Partner 14:

GKSS (Geesthacht, Germany)

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Helmholtz Association of German Research Centres

GKSS FORSCHUNGSZENTRUM

Institute for Coastal Research

Operational Systems

- Radar Hydrography
- Remote Sensing
- Coastal Oceanographic Measurement Systems
- In situ Measurements
- Ecosystem Modelling
- Marine Bioanalytical Chemistry

Systems Analysis and Modelling

- Coastal Climate
- Regional Atmospheric Modelling
- Modelling for the Assessment of Coastal Systems
- Data Analysis and Data Assimilation
- Palaeoclimatology
- Environmental Chemistry
- Human Dimension of Coastal Areas

Data Analysis and Data Assimilation (KSD)

Remote Sensing

- SAR

Numerical Modeling

- Wind waves
- Circulation
- Biogeochemistry and SPM transport
- Data Assimilation

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European Projects in KSD

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WASP	The Wadden Sea Project	MAST I	1991-1993
RACC	Regionalization of Anthropogenic Climate Change Simulations	MAST I	1993-1996
MTCF	Medium Term Climatic Variability	MAST II	1993-1996
NEPTUNE	An Integrated Approach for Determing NW European Coastal Extremes	MAST II	1994-1996
EROS 2000	Interaction between the River Danube and the north-western Black Sea: Pilot Phase.	Climate and Environment	1994-1996
WASA	Waves and Storms in the North Atlantic	Climate and Environment	1994-1997
EROS 21	Biogeochemical Interactions between the Danube River and the North-western Black Sea	Climate and Environment	1996-1999
VENTIL	Ventilation of Black Sea anoxic waters	INCO-COPERNICUS	1996-2000
EuroROSE	European Radar Ocean Sensing	MAST III	1998-2001
PIONEER	Modelling of transport of Nutrients including data assimilation	MAST III	1998-2001
PROMISE	PRe-Operational Modelling In the Seas of Europe	MAST III	1998-2001

Co-ordinated by GKSS   Sofia/Oldenburg

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European Projects in KSD-2000s

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ARAL-KUM	Desertification in the Aral Sea Region : a Study of the Natural and Anthropogenic Impacts	INCO-COPERNICUS	2000-2003
MaxWave	Rogue waves - Forecast and impact on marine structures	FP 5 Environment	2000-2003
Searoutes	Advanced Decision Support for Shiprouting based on Full-scale Ship-specific Responses as well as Improved Sea and Weather Forecasts including Synoptic, High Precision and Realtime Satellite Data	FP 5 Transport	2000-2003
Hipocas	Hindcast of Dynamic Processes of the Ocean and Coastal Areas of Europe	FP 5 Environment	2000-2003
DANUBS	Nutrient management in the Danube basin and its impact on the Black Sea	FP 5 Environment	2001-2005
ASSEMBLAGE	ASSEsMent of the BLAck sea sedimentary system since the last Glacial Extreme	FP 5 Environment	2003-2006
ADOPT	Advanced decision support system for ship design, operation and training	FP 6 Transport	2005-2009
SAFEDOR	Design, operation and regulation for safety of ships	FP 6 Transport	2005-2009
SESAME	Assessing and Modelling Ecosystem changes	FP 6 Environment	2006-2010
ECOOP	European COastal-shelf sea OPerational monitoring and forecasting system	FP 6 Environment	2006-2009
YEOS	Yellow Sea observation, forecasting and information system	FP 6 Global Change	2007-2009
HYPOX	In situ monitoring of oxygen depletion in hypoxic ecosystems of coastal and open seas, and land-locked water bodies	FP 7 Environment	2009-2012

