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Evaluation, in a global modelling context, of a unified multi-campaign bulk parameterization for air-sea turbulent fluxes

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A new bulk parameterization is used in a modelling context to force a global ocean numerical model as part of the Meteo-France contribution to the "Forcing fields" workpackage of the european integrated MERSEA project. This work also takes part in preliminary studies focusing on the improvement of the air/sea interface for the future MERCATOR global ocean operational system.

The new bulk formulation was derived by Meteo-France from an extended database (ALBATROS) gathering 10 years of consistent estimates issued from cruises dedicated to air-sea measurements in the Atlantic and Mediterranean oceanic regions (SEMAPHORE, CATCH, FETCH, EQUALANT99 and POMME). This new parameterization takes advantage of sampled atmospheric and oceanic conditions ranging from very light (0.3 m/s) to very strong (up to 29 m/s) wind speeds, and from unstable to extremely stable atmospheric boundary layer stratification.

The methodology of the present study relies on the use of this new bulk formulation together with meteorological variables provided by the ECMWF (European Centre for Medium Range and Weather Forecast) atmospheric forecast model, in order to get surface boundary conditions for the MERCATOR 2˚ global ocean-ice coupled model (ORCA2/LIM model). Various sensibility studies are carried on in order to separate impacts due to turbulent heat fluxes from those due to wind stress. Comparisons are made with respect to a reference simulation, where surface boundary conditions are provided by wind stress data issued from the ECMWF model together with turbulent heat fluxes computed using the original bulk formulation of the ice model.

As a result of a weaker drag transfer coefficient, the use of the new bulk formulation reduces both the cold bias in the equatorial Pacific and the too deep mixed layer depth simulated in the North Atlantic, while increasing the too weak summer sea ice extent in Antarctica. Estimates of the oceanic transport through sections defined following GODAE metrics and comparisons with in situ temperature and salinity profiles complete this study by quantifying the impact on the oceanic vertical structure of such a change in the air/sea interface.