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Stochastic Coastal/Regional Uncertainty Modelling: a Copernicus marine research project in the framework of Service Evolution

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The project entitled Stochastic Coastal/Regional Uncertainty Modelling (SCRUM) aims at strengthening CMEMS in the areas of ocean uncertainty quantification, ensemble consistency verification and ensemble data assimilation. The project has been initiated by the University of Athens and LEGOS/CNRS research teams, in the framework of CMEMS Service Evolution.

The work is based on stochastic modelling of ocean physics and biogeochemistry in the Bay of Biscay, on an identical sub-grid configuration of the IBI-MFC system in its latest CMEMS operational version V2. In a first step, we use a perturbed tendencies scheme to generate ensembles describing uncertainties in open ocean and on the shelf, focusing on upper ocean processes. In a second step, we introduce two methodologies (i.e. rank histograms and array modes) aimed at checking the consistency of the above ensembles with respect to TAC data and arrays.

Preliminary results highlight that wind uncertainties dominate all other atmosphere-ocean sources of model errors. The ensemble spread in medium-range ensembles is approximately 0.01 m for SSH and 0.15 °C for SST, though these values vary depending on season and cross shelf regions. Ecosystem model uncertainties emerging from perturbations in physics appear to be moderately larger than those perturbing the concentration of the biogeochemical compartments, resulting in total chlorophyll spread at about 0.01 mg.m-3. First consistency results show that the model ensemble and the pseudo-ensemble of OSTIA (L4) observation SSTs appear to exhibit nonzero joint probabilities with each other since error vicinities overlap. Rank histograms show that the model ensemble is initially under-dispersive, though results improve in the context of seasonal-range ensembles.