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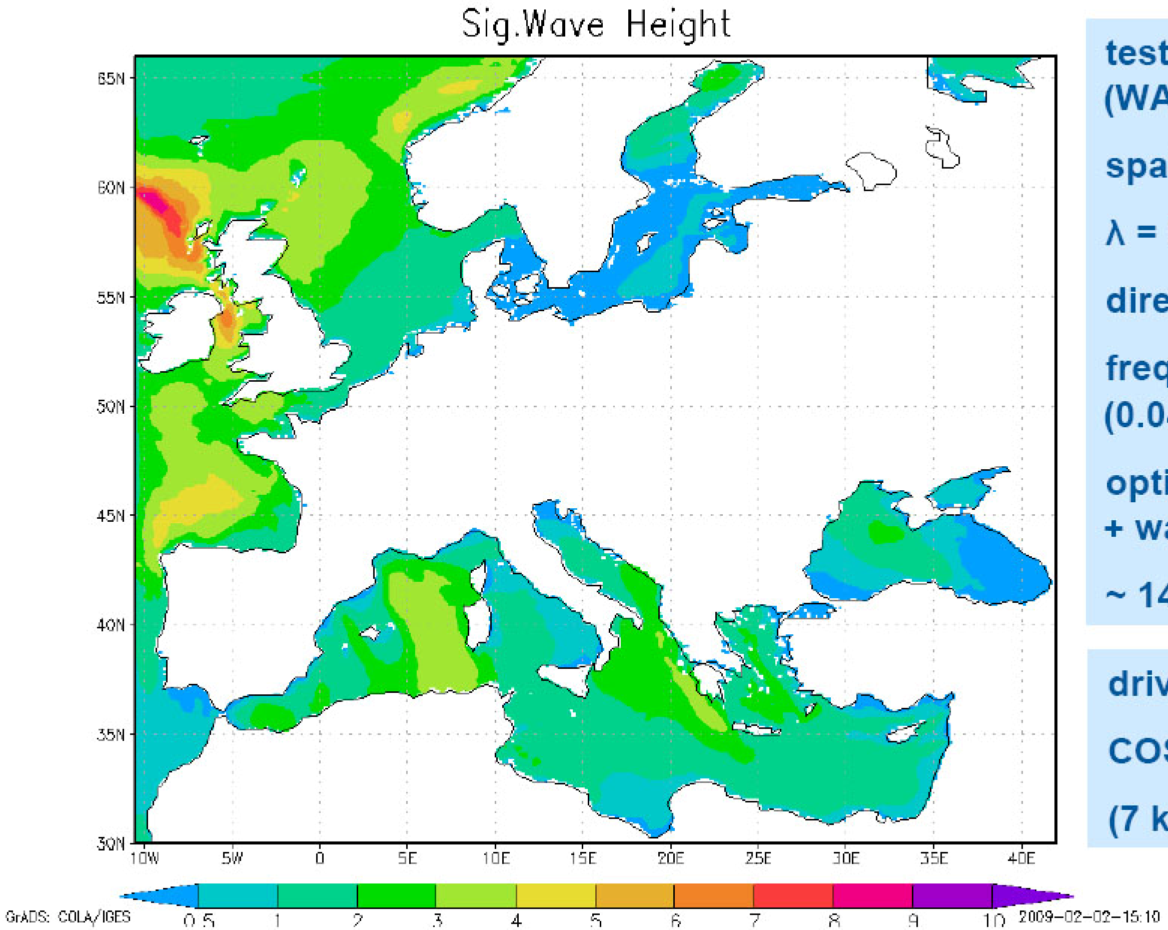
Future DWD regional wave model



testrun: 20090122 00 UTC
(WAM Cycle 4.5.1_MPI)

spatial resolution:

λ = 0.1° , φ = 0.05 °

directions : 24 (15°)

frequencies : 30
(0.04177 - 0.66264 Hz)

options : depth refraction
+ wave breaking

~ 140.000 active gridpoints

driving wind fields :

COSMO-EU

(7 km spatial resolution)

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Nested-grid circulation models

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North Sea-Baltic Sea

$\Delta\lambda=\Delta\phi=$ 3 min, Time step = 30 s

2 open boundaries (S and N)

German Bight

$\Delta\lambda=\Delta\phi=$ 1 km, Time step = 10 s

2 open boundaries (W and N)

Wadden Sea

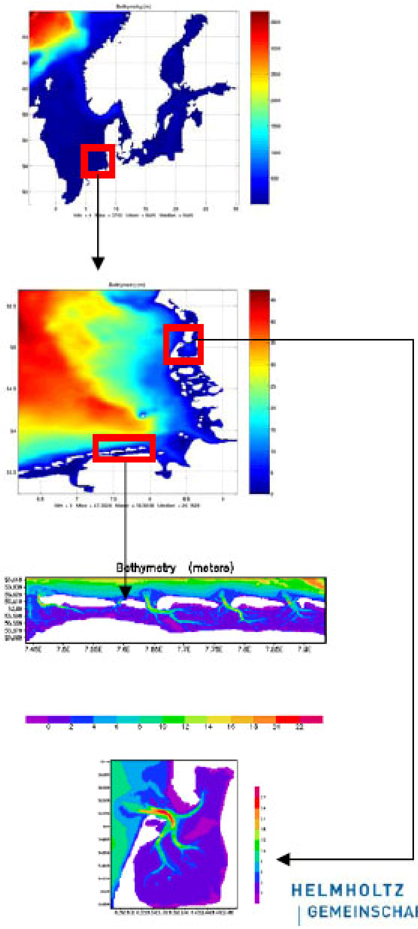
$\Delta\lambda=\Delta\phi=$ 200 km, Time step = 3 s

3 open boundaries (W, N and E)

Sylt-Römö

$\Delta\lambda=\Delta\phi=$ 200 km, Time step = 3 s

3 open boundaries (W, N and E)



