

BALT-HYPE:

A Tool For High Resolution Hydrological
Modelling of Climate Change and
Nutrient Reduction Scenarios

Chantal Donnelly, Johan Strömqvist, Wei Yang,
Charlotta Pers, Jörgen Rosberg, Joel Dahne and
Berit Arheimer



Cyanobacteria bloom in Baltic proper, Summer 2005

Objectives:

Provide a modelling tool that

- Calculates water runoff quantity and nutrient concentration to the Baltic Sea, on a daily timescale, and at a high spatial resolution
- Calculates water runoff quantity and nutrient concentration, on a daily timescale, and at a high spatial resolution within the catchment area, e.g. for groundwater, rivers and lakes
- Can be used for modelling of both climate change and nutrient reduction scenarios (operational model)
- Uses quality-assured historical and forecast data, assessments and analyses at different resolutions scaling from local to pan-european level.

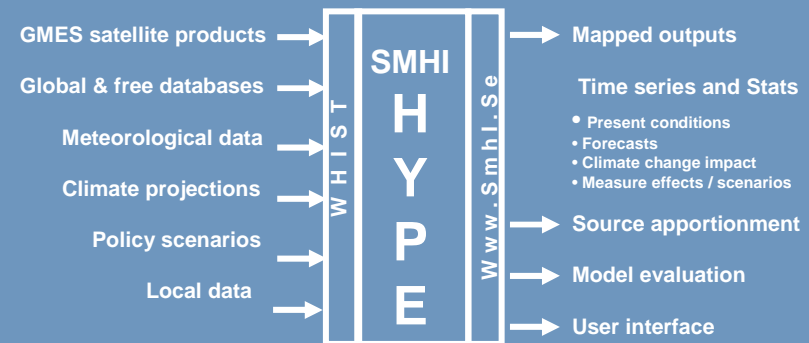
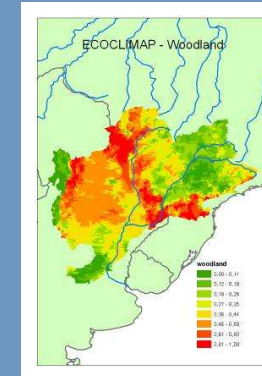
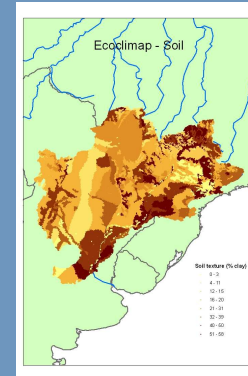
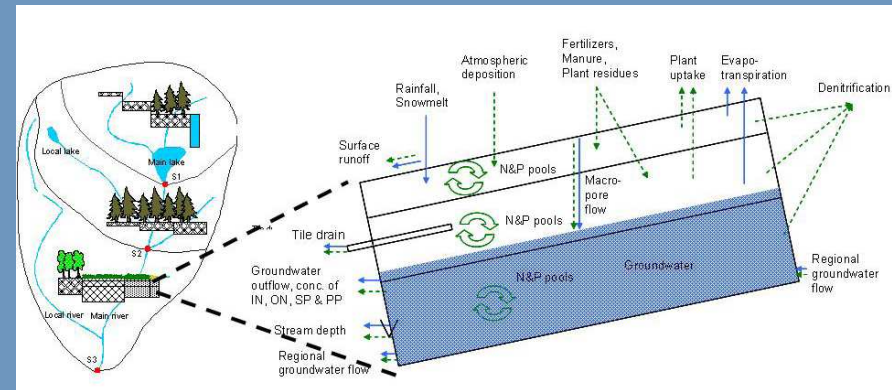
BALT-HYPE model domain



INPUT DATA, CALIBRATE AND MODEL *HOMOGENOUSLY* OVER THE ENTIRE MODEL DOMAIN

What is required?

