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ECOSUPPORT

T1.3: Transient Scenario Simulations of River Discharge and Nutrient Loads to the Baltic Sea 1961-2100

SMHI Department of Research, Unit for Hydrology.

The Story So Far....

- Hindcast simulation based on *ERAMESAN* (*ERA-40* and *ERA-40 – RCA3* tested)
- 1 Climate scenario complete – *ECHAM5-RCA3-A1B-50km*
- 1 'Worst' case scenario (WWT same, All agriculture as intense as in Denmark) run with the above climate scenario
- 1 'Best' case scenario (all UWWT tertiary, all agricultural fertilisation reduced by 20 %) run with the above climate scenario
- 1 Climate scenario underway – *ECAM5-RCAO-A1B_3-25km*
- 3 more Climate scenarios underway:

  -ECHAM5-RCAO-A2-25km,

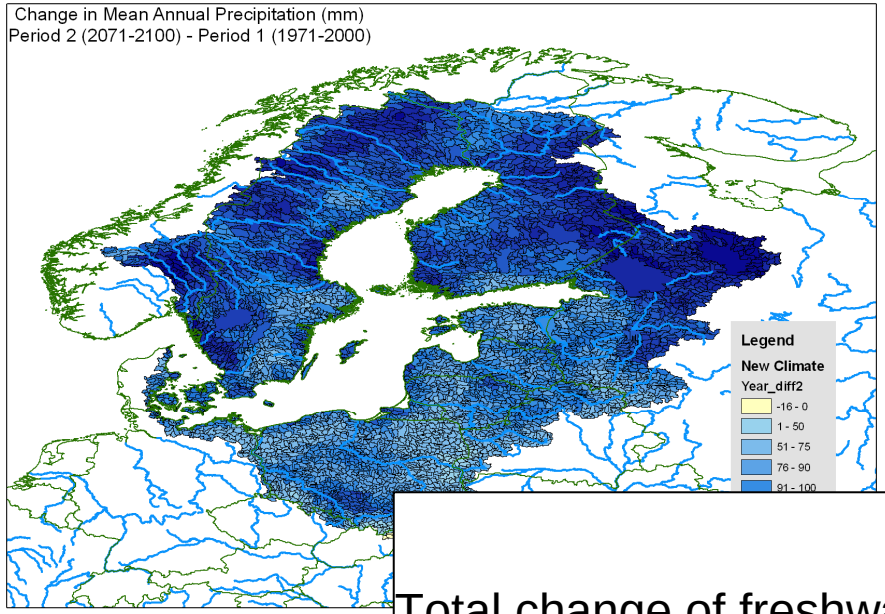
  -HadCM3-RCAO-A1B-25km,

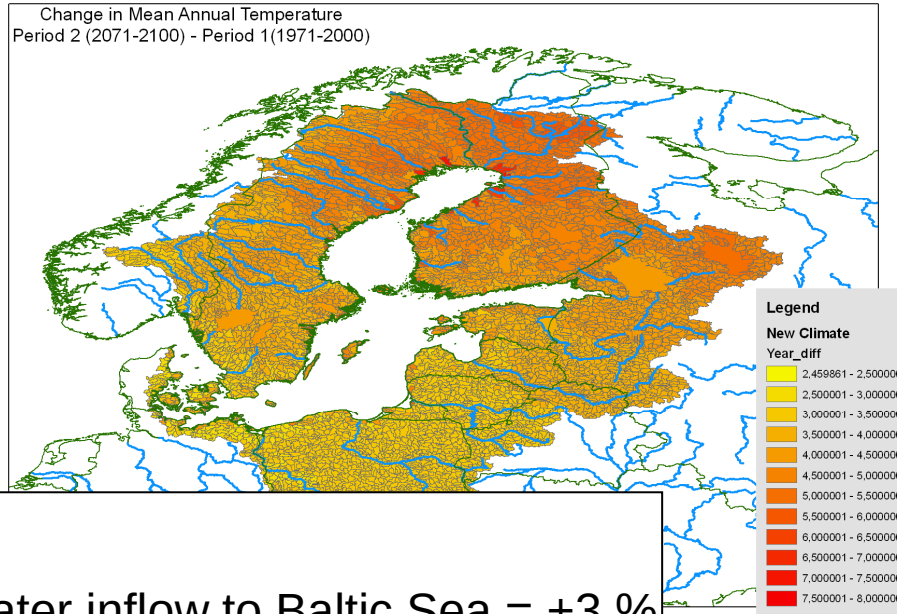
  -ECHAM5-RCAO-A1B-1-25km

Obs! Nutrient loads made only with time-slice runs due to uncertainties regarding development of N and P pools in the ground.

Suggest a linear interpolation of concentrations between today's and future climate to use in oceanographic models!