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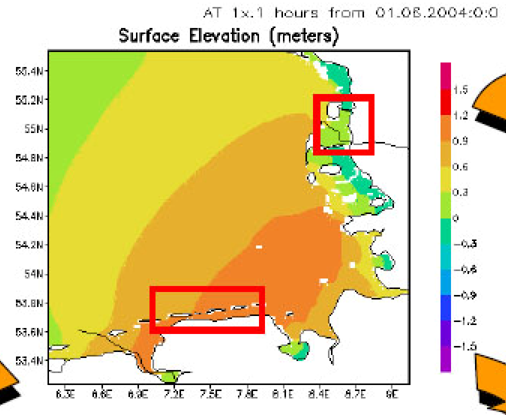
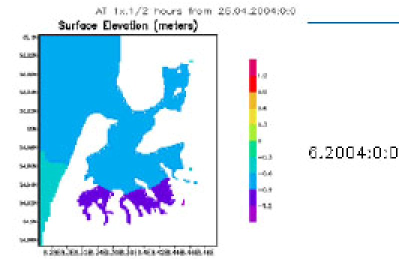
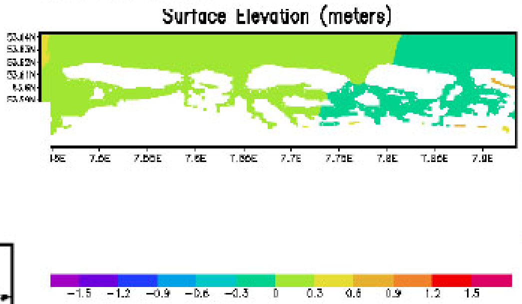
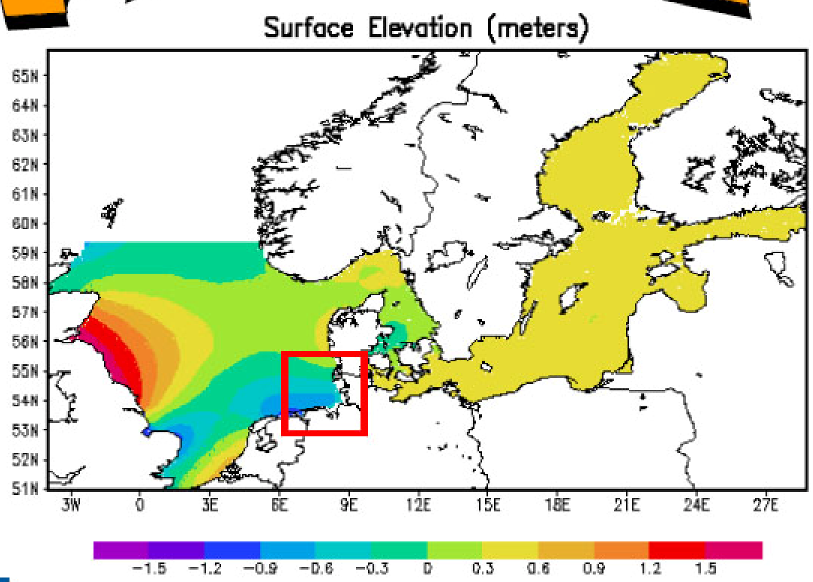
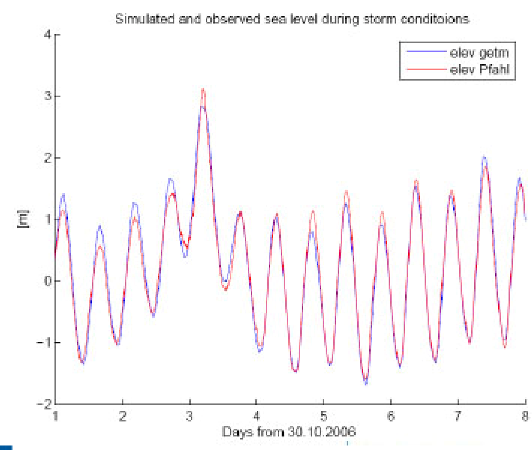
Nested models – Sea level











