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Towards the construction of a validated numerical system to study the mesoscale dynamics of the North East Atlantic (2003-2006)

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A detailed validation study contributed to the construction of a NE-Atlantic (NEA), ocean circulation model, for the 2003-2006 period. The comparison between model solutions, remote sensing and in situ data, concentrated on the analysis of the most dynamical NEA sub-regions. Model validations included (i) comparations with Sea Surface Temperature (SST), from AVHRR and Microwave-OI; (ii) eddy kinetic energy computed from altimetry; and (iii) Temperature and Salinity profiles computed from ARGO floats. Simple statistical metrics were used to quantify the differences, these included: Root Mean Squared Error (RMSE), Mean Absolute Error (MAE), Correlation Coefficient (R) and Bias. In general, regional solutions show a good correlation and small RMSE with satellite SST. Regarding the comparisons between altimetry derived and model EKE, a good agreement was found, with RMSE ≤ 0.05. Additionally, the main water masses were well depicted by the regional model, especially regarding the detection of the North Atlantic Deep Water (NADW); while the high salinity region, often dominated by Mediterranean Intermediate Water (MIW), was less accurately resolved. The initial condition and boundary forcing of the regional model was evaluated, particularly concerning the usage of Ocean General Circulation Models (OGCM's), as an alternative to the classical climatological forcing. In order to determine the best one to use, four OGCM solutions were considered. The analysis of their Kolmogorov energy spectrum determined their effective resolutions and their eddy kinetic energy levels. MERCATOR global solution at 1/4°, was shown to be the best available OGCM for studying the 2003-2006 period. The energy spectrum analysis also showed that new 1/12° (downscaled), regional solution resolved more energetic scales than the original OGCM, confirming the need to use high spatial resolution regional ocean circulation models to resolve mesoscale and sub-mesoscale phenomena. The constructed regional model was also able to reproduce an Iberian Peninsula upwelling event as well as other previously documented NEA processes such as the westward propagating eddies associated with the Azores Front, and with the Canary and Madeira Archipelagos. Future work, includes the analysis of a 1/24° regional solution for the NEA.