BENEFITS OF A GEOSTATIONARY SENSOR FOR DAILY SATELLITE BIOGEOCHEMICAL PRODUCTS

Bellacicco, M.[(1)], Ciani, D. [(2)], Marullo, S.[(3)], Doxaran, D. [(1)], Wang, M. [(4)], Vellucci, V. [(1)], Antoine, D. [(1),(5)], D'Ortenzio, F. [(1)]

(1) Sorbonne Université, CNRS, Laboratoire d'Océanographie de Villefranche, LOV, F-06230 Villefranche-sur Mer, France
(2) Institute of Marine Sciences (ISMAR)-CNR, Rome, Italy
(3) Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA), Frascati, Italy
(4) NOAA/NESDIS Center for Satellite Applications and Research, College Park, Maryland, USA
(5) Remote Sensing and Satellite Research Group, School of Earth and Planetary Sciences, Curtin University, Perth, WA 6845, Australia

MAIN GOAL

Nowadays, satellite ocean color observations represent one of the main tools to study ocean optical, and biogeochemical properties. Satellite-derived observations are available at daily temporal resolutions, while weekly, monthly, seasonal and annual are the widely used derived products. The daily maps of the main oceanographic variables are generally derived from few satellite observations per day, *e.g.* when polar satellites are used. **Our goal is to demonstrate the potential benefits of having high-temporal resolution observations from geostationary sensors to reduce errors in the reconstructed biogeochemical daily products (*e.g.* surface chlorophyll).**

METHOD DEVELOPED

STEP 1

Hourly Chl data from a biogeochemical model in the Baltic Sea (HIROMB BOOS Model, HBM, from CMEMS)

STEP 2

a) **Re-grid** the Chl fields onto SEVIRI observations spatial resolution
b) **Application** of cloud masks from SEVIRI imager to simulate gaps in the Chl field

STEP 3

a) **Observations** from both geostationary and polar-orbiting satellites are **simulated** (in presence of sunlight): selection of the specific hourly passages as seen by both "*satellite*" simulations (*i.e.* solar zenith angle).
b) In both cases, a **Gaussian noise** is added on Chl images.

STEP 4

Reconstruction of a hourly and daily Chl maps using the **M-SSA** technique and **statistical** analysis of the **errors** between reconstructed and modelled data fields

$$RMS = \sqrt{\frac{1}{N}\sum_{i=1}^{N}\left(\frac{reconstructed - original}{original}\right)^2} \qquad BIAS = \frac{1}{N}\sum_{i=1}^{N}(reconstructed - original)$$

