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Stochastic Resonance in a Thermohaline Circulation Box Model

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We perform an analysis of the uncoupled version of the Rooth 3-box model of the thermohaline circulation (THC). The model consists of three boxes, representing is avery simplified way the northern, tropical and southern Atlantic ocean. We first study the bistable behaviour and the bifurcation points, showing the distribution of THC strength values for different freshwatwer fluxes, using random initial conditions. Subsequently, we perturb our models with noise of various intensity, finding the stationary distribution of THC strength for different value of the fluxes. We then combine a weak periodic forcing (period of 19ky) and "plausible" stochastic noise in freshwater fluxes to study stochastic resonance. In three different cases we observe a strong response to the frequency of the forcing for a given interval of noise strenght. In the most relevant case of antisymmetric periodic forcing, using the noise strength value which maximizes the response to the periodic forcing, we find that the average waiting time between the transitions from a positive to a negative circulation is close to half of the period of the forcing.