A supplement to model validation: estimating uncertainty between ocean forecast products of the Baltic Sea and the North Sea by use of a multi-model ensemble approach

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Several independent operational ocean-forecasting models are available for the North Sea and the Baltic Sea providing a sometimes wide range of predictions of the ocean's state. It is essential to provide highly qualitative forecasts for e.g. sea level warning or oil drift predictions. Therefore there is a special need to continuously validate and improve the model systems in order to enhance their predictability. A Multi-Model Ensemble (MME) has been developed in the EU-funded MyOcean project and is now further monitored and augmented in the Copernicus Marine Environment Monitoring Service (CMEMS). The MME serves as supplement to validation and shall provide additional information to the users of a single-model forecast, especially in those regions where comprehensive observations are lacking. The aim of this MME initiative is to assess the amount as well as temporal and spatial distribution of uncertainties between the ensemble members for several physical parameters. Presently, there are 13 different operational ocean forecasting models of the North Sea and the Baltic Sea providing 48h-forecasts which serve as input for the MMEs of the following parameters: 2D salinity and temperature at the sea surface and the bottom, 2D sea surface currents, vertically integrated water transports across NOOS and BOOS[1] transects, and sea surface height at 24 stations along the coast of the Baltic Sea. So-called ensemble statistics are calculated each day based on the actual forecast and the resulting figures and data are displayed and provided on the NOOS and BOOS MME websites[2]. For the MME of sea surface height a weighting method is applied yielding a best estimate of the water level forecast at each station in the Baltic Sea. Moreover, sea surface temperature is validated with Copernicus satellite data and temperature and salinity are evaluated with in-situ data at offshore stations on a monthly basis.
We would like to present the MMEs showing results of the ensemble statistics and validation performed on temperature and salinity. Deviations between each ensemble member, including the CMEMS products of these regions, and the MMEs are also presented giving information about the spread and uncertainty between the different forecasts.

[1] North West Shelf - and Baltic Operational Oceanographic System
[2] http://www.boos.org/index.php?id=mme, http://noos.bsh.de/model-results/multi-model-ensemble/