....HYPOX partner institutions: GKSS

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COSYNA

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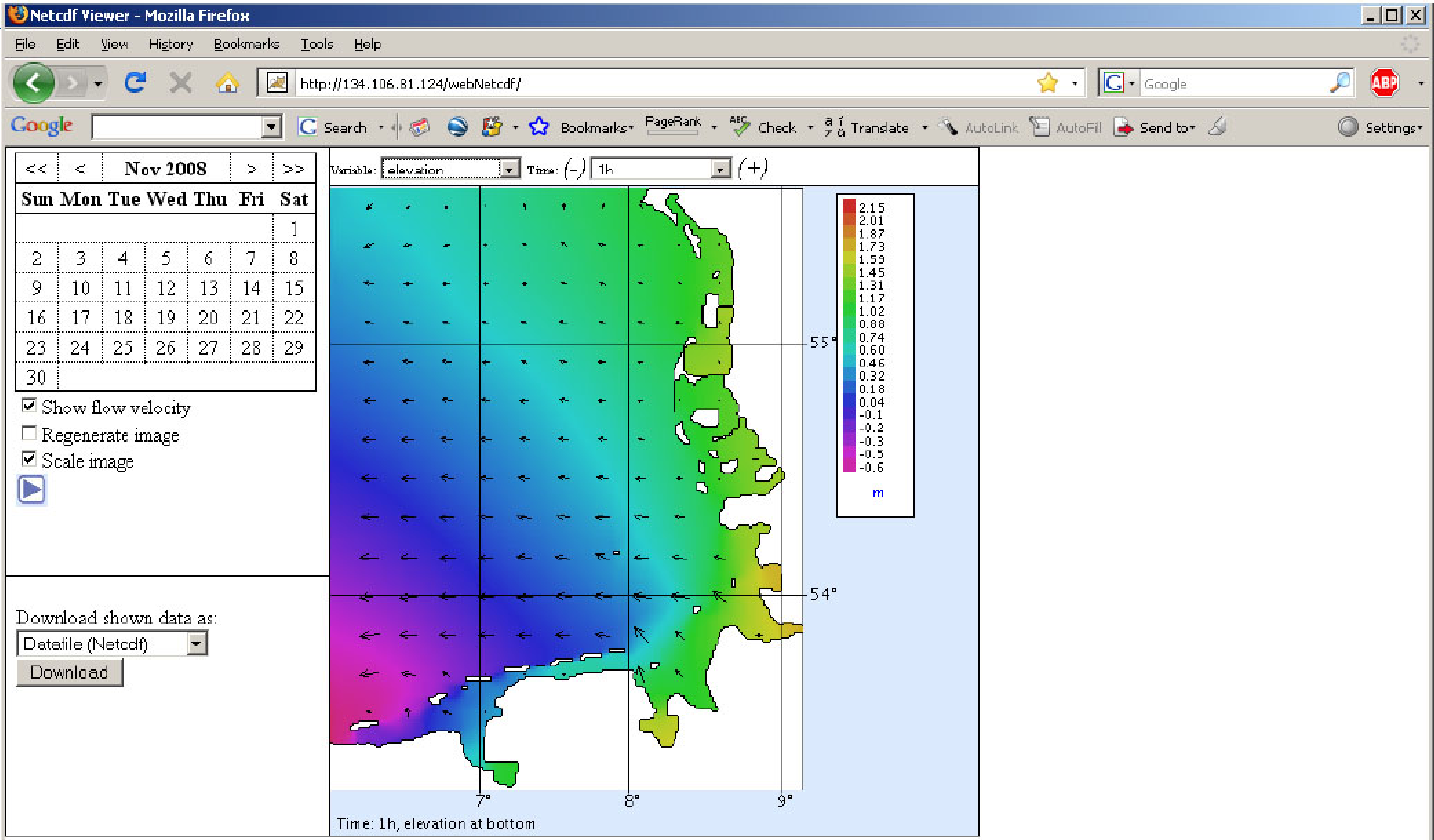

http://134.106.81.124/webNetcdf

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Satellite Data Assimilation into a Suspended Particulate Matter Transport Model

Mikhail Dobrynin, Heinz Günther and Gerhard Gayer

Institute for Coastal Research

GKSS Research Center

Germany

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Processes included in the model:

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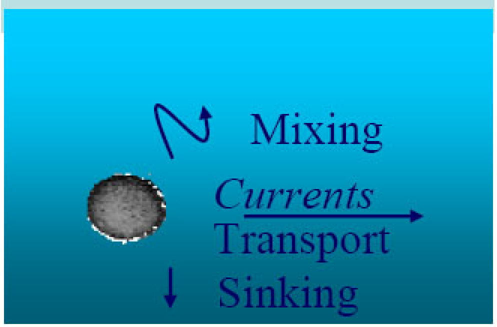
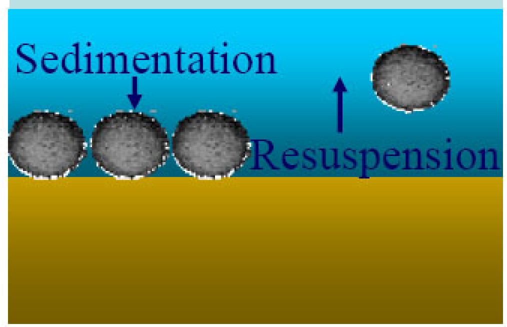
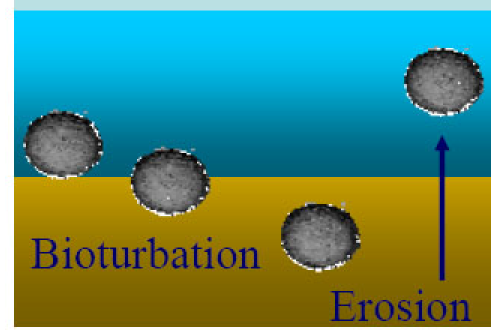
Water column	Water column ↔ Seabed	Seabed
Transport with ocean currents	Sedimentation	Bioturbation
Mixing due to waves and currents	Resuspension	Erosion
Sinking		

