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Impact of different initialization procedures on the predictive skill of an ocean-atmosphere coupled model

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The sensitivity of the forecast skill of climate predictions through improving the initialization procedures of a coupled ocean-atmosphere (MITgcm/UCLA) climate model is investigated. Although only short-term climate predictions can be considered purely as "initial value problems", for which detailed knowledge of the observed conditions is required to define the starting point (Meehl et al. 2009), the evaluation of the impact of different initialization strategies on the predictive skill of the model remains important also for seasonal to decadal timescales. The coupled model combines two state of the art grid point general circulation models: the MITgcm model for the ocean (resolution $1^{o}x1^{o}$) and the UCLA model for the atmosphere (resolution $2.5^{o}x2^{o}$). The ocean component of the model is initialized with the ocean synthesis data available from the German contribution to Estimating the Circulation and Climate of the Ocean (GECCO) project that combines ocean GCM and observations (both satellite and in situ) creating dynamically balanced initial conditions. One of the problems of coupled climate models simulations is a drift with time away from initial conditions toward the model's climate. This drift may be caused by various imbalances and systematic errors that grow in time until the model attractor is reached. In this study anomaly initialization and flux correction techniques are implemented to eliminate the drift. Hindcast experiments are initialized from GECCO temperature, salinity, zonal and meridional velocities and sea surface height fields at the intervals of one month. Ensembles of forecast experiments are performed at constant intervals every 5 years, 10 years forward over the period 1952-2001. The predictive skill of forecast experiments is evaluated and compared for different initialization techniques, namely the full state initialization, anomaly initialization and full state initialization with flux correction.