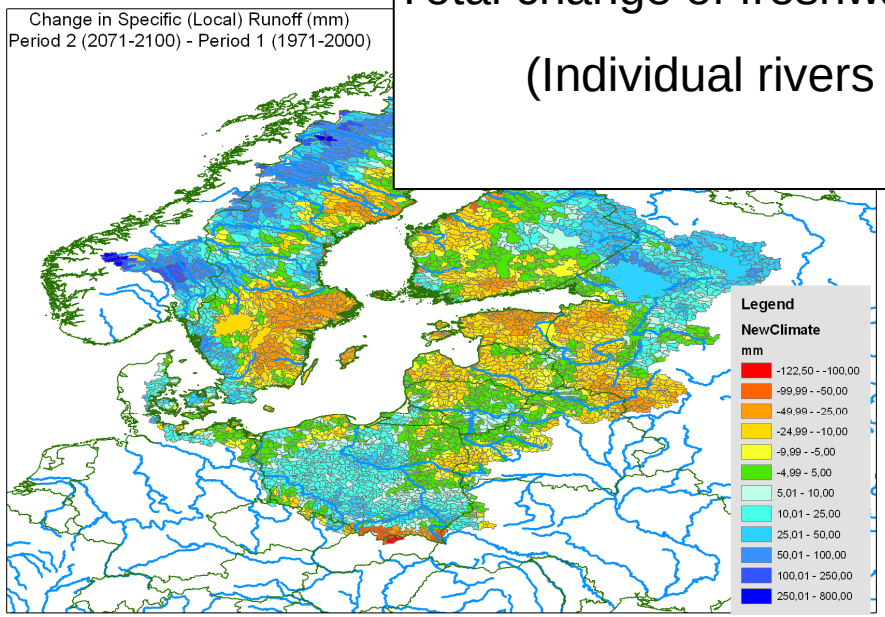
CLIMATE RUNS (ECHAM5-RCA3-A1B, 50km)

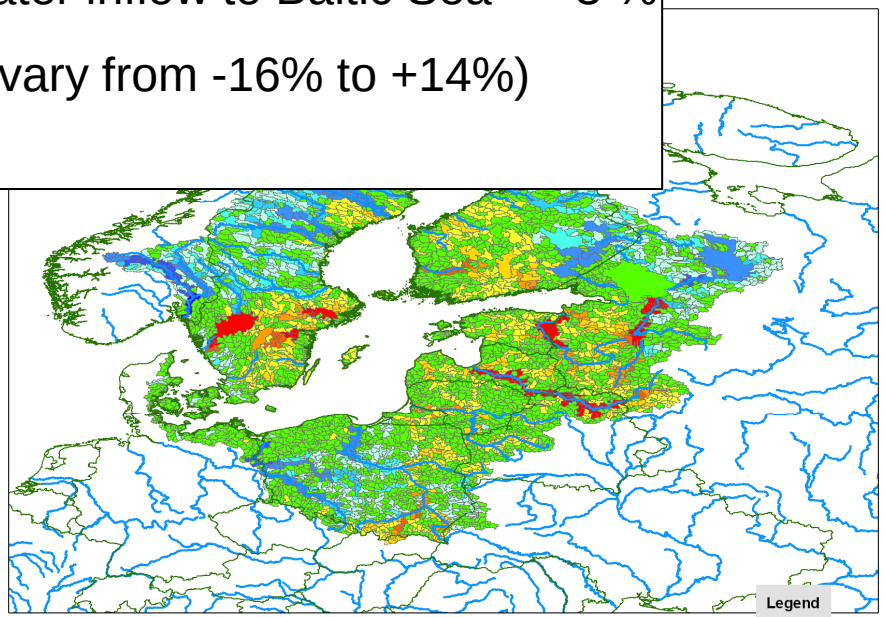




Total change of freshwater inflow to Baltic Sea = +3 %

(Individual rivers vary from -16% to +14%)





Water Quality (N and P transports)

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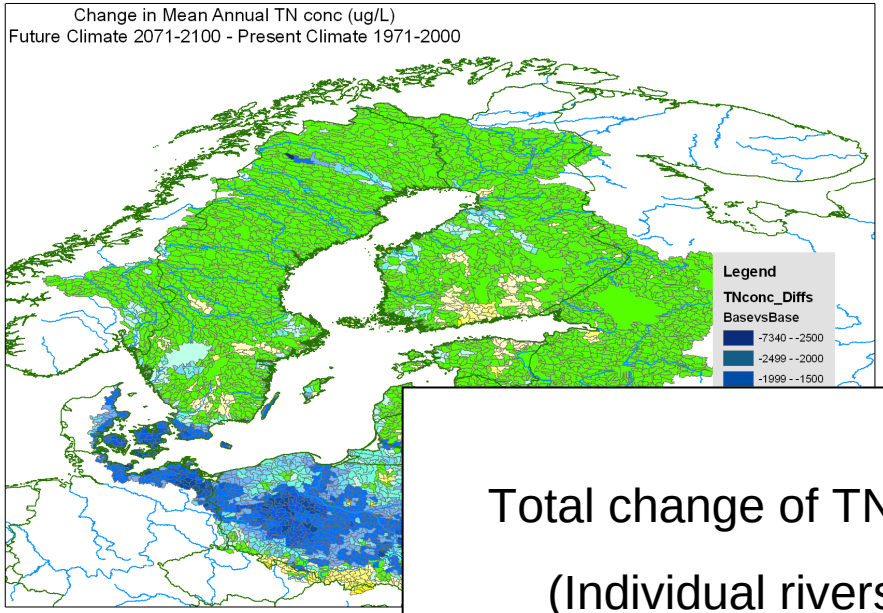
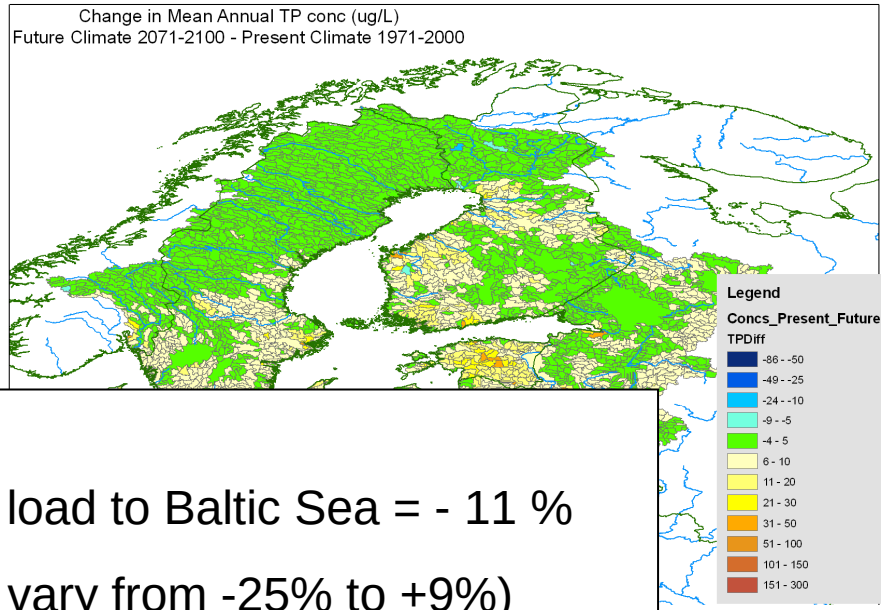


