BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

Assimilative ecosystem modelling to support environmental monitoring and assessment

Usage of EO data

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BSH: Tasks and services

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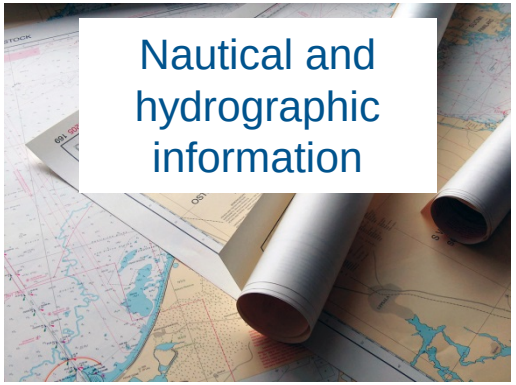


Nautical and hydrographic information

Services for maritime shipping

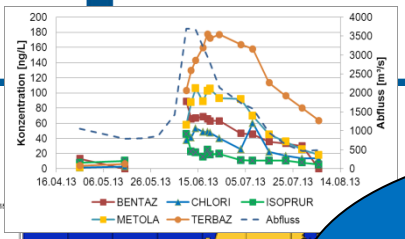
Marine monitoring

Maritime Forecasting Services

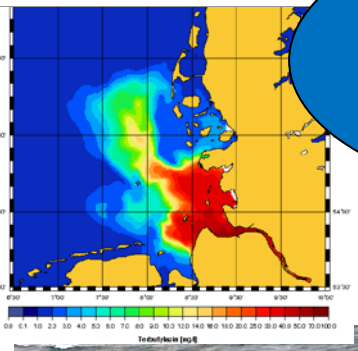
Order of the seas

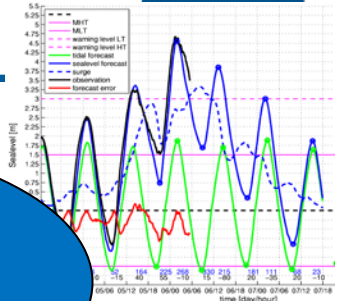
National, supranational, international obligations to report

Main applications

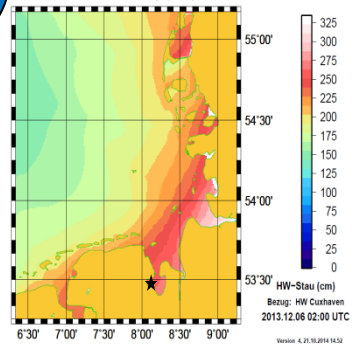


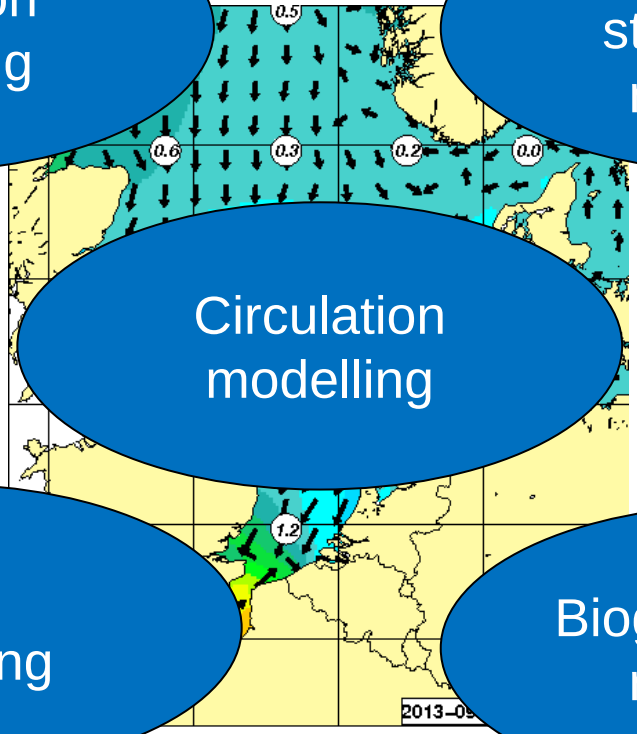
Dispersion modelling





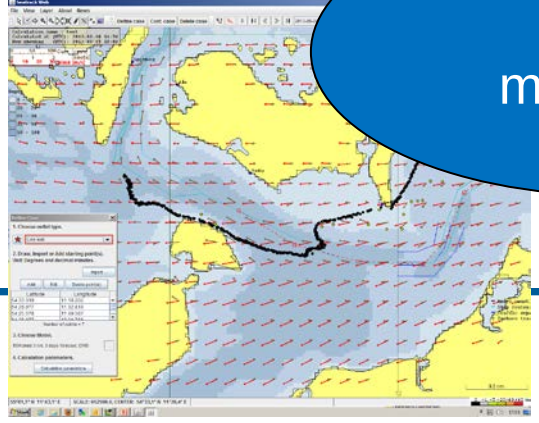
Water level & storm surge modelling



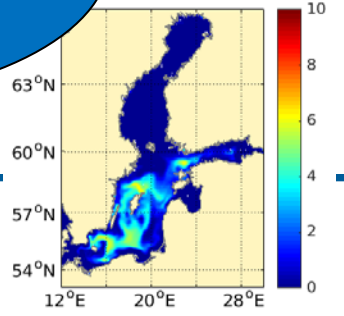


Circulation modelling

Drift modelling



Biogeochemical modelling



Motivation for biogeochemical modelling

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- Information about biogeochemical and physical status of the marine environment important for different purposes
  - Public Authorities
  - Stakeholders
  - Companies
  - Public

- Provide operational data sets for support of marine management plans (MSFD) and conventions (OSPAR, HELCOM)

- Provide information for events of public interest, e.g. algae blooms, oxygen deficit, …

➢ **Combine in-situ data, model data and earth observation data by validation and data assimilation to provide high quality data sets for users**

Biogeochemical modelling development at BSH

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- 2007 to 2009 ECOOP
  - ECOHAM for the North Sea, ERGOM for the Baltic Sea
  - Hindcast runs

- 2012 to 2015 DeMarine2
  - Funded by DLR, consortium with AWI and Brockmann consult
  - ERGOM with HBM for the North and Baltic Sea
  - Hindcasts runs for 2008
  - Daily pre-operational runs, results archived and uploaded on ftp of project partners, daily figures (intranet)
  - First data assimilation tests

