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ECOOP IP

European COastal-shelf sea OPerational Observing and forecasting system Integrated Project

D10.1.5.1: Multidecadal databse of modelled shelf seas-coastal climate and ecosystems

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1. Publishable Executive Summary

Results from hindcast simulations of physics and lower trophic levels for the North Sea and Baltic Sea have been made freely available for download through OpenDAP and ftp.

2. Introduction

The main focus in ECOOP WP10 has been on quantification of monthly to decadal variability of the shelf seas (North Sea and Baltic Sea) climate and lower trophic levels. This objective has been fulfilled through a number of models simulations by the different partners. To make these results available both for the rest of ECOOP and for users outside ECOOP the results has been made available for download.

The present report gives a brief overview of the data sets that is available, and how to get access to them. For a full description of the outputs of the simulations, please refer to the other WP10 deliverables.

3. PARTNER CONTRIBUTIONS

3.1. UiB-GFI – the ECOSMO database

3.1.1. Database, long-term simulations

UiB-GFI: ECOSMO North Sea/Baltic (physics, 10km)	1958	2004	Schrum et al., 2003
UiB-GFI: ECOSMO North Sea/Baltic (physics, prim.prod, sec.prod, 10km)	1980	2004	Schrum et al., 2006

Modeled lower-tropic levels dynamics (phyto- and zooplankton biomass and production) as well as corresponding hydrodynamics are available at ftp.uib.no/pub/gfi/corinna/RECLAIM/.

3.1.2. Content

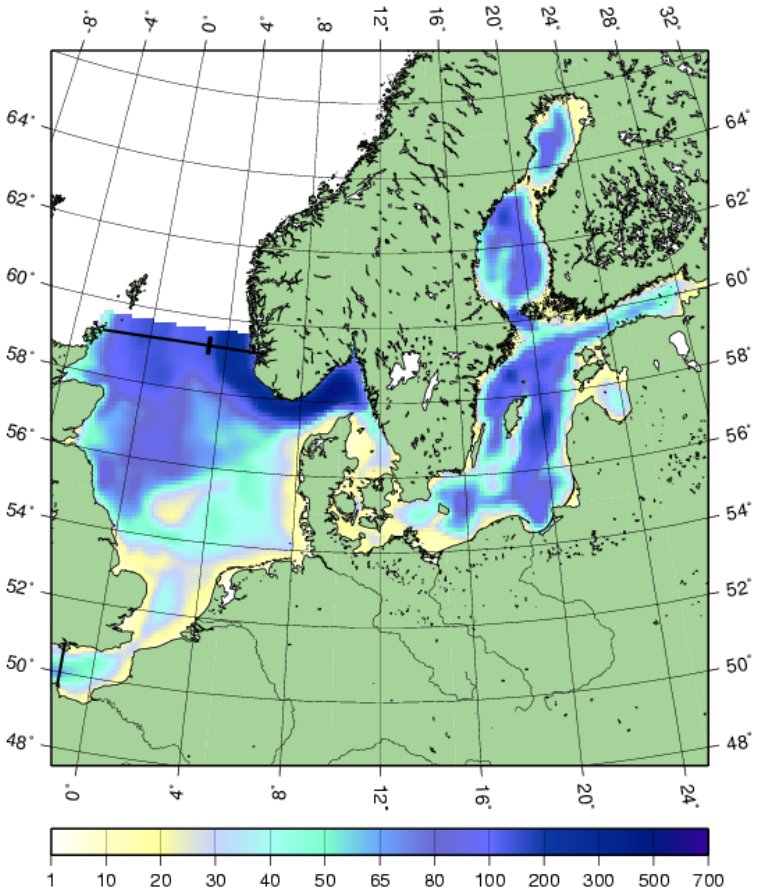

Figure 3.1.1:Model area and bathymetry [m].

The data base contains model data derived from long-term simulation runs of the model ECOSMO (ECOSystem Model, Schrum et al., 2003; Schrum et al., 2006a+2006b; 3-d Physical-biological model, North Sea/Baltic Sea, 10 km resolution). The data are 2-d fields provided in weekly and monthly resolution for the period 1980-2004 (Run M24) and for the period 1958-2004 (Run TCH/N13). Weekly

and monthly averages of the parameters are gridded on the model regular spherical coordinate grid with a horizontal resolution of approximately 10km. The data set combines physical and biological parameters derived directly from the model output (temperature, salinity and horizontal velocity field, primary and secondary production, zooplankton and phytoplankton biomass) and, a number of second order physical parameters, a detailed documentation about data structure, model setup and a number of critical analysis isprovided as part of the database and available online. The data are provided in both ASCII and binary NetCDF formats.

