



Passive mechanism of decadal variation of thermohaline circulation

M. Mu (1), L. Sun (2)

(1) LASG, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China

(2) Department of Modern Mechanics, University of Science and Technology of China, Hefei, Anhui 230027, China (mumu@lasg.iap.ac.cn/Fax-Nr. (86-10-62043526))

Abstract The decadal variation of thermohaline circulation (THC) is investigated in a simple coupled ocean-atmospheric two-box model with the new approach of conditional nonlinear optimal perturbation (CNOP). First, the nonlinear optimal initial perturbations with different constraints are found by this approach. There are two different types of perturbations in the nonlinear regime. One is the freshwater flux perturbation, which is the CNOP of THC and has stronger amplification. The other is salinity flux perturbation, whose amplification is weaker. Freshwater (salt) perturbations weaken (enhance) the mean circulation, hence weaken (enhance) the stability of THC. Second, the passive variabilities of THC are investigated by superposing the initial perturbations to the thermohaline circulation. The passive variabilities found in this model are due to non-normal and nonlinear growth of initial perturbations. These variabilities, measured as damping time of perturbations, can cause decadal variability of THC.