History of biogeochemical modelling at BSH

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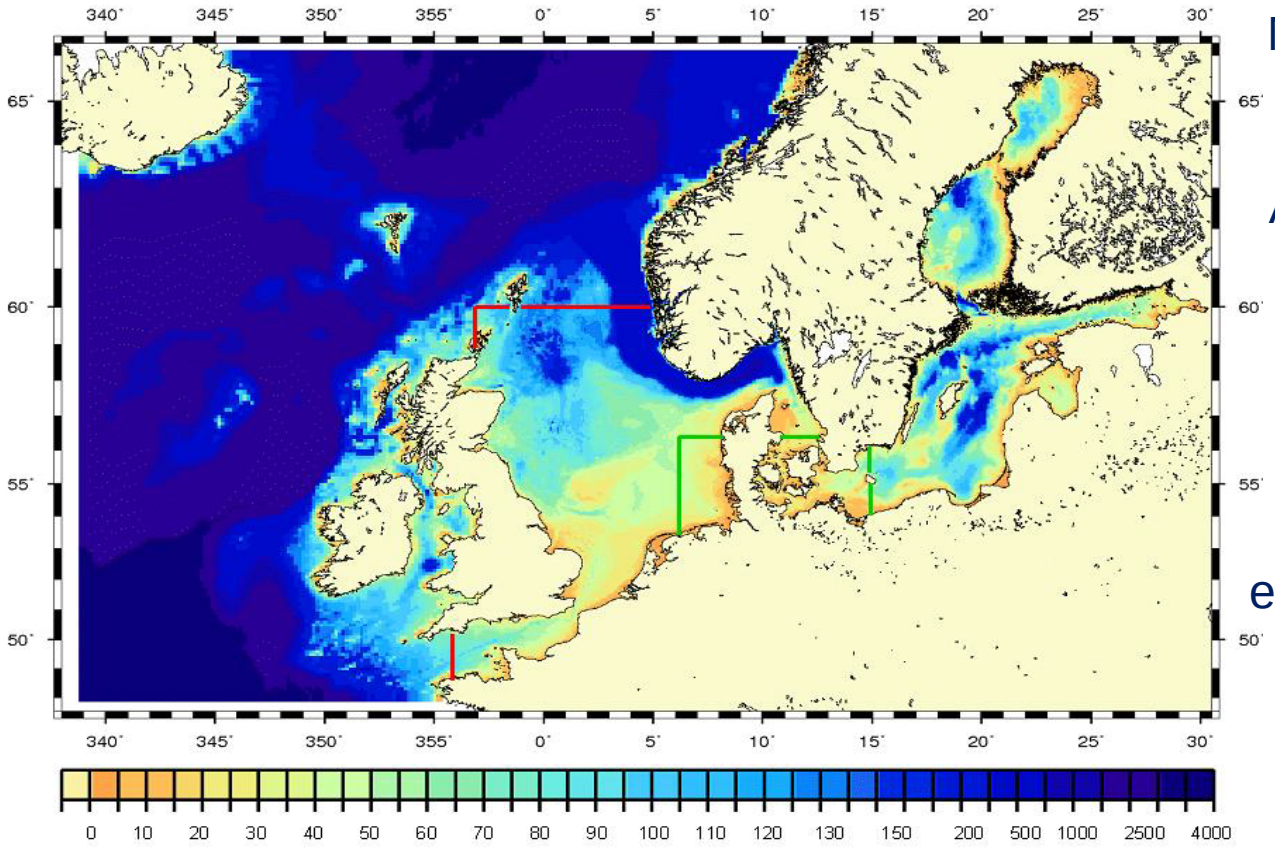
- Since 2014 CMEMS
  - Part of Copernicus World (with circulation model already from beginning of MyOcean)
  - Backup for MyOcean/Copernicus
  - Daily forecast
  - Development of HBM-ERGOM ongoing

- Since 05/2016 MeRamo
  - Funded by DLR, consortium with AWI, HZG, IOW
  - Usage of Sentinel data for assimilation
  - Aiming at providing infortmation directly usable for the Marine Strategy framework directive

