

# OPERR

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## Objectives

The first objective is to run a pan-European discharge model in operational mode and deliver real-time and forecast data to shelf sea models. This objective will be achieved by extending an already running operational discharge model (HYPE) for the Baltic Sea to cover all European rivers. The second main objective is the validation of model data in comparison with observed data. The validation covers both operational products and climate scenarios which use hindcast runs of the E-HYPE model.

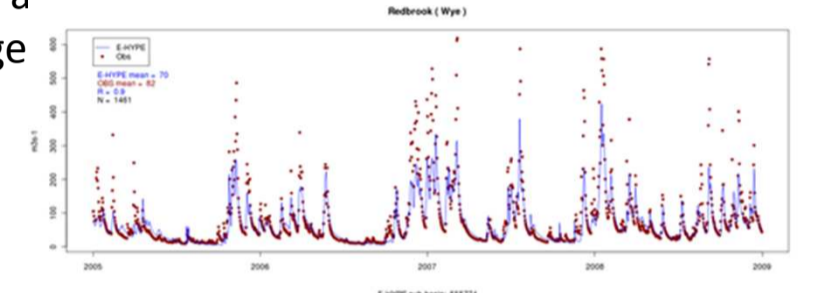
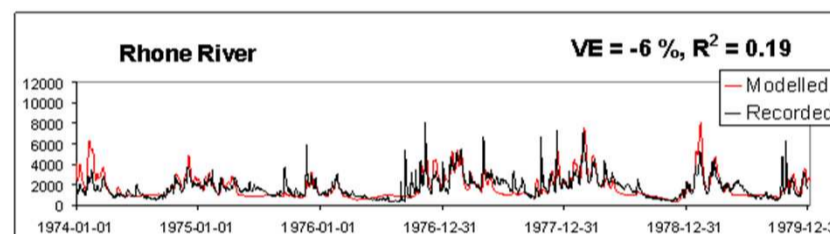
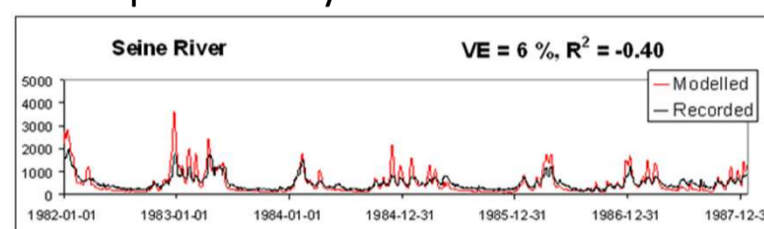
Essential for the success of the project is the dissemination of the products.

## Model validation

### Comparison of measured and modeled discharge in river outlets

Validation has only been performed in hindcast mode against measurements at regular stations or from special campaigns (including nutrient concentrations). The currently available E-HYPE hindcast used HYPE model v1.0. The model results agree well with observations from three major continental rivers (below left).

Normally the model performs better for big rivers as the difference in the spatial precipitation pattern smooths out. For smaller drainage basins, local and heavy showers have an almost immediate effect on the discharge and degrade the agreement. Examples from smaller basins in the UK (below, right) show a somewhat poorer agreement, especially an underestimation of the maximum flows. Note that the UK examples used a new hindcast based on HYPE v 2.0; the preliminary validation indicates that it ge



Station	River / catchment	E-HYPE sub-basin ID	Mean flow OBS : HYPE	Max flow OBS : HYPE	R
Kingston	Thames	527559	59 : 37	362 : 358	0.76
Sheepmount	Eden	547217	59 : 54	1090 : 327	0.71
Norham	Tweed	541978	88 : 65	1053 : 233	0.70
Redrock	Wye	555774	82 : 70	619 : 423	0.90

Table 1. Summary comparison of observed and modelled river flow ( $m^3 s^{-1}$ ) at selected gauging stations in the UK for the period 2005-2008. Observations are near-real-time data from NRA; model data from HYPE 2.0 hindcast. Ordering is by mean observed flow. R is the correlation coefficient (Pearson method).

## Make it operational

A sustainable system which can deliver requested products at a 24/7 service is a key element in an operational service. To maintain this downstream service with satisfactory quality, feedback of on-going assessment of the products and services by users is of fundamental importance. Further, data should be easily accessible and in standard format. The E-HYPE system is very stable and the theoretical maximum downtime is 12 hours. Real-time observations of river discharge can be assimilated into the model.

## E-HYPE model

A model system for river discharge is more complex compared with e.g. atmospheric and ocean models in respect of requirements of background data. During the land part of the water cycle, individual water molecules undergo a number of processes. To model these processes information of different land elements is needed.

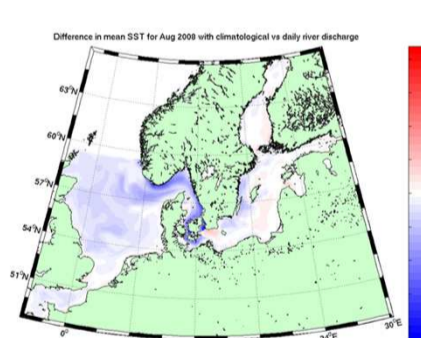


The E-HYPE model is divided into five separate sub-basins: Barents Sea, Baltic Sea, Atlantic, Mediterranean and Black Sea.