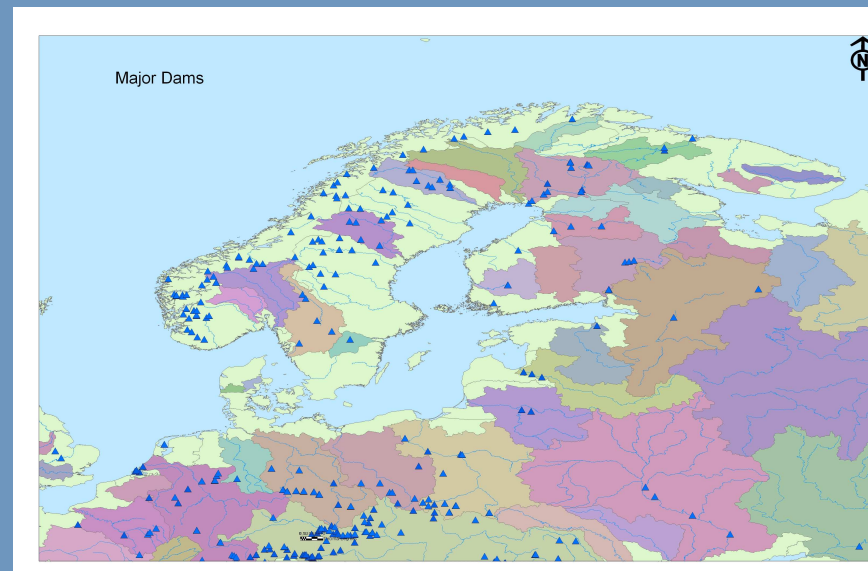
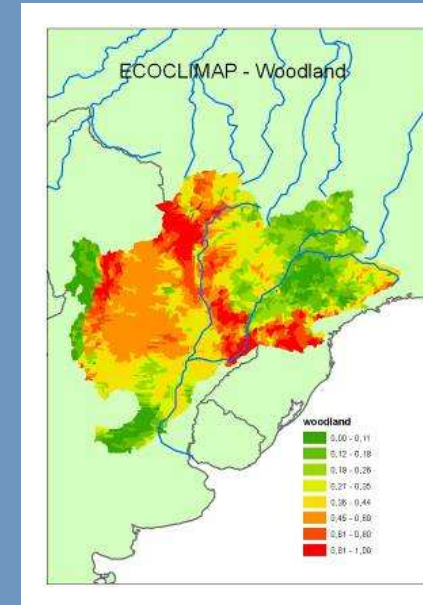
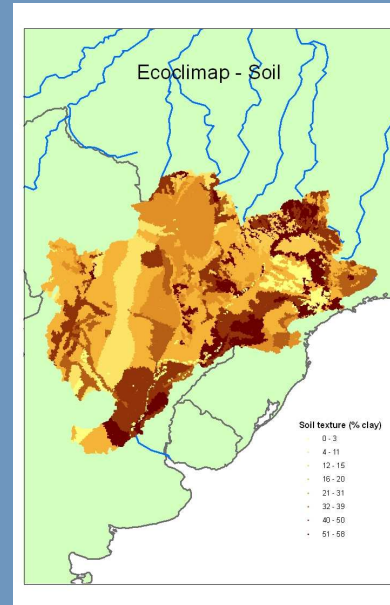
- Modelling tool: HYPE = Hydrological Predictions for the Environment
- Access to data required by model – preferably readily available global databases = homogenous data over entire model domain
- New system for streamlining in-data handling and modelling: HYSS + WHIST



Input Data:

Readily Available Global Databases

- Topography: Hydro1K, HYDROSHEDS
- Land use + soil: ECOCLIMAP
- Forcing data (P & T): Hindcast = combination of ERA-Interim (ECMWF) and ERAMESAN data; Climate runs = ECHAM5 A1B,R3, ??
- Major Dams: ICOLD
- Agricultural Data: Eurostat (as used in CAPRIS model inputs)
- Point Sources: Population data from HYDE database, treatment level and standard values for emissions
- Atmospheric Deposition: Long term averages taken from an atmospheric chemistry model, the MATCH model (SMHI)