3.1.3. List of primary and secondary model parameter

Model bathymetry and model parameter are provided on the model grid at model T-points (center of grid cell). For the ASCII data sets we only stored valid (wet) grid points. In the following, this grid is referred to as 'basic' grid. The data include primary model state variables (such as temperature, salinity, velocities fields), which are defined at T-points (center of grid cell) as well as secondary parameters, which were calculated in addition (indices of stratification, depth of thermocline/pycnocline, indices of frontal activity). The primary parameters (1-11) and model bathymetry are associated with the 'basic' grid. Because indices of stratification and thermocline/pycnocline depth were produced using vertical differences, they are defined only in model grid points which are resolved by at least 2 model layers (basic-1), this refers to parameter 1, 12, 13, 15, 16. For indices of frontal activity (14 and 17), the valid values are prescribed at the grid points which have more than 2 layers and in addition, these have to be surrounded by grid cells with 2 defined layers (basic-2). Undefined data points are assigned to the value .99900E+03 (only in case of basic-1 and basic-2 grids)**.**
All output in NETCDF files is stored using the full 2-d model grid model grid including undefined and/or 'dry' data points. These are set to 0.99900E+03 (basic-0).

Table3.1.1. List of physical variables and secondary parameter.

nn	Physical parameters (1-17)	Units	Grid ASCII
	Basic parameters		
1.	Bottom shear stress (vertical eddy viscosity coefficient above the bottom)	10^3* m^2s^{-2}	basic-1
2.	Current U-component (E-W) at the surface	$m\ s^{-1}$	Basic
3.	Current V-component (S-N) at the surface	$m\ s^{-1}$	Basic
4.	Speed of current at the surface	$m\ s^{-1}$	Basic
5.	Current U-component (E-W) above the bottom	$m\ s^{-1}$	Basic
6.	Current V-component (S-N) above the bottom	$m\ s^{-1}$	Basic
7.	Speed of current above the bottom	$m\ s^{-1}$	Basic
8.	Temperature at the surface	ºC	Basic
9.	Temperature at the bottom	ºC	Basic
10.	Salinity at the surface	PSU	Basic
11.	Salinity at the bottom	PSU	Basic
	Temperature based indices and related parameters		
12.	Temperature index of stratification (max. vertical temp. gradient)	ºC	basic-1

13.	Depth of thermocline (at the max. vertical temp. gradient)	M	basic-1
14.	Temperature index of frontal activity*	-	basic-2
	Density based indices and related parameters		
15.	Density index of stratification(max. vertical density differences)	kg m^{-3}	basic-1
16.	Depth of pycnocline (at the max. vertical density differences)	M	basic-1
17.	Density index of frontal activity*	-	basic-2
	Bathymetry		
	Model bathymetry	M	Basic

- dimensionless with a range: 0~200.

Table 3.1.2.Names of files containing physical parameters.

nn	Physical parameter	Parameter_name
	Basic parameters	
1.	Bottom shear stress	Bott_ShearStress
2.	U-component at the surface	U_CurrentSurface
3.	V-component at the surface	V_CurrentSurface
4.	Speed at the surface	UV_speed_Surface
5.	U-component above the bottom	U_current_Bottom
6.	V-component above the bottom	V_current_Bottom
7.	Speed above the bottom	uv_speed_Bottom
8.	Temperature at the surface	Temp_Surface
9.	Temperature at the bottom	Temp_Bottom
10.	Salinity at the surface	Salinity_Surface
11.	Salinity at the bottom	Salinity_Bottom
	Temperature based indices and related	
12.	Temperature index of stratification	T_index_of_strat
13.	Depth of thermocline	ThermoclineDepth
14.	Temperature index of frontal activity	T_index_of_front
	Density based indices and related	
15.	Density index of stratification	D_index_of_strat
16.	Depth of pycnocline	Pycnocline_Depth
17.	Density index of frontal activity	D_index_of_front
	All parameters	PHYSICS

Table 3.1.3.List of variables included in the 'biological' data set. The last column lists corresponding files names.

