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Operational Biogeochemical Modelling and Data Assimilation

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The Waterforecast (http://www.waterforecast.com) has been operated since year 2002 providing daily 5-days forecast on physical parameters such as wave climate, water levels, currents, salinity and temperature. However, also biogeochemical parameters have been included in the forecasts since 2002 providing similar 5-days forecasts for parameters such as dissolved oxygen and chlorophyll-a.

Data assimilation has been carried out for the physical parameters in basin to global scales for more than a decade and are now also advancing to regional systems in forecast. However, advanced data assimilation of biogeochemical parameters is less pronounced and only carried out by few modeling groups (e.g. Triantafyllou et al., 2007).

In two cases we have now successfully combined advanced data assimilation and biogeochemical modeling: 1) Hindcast modeling of oxygen concentrations in the Baltic Sea and transition area assimilation oxygen profiles from various measurements stations, and 2) on-line assimilation of satellite images of chlorophyll-a providing updated and improved forecasts on algae blooms within the Baltic Sea, North Sea and interconnecting seas.

A successful assimilation of satellite chlorophyll-a rely on a rather well defined algae growth model defining the most dominant algae species. Hence, the model has been expanded to include 3 functional different algae species, improving both the algae dynamics and allowing to distribute the EO data more realistic.

By combining all data sources available with a process based modeling framework, the resulting integrated use of the available information can supply a consistent and in many respects a superior interpretation of the state and evolution of biogeochemical parameters. When model and measurement (including the representativeness) errors are complex, the key ingredients in a successful assimilation strategy are first order error description and robust assimilation scheme.

Triantafyllou G. , G. Korres, I. Hoteit, G. Petihakis, and C. Banks “Assimilation of ocean colour data into a Biogeochemical Flux Model of the Eastern Mediterranean Sea”, Ocean Science, 3, 397-410, 2007