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Evaluation of convective boundary layer parameterizations versus Large-Eddy simulation data

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Convective internal boundary layers (CBLs) are major contributors to atmosphere - earth surface heat exchange. it's crucial to represent CBLs precisely in numerical weather prediction and global climate models because they affect climate feedback systems such as cloud albedo. However, they still cannot be resolved explicitly on these models' grids, so their impact must be parametrized. The first analytic solutions for CBL growth over time was presented almost 80 years ago (Zubov 1945), since then a wide range of parameterizations was developed. This study is aimed to evaluate the most recent of them (e.g. Zilitinkevich et al. 2012) and their performance over a variety of different background flow conditions by comparison to Large Eddy Simulation experiments conducted with LES model developed in Institute of Numerical Mathematics of Russian Academy of Science (Glazunov 2009). Those parameterizations are based on a bunch of assumptions such as linearity of heat flux with height, horizontal homogeneity of buoyancy inside CBL, etc. The validation of these assumptions under different background flow and surface conditions and an assessment of respective errors in CBL parameters are presented.

N. N. Zubov, Arctic Ice (Izd. Glavsevmorputi, Moscow, 1945) [in Russian].

S. S. Zilitinkevich et al. (Izvestiya, Atmospheric and Oceanic Physics, 2012) Vol. 48, No. 1, pp. 133–142.

Glazunov A.V. Large-eddy simulation of turbulence with the use of a mixed dynamic localized closure: part 2. Formulation of the problem, model description and diagnostic numerical tests.Izvestiya. Atmospheric and Oceanic Physics. 2009. Is. 45. vol. 1. pp. 25-36.