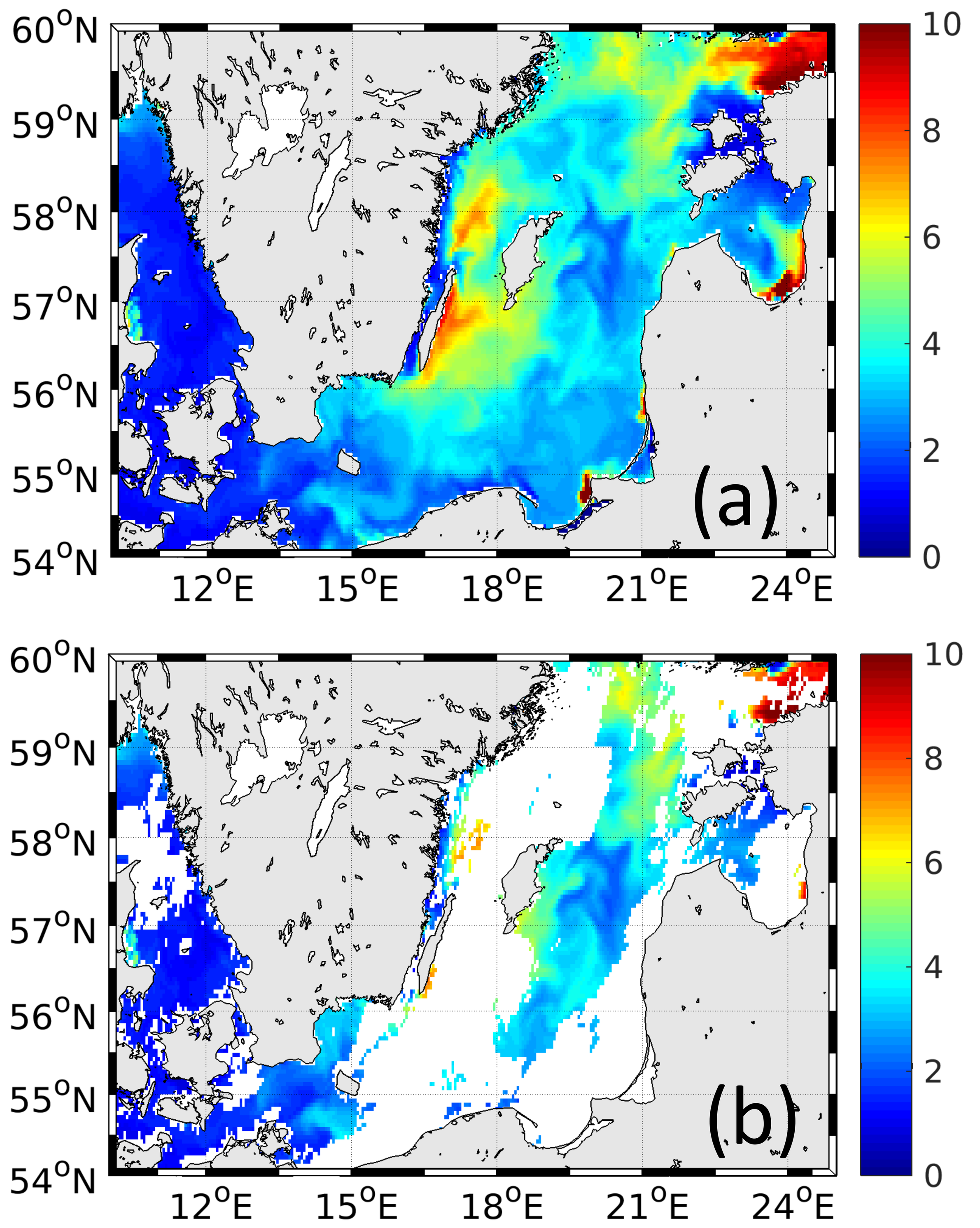
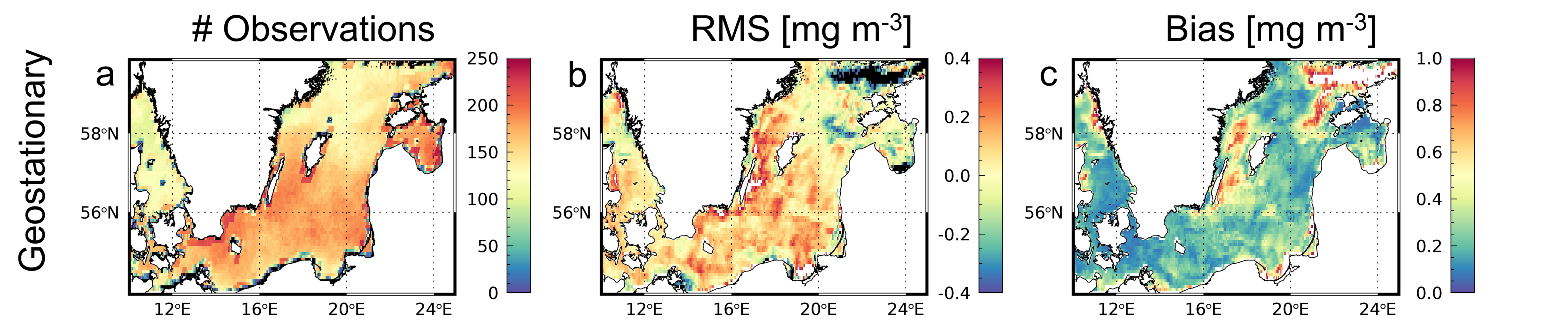
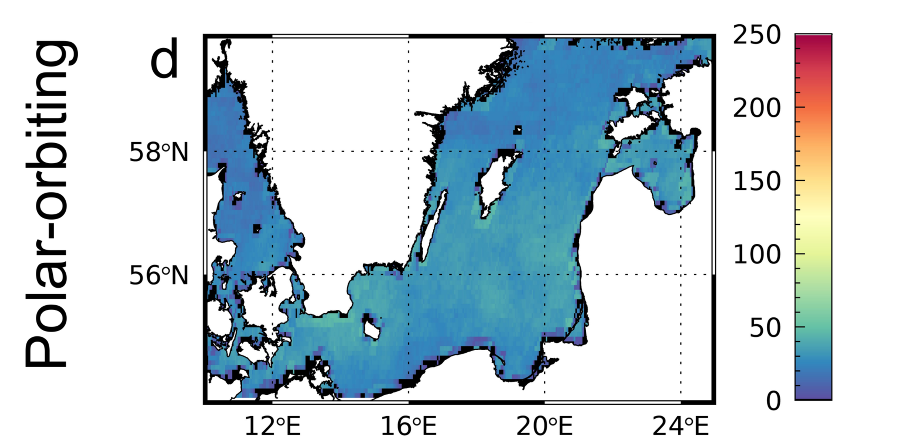