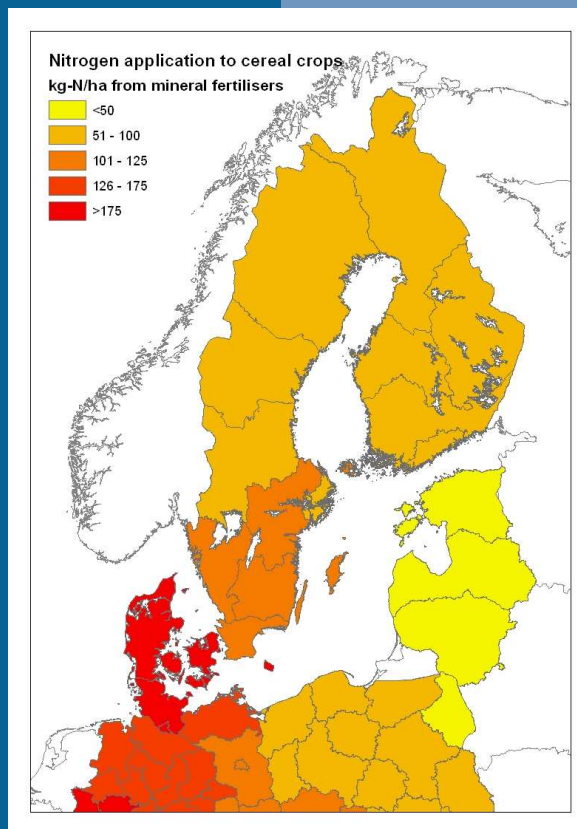


Agricultural statistics

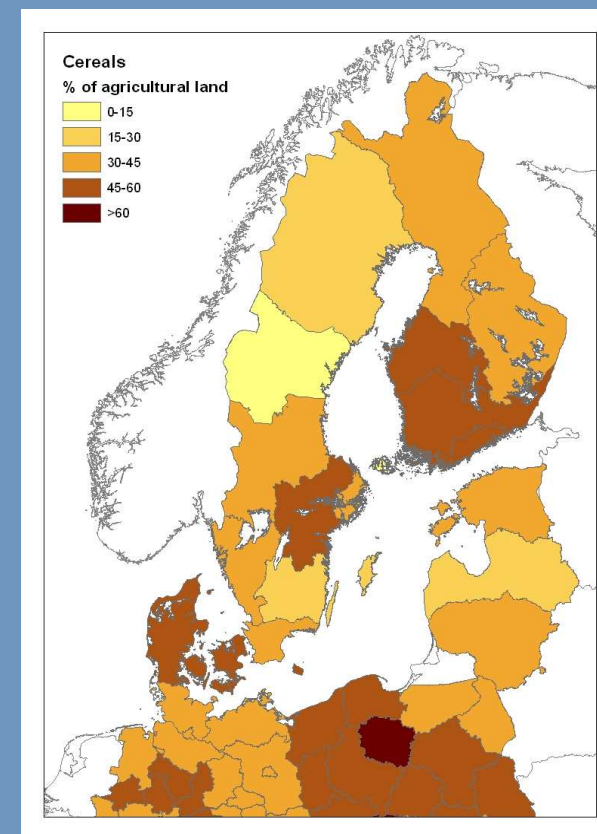
*From the CAPRI model
(agro-economy model)*

- Crop distribution
- Crop yield
- Input of nitrogen and phosphorus mineral fertilizers and manure
- Information about Russia from other sources

Example fertiliser input



Example crop distribution



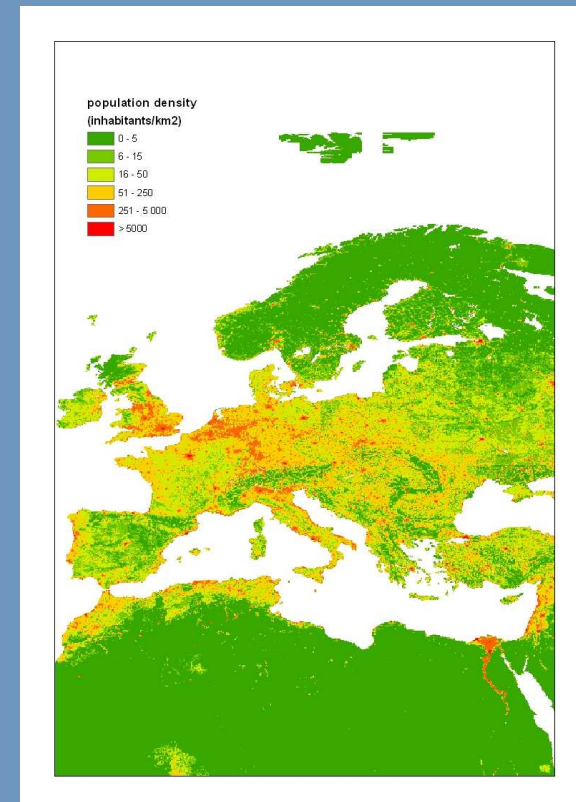
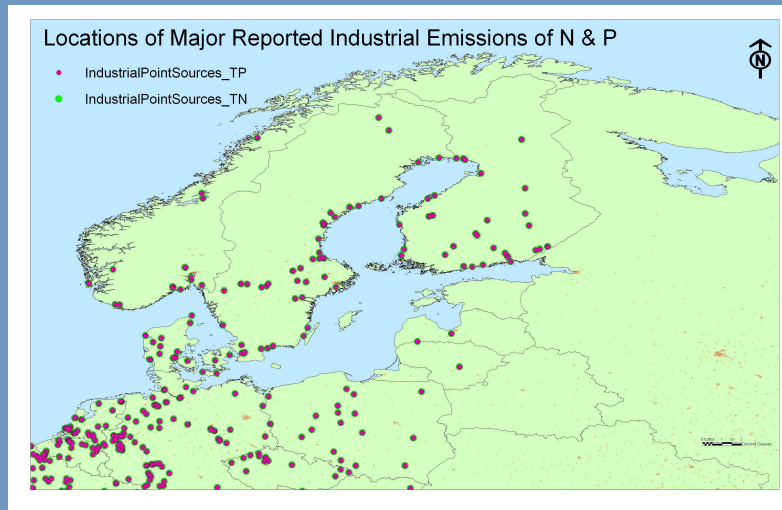
Point Sources: Industrial, Urban and Rural

