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Influence of Initialization Method on the Quality of Decadal Climate Predictions

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Many uncertainties remain on the most appropriate methods to realize decadal climate predictions. In that context, we are studying how the choice of the methodology affects the prediction quality. Numerical experiments are realized with the coupled model LOVECLIM, a climate model of intermediate complexity with relatively low computational cost. This allow us to perform numerous experiments within a reasonable time. As in most of predictability studies, ensemble simulation method is used. Three important sources of uncertainties had been identified: initial condition estimate, perturbation of the initial condition and systematic model errors. We are currently focusing on methods capable of providing an optimal estimate of the initial condition which is required in order to perform accurate and reliable decadal predictions. Data assimilation methods can provide an optimal estimate of the initial state given inaccurate and incomplete observations and imperfect model equations. We are dealing with different data assimilation methods: two sophisticated ones (the particle filter and the ensemble Kalman filter) as well as a simpler one (the nudging). Assimilation is performed monthly or seasonally and provide initial condition which is then used to initialize hindcast experiments spanning the last 50 years. This way, we can systematically evaluate the efficiency of the different methods tested by comparing the results of these hindcast experiments with available observations. Our analyses focus on the North Atlantic area as well as on the Austral Ocean. Indeed, recent studies show that there is a good potential predictability for decadal predictions there. The particle filter and the nudging used in the framework of the present project will be presented. Results for hindcast experiments initialized thanks to these methods will be discussed.