Modell system at BSH



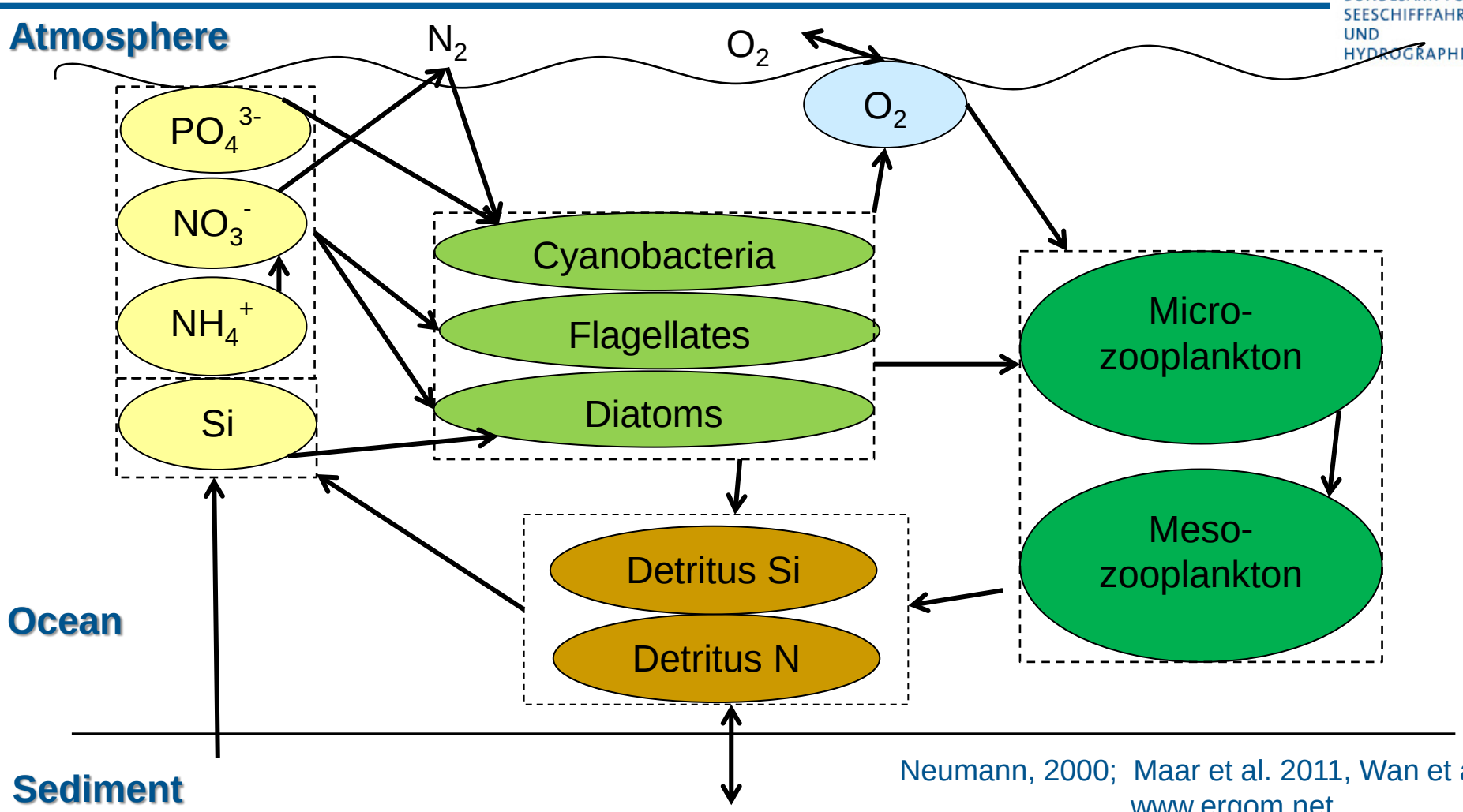
- 5 km
- 900 m

Meteorology from DWD
Boundary conditions
Riverinput
Atmospheric deposition

Circulationmodel (**HBM**, Brüning et al. 2014, *Die Küste*) coupled to ecosystem model (**ERGOM**, Neumann 2000)

