Geophysical Research Abstracts
Vol. 16, EGU2014-4227, 2014
EGU General Assembly 2014

Balanced and Coherent Climate Estimation by Combining Data with a Biased Coupled Model

Shaoqing Zhang, You-Soon Chang, Xiaosong Yang, and Anthony Rosati
Princeton University, Geosciences, Princeton, United States (shaoqing.zhang@noaa.gov, +1 609 987-5063)

Given a biased coupled model and the atmospheric and oceanic observing system, how to maintain balanced and coherent climate estimation is of critical importance for producing accurate climate analysis and prediction initialization. However, due to limitation of the observing system (most of the oceanic measurements are only available for the upper ocean, for instance), directly evaluating climate estimation with real observations is difficult. With two coupled models which are biased with respect to each other, a "biased" twin experiment is designed to simulate the problem. To do that, the atmospheric and oceanic "observations" drawn from one model based on the modern climate observing system are assimilated into the other. The model that produces "observations" serves as the "truth" and the degree by which an assimilation recovers the "truth" steadily and coherently is an assessment of the impact of the data constraint scheme on climate estimation. Given the assimilation model bias of warmer atmosphere and colder ocean, while the atmospheric-only (oceanic-only) data constraint produces an over-cooling (over-warming) ocean through the atmosphere-ocean interaction, the constraints with both atmospheric and oceanic data create a balanced and coherent ocean estimate as the observational model. Moreover, the consistent atmosphere-ocean constraint produces the most accurate estimate for North Atlantic Deep Water (NADW), while NADW is too strong (weak) as the system is only constrained by atmospheric (oceanic) data. These twin experiment results provide insights that consistent data constraints of multiple components are very important when a coupled model is combined with the climate observing system for climate estimation and prediction initialization.