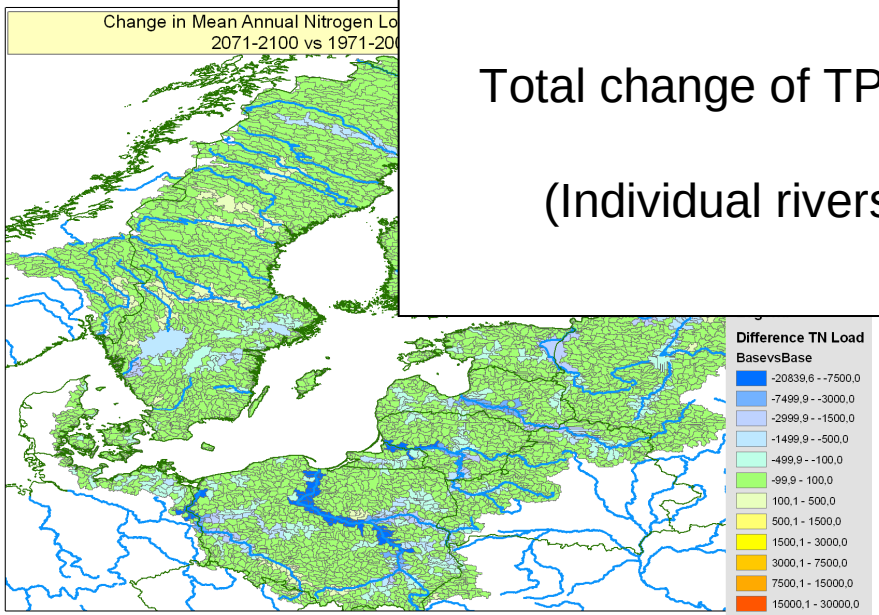


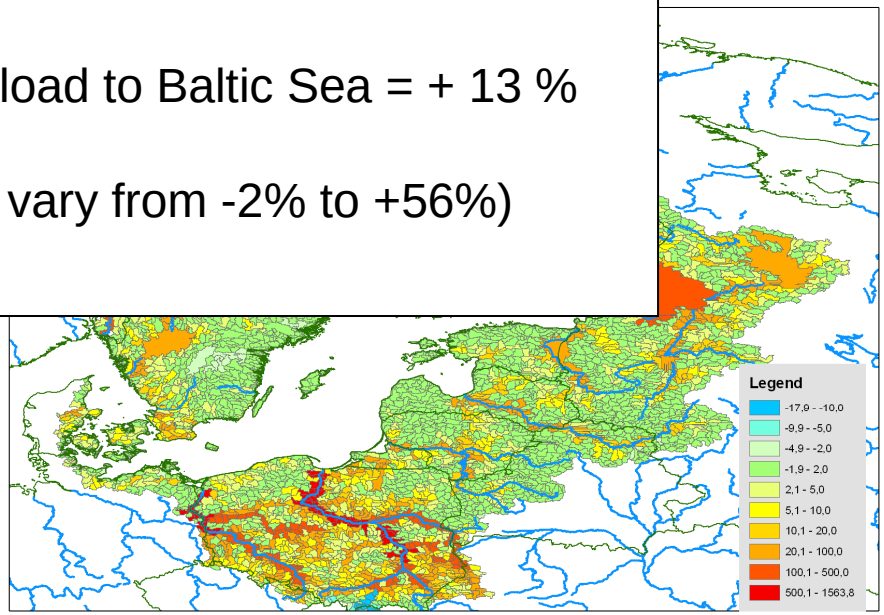
Total change of TN load to Baltic Sea = - 11 %

(Individual rivers vary from -25% to +9%)

Total change of TP load to Baltic Sea = + 13 %

(Individual rivers vary from -2% to +56%)