Figure 1: Hourly Chl in the Baltic Sea as obtained from the HBO model for the 1st May 2016 at 12:00 (a), and after the application of real clouds (in white) by SEVIRI imager at the same time

GEOSTATIONARY-ORBITING SENSOR FOR DAILY CYCLE RECONSTRUCTION



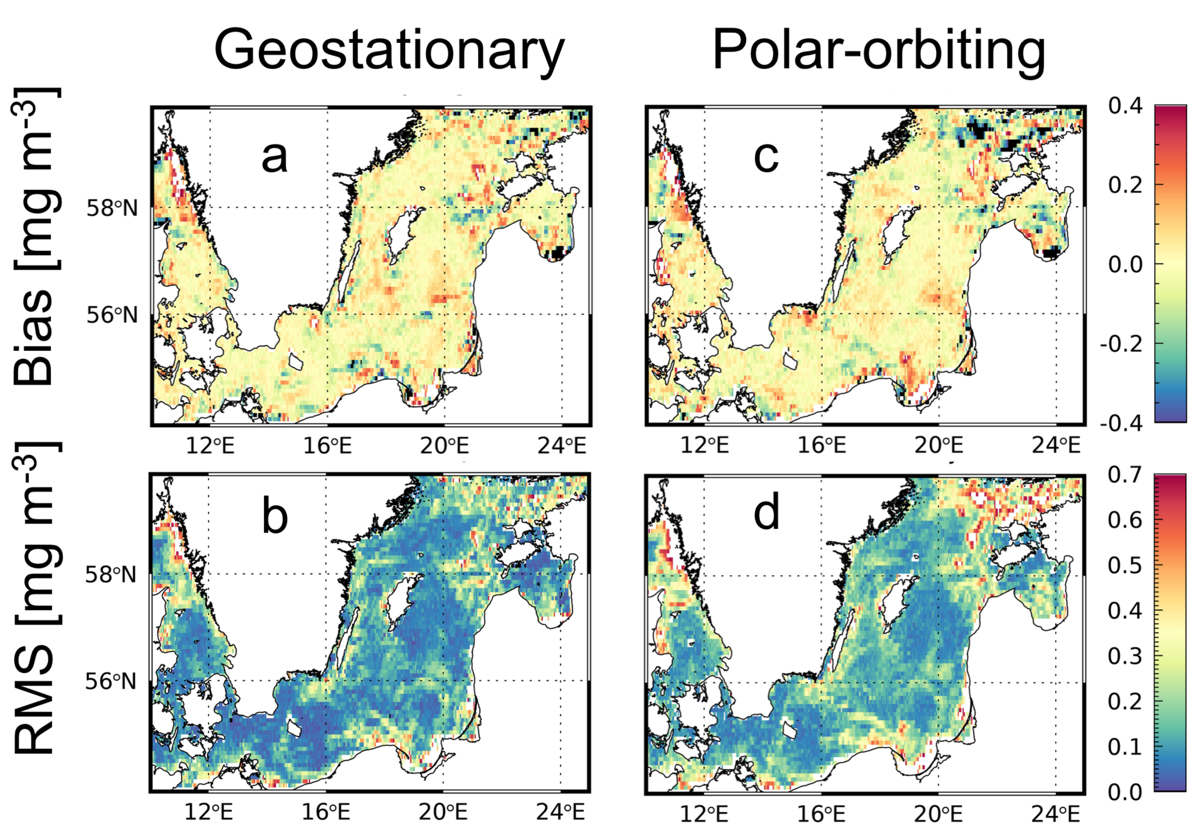


MAIN RESULTS:

