Improved Diurnal Variability Forecast Of Ocean Surface Temperature through Community Model development (DIVOST-COM)

Ioanna Karagali\(^1\), Jun She\(^2\), Jens Murawski\(^2\), Jacob L. Høyer\(^2\)

\(^1\)DTU-Technical University of Denmark, Risø Campus, Roskilde.

\(^2\)Climate & Arctic Research, Danish Meteorological Institute, Copenhagen.

Introduction

- The diurnal variability (DV) of Sea Surface Temperature (SST) driven by the coincident occurrence of moderately low winds and solar heating.
- SST retrievals from space: identification of diurnal warming events, occurring at all latitudinal bands in coastal and open ocean conditions [3, 4, 5].
- DV not properly resolved in models impacts estimation of surface heat fluxes [2, 1] and the exchange of CO\(_2\) between the ocean and the atmosphere.
- Most operational atmospheric & oceanic models and products from the Copernicus Marine Environment Monitoring Service (CMEMS) do not account for DV of SST.
- DV of SST complicates merging of SSTs from different satellite sensors thus having a direct impact on efforts to create climate records.
- Misrepresentation of the diurnal variability of the upper ocean temperature may result in errors when modelling harmful algal blooms.

DIVOST-COM to develop & integrate a diurnal variability model with the HIROMB-BOOS Model (HBM) Baltic Modelling Forecasting Center (MFC) to improve existing products & services for the Baltic Sea.

- 1-dimensional General Ocean Turbulence Model (GOTM) using forcing from the MFC PHY-BIO forecast & SST Thematic Assembly Centre (TAC) products.
- Resolve and forecast the vertical temperature structure of the upper ocean with very high resolution.
- Recommendations provided could be applicable for all MFCs & TACs.
- SEVIRI, Sentinel-3 & L4 SST products used for model validation.

Methods & Data

GOTM
- 1-d equations: heat, momentum & salt
- TKE K\(_t\) turbulence scheme
- 2- vs 9-band light absorption
- Forcing: x, y wind components, Air pressure & temperature, Relative humidity, Cloud cover, Temperature & Salinity profiles

SEVIRI SST
- O&SI SAF L3C
- Hourly, regular .05° grid
- DOI 10.15770/EUM_SAF_OSI_0004
- DV Analysis
- 4 dates in 2018 identified
- GOTM simulations: surface to 25 m depth

CMEMS
- 6 with T, S profiles
- 9 surface stations
- Depths: 8 m to 110 m

GOTM vs HBM

- GOTM 2 mm layer (a, c, e, g) and GOTM 1.5 m layer (b, d, f, h) minus top HBM layer (1.5 m) for the 4 different dates at 13:00.

References


Conclusions

- GOTM 1.48 m depth different that HBM 1.5 m depth up to 1° in the examined cases.
- Differences become larger when GOTM 2 mm depth is compared to HBM.
- GOTM 2 mm layer compares best with SEVIRI SST.
- Significant warming missed by HBM.

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