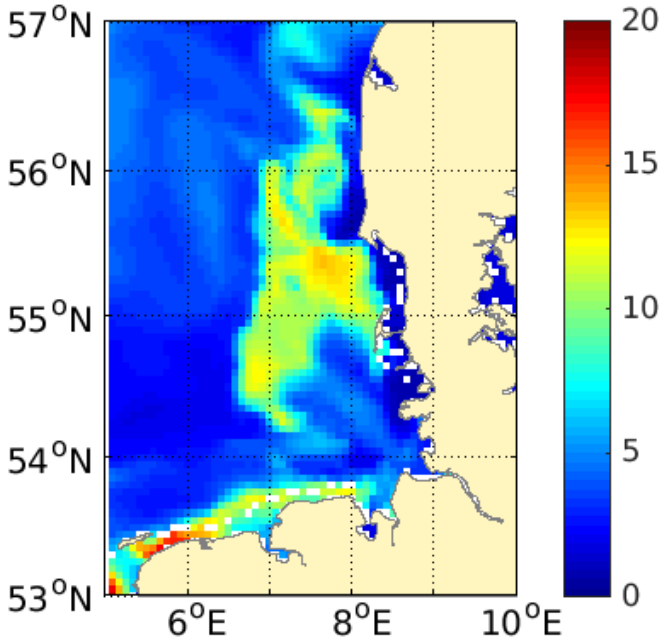
Forecast
Hindcast

ERGOM

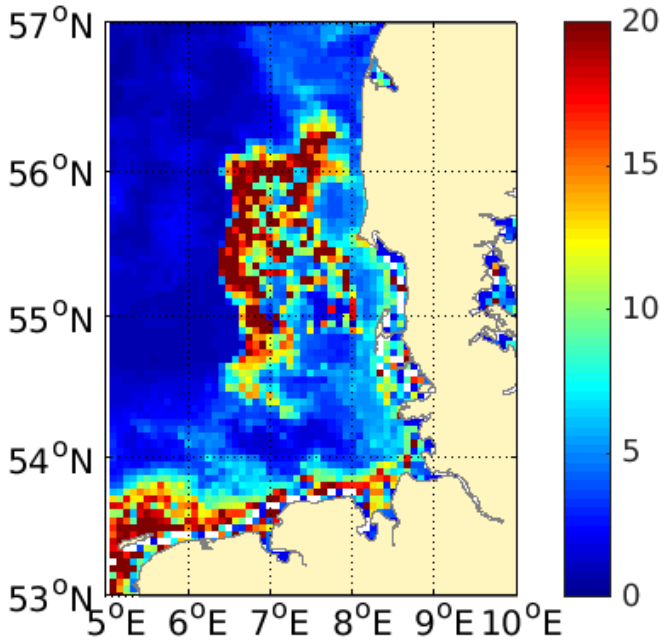


Neumann, 2000; Maar et al. 2011, Wan et al. 2012
www.ergom.net

Validation: EO-Data

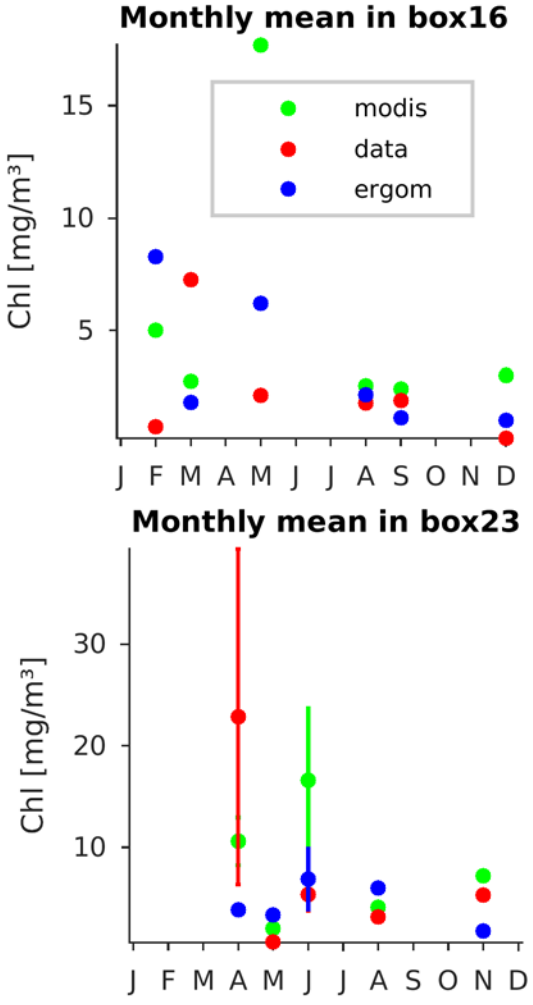


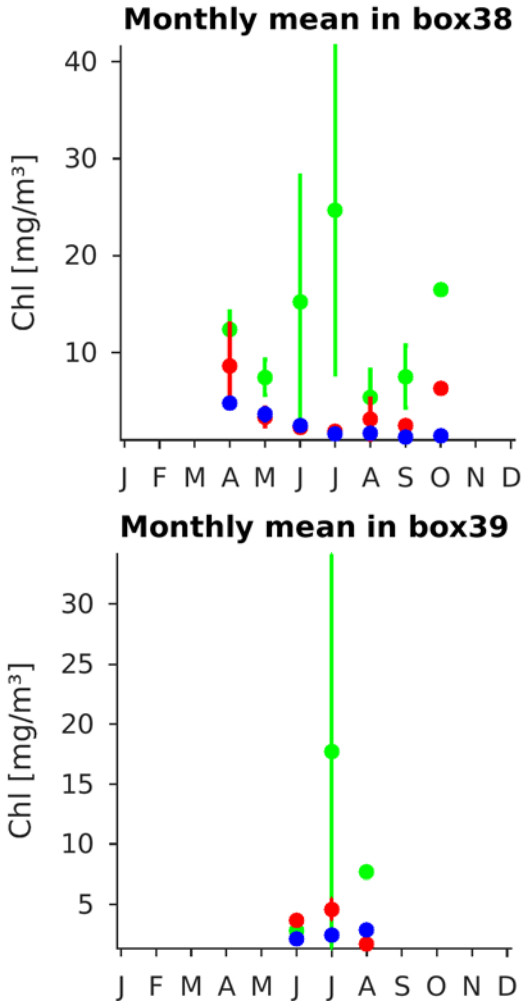
Chlorophyl from ERGOM
mg /m³
20.4.2008 German Bight