a) MORE # OBSERVATIONS USING A GEOSTATIONARY SENSOR RESPECT TO THE POLAR-ORBITING SENSOR.
b) A GEOSTATIONARY SENSOR CAN RESOLVE THE DAILY CYCLE WITH A REASONABLE **BIAS** AND **RMS** ERRORS.

Figure 2: Number of observations for a geostationary simulation (**a**) and RMS (**b**) and BIAS (**c**) of daily Chl field using hourly data and resolving the diurnal cycle. Panel **d** shows the number of observations in case of a polar sensor.

COMPARISON FOR MEAN DAYTIME CHLOROPHYLL FIELD



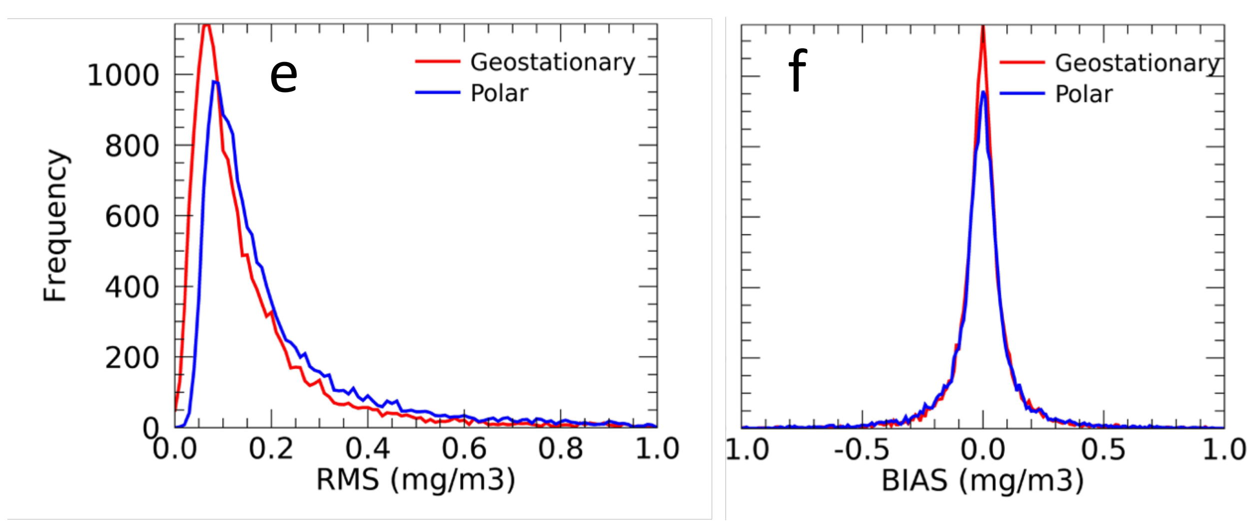


Figure 3: Bias and RMS errors in case of geostationary (**a** and **c**) and polar-orbiting (**b** and **d**) simulations for mean Chl daytime field. RMS and bias statistical distribution in case of both sensors are shown in panel **e** and **f**.

CONCLUSIONS

- High frequency observations increase the number of available observations from < 30 (polar) up to > 100 (geostationary) enable to take into account the diel temporal variability and significantly help to properly reconstruct gap-free Chl fields.
- In case of mean daytime Chl field, the interpolation RMS error is reduced by 25% using a geostationary sensor.
- The interpolation bias error is similar in case of polar and geostationary simulation for mean daytime Chl field.

PERSPECTIVES

- Future research pathways are to generalize the method developed to compare the capabilities of the ESA-CCI and GOCI observations for the production of daily gap-free bio-optical data in the Japan Sea.
- Another pathway will be to consider the method developed for a longer time-series taking into account the seasonal and annual variability.

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Marco.Bellacicco@obs-vlfr.fr