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# Parameter estimation of turbulent closure schemes in marine circulation models using Simultaneous Perturbation Stochastic Approximation method: a proof-of-concept

Clement Aldebert (1), Philippe Fraunie (1), Pierre Garreau (2), Ivane Pairaud (3), and Jean-Luc Devenon (1)

(1) Mediterranean Institute of Oceanography, Aix-Marseille University, Toulon University, IRD/CNRS, France, (2) LOPS, IFREMER Brest, France, (3) LER PAC, IFREMER La Seyne sur Mer, France

Fluxes between the oceanic surface layer and the atmosphere is one of the main difficulty to solve to ensure acceptable results for the numerical models of marine circulation. The upper mixing layer is often a weakness of numerical modelling near the air-sea interface, due to the great difficulty to obtain reliable and accurate measurements close tothe sea surface. Then, modelling this surface layer with turbulent closure schemes is a challenging issue. A major problem for practical applications is the parameterization of these closure schemes. The TURBIDENT project aims to optimize the parameters of turbulent closure models through an inverse approach applied to an original and well-suited set of data issued from HF radars and AUV-mounted ADCP. Here, we present the first results based on a simple one-dimensional model used as a proof-of-concept for the new data assimilation method. This method, called Simultaneous Perturbation Stochastic Approximation (Zhu & Spall, 2002), has never been used for turbulent closure schemes optimization , despite it seems well-suited for this type of problems (non linearity, coupling and downscaling). The SPSA method is not based on an adjoint model, but simply on model estimates. The number of those estimates is kept small by the use of stochastic perturbations of parameter values, which allows to optimize a high number of parameters at the same time. In the present application, the optimized parameters link the observed quantities of the mean motion (as well as temperature and density) to the mixing properties (turbulent diffusivity). Future work will involve realistic applications based on different closure scheme such as KPP and k-epsilon.