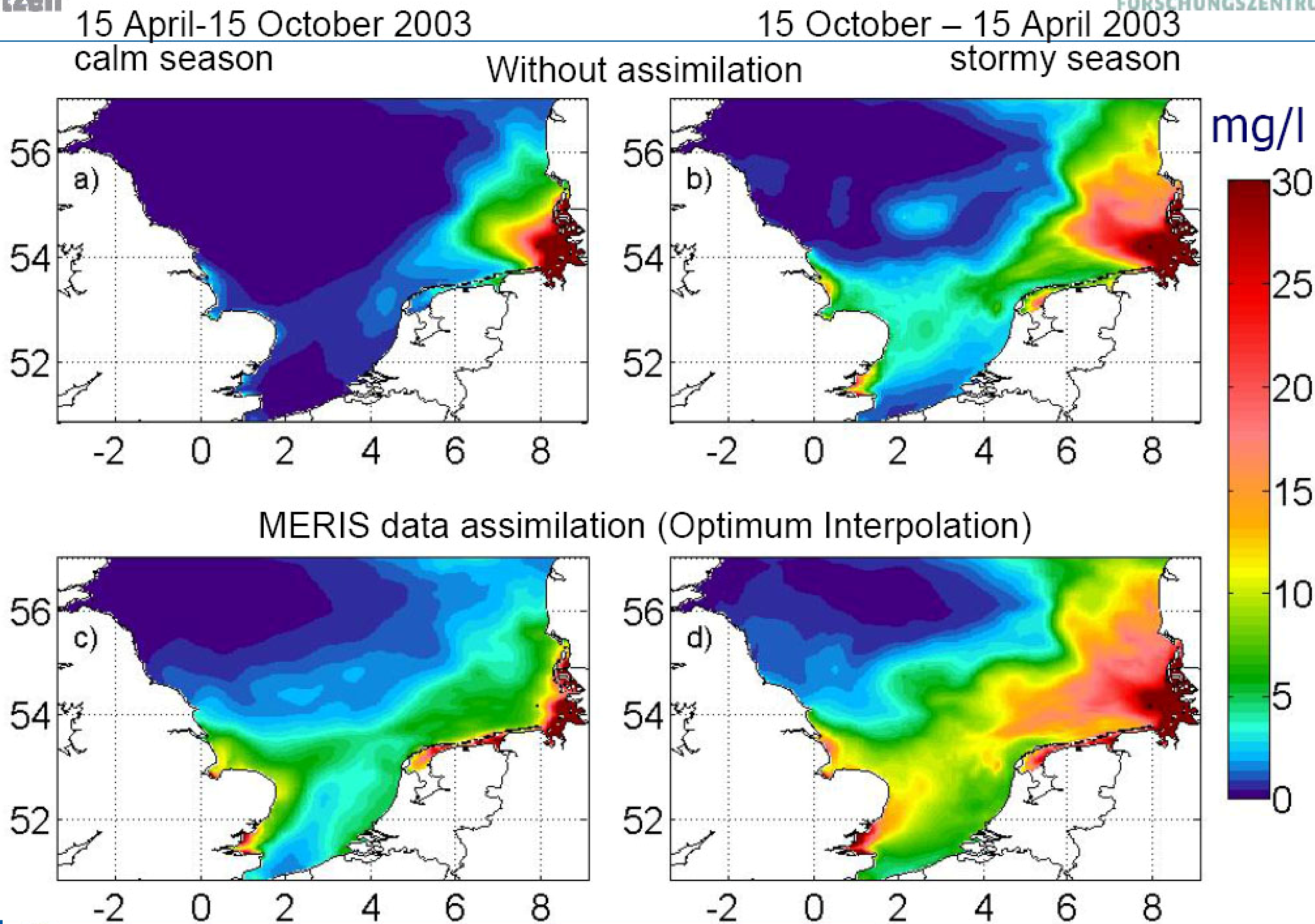






21 Water layers		21 Seabed layers
5-10 m		0.5-1.0 mm

Modeled seasonal mean surface SPM concentration:



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http://www.tos.org/oceanography/issues/issue_archive/issue_pdfs/18_2/

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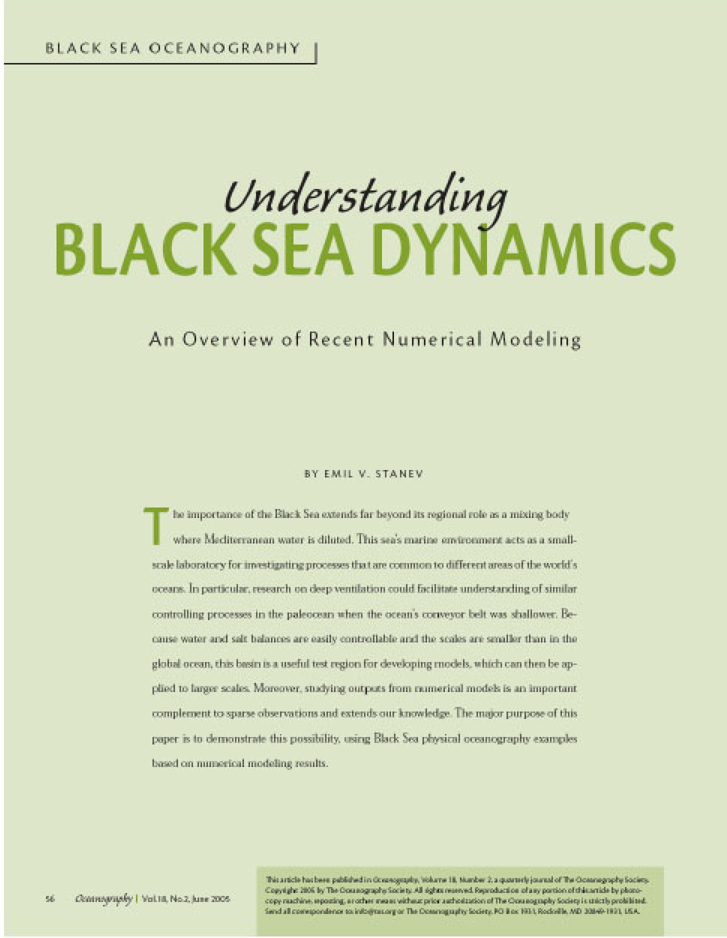


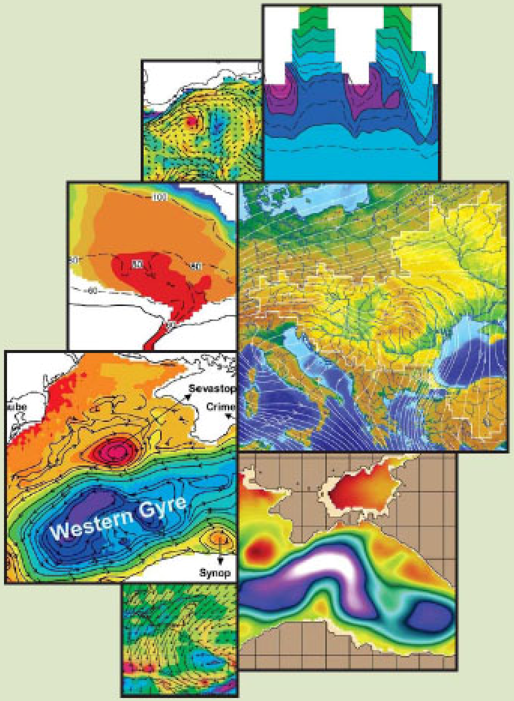
BLACK SEA OCEANOGRAPHY

Understanding BLACK SEA DYNAMICS

An Overview of Recent Numerical Modeling

BY EMIL V. STANEV

The importance of the Black Sea extends far beyond its regional role as a mixing body where Mediterranean water is diluted. This sea's marine environment acts as a small-scale laboratory for investigating processes that are common to different areas of the world's oceans. In particular, research on deep ventilation could facilitate understanding of similar controlling processes in the paleocean when the ocean's conveyor belt was shallower. Because water and salt balances are easily controllable and the scales are smaller than in the global ocean, this basin is a useful test region for developing models, which can then be applied to larger scales. Moreover, studying outputs from numerical models is an important complement to sparse observations and extends our knowledge. The major purpose of this paper is to demonstrate this possibility, using Black Sea physical oceanography examples based on numerical modeling results.