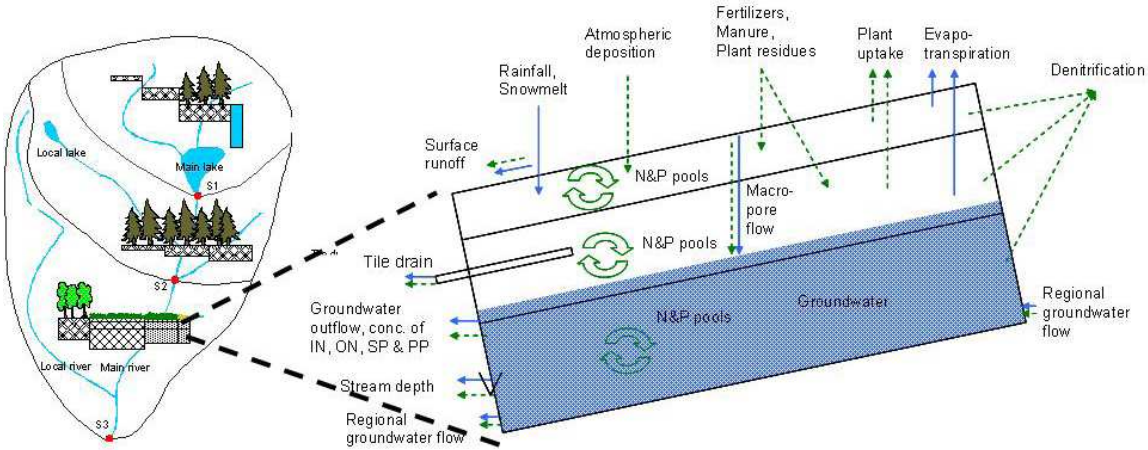
Why the Reduction in TN?

Processes that increase N in future climate (warmer & wetter):

- More mineralisation of N as temperature increases
- Higher leaching of N from upper soil layers as groundwater level increases (upper layers are more N rich)

Processes that decrease N in future climate (warmer & wetter)

- Denitrification of N in the soil (temperature dependent)
- Denitrification of N in rivers and lakes (temperature and residence time – may decrease with increased flow. but flow in Summer decreases when T is highest)



Management Scenarios 2071-2100 TN

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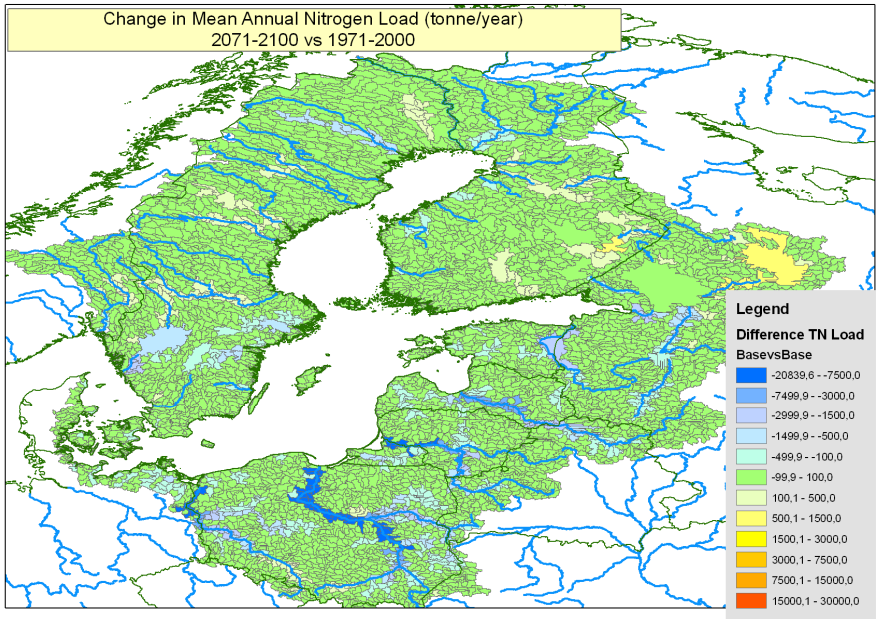

