

HYPE (HYdrological Predictions for the Environment)

HYPE OSC (HYPE Open Source Community)

<http://hype.sourceforge.net/>

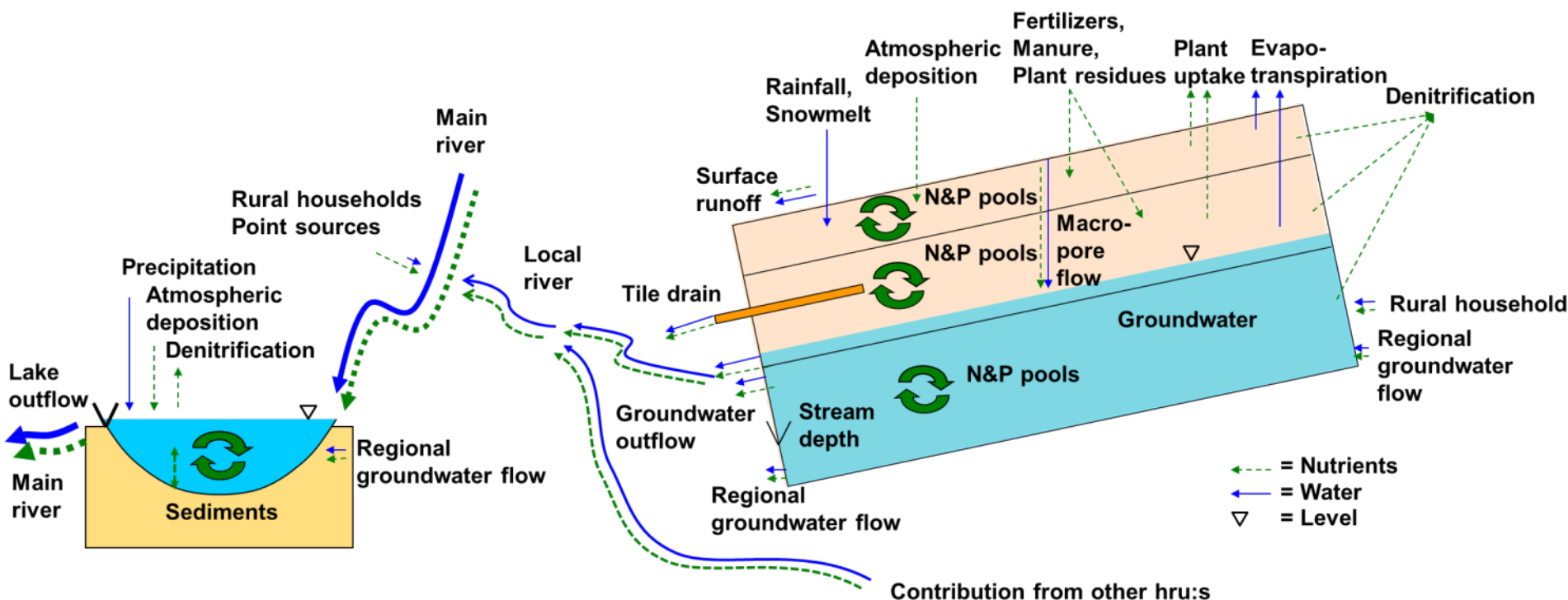


# HYdrological Predictions for the Environment (HYPE) model

Lake

Rivers

Soil



## The European HYPE (E-HYPE):

- a Pan-European hydrological model with high resolution
- operational in the SMHI production environment
- based on readily available global databases
- open for improvements and cooperation
- The model has been initiated and funded by GMES and several EU FP7 projects