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Stagnant waters

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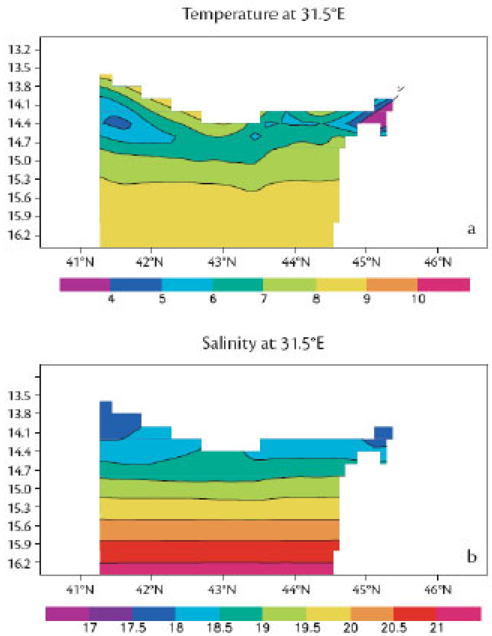

Figure 6. Meridional cross sections of simulated (a) temperature and (b) salinity in density coordinates at 31.5°E during April 1993. The simulations have been done with the 5-minute-resolution Black Sea Modular Ocean Model (MOM). Its setup, forcing, and other technical details are described by Stanev and Staneva (2001) and Stanev et al. (2003). The upper panel represents the CIL. The larger "depth" of CIL in the interior Black Sea seen in isopycnical coordinates is due to upwelling (causing shallower isopycnals). The bottom panel demonstrates, that below σ_t = 15.5 (density layer in kg/m^3), stratification is entirely dependent on salinity, and isohalines coincide with the isopycnals.

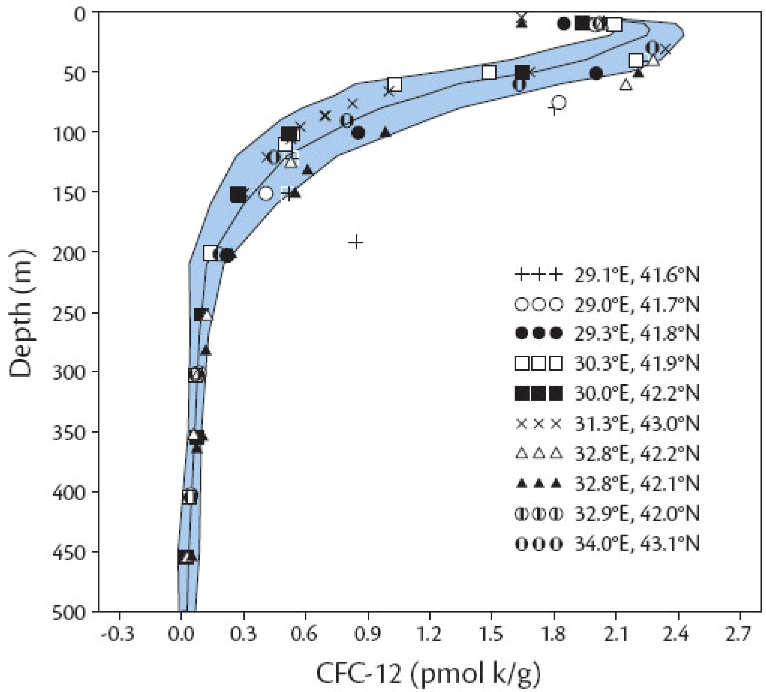

Figure 7. CFCs are passive tracers giving a valuable information about pathways of water masses (Stanev et al., 2004). Here, we show vertical profiles of CFC-12 in the Black Sea (area mean and one standard deviation) as simulated by the Black Sea Modular Ocean Model (MOM). The accuracy of simulations in replicating the penetration of surface signals is supported by comparisons with field observations. Data from the R/V *Knorr* 1988 cruise (for more details see Stanev et al., 2004) are plotted by symbols. The legend gives the correspondence between symbols and station numbers. The outlier at 200 m is from measurements very close to the strait, thus, this value is higher, displaying deep ventilation by the buoyant plume.

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Ventilation

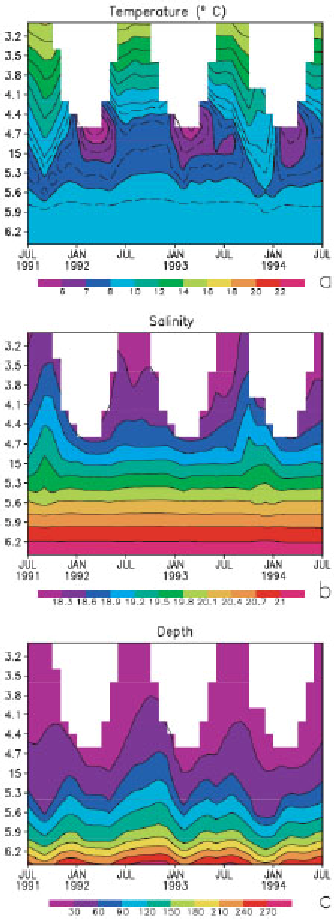

Figure 8. Simulated (a) temperature, (b) salinity, and (c) depth of isopycnic surfaces during 1991-1995 plotted in time-density coordinates. The coordinates of the location are 42.5°N and 31°E, which is in the interior of the western basin. The ventilation in the Black Sea is confined in a very thin surface layer and is manifested by the outcropping isopycnal surfaces in winter, which completely submerge in summer as they are overlain by light surface water. Note also the haline-dominated density in (b) and the up-and-down excursions of isopycnal surfaces (c).

