Progresses in the CMEMS BS-MFC for improving forecasting capabilities and monitoring the Black Sea region through high quality modelling systems

Stefania Angela Ciliberti[2], Atanas Palazov[1], Marilaure Gregoire[3], Joanna Staneva[5], Elisaveta Peneva[4], Simona Masina[2], Rita Lecci[2], Veselka Marinova[1], Marius Matreata[6], Sergio Creti[2], Luc Vandenbulcke[3], Arno Behrens[5], Francesco Palermo[2], Eric Jansen[2], Leonardo Lima[2], Laura Stefanizzi[2], Farshid Daryabor[2], Diana Azevedo[2], Nadezdha Valcheva[1], Paola Agostini[2], Giovanni Coppini[2], Nadia Pinardi[2] and the CMEMS Black Sea Monitoring and Forecasting Center Team

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Operations

BLKSEA_ANALYSIS_FORECAST_PHYS_007_001

- Improvement in data assimilation model and physical parameterization, assimilation of S3A and J2/3 data
- Operational product quality (CLASS1, CLASS4) through regional website - http://bsfs.cmcc.it/
- Product centered at noon (nominal start of the product at 00:00Z of J)

BLKSEA_ANALYSIS_FORECAST_BIO_007_009

Product Catalogue: NRT systems deliver analysis and 10-days forecast fields for essential blue and green ocean variables

Quality Improvements & Updated Datasets

- Online coupled NEMO-BAMHBI system
  - From GHER to NEMO 3.6
  - New carbonate module
- Product centered at noon (nominal start of the product at 00:00Z of J) including CHL, PHYC, O2, NO3, PO4, Primary Production and carbonate system components

BLKSEA_ANALYSIS_FORECAST_WAV_007_003

- Upgraded BS-WAV NRT catalogue with extended processing system from 5 to 10-days forecast
- WAM state-of-the-art
- Tuning of wave age parameter
- NRT validation procedures following the Wave working group decisions and PQWG recommendations

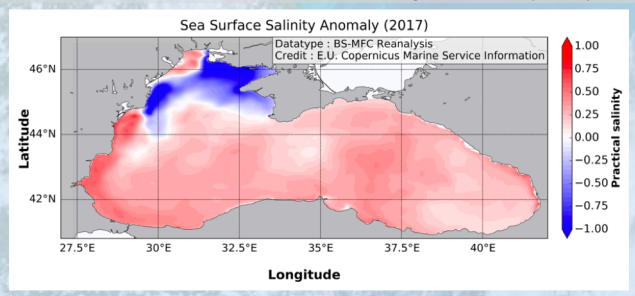
BLKSEA_REANALYSIS_PHYS_007_004

BLKSEA_REANALYSIS_BIO_007_005

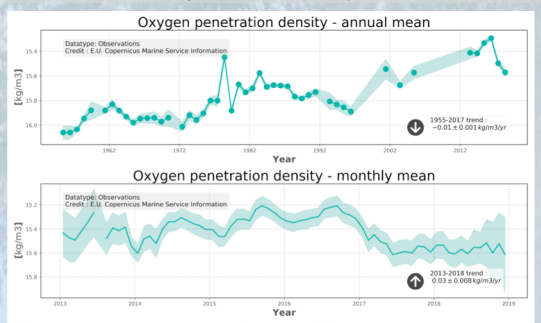
BLKSEA_REANALSYSIS_WAV_007_006

Product Catalogue: MY systems deliver timeseries from Jan 1992 to Dec 2018 for climate and monitoring purposes

