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Optimal adjustment of atmospheric forcing parameters for long term simulations of the global ocean circulation

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Sea surface temperature (SST) is more accurately observed from space than near surface atmospheric variables and air-sea fluxes. But ocean general circulation models that carry out operational forecasts, ocean reanalysis, or simulations of the recent ocean variability (the last 40 years) use, as surface boundary conditions, bulk formulae which do not directly involve the observed SST. In brief, models do not benefit in their forcing from one of the best observed ocean surface variable, except when explicitly assimilated. The objective of this research is to develop a new assimilation scheme based on advanced statistical methods that will use SST satellite observations to constrain (within observation-based air-sea flux uncertainties) the surface forcing function of ocean circulation simulations (bulk formulae surface atmospheric input variables). The idea is to estimate a set of corrections for the atmospheric input data from the ERAinterim reanalysis, covering the period from 1989 to 2007. We use a sequential method based on the SEEK filter, with an ensemble experiment to evaluate the impact of uncertain atmospheric forcing on the ocean state. The control vector is extended to correct forcing parameters (air temperature, air humidity, downward longwave and shortwave radiations, precipitation, wind velocity). Over experiments of one month duration, we assimilate observed monthly SST products (Hurrel, 2008) and SSS seasonal climatology data (Levitus, 1994), to obtain monthly parameter corrections that we can use in a free run model. This work is carried out with a global configuration of the NEMO model, at a 2^{o} resolution. The first results (obtained for every month of 2004) show that the estimated parameters directly used in the model has the same type of impact on the SST than the analysis itself. We can thus produce, on a global scale, and over a large time period, an optimal flux correction set that leads to a better agreement between free run model SST and observations. Moreover, the objective corrections obtained with this method are comparable, for the net heat flux, to empirical corrections applied in the past to produce better forcing set (Brodeau, 2009). We are now proceeding the same way for the whole ERAinterim reanalysis period, and the mathematical optimality of the method makes it possible to learn more about the partitioning of the corrections between all the components of the net heat flux.