Geophysical Research Abstracts, Vol. 8, 05307, 2006
SRef-ID: 1607-7962/gra/EGU06-A-05307
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Statistical parameterization of oceanic convection

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A statistical convective adjustment scheme is proposed that attempts to account for the effects of mesoscale and sub-mesoscale variability of temperature and salinity typically observed in the oceanic convective regions. Temperature and salinity in each model grid-box are defined in terms of their mean, variance and mutual correlations. Sub-grid scale instabilities lead to partial mixing between different layers in the water column. This allows for a smooth transition between the only two states (convection on and convection off) allowed in standard convective adjustment schemes. The advantage of the statistical parameterization is that possible instabilities associated to the sharp transition between the two states, that are known to occasionally affect the large scale model solution, are eliminated. The procedure also predicts the generation of correlations between temperature and salinity and the presence of convectively induced up-gradient fluxes that have been obtained in numerical simulations of heterogeneous convection and that cannot be represented by standard convective adjustment schemes.