Geophysical Research Abstracts
Vol. 13, EGU2011-8645, 2011
EGU General Assembly 2011

SST data assimilation in the 7km Atlantic Margin Model: initial results

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The 7km Atlantic Margin Model (AMM7) is a model of the physical and biogeochemical processes active within the shelf seas off the north-west coast of Europe. Based upon the NEMO ocean modelling framework, combined with the ERSEM biogeochemical model, AMM7 aims to model the key processes active in shelf sea waters. AMM7 will form the framework of the next generation Met Office shelf seas model. As part of its commitment to developing the AMM7, the Met Office has developed and implemented an SST data assimilation system within the model. Assimilation is performed using an optimal interpolation type scheme, whereby model and observation error covariances are assumed constant during an assimilation cycle. Observations from the SEVIRI, AMSRE, AATSR, METOP and AVHRR satellite instruments are assimilated along with in-situ measurements taken from ships, drifting buoys and moorings. These observations are compared to the model at the actual time of measurement using a First Guess at Appropriate Time (FGAT) system. By processing the observation minus model differences we are able to calculate increments to the SST field that will bring the model closer to reality. Once calculated, increments to SST are added to down to the base of the mixed layer using an Instantaneous Analysis Update (IAU) scheme. In contrast to other Met Office ocean models, an instantaneous mixed layer, defined by a 0.2^0C change in temperature from the surface, is used. The AMM7 assimilation system also uses a new set of error covariances generated specifically for the shelf. The new error covariances were iteratively calculated from successive model runs by firstly applying the Quick Canadian (QC) method to a non-assimilating run. Error covariances calculated via the QC method were then used in a subsequent run which included data assimilation. A combination of the Hollingsworth & Lönnberg /NMC methods was then used to calculate a final set of error covariances from this second model run.

We present the details of the AMM7 model and assimilation system and also demonstrate the utility of our methods by presenting results taken from a two year (2007-2008) experiment. This experiment consisted of two model runs: a run that included data assimilation and a control that did not. By comparing these two runs we show that data assimilation very rapidly reduced both bias and RMS error in SST over most of the domain. As we assimilated only SST, the impact of assimilation on other aspects of the model was limited and, crucially, did not degrade the performance of the system. In particular, we demonstrate that assimilation did not have an adverse effect on the biogeochemical components of the model; a problem that has been observed in other systems where physical assimilation has occurred alongside biogeochemical modeling.