## European HYPE users:

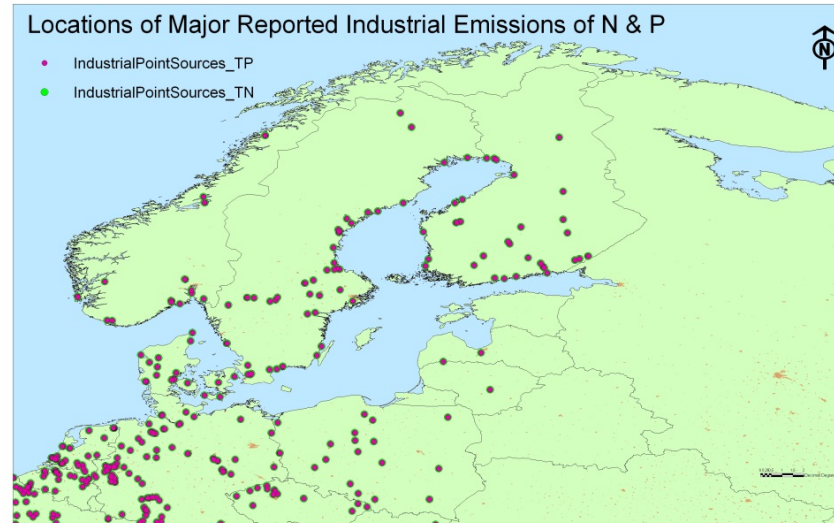
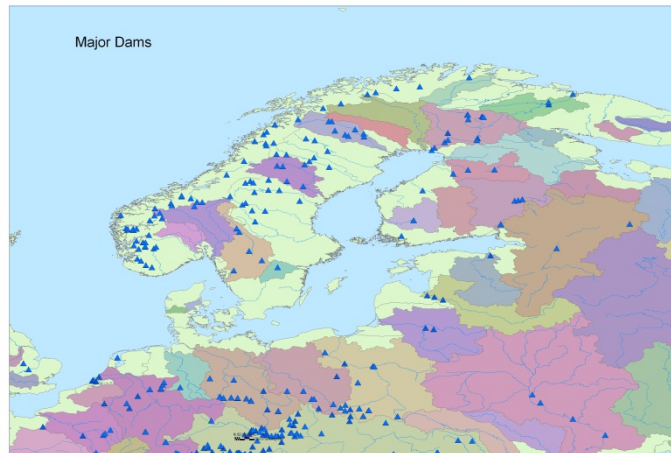
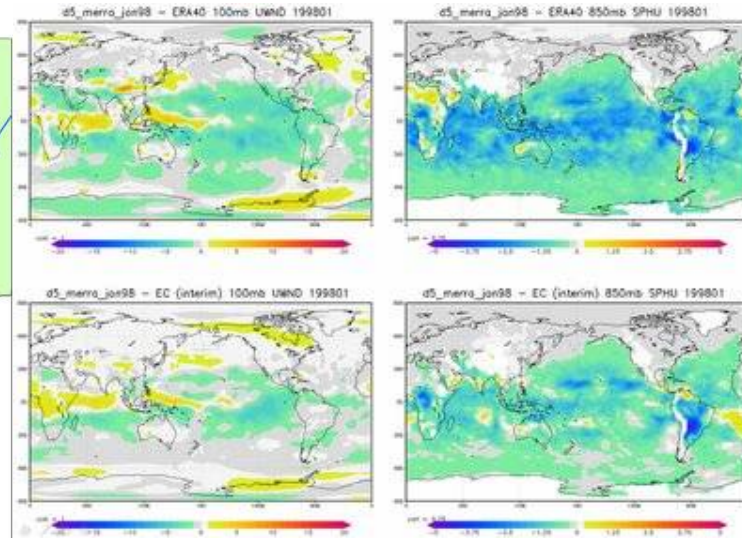
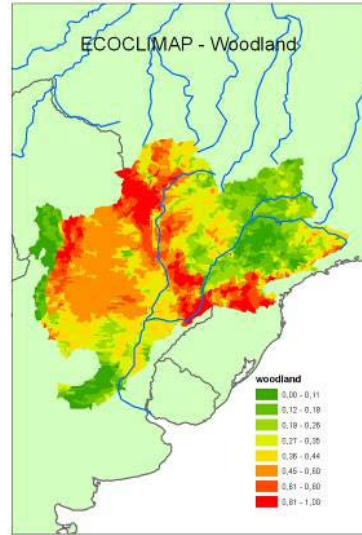
- Water management and status in Sweden, **WFD**  
(Water Framework Directive)
- Oceanographic forecasting, EuroGoos
- Eutrophication combatement of Baltic Sea
- Adaptation to climate change in the Baltic Sea region, **MSFD**  
(Marine Strategy Framework Directive)
- Climate services



# Input Data

## Readily Available Global Databases

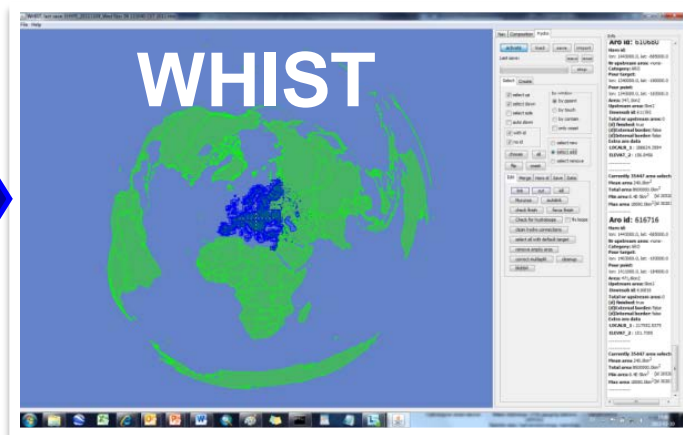
- Topography: **HydroSHEDS**
- Observed river discharge: **GRDC, BALTEX, EWA** (daily and monthly)
- Observed nutrients and yearly river discharge: **EEA**
- Land use + soil: **ECOCLIMAP** and European Soil Atlas
- Forcing data (P & T):  
Re-analysis products (e.g. downscaled **ERA40, Climate runs**)
- Major Dams: **ICOLD**