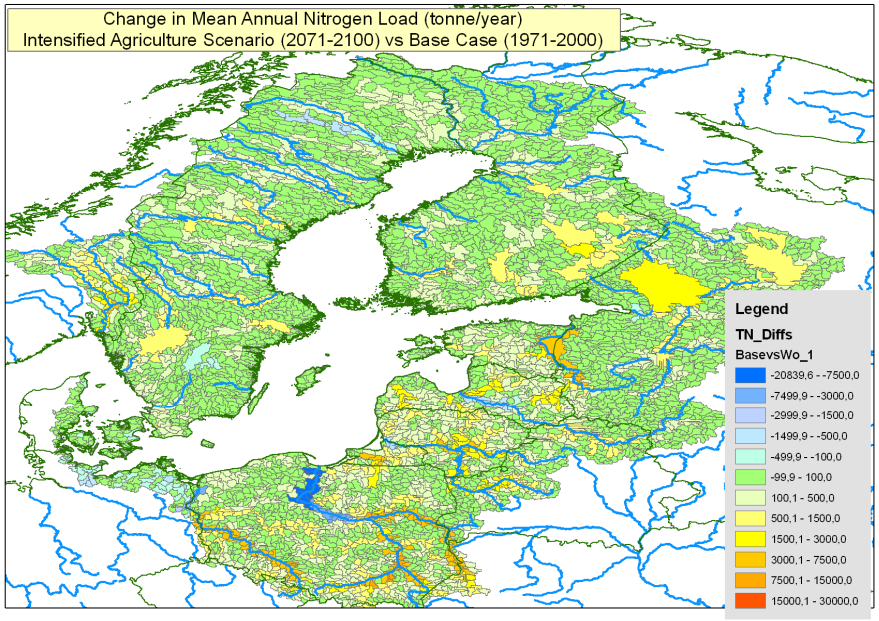

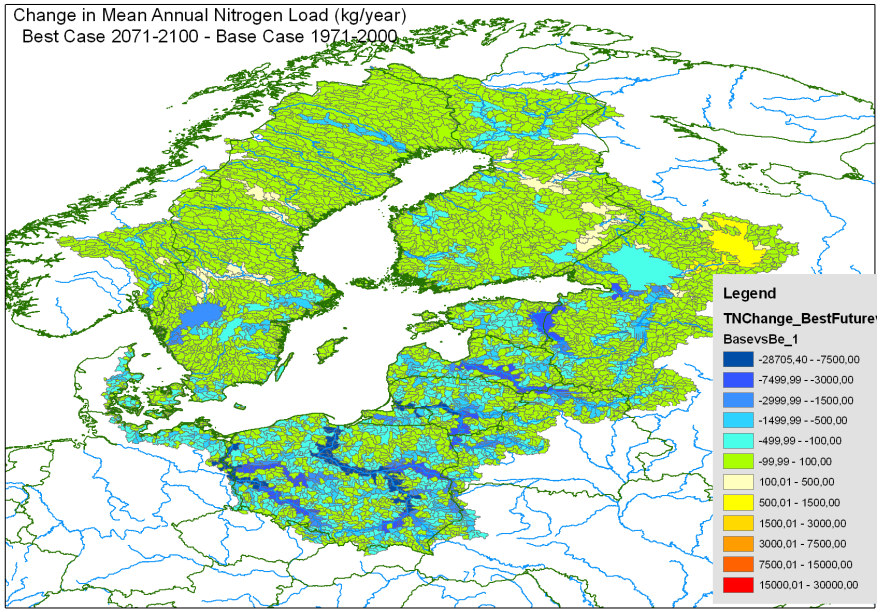

Management Scenarios 2071-2100 TP

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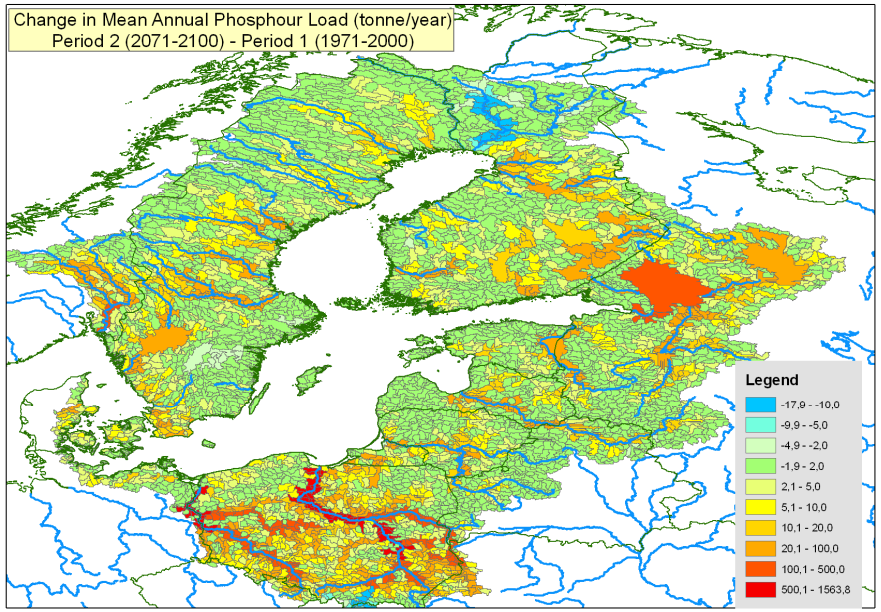
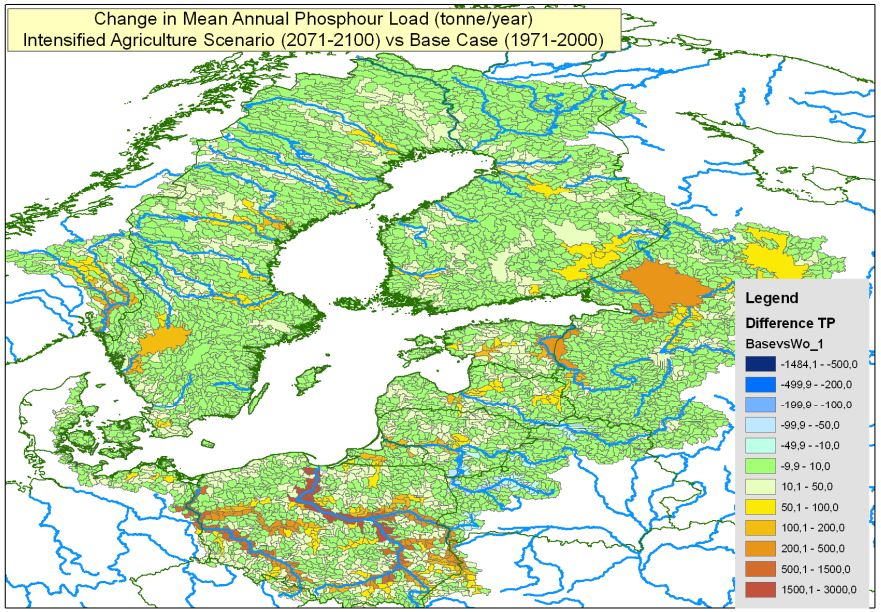
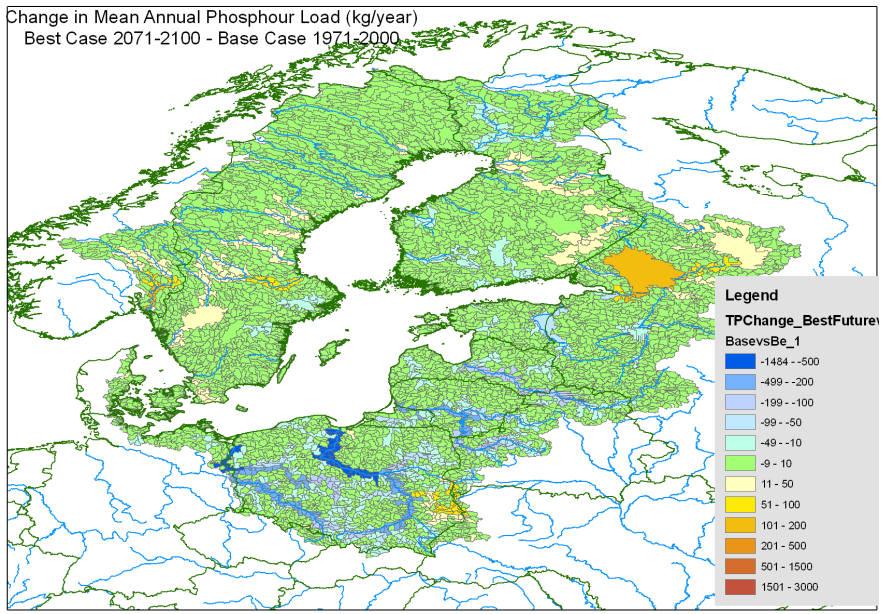