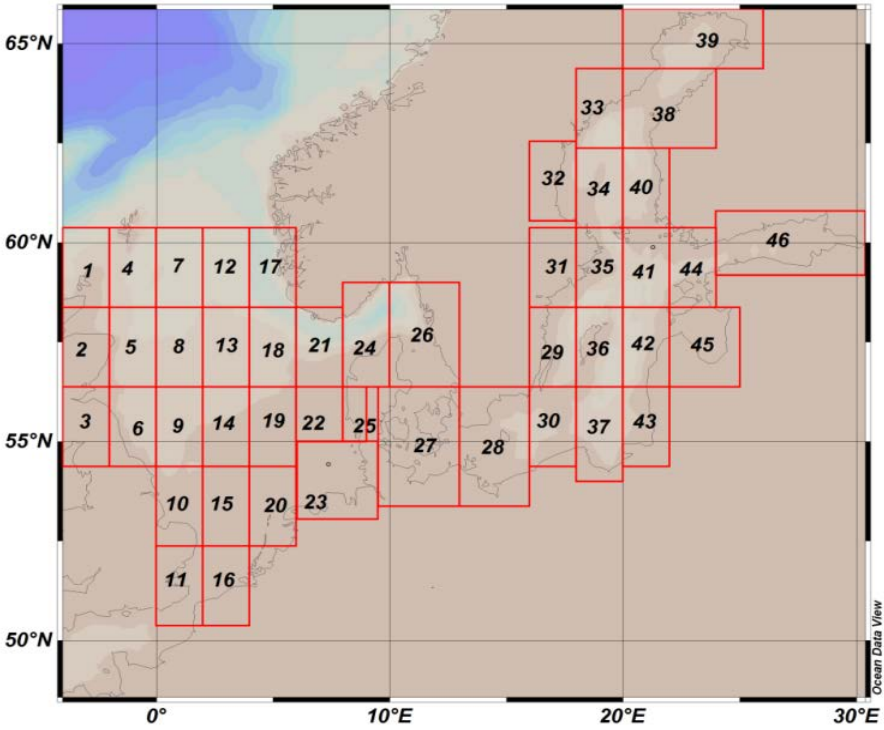


Chlorophyl mg /m³
MODIS
20.4.2008 German Bight

Validation: In-Situ, model and EO-Data

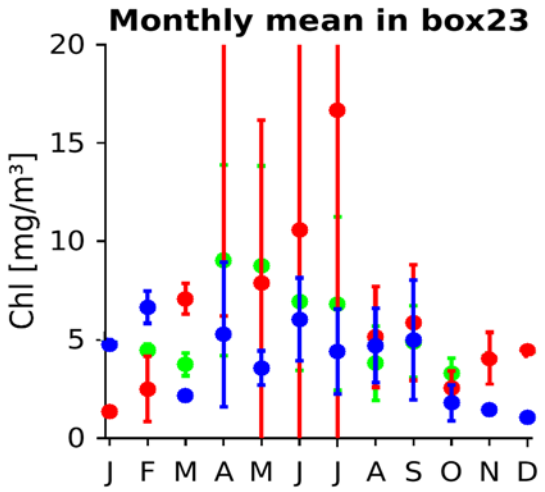


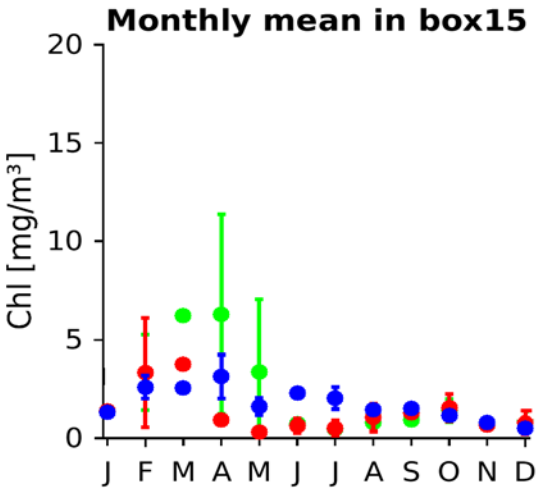


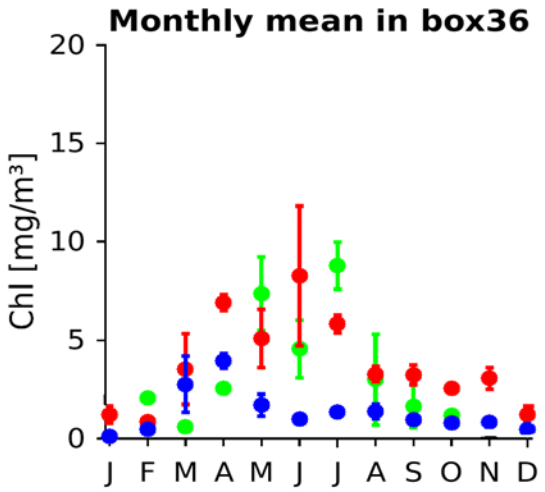


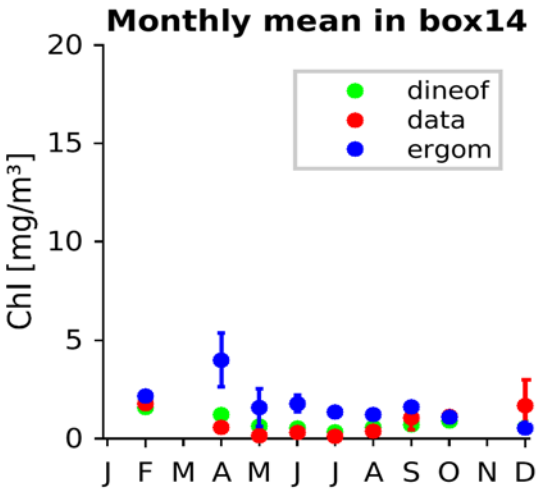
Modis Data from Brockmann Consult

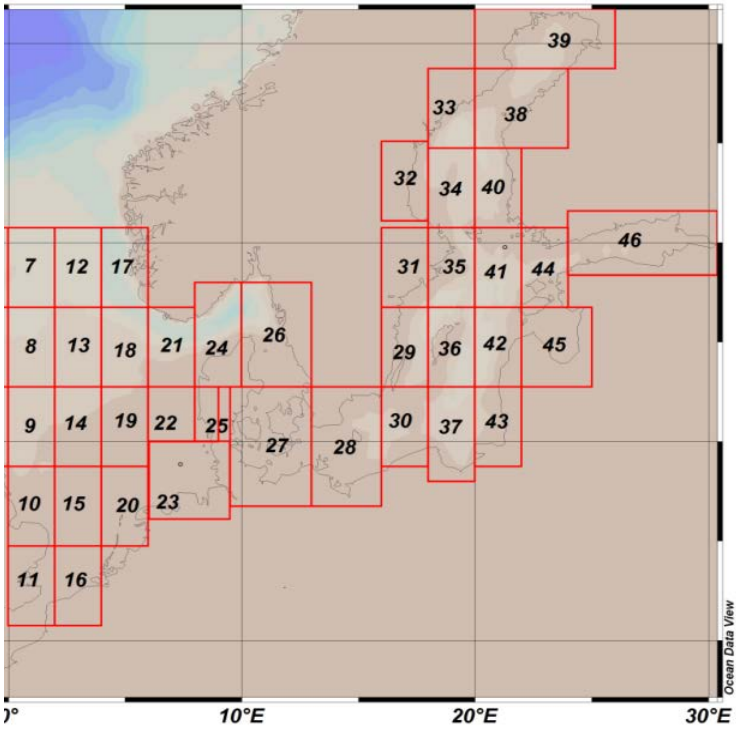
Validation: In-Situ, model and EO-Data