# WHIST – World Hydrological Input Set-Up Tool

From global geographic databases to Hydrological Models



**INPUT FILES**  
for Hydrological Models:

HBV  
HYPE  
VIC

*e.g. Subbasin delineation & routing, subbasin characteristics, meteorological data*

## HYPE services

**2011 the version of E-HYPE2.0 is released**

**2011 an Open Source Community for the HYPE code is launched**

**<http://hype.sourceforge.net/>**

**2012 The model provides forecasts and climate change impacts**

**2012 Nutrient load provided for the whole European domain**

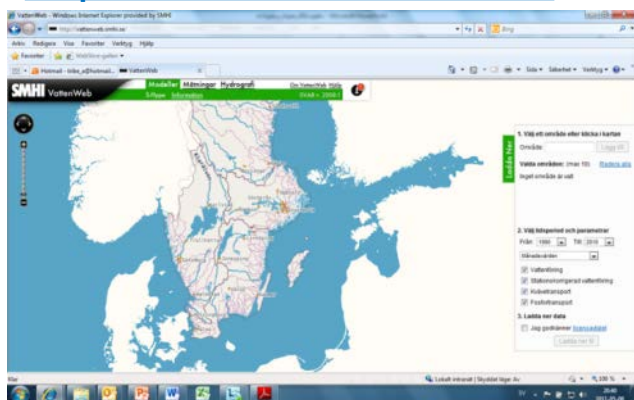
**2012 Model results available for free downloading for La Plata Basin**

**2013 Model results available for free downloading for Niger River**

# Large-scale HYPEs on the web

## SWEDEN

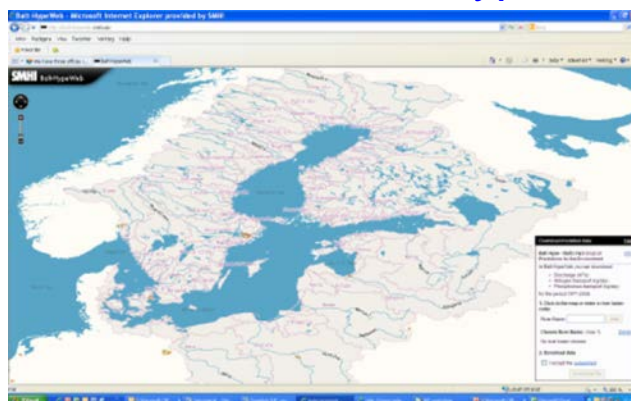
<http://vattenweb.smhi.se/>



450 000 km<sup>2</sup>  
 38 000 sub-basins  
 400 observation sites

## Baltic Sea basin

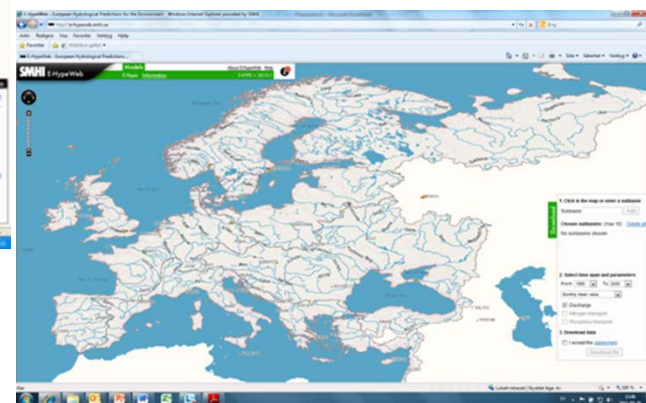
[www.smhi.se/balt-hype](http://www.smhi.se/balt-hype)