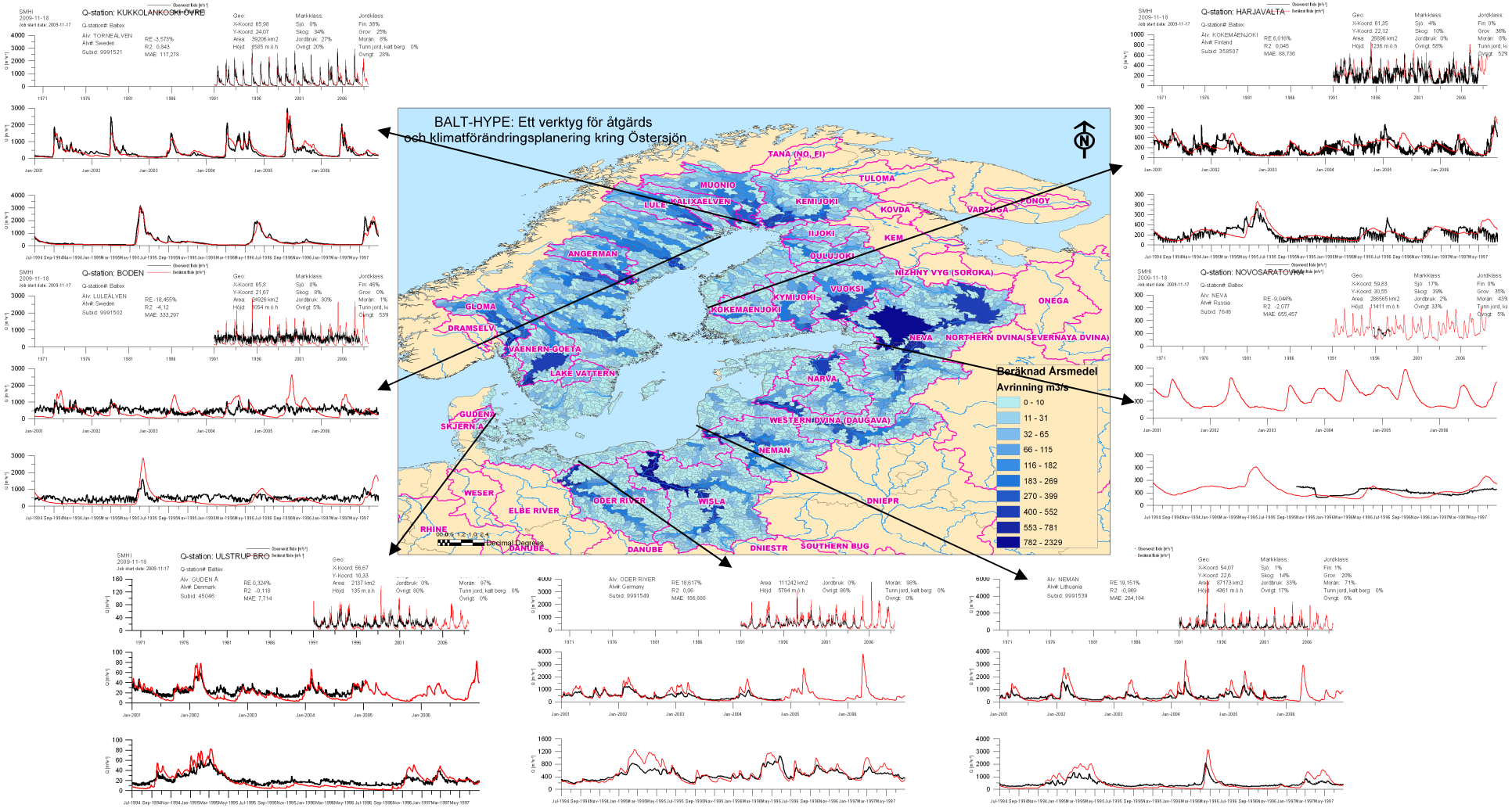




Thanks for your Attention

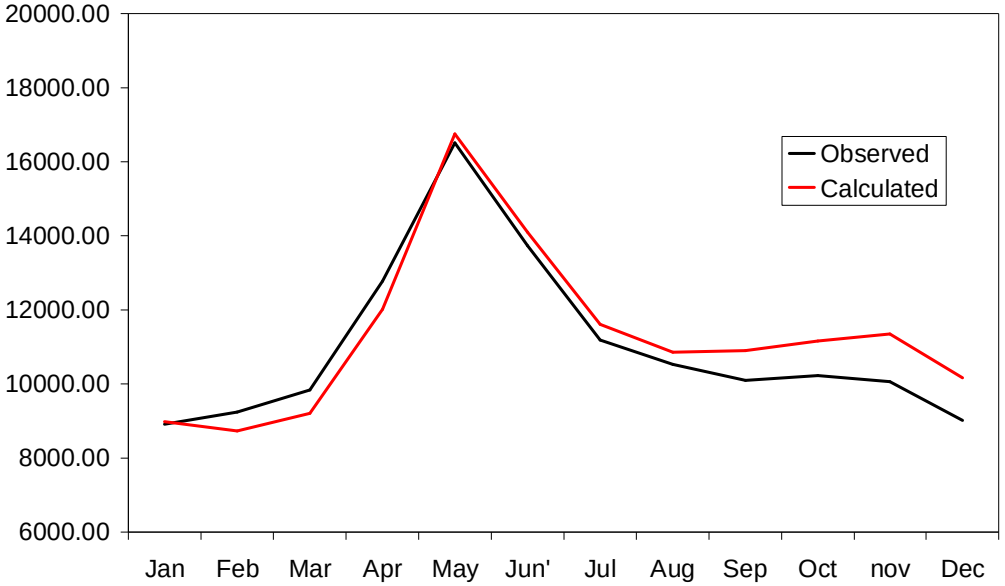
The hydrology research team at SMHI

BALT-HYPE :Validation of Discharge at Major River Mouths

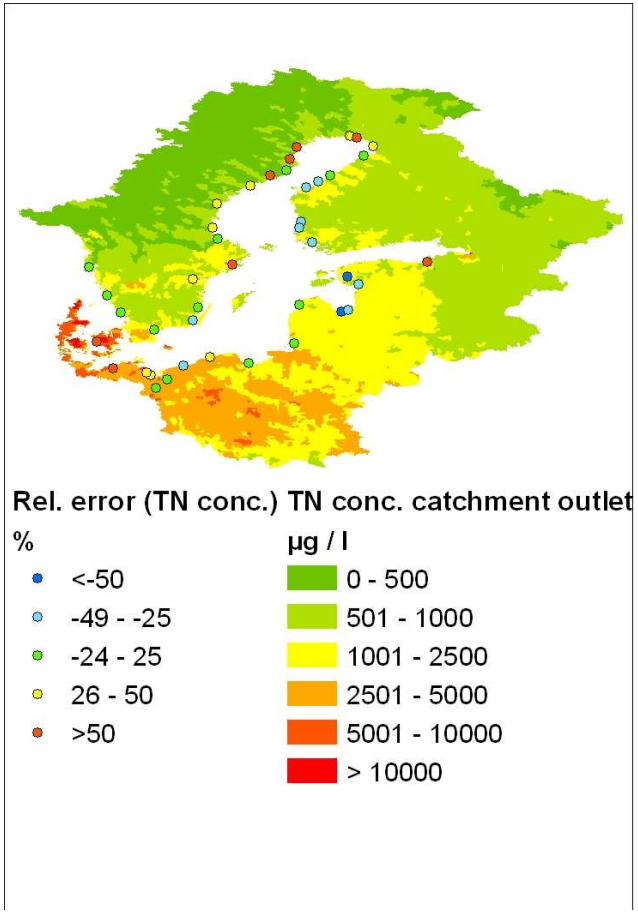


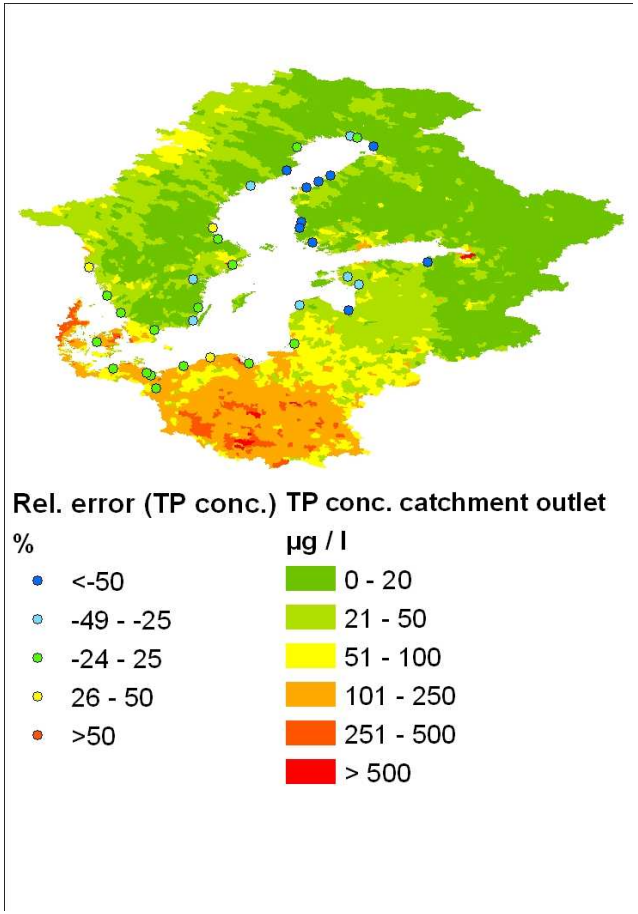
BALT-HYPE – Evaluation of seasonal discharge patterns

Mean monthly discharge: where mean is calculated ONLY for periods where observed data is available between 1980 - 2005



BALT-HYPE :Evaluation of Nutrient Inflows





How can the BALT-HYPE tool be improved?

