Geophysical Research Abstracts
Vol. 18, EGU2016-6008, 2016
EGU General Assembly 2016
© Author(s) 2016. CC Attribution 3.0 License.

# Variational estimation of process parameters in a simplified atmospheric general circulation model

Guokun Lv, Armin Koehl, and Detlef Stammer
Institute of Oceanography, Center for Earth System Research and Sustainability (CEN), University of Hamburg, Germany

Parameterizations are used to simulate effects of unresolved sub-grid-scale processes in current state-of-the-art climate model. The values of the process parameters, which determine the model's climatology, are usually manually adjusted to reduce the difference of model mean state to the observed climatology. This process requires detailed knowledge of the model and its parameterizations.

In this work, a variational method was used to estimate process parameters in the Planet Simulator (PlaSim). The adjoint code was generated using automatic differentiation of the source code. Some hydrological processes were switched off to remove the influence of zero-order discontinuities. In addition, the nonlinearity of the model limits the feasible assimilation window to about 1day, which is too short to tune the model's climatology. To extend the feasible assimilation window, nudging terms for all state variables were added to the model's equations, which essentially suppress all unstable directions. In identical twin experiments, we found that the feasible assimilation window could be extended to over 1-year and accurate parameters could be retrieved. Although the nudging terms transform to a damping of the adjoint variables and therefore tend to erases the information of the data over time, assimilating climatological information is shown to provide sufficient information on the parameters. Moreover, the mechanism of this regularization is discussed.