1.8 milj km<sup>2</sup>  
 5 128 sub-basins  
 150 observation sites

## EUROPE

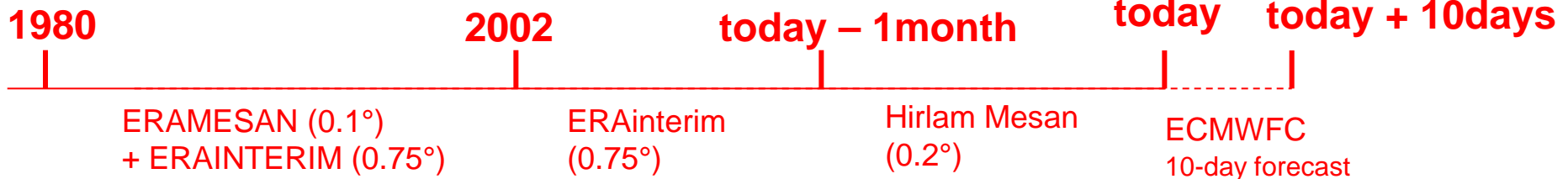
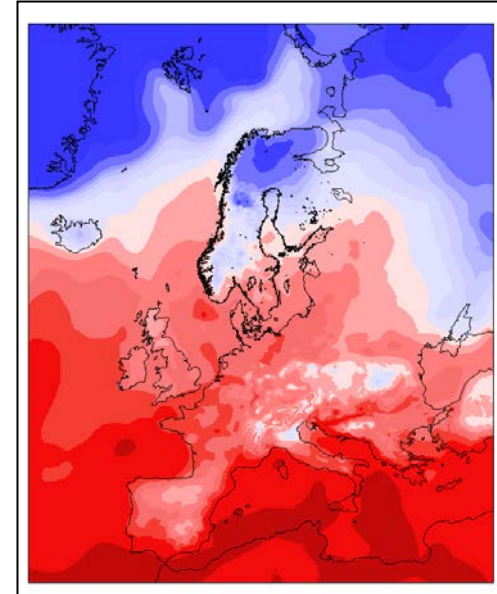
[www.smhi.se/e-hype](http://www.smhi.se/e-hype)



8.8 milj km<sup>2</sup>  
 35 000 sub-basins  
 950 observation sites

## Operational System at SMHI

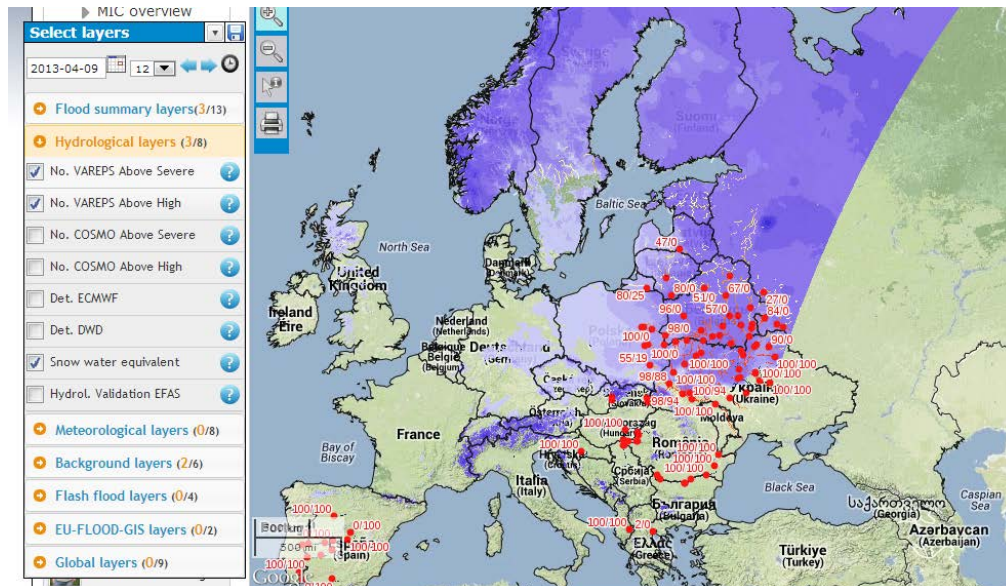
- E-HYPE in the hydrological production system
  - ✓ Since 2010: Baltic Sea and Atlantic Ocean (discharge)
  - ✓ Nov. 2012: All European seas (discharge, nitrogen, phosphorous, E-HYPE 2.1)
- Delivery to users via FTP on request
- Model forcing:





# European Flood Alert System (EFAS)

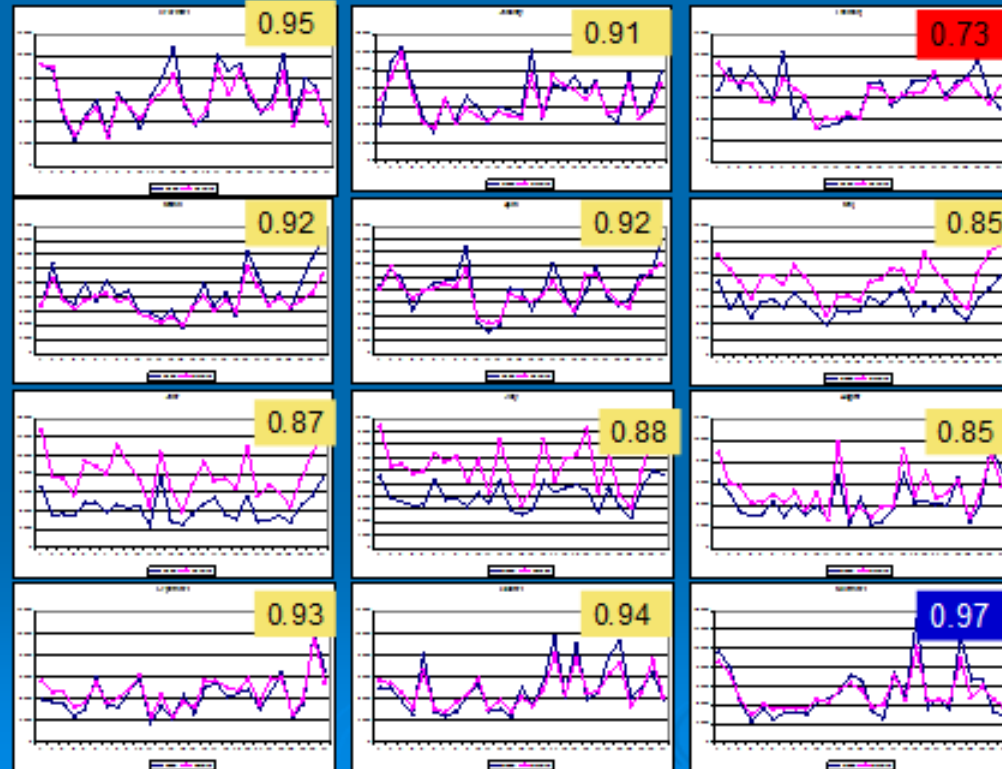
- SMHI currently involved as EFAS Dissemination Centre – ie issuing EFAS alerts/watches
- Forecasts based on ECMWF VAREPS & DET + DWD Det + COSMO weather forecasts run through the LISFLOOD model (from JRC)
- Added value of more hydrological models (e.g. situation shown with snowmelt floods)



## Current negotiations to include E-HYPE in EFAS

- Currently E-HYPE compares surprisingly well against LISFLOOD, given the coarser forcing data and lack of regional calibration
- 2013: Test E-HYPE with JRC's own 5 km interpolated Precipitation data set, possibly some regional fitting?
- SMHI to make E-HYPE forecasts operationally available via a WMS – (note that rather than absolute discharge, SMHI will deliver relative discharge, ie relative to flooding return periods)

