Use of implicit inverse methods to estimate uncertain parameters in (reduced) models

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Many models of the ocean, atmosphere and climate contain a set of uncertain parameters, for example those in the parameterization of subgrid scale processes. Inverse methods are frequently used to attempt to estimate the values of these parameters. In this presentation, we discuss the use of recently developed implicit inverse methods, i.e. where the model transient integration is fully implicit, for these parameter estimation problems. As a background model, a fully-implicit barotropic quasi-geostrophic model of the wind-driven double-gyre ocean circulation will be used. For the latter model, the different regimes of flow behavior and the regime boundaries (i.e., bifurcation points) are well known and hence the parameter estimation problem can be systematically studied.