.

Model components of the impacts on public health and the external environment.

The system will be designed to minimize the grand costs of Danish energy system.

Boundary conditions will be obtained from a global and regional energy system model and from a global air pollution model.

Global energy and emission scenarios, supplying boundary conditions to the regional and local models, we focus on the Markal family of models and relevant projects (such as NEEDS).

Emissions

EDGAR (1° x 1°) (SO_2, NO_x, VOC, CO, 1990,1995)

JRC/IIASA (1° x 1°) (SO_2, NO_x, VOC, CO, 1990,1995,2000,2010bau, 2010mfr,2020bau,2020mfr)

EDGAR-HYDE (1° x 1°) (SO_2, NO_x, VOC, CO,NH_3, 1890-1980, 10 years interval)

EMEP (50 km x 50 km for Europe) (SO_2, NO_x, VOC, CO,NH_3, PM, 1985-2020)

GENEMIS (16.67 km x 16.67 km for Europe) (SO_2, NO_x, VOC, CO,NH_3, 1994)

Denmark data (1 km x 1 km) (NO_x, NH_3, 1989-2004)

GEIA (1° x 1°) (NH_3, Soil NO_x, NO_x lightning, Black Carbon)

GEIA/AMAP (1° x 1°, 0.5° x 0.5°) (Hg, 1995,2000)

Speciation based on the old EDGAR speciation

All emission categorized in 13 SNAP categories

Each SNAP category have own temporal (monthly, weekly, daily variations) and vertical distribution