# Danube



Winter

Spring

Summer

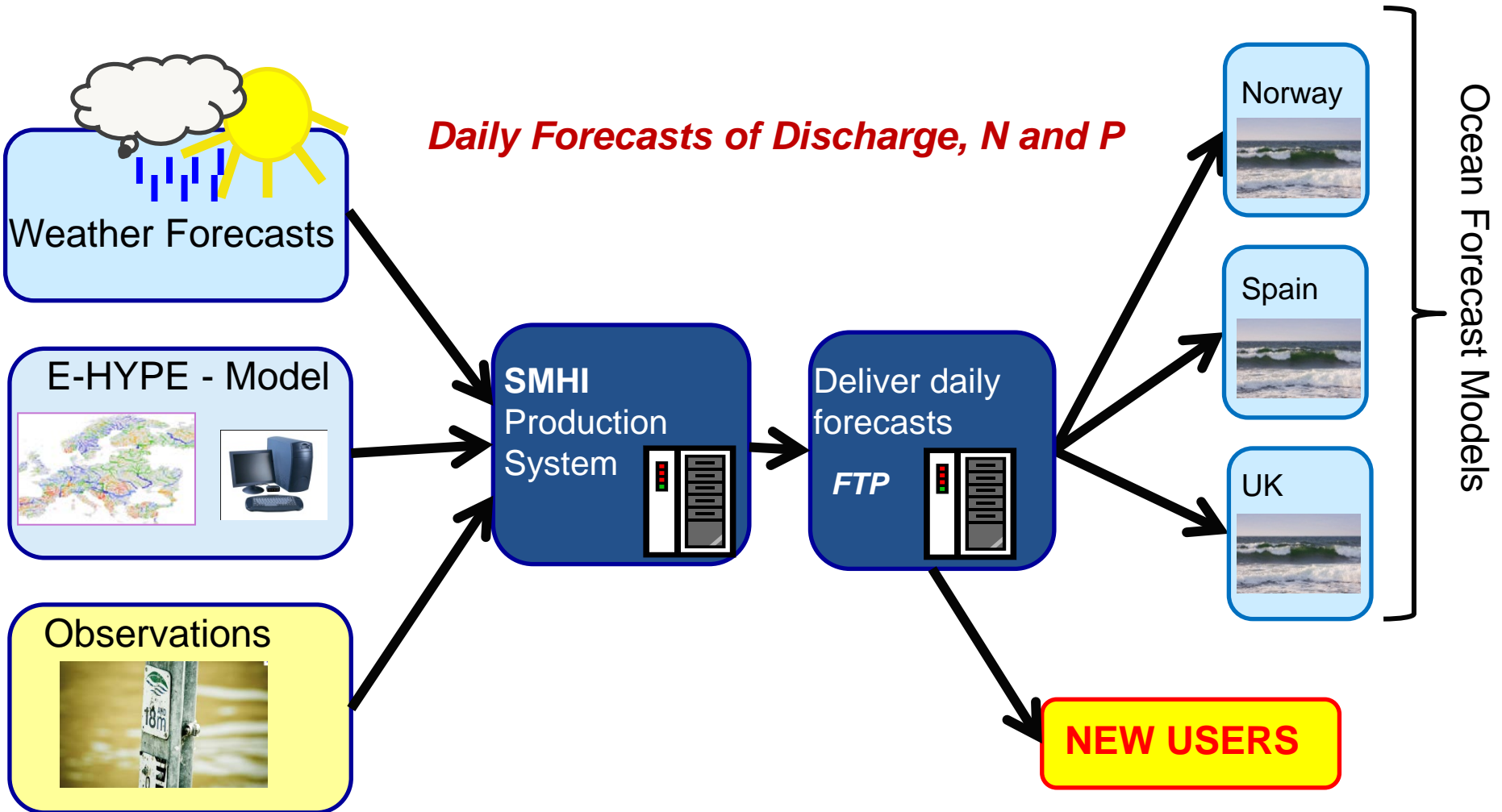
Autumn

Danube (817,000km<sup>2</sup>):

Correlation coefficient between observed and simulated monthly river discharge data for each month (Dec→Nov) during 1980-2006.

