NORTH WEST EUROPEAN SHELF & ATLANTIC MARGIN

INSTITUTE: PML
MODEL NAME: POLCOMS-ERSEM
AREA OF APPLICATION: North West European Shelf & Atlantic Margins (20°W-13°E, 40°N-65°N.)

MODEL DOMAIN: (20°W-13°E, 40°N-65°N.)

STATE VARIABLES:
ERSEM's biological state variables generally have variable stoichiometry and are hence defined by a set of 3 or 4 'statelets'. So for example diatoms (P1) are defined by their carbon, nitrogen, phosphorous and silicon content (P1c, P1n, P1p, P1s).

	PELAGIC	C mg/m3	N mmol/m3	P mmol/m3	Si mmol/m3	Fe** umol/m3	Chl-a mg/m3	others	
Inorganic	Nitrate		X						
	Phosphate			X					
	Ammonium		X						
	Silicate				X				
	Iron					X			
	Oxygen							mmol/m3	
	DIC	mmol.m^{-3}							
	Temperature							°C	from physical model
	Salinity							psu	from physical model
Org. matter	Labile diss.	X	X	X					
	semi-lab. diss.	X							
	small particulates	X	X	X					
	medium particulates	X	X	X	X				
	large particulates	X	X	X	X				
Phytopl	Diatoms	X	X	X	X	X	X		
	Flagellates	X	X	X		X	X		
	Picophytopl	X	X	X		X	X		
	Large ined dinofs	X	X	X		X	X		
	Bacteria	X	X	X					
Zoopl	Mesozoo	X	X						
	Microzoo	X	X	X					
	Het. nanofl	X	X	X					

	BENTHIC	C (mgC/m2)	N (mmol/m2)	P (mmol/m2)	Si (mmol/m2)	others
Inorganic	Phosporous			X		
	Nitrate		X			
	Ammonium		X			
	Silicate				X	
	Oxygen					mmol/m2
	DIC	mmol/m2				
	NO2'					mmol/m2
Org. matte	diss. detrital	X	X	X		
	slowly degr.	X	X	X	X	
	avail. Refract.	X	X	X		
	buried refract.	X	X	X		
Bact	Aerobic	X				
	Anaerobic	X				
Zoober	deposit feed.	X				
	filter feeders	X				
	meio-	X				
Depth	aerobic layer					m
	reduced layer					m
	refractory	m	m	m		
	slowly degr.	m	m	m	m	

	Derived Variables	Pelagic	Benthic	Notes
Carbonate	total Alkalinity	mmol/m3		
	CO2 (partial pressure)	ppmv		
	Carbonates	mmol/m3		Output from carbonate system module.
	Bicarbonates	mmol/m3		
	Carbonic acid	mmol/m3		requires DIC and a formulation for Talk, T, S, P as inputs
	pH	pH		
	Carbonate sat. level	~		
	air-sea exchange of CO2	$mmol.m^{-3}.d^{-1}$		
Links	Net / Gross production	$mgC.m^{-3}.d^{-1}$		for individual pfts or community
	Respiration	$mgC.m^{-3}.d^{-1}$	$mgC.m^{-2}.d^{-1}$	for individual pfts or community
	Uptake fluxes	$mgC.m^{-3}.d^{-1}$	$mgC.m^{-2}.d^{-1}$	for each uptake link or aggregated
	Nutrient uptake	$mmol.m^{-3}.d^{-1}$		for individual pfts or community (f-ratios)
P-B	Sedimentation		$mgC.m^{-2}.d^{-1}$	
	Nutrient exchange		$mmol.m^{-2}.d^{-1}$	

OBJECTIVES:
to understand the impacts of ocean acidification, climate change and other anthropogenic pressure on the carbon and nutrient cycles and productivity of the NW European Shelf seas.

VALIDATION:

Like-with –like comparison:
A series of metrics will be calculated from the comparison of model results against observed data coming from a series of scientific cruises:
Mean error, NRMS (Normalised Root Mean Square error, i.e. RMS normalised to the standard deviation of observation), Cost Function (Moll, 2000), Nash-Sutcliff Model Efficiency (Nash and Sutcliff, 1970), correlation coefficient, RSD (ratio between the standard deviation, Taylor diagram.

Satellite comparison:
Surface patterns of SST and Chl-a will be compared with Seawifs monthly composite. The analysis will be conducted using the same metrics as above, plus the wavelet analysis (casati et al, 2004) to investigate the spatial scale of the patterns better reproduced by the model.

As example of validation, here are the coordinates to plot the Taylor diagram. Those metrics (except Chlorophyll) have been calculated comparing the model results with *in situ* data coming from the CANOBA dataset (Thomas et al., 2004) for the year from summer 2001 to spring 2002. Chlorophyll has been validated against satellite observation from Global colour for the year 2004.

Variable	R^2	$\sigma_{obs}/\sigma_{model}$
Temperature	0.898	1.008
Salinity	0.561	1.139
Phosphate	0.604	1.0261
Nitrate	0.5208	1.0642
Silicate	0.315	1.183
Dissolved oxygen	0.365	0.907
DIC	0.494	0.823
Total Alkalinity	0.303	1.047
Chlorophyll *	0.121	1.410

References

Casati, B., Ross, G. and Stephenson, D.B., 2004. A new intensity-scale approach for the verification of spatial precipitation forecasts. Meteorol. Appl., 11:141-154.

Moll, A., 2000. Assessment of three-dimensional physical–biological ECOHAM1 simulations by quantified validation for the North Sea with ICES and ERSEM data. ICES J. Mar.Sci. 57, 1060–1068

Nash, J.E., Sutcliffe, J.V., 1970. River flow forecasting through conceptual models. Part I—a discussion of principles. J. Hydrol. 10 (3), 282–290.

Thomas, H., Bozec, Y., Elkalay, K. and de Baar, H.J.W., 2004. Enhanced Open Ocean Storage of CO2 from Shelf Sea Pumping. Science, 304:1005-1008.