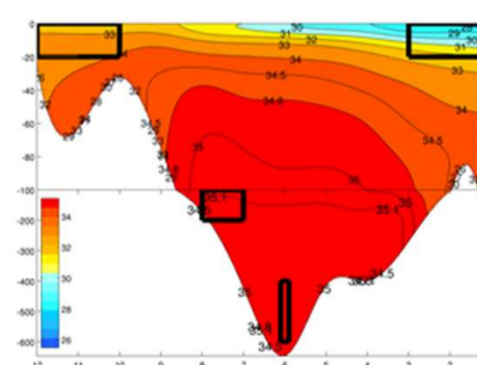
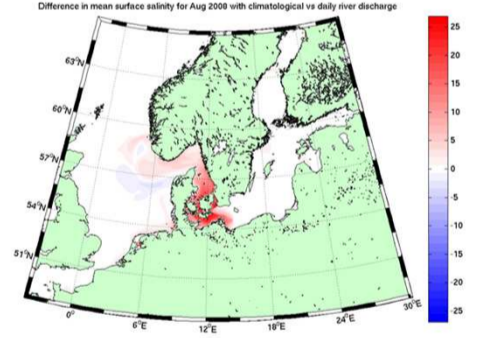
## Model assessment

Operational daily E-HYPE forecast data is used at MERCATOR Ocean for the operational IBI-ROOS ocean model since autumn 2011 and for the SMHI operational model HIROMB for the North Sea/Baltic Sea region.

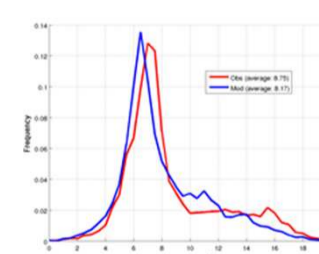
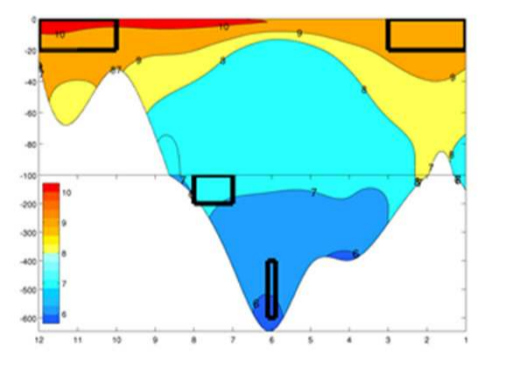
Assessment of the impact of E-HYPE hindcast data has been performed at SMHI and IMR (Bergen) for the North Sea/Baltic Sea, for the North-West Shelf by MetOffice and for the IBI-ROOS region by Mercator Ocean.



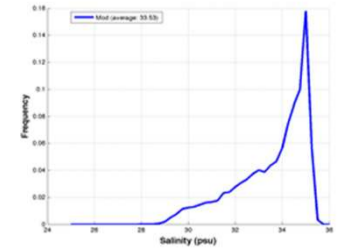
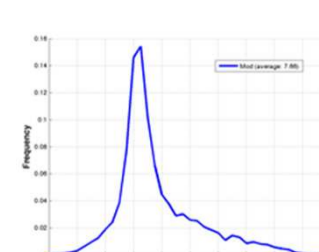
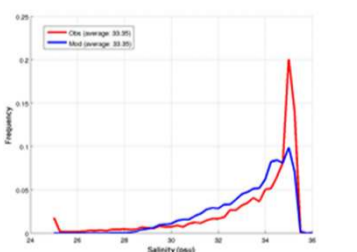
Difference in mean SST (left) and SSS (right) for August 2008 between climatological and daily river forcing of the ocean model.



Mean observed salinity (left) and temperature (right) along the Torungen-Hirtshals transect

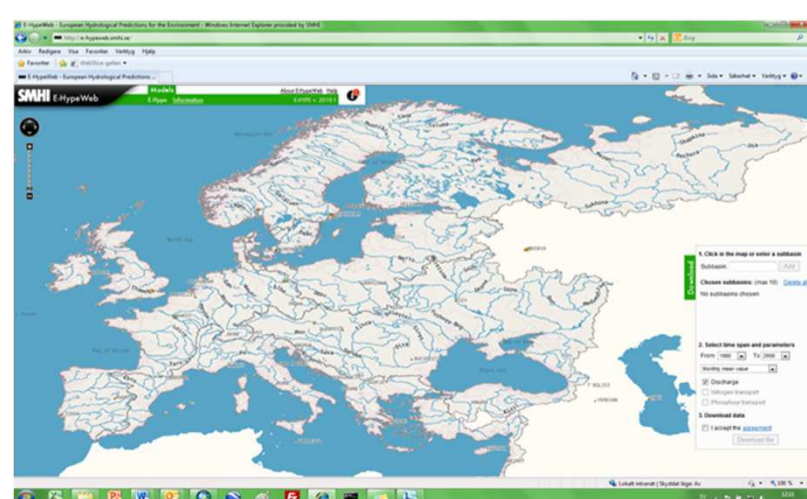


PDFs of the whole data set. Temperature (left) and salinity (right). Data and reference (upper), E-HYPE simulation (lower)



## Model output

Data from the 30 years hindcast period is available and can be downloaded from the E-HYPE web page <http://e-hypeweb.smhi.se>. An updated version of this data base is under preparation when new quality controlled data has been included. A similar web page has been set up for the Baltic drainage basin with higher resolution and with nutrients included, <http://balt-hype.smhi.se>. Dissolved nitrogen and phosphate are included in the new version of the E-HYPE hindcast data base.



10 days forecasts of river discharge for the Baltic Sea and the Atlantic coast are available on ftp. To get user and password

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Forecasts for the whole Europe will be available in autumn 2012