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Using a 1D Atmospheric Boundary layer to improve air-sea interactions, first tests in the North-East Atlantic

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Air-sea interactions at mesoscales can have a significant impact on the oceanic circulation. Dynamic and thermal feedbacks are modulating the wind work input in the ocean, therefore influencing the upper ocean. High-resolution fully coupled ocean-atmosphere models are able to reproduce realistically these interactions, but the computational cost of such configurations remain very high.
To overcome such constraint, the alternative approach proposed here is based on a uni-dimensional vertical , Toulouse, FranceAtmospheric Boundary Layer (ABL1D) model. The model is driven by large-scale atmospheric data and reproduce turbulent vertical processes within the Atmospheric Boundary Layer. The ABL1D model is implemented within the NEMO ocean model.
Here, we compare two-weeks oceanic forecasts generated with the NEMO model forced by deterministic atmospheric forecasts with those generated by the ABL1D-NEMO coupled model over the Iberian – Biscay – Irish (IBI) regional configuration.
The impact on oceanic forecasts is evaluated by different ways: first, the model behavior regarding ocean-atmosphere feedbacks is evaluated by computing dynamic and thermal coupling coefficients and by assessing the impact on the surface EKE. Then, the model realism is validated against classic observations such as currents, sea surface temperature, salinity and temperature profiles and Mixed Layer Depth. We show that the coupled model is able to realistically simulate coupling coefficients and to improve EKE level. Our results suggest that our approach is well-suited to represent realistically air-sea interactions without the computational cost of a complete ocean-atmosphere coupled model.