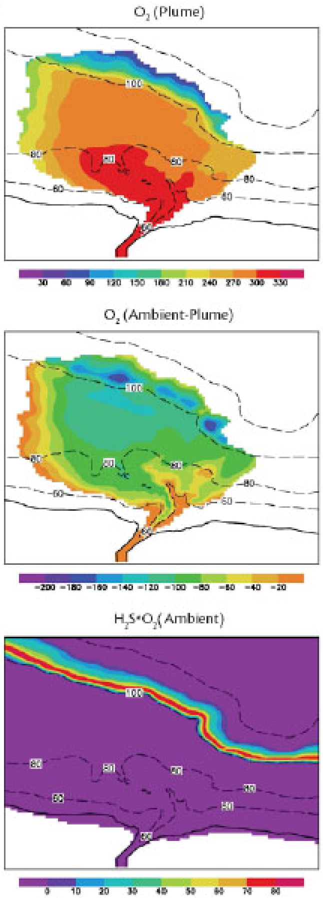

Figure 11. Stanev et al. (200[illegible] developed a reduced-gravit[illegible] model for the buoyant plun[illegible] originating from the Bospor[illegible] Strait with 600 m horizontal resolution. Unlike the case shown in the Box 1, Figure [illegible] the bottom layer moves an[illegible] the surface layer is motionle[illegible] Stratification of the motion-less ambient fluid (including chemical tracers) is prescrib[illegible] from observations. The mo[illegible] is coupled with a simple che[illegible] cal model simulating the o[illegible] tion of H_2S by O_2. The upper panel gives the distribution O_2 in the plume, and the mi[illegible] dle panel shows the differen[illegible] between O_2 in the ambient fluid and plume. The botto[illegible] panel gives an idea about th[illegible] projection of the suboxic la[illegible] on the bottom represented the product between H_2S a[illegible] O_2 (low values are due to ei[illegible] a negligibly small concentra[illegible] of H_2S in surface layers, or O[illegible] in deep layers.) The narrow strip follows a depth of ~12[illegible] m, which is approximately t[illegible] depth of sulfide onset in the open sea (Konovalov et al., 2003). As seen in the upper and middle panels, the plun[illegible] reaches a depth of ~250 m. plotted area extends betwe[illegible] 28.8°E and 29.51°E and 41.1[illegible] and 41.6°N. Depth contours down to 100 m are plotted with dashed lines with a co[illegible] tour interval of 20 m, the la[illegible] dashed line is isobath 500 m.

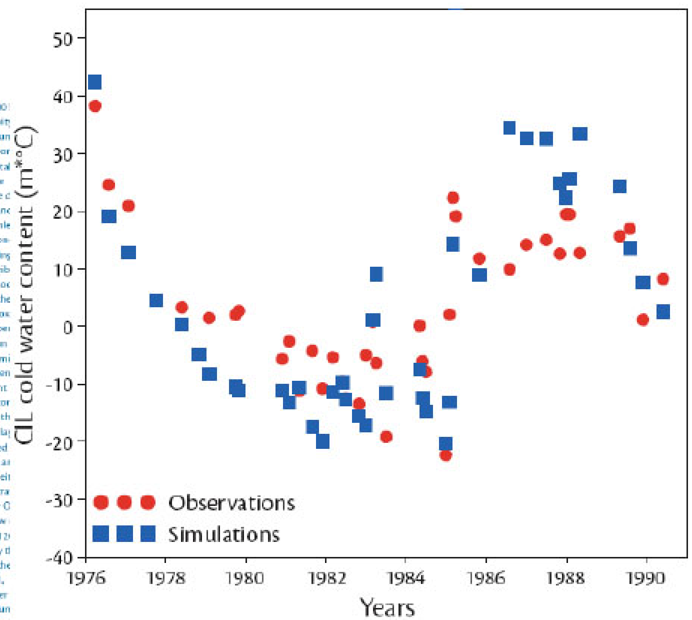

Figure 12. Temporal variability of the cold water content between isopycnal levels σ_t =14.4 and 15.6. Observations and simulations with the Black Sea Modular Ocean Model (MOM) are shown. This variability is triggered by large-scale atmospheric forcing (Stanev and Peneva, 2002; Oguz, paper 2, this issue).