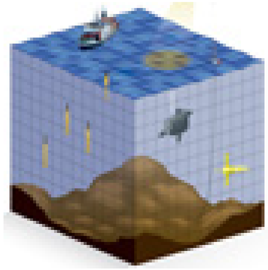

Contribution ID: **56** Type: **Poster presentation**

A Neural Network-Based Observation Operator for Coupled Ocean-Acoustic Variational Data Assimilation

Variational data assimilation requires implementing the tangent-linear and adjoint (TA/AD) version of any operator. This intrinsically hampers the use of complicated observations. Here, we assess a new data-driven approach to assimilate acoustic underwater propagation measurements (Transmission Loss, TL) into a regional ocean forecasting system. TL measurements depend on the underlying sound speed fields, mostly temperature, and their inversion would require heavy coding of the TA/AD of an acoustic underwater propagation model. In this study, the non-linear version of the acoustic model is applied to an ensemble of perturbed oceanic conditions. TL outputs are used to formulate both a statistical linear operator based on canonical correlation analysis (CCA), and a neural network-based (NN) operator. For the latter, two linearization strategies are compared, the best-performing one relying on reverse-mode automatic differentiation. The new observation operator is applied in data assimilation experiments over the Ligurian Sea (Mediterranean Sea), using the Observing System Simulation Experiments (OSSE) methodology to assess the impact of TL observations onto oceanic fields. TL observations are extracted from a nature run with perturbed surface boundary conditions and stochastic ocean physics. Sensitivity analyses indicate that the NN reconstruction of TL is significantly better than CCA. Both CCA and NN are able to improve the upper ocean skill scores in forecast experiments, with NN outperforming CCA on the average. The use of the NN observation operator is computationally affordable, and its general formulation appears promising for the adjoint-free assimilation of any remote sensing observing network.

Which theme does your abstract refer to?

Applications of machine learning in data assimilation

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