- Need to validate the model with regard to earlier responses of river systems to changes in nutrient forcing
- Stability of Nitrogen and Phosphorous pools in the ground – how do these change over large temporal scales?
- Changes in glacier volumes not yet described (large effect in glacial catchments)
- Ice-damming of Lake Ladoga on the Neva River (Europe's largest lake, mean Q = 2616 m3/s) is hardcoded. The period of ice damming likely to decrease in future climate.
- Improved interpretation of precipitation and temperature from climate models (even dynamically downscaled RCMs)
- Scenarios: choice/description of scenario, modelling of scenario

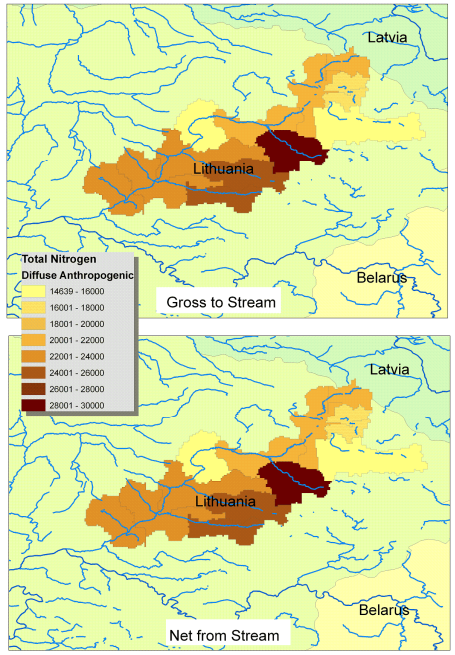
- Input from local partners (both data and processes),

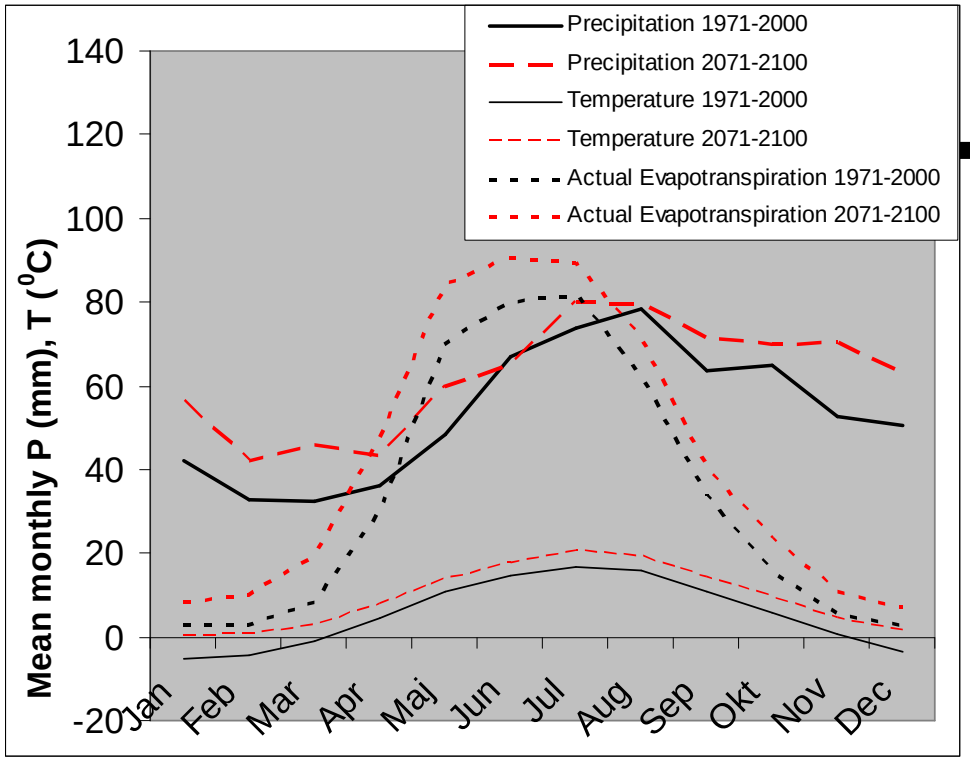
- Sharing and improvement of an open access code in cooperation with partners around the Baltic Sea

What can BALT-HYPE be used for?

- Local River Basin studies (can extract a submodel from BALT-HYPE and improve with local data)
- Transboundary River Basin studies (impartial platform for negotiating transboundary management plans)
- National Scenario Management (can extract a group of submodels from BALT-HYPE and improve with national data)
- Scenario Management at the Baltic Scale (also in ensemble with other existing models)
- Input to oceanographic models (both scenarios and operational as of October 2010)

Sventoji River using GlobCover 2000
Diffuse Anthropogenic N Load
(kg/km2/year)





Net change (P-ET) = -4.17 mm/year

Net change discharge (P-ET)A =-235 m^3/s