



A linearly perturbed climatology to implement atmospheric feedbacks in an ocean-only model

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An atmosphere/ocean/sea-ice coupled general circulation model (Speedo/CLIO) is used to compute a climatology with linear perturbations. The model is run with two different setups. First, the statistical steady state of the model is recorded. In a second experiment, a collapse of thermohaline circulation is induced with a freshwater perturbation in the north Atlantic. Thermohaline circulation does not recover even after the release of the perturbation, and a second steady state with no thermohaline circulation is attained. Using these two runs, the perturbed climatology can be computed as linear regression on the local value of sea surface temperature and on northern hemisphere average sea surface temperature separately.

The climatology produced will be used in a fully implicit model to compute bifurcation diagrams of thermohaline circulation. By including parts of the perturbed climatology, regressed on sea surface temperature, we are able to include the effect of atmospheric feedbacks. This approach enables to selectively choose which linear feedbacks are operating at the surface of the ocean-only model, thus giving the opportunity to understand which role is played by each physical process active at the air-ocean interface.