nn	Parameters	Units	Parameter_name
	Biomass		
1.	Total phytoplankton	gC m^{-2}	Biom_P
2.	Total zooplankton	gC m^{-2}	Biom_Z
	Productivity		

3.	Total primary production	gC m^{-2} day^{-1}	Prod_P
4.	Grazing Z on phytoplankton	gC m^{-2} day^{-1}	Prod_ZonP
5.	Grazing Z on phytoplankton and detritus	gC m^{-2} day^{-1}	Prod_ZonPD
6.	Grazing Z on phytoplankton, detritus and small zoo	gC m^{-2} day^{-1}	Prod_ZonPDZ
Concentration			
7.	Oxygen at the bottom (O2)	ml/l	Conc_O2

- Biomass and production were derived as depth integrated values and then were averaged in time. Thus, productivity characteristics are weekly and monthly means in gC m^{-2} day^{-1}, not accumulated values.

Data structure

Main specifications of the data follow below:

Temporal resolution: weekly and monthly averages.

Spatial resolution: φ=6' x λ=10' (~10km x 10km) on the model regular spherical coordinate grid.

Spatial coverage:

the North Sea domain:
Minimum latitude: 49.283, Minimum longitude: -3.667
Maximum latitude: 58.983, Maximum longitude: 10.00
the Baltic Sea domain:
Minimum latitude: 53.88333, Minimum longitude: 10.16667
Maximum latitude: 65.78333, Maximum longitude: 30.16667.

Model topography is provided in acsii files: topo_NSea.dat and topo_BSea.dat for the domains of the North Sea and the Baltic, respectively.

Data are stored in files of two data types: 1) including only one single parameter and 2) including all physical parameters. File names are organized in the following forms:

1) **Parameter_name_ Sea_X _YYYY-YYYYY_ppp.ext** where
   Sea is 'NSea' for the North Sea and 'BSea' for the Baltic,
   X identifies temporal resolution, 'W' (weekly) or 'M' (monthly),
   YYYY-YYYYY is the period '1958-2004' or '1980-2004',
   ppp is the model experiment 'tch' for data 1958-2004 and 'm24' for 1980-2004 (sea explanations on the model experiments and temporal coverage of the data below),
   ext identifies a file format, ascii: 'dat' or netCDF: 'nc'.

   Parameter_name are names corresponding to each of the physical parameters.

2) The file containing all parameters is called with **Parameter_name '**PHYSICS**'** .

   All file names corresponding to **Parameter_name** are listed in Tab 3.1.2

References

Schrum, C., Siegismund, F, St. John, M (2003): Decadal Variations in the stratification and circulation patterns of the North Sea. Are the 90's unusual? ICES Symposium of Hydrobiological Variability in the ICES area 1990-1999, ICES Journal of Marine Science, Symposia series, Vol. 219, 121-131.

Schrum, C, Alekseeva, I, St. John, M (2006a): Development of a coupled physical–biological ecosystem model ECOSMO Part I: Model description and validation for the North Sea, Journal of Marine Systems, doi:10.1016/j.jmarsys.2006.01.005.

Schrum, C, St. John, M, Alekseeva, I (2006b): ECOSMO, a coupled ecosystem model of the North Sea and Baltic Sea: Part II. Spatial-seasonal characteristics in the North Sea as revealed by EOF analysis. Journal of Marine Systems, doi:10.1016/j.jmarsys.2006.01.004

3.2. IMR – NORWECOM database

The NORWegian ECOlogical Model system (NORWECOM, Skogen et al. (1995), Skogen & Søiland (1998)) hindcast, has been run for the period 1985-2008 for an extended North Sea. The results from the hindcast are fully described in Hjøllo et al., (2009) and Skogen & Mathisen (2009). A short overview are also in given in ECOOP D10.1.1.1 and D10.1.2.1.