Industrial Sources : from European Pollution Emission Database

N Emissions to waterways = f(population, protein consumption per capita, connection to WWT, treatment levels of WWT plants)

P Emissions to waterways = f(population, protein consumption per capita, laundry detergent (LD) consumption, rate of P-free LD use, dishwasher detergent consumption, connection to WWT, treatment levels of WWT plants)

Rural: Calculated from percent of population not connected (treated 50 % as point and 50 % as diffuse source)

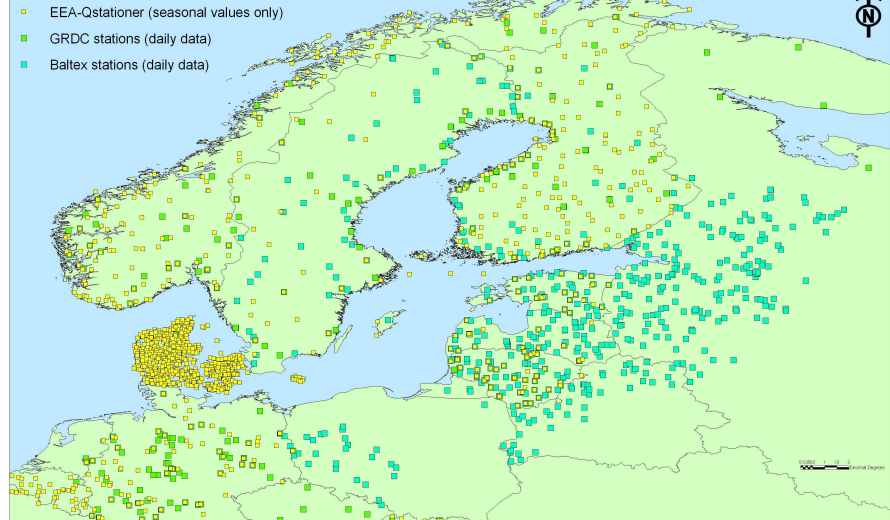


Data for model calibration and evaluation

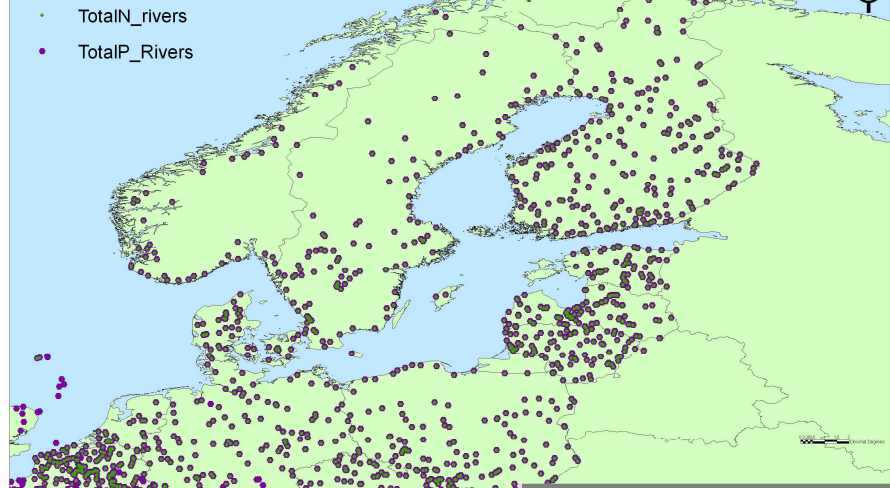
Readily Available European Databases

- Observed river discharge: GRDC, BALTEX (daily and monthly)
- Observed yearly river discharge: EEA (yearly volumes)
- Observed nutrients: EEA, seasonal and yearly totals and averages
- Possibility for additional data through collaboration and partnership