Dineof Data from
Brockmann Consult

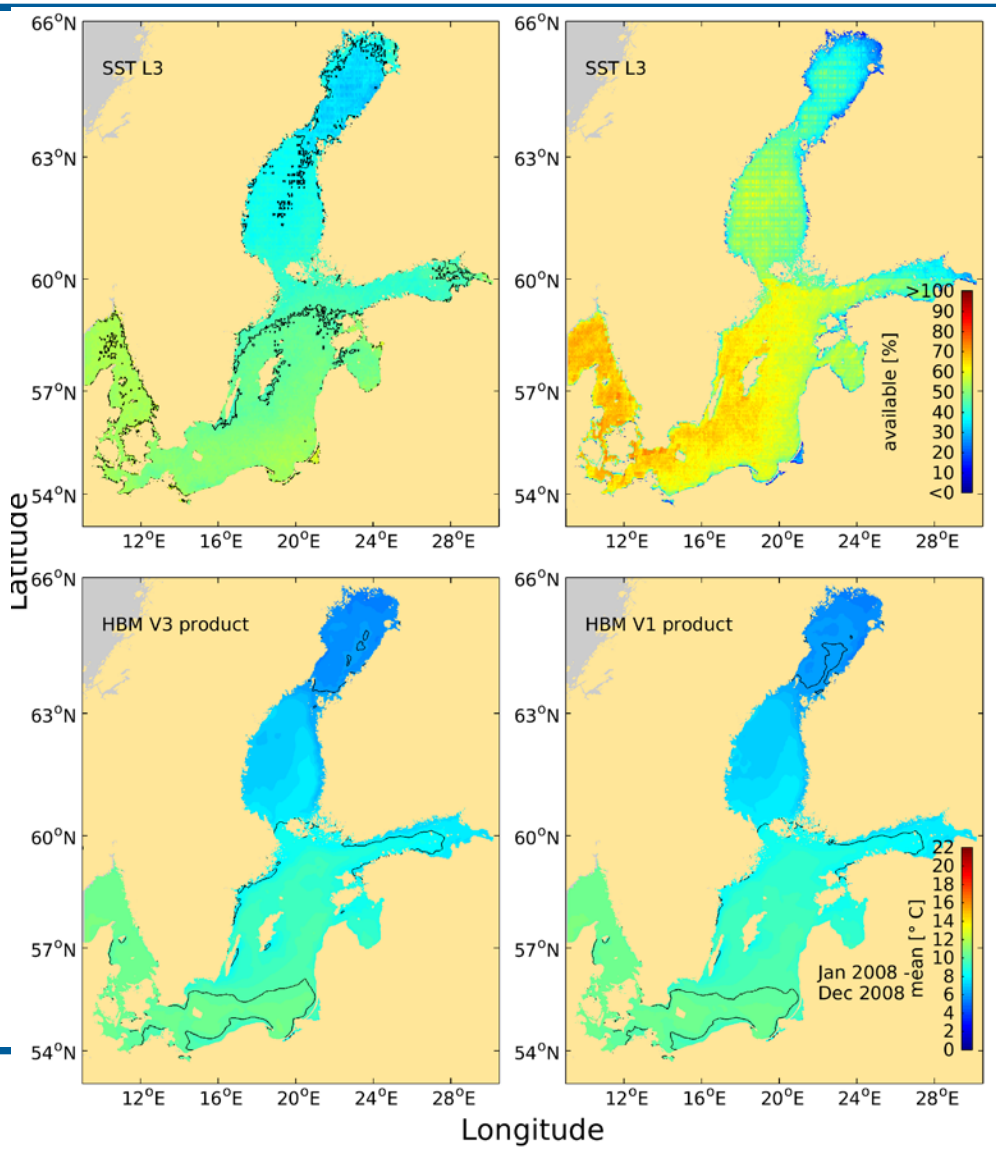
Productqualification

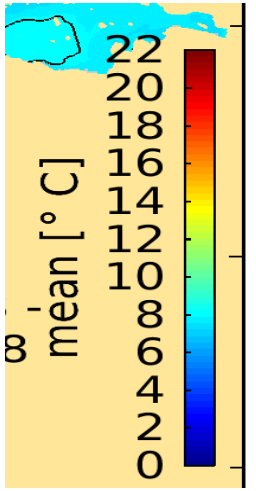
SST L3 from CMEMS

SST L3 from CMEMS Availability

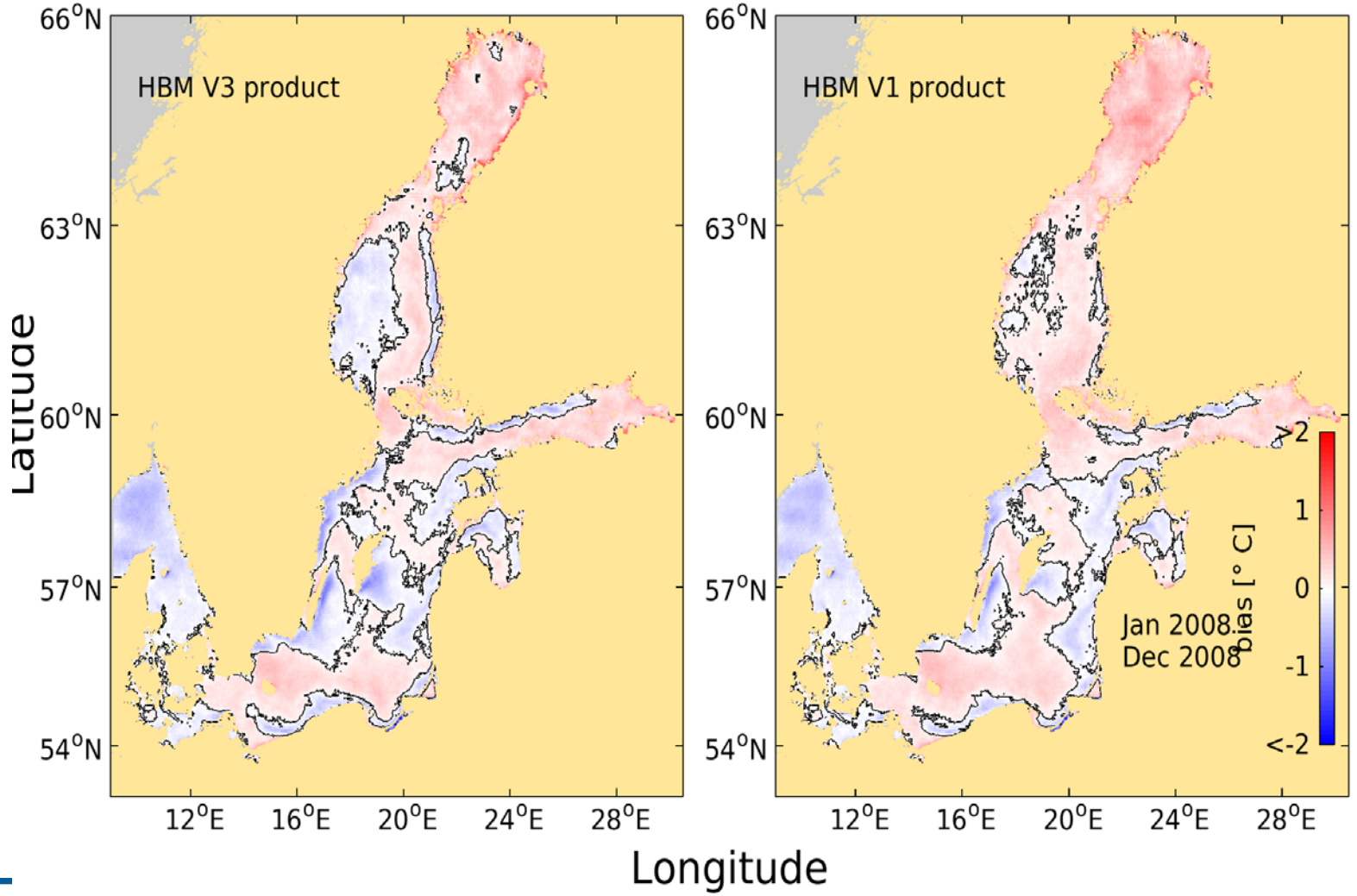
Model SST from product candidate

Model SST from current product





Productqualification



Dataassimilation

DeMarine

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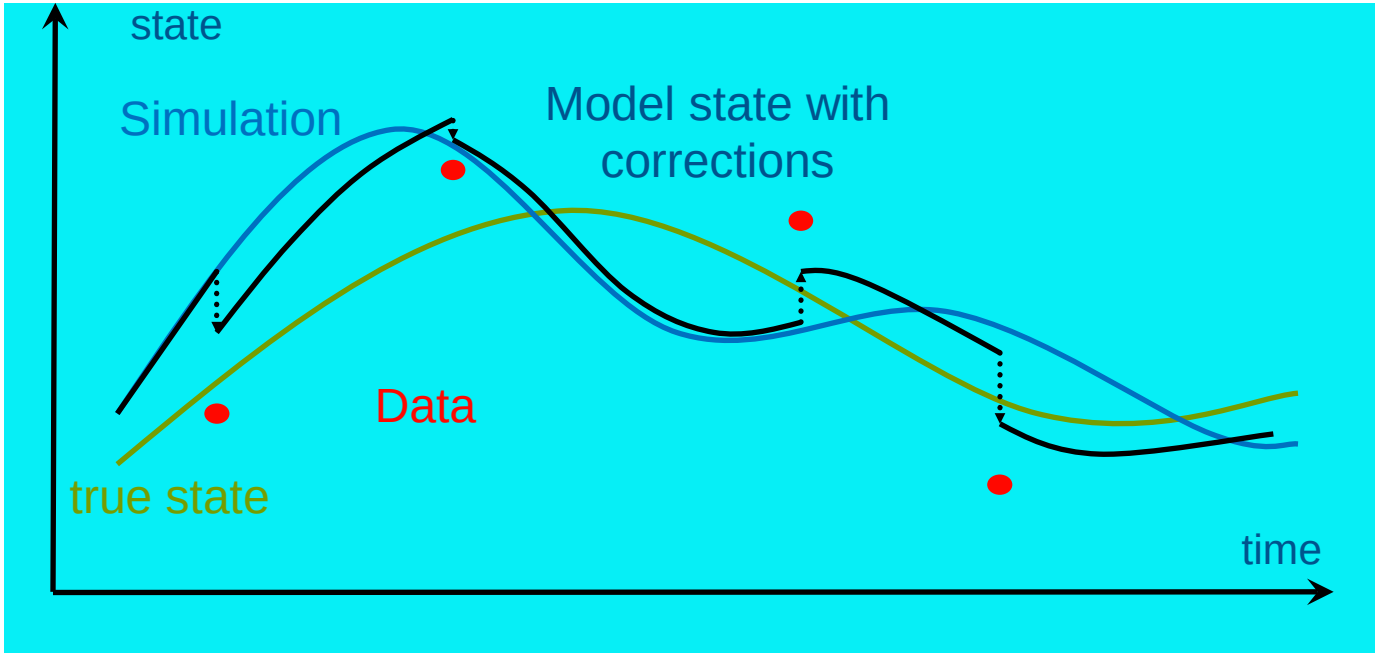