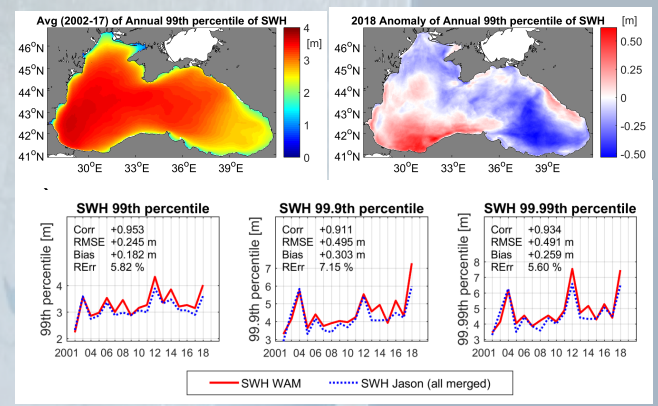
Ocean Monitoring Indicators (OMIs) and Contribution to Ocean State Report 4 for OHC (Lima et al., under rev.) and for Extreme Events (Staneva et al., under rev.)



The Black Sea Physics Reanalysis shows a SSS positive anomaly in 2017. The exception is around the NW shelf where there are negative anomaly values in the vicinity of the Danube delta and Dnieper river mouth. The predominance of positive anomalies is qualitatively corroborated by the 0-10 m layer ARGO measurements, which also captured high values of salinity anomaly in 2017.



The oxygenation of subsurface water is closely related to the intensity of cold water formation. In 2017 and 2018,, a substantial amount of cold water was formed, which resulted in a partial reoxygenation of the intermediate layer and provided, at least, a temporary relief in the preceding deoxygenation trend.



Mean 99th percentile of significant wave height (SWH) and its anomaly of 2018 (top) and time series of the W Black Sea specific annual quantiles of SWH from Jason satellite (blue dots) and WAM (red line)

EGU General Assembly 2020

1 IO-BAS, 2 CMCC, 3 ULIEGE, 4 USOF, 5 HZG, 6 NIHWM

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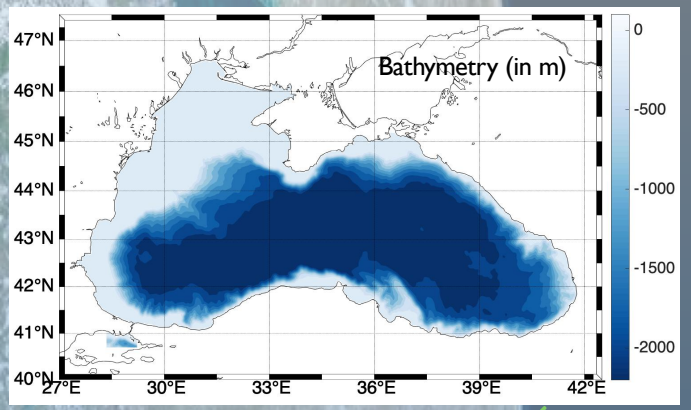
Service Evolution

PHY

- Increased number of vertical levels: from 31 to 121 levels to better represent shelf dynamics and vertical mixing, from NEMO v3.6 to NEMO v4.0
- The Bosporus Strait as open boundary condition for the optimal interface between Mediterranean Sea and Black Sea through the Marmara Sea
- Upgrades in data assimilation model to account increased vertical resolution; the Danube River interannual variability and forecasting
- New NRT and MY system, the latter based on improved representation of the Bosporus Strait as closed boundary condition and forced by ERA5
- Revision of bathymetric dataset: GEBCO 30" + HR dataset for the Bosporus Strait



BIO

- Coupling strategies with BS-PHY: online vs offline
- Data assimilation upgrades: assimilation of multivariate data (e.g., oxygen, chlorophyll) and register for rejected data
- Upgrades in the NRT system and new MY system, based on online coupled NEMO v3.6-BAHMBI and forced by ERA5 atmospheric forcing

WAV

- Improved products by using HR winds
- Coupling with BS-PHY
- Provision of Wave-Currents interaction variables
- Evolution of data assimilation strategies using along track NRT SWH observations implementing model adjustments

Product Quality: new metrics and operational deliveries

CMEMS Working Group: BioDA, SL, MLD, TWG

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Credits for background image: NASA