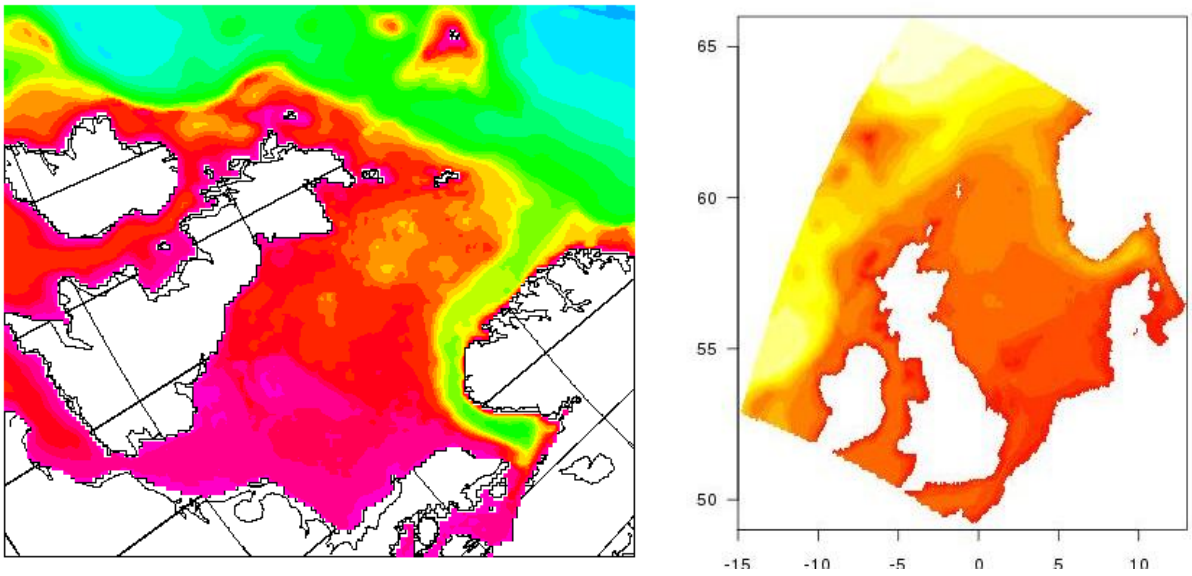

Figure 3.2.1: Model area and bathymetry. Polarstereographic grid via ftp (left) and regular long/latt grid via OpenDAP (right)

Results from the hindcast are stored in netCDF as monthly means (one file pr.year) and are available for download both via ftp (ftp://ftp.imr.no/morten/ecoop) and OpenDAP (http://talos.nodc.no:8080/opendap/norwecom/). Via ftp the original dataset are stored in sigma layers on a polar stereographic North Sea grid (Figure 1, left) with 10km horizontal resolution (160x140 points), while on the OpenDAP the results are stored on a regular longitude/latitude grid (0.1 x 0.1 degress, see Figure 1, right) in 18 fixed depths (0, 5, 10, 20, 30, 50, 75, 100, 150, 200, 250, 500, 750, 1000, 1500, 2000, 3000, 4000) with a total of 171x281 points in each layer. Time is given in hours since 1950-01-01 01:00:00

The parameters available are:

Parameter name	Unit	Remark
Bathymetry	m	
Longitude	degrees	only on ftp dataset
Latitude	degrees	only on ftp dataset
Surface elevation	m	
U-velocity	m/s	ftp: model grid orientation
V-velocity	m/s	ftp: model grid orientation
Salinity	ppt	
Temperature	degress Celsius	
Inorganic nitrogen	mg/m^3	
Phosphate	mg/m^3	
Silicate	mg/m^3	
Diatoms	mgN/m^3	
Flagellates	mgN/m^3	
Oxygen	mg/m^3	

The data are free for download for non-commercial use. To cite the data, the references below can be used. For further questions please contact morten@imr.no **:**

References:

Hjøllo, S.S., Skogen, M.D. and Svendsen, E. (2009). Exploring currents and heat within the North Sea using a numerical model*, Journal of Marine Systems*, **78**:180-192

Skogen, M.D. and Mathisen, L.R. (2009). Long term effects of reduced nutrient inputs to the North Sea. *Estuarine Coastal and Shelf Science* **82**:433-442.

Skogen, M.D., Svendsen, E., Berntsen, J., Aksnes, D. and Ulvestad, K.B. (1995). Modeling the primary production in the North Sea using a coupled 3D Physical Chemical Biological Ocean model, *Estuarine, Coastal and Shelf Science*, **41**:545-565.

Skogen, M.D. and Søiland, H. (1998). *A User's guide to NORWECOM v2.0. The NORWegian ECOlogical Model system.* Tech.report, Fisken og Havet 18/98, Institute of Marine Research, Pb.1870, NO-5024 Bergen, 42pp.

3.3. NERC

No contribution delivered