Geophysical Research Abstracts, Vol. 7, 08423, 2005 SRef-ID: 1607-7962/gra/EGU05-A-08423 © European Geosciences Union 2005



Signal-to-noise ratios for the detection of ocean circulation changes

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Our analysis shows that the temperature structure in the Atlantic Ocean can be a sensitive indicator identifying early Atlantic thermohaline circulation (THC) weakening with a high signal-to-noise ratio. Simulations with the coupled atmosphere-ocean circulation model ECHAM5/MPI-OM emphasize the subsurface temperature signature in the Atlantic Ocean with its potential to trace THC changes. A part of this signature can be understood with the advective-diffusive balance which is confirmed in a stochastic low-order model of the Atlantic Ocean circulation. It is shown that the integration of noise, which enters in a multiplicative way into the stochastic differential equation, is linked to the predictive skill of mid-depth temperatures for possible THC change.