Geophysical Research Abstracts
Vol. 12, EGU2010-1713, 2010
EGU General Assembly 2010


# Testing a data assimilation method devoted to reconstruct the climate of the past millennium

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Since a few years now, several studies have applied data assimilations methods to study the climate of the past millennium. This is very challenging for many reasons, including the scarceness of the data in particular over the ocean, the need to assimilate variables that are seasonal or annual averages, the different response time scales of the ocean and the atmosphere, etc. Many questions are thus remaining regarding the best way to perform such data assimilations. Some of them will be tackled here using twin experiments, i.e. experiments in which we assimilate pseudo-observations derived from model results, performed with the coupled climate model of intermediate complexity LOVECLIM. The method applied is a simple particle filter in which a resampling of an ensemble of simulations is performed at every assimilation step, resampling which is based on the likelihood of each of the members of the ensemble. In particular we will focus on four aspects. 1/ The number of simulations required to reconstruct some specific variables; 2/ The number of degrees of freedom that can be reconstructed using an ensemble of a particular size; 3/ The role of initial conditions compared to the one of the internal variability generated during each step of the model; 4/ The importance of the forcing (to what extent can we reproduce the changes in the system in presence of strong biases in the forcing ?).