



Variational inversion in NEMO using a modular graph approach.

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The YAO software (<http://www.locean-ipsl.upmc.fr/~yao/>) was used for variational data assimilation. This software represents the numerical model through a modular graph formalism. Each modulus represents a function and its jacobian. Connecting all the modules constitutes the graph. Running the graph forward represents the direct model; running it backwards and associating the different jacobians represents the adjoint of the direct model. YAO is thus able to generate the code for the direct model, the adjoint model and the linear tangent that are necessary to minimize the cost function defined in the variational assimilation formalism. It also provides a flexible toolbox in order to design several data assimilation experiments.

In order to illustrate the YAO approach and to test some assimilation procedures, the ocean model NEMO (<http://www.nemo-ocean.eu/>) was represented with the YAO formalism for the academic configuration named GYRE. Performances between the original and YAO code were compared. NEMO adjoint was numerically validated and twin experiments were conducted. Several aspects (type of observations, type of assimilation procedure, code optimization) were tested and demonstrate the flexibility and the potential of the YAO approach to develop data assimilation procedures.