Runoff Measurement Stations

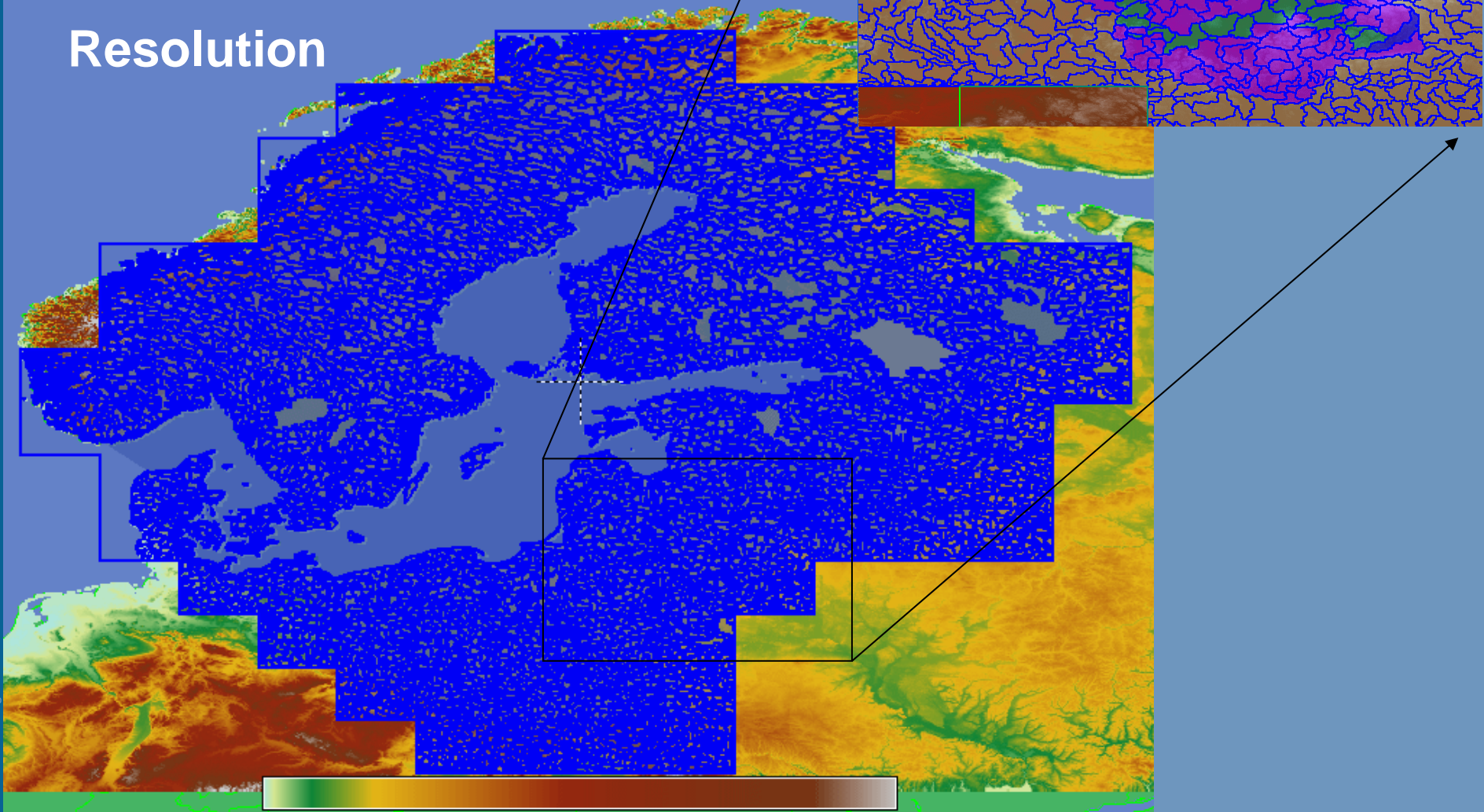


Nutrient Concentration Measurement Stations



What sort of results can be expected?