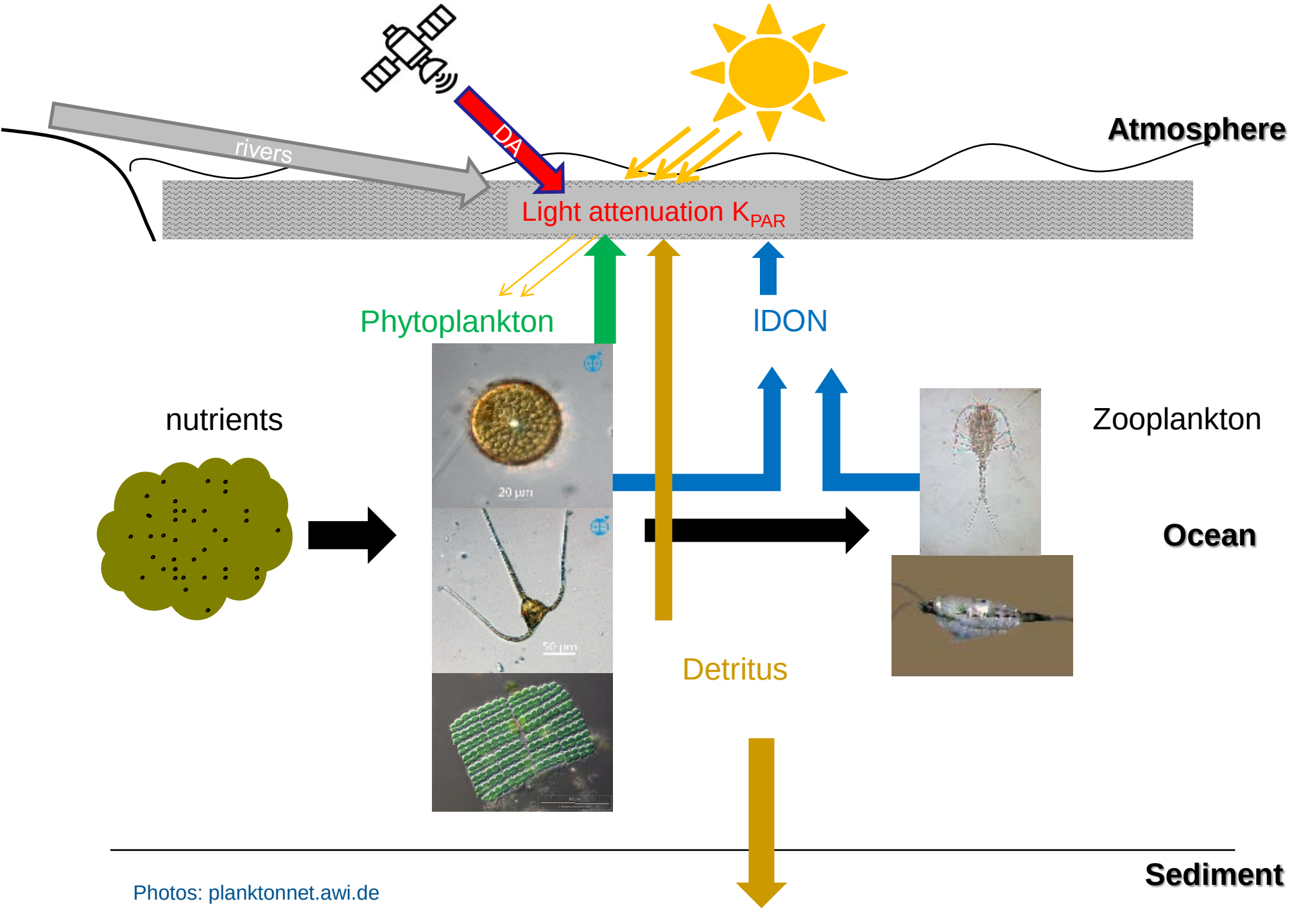
- Using PDAF (Nerger & Hiller 2013)
- combination of model and observation (e.g. SST)
- Correction depends on error estimates
- Model error and covariances from ensemble estimates





Photos: planktonnet.awi.de

Dataassimilation SST

DeMarine

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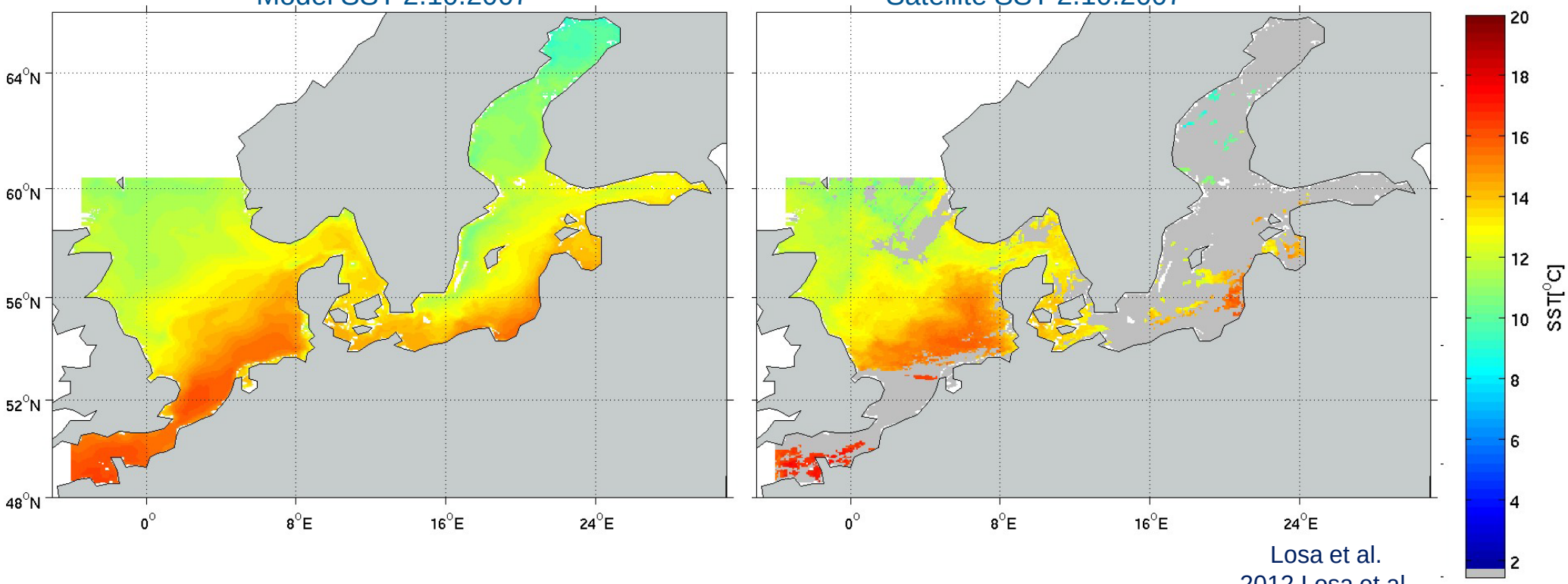
Model SST 2.10.2007