## Example: E-HYPE for Delivering Operational Forecasts

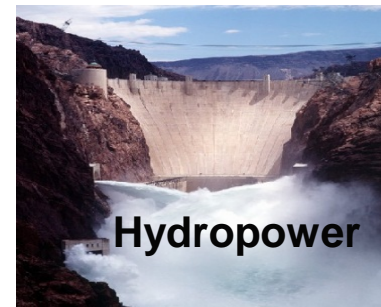
*Daily Forecasts of Discharge, N and P*





## What can E-HYPE be used for?

*Simulations for all of Europe: homogenous, simultaneous*



**1970**

**2012**

**2020**

**2100**

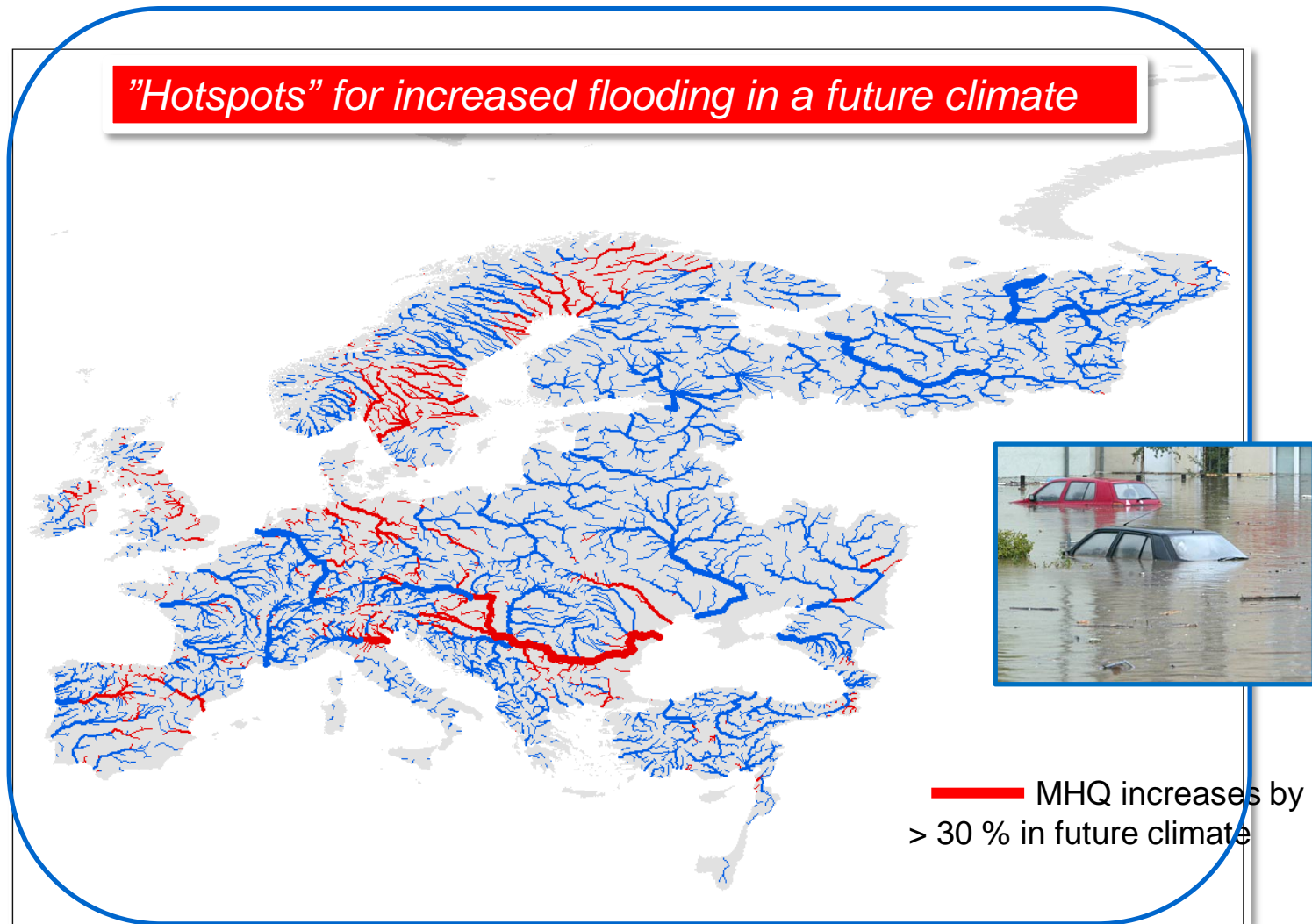
**Hindcasts**

**Forecasting**

**Decadal Predictions**

**Climate Scenarios**

## Example: E-HYPE for future climate predictions

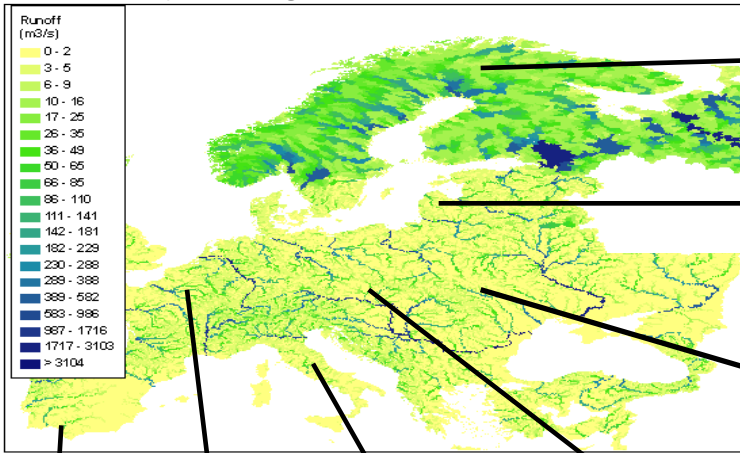


## Why collaborative coding

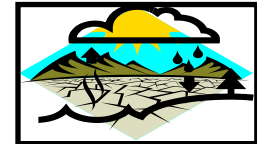
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- **New challenges with water in focus:** e.g. environmental issues, climate change, EU directives... which are interdisciplinary! Thus, new codes are needed!
- More effective model development – lower cost!
- Higher quality – more brains developing the same code!
- Enables specialisation and testing in parts of a holistic system.
- Facilitates ensemble modelling and uncertainty estimates.
- Facilitates models comparison and evaluation.
- Enables transparency, reviews and dialogues.
- One voice – although no one group have all answers!