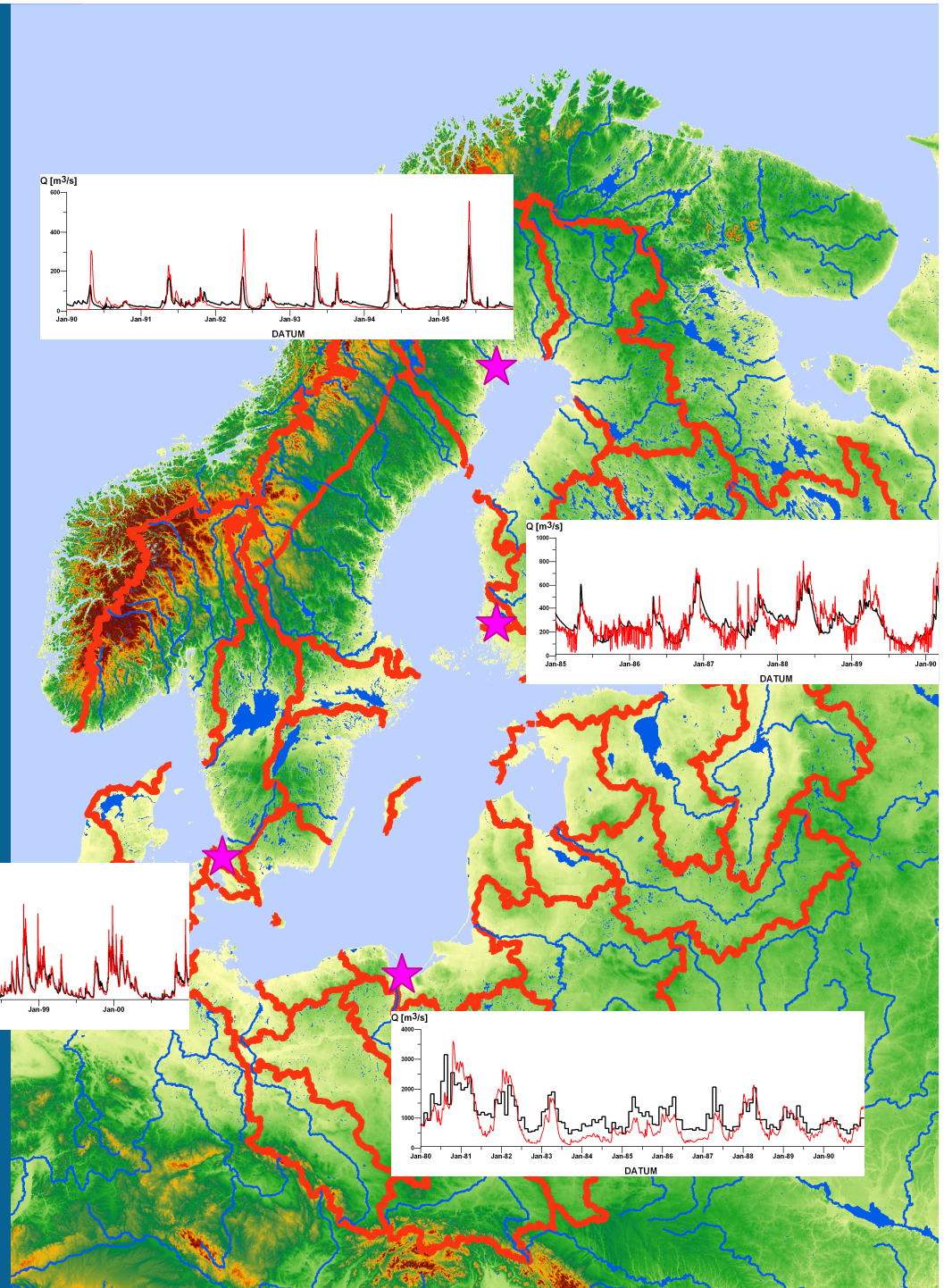
Model Domain and Resolution



What sort of results can be expected?

Results of BALT-HYPE discharge modelling

- Preliminary results at larger model resolution.



Deliverables

**Daily Q, N & P from all river outlets
and from small areas along coast:**

- **Hindcast 1961-2008**
- **Climate runs - ECHAM5 A1B,R3
+ others?**

Expected delivery November 15 2009,

Other climate runs by Dec 09.