Satellite SST 2.10.2007



Losa et al. 2012,Losa et al. 2014

Dataassimilation SST

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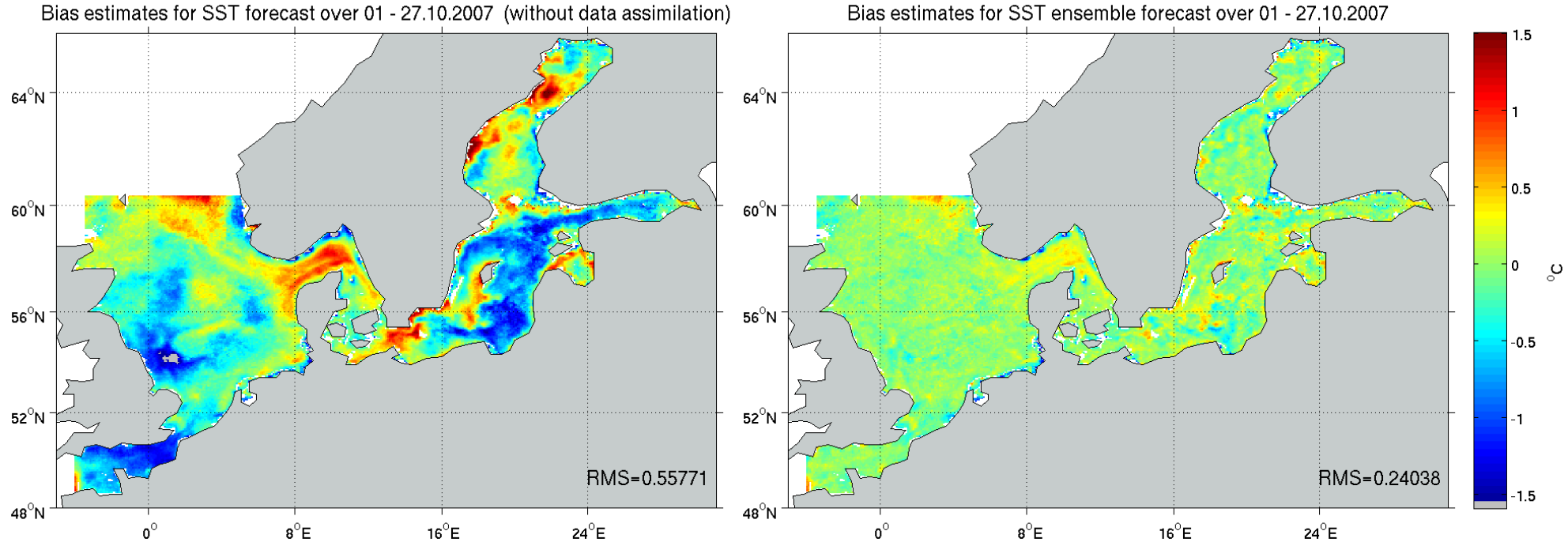

Current project MeRamo

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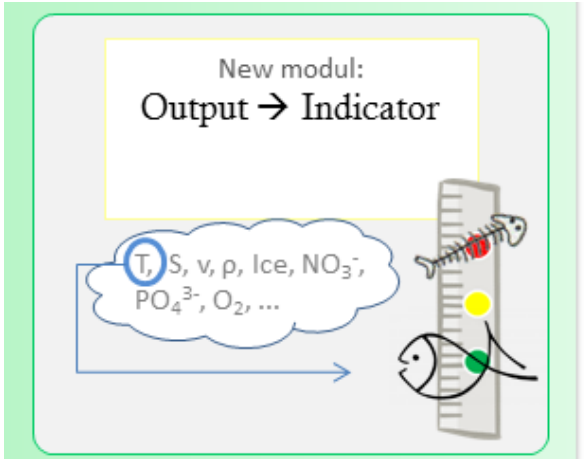
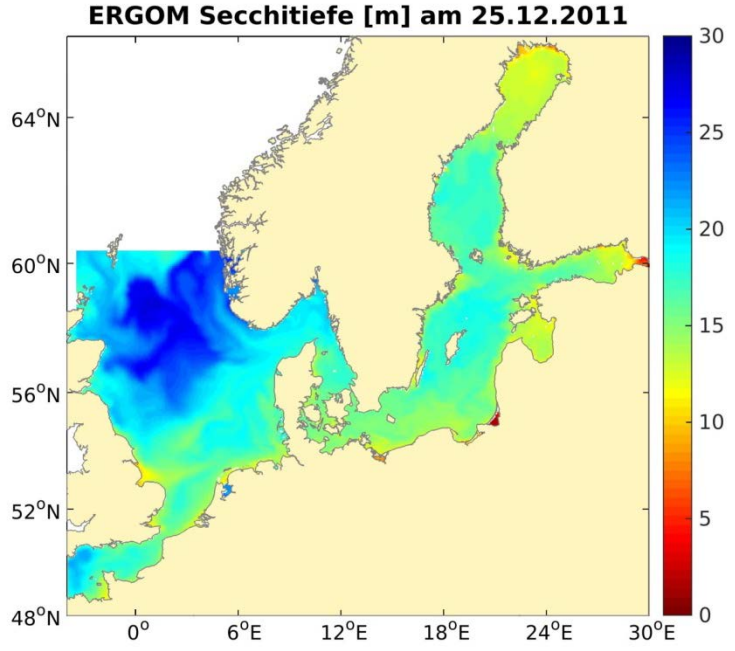
- Since 5/2016
- Funded by national aeronautics and space research centre (DLR)
- In cooperation with AWI, IOW and HZG
- Focus on assimilation of Sentinel data into biogeochemical model
- Specific output modul to support reporting for the Marine Strategy Framework Directive





Thank you!

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