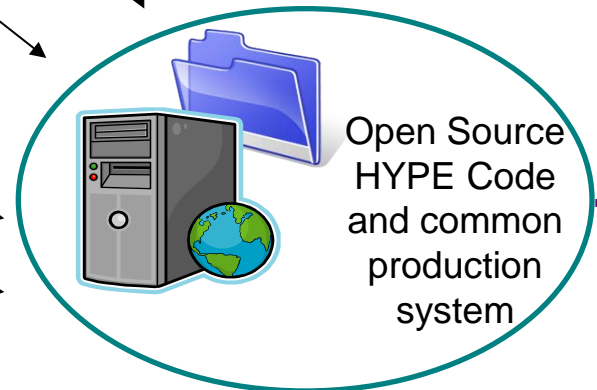
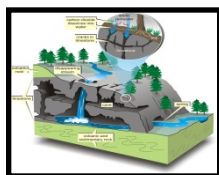
## Local Hydrological information



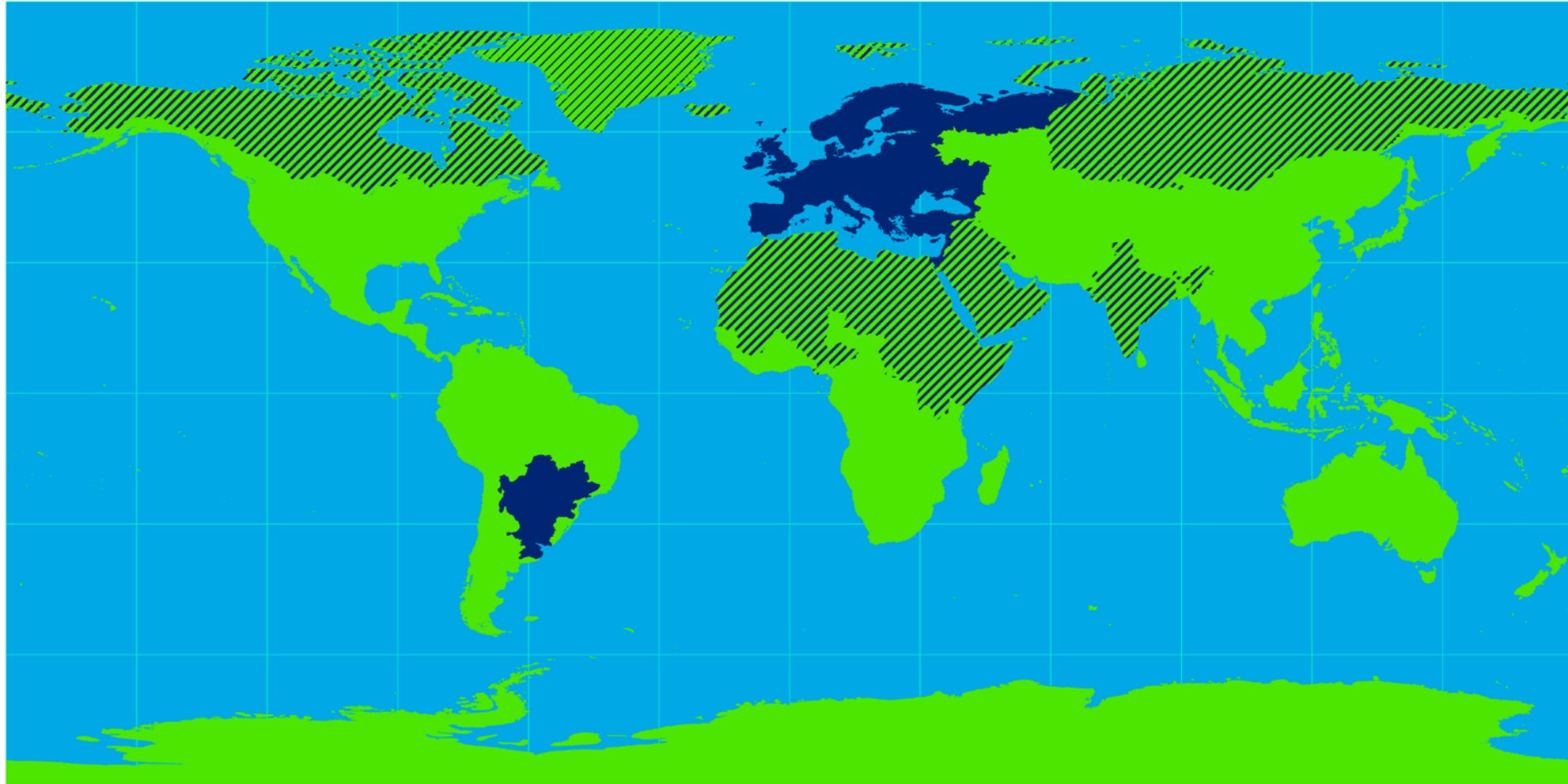
## Local Processes and issues



## Local Processes and issues







**Developed: E-HYPE, Balt-HYPE, S-HYPE, LPB-HYPE**

**In progress: Arctic-HYPE<sup>\*</sup>, Niger-HYPE, MENA-HYPE, In-HYPE**

*\*First hindcast delivered for oceanographic model 2013-03-09!*