The use of combined closure in convection parameterization scheme

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The SL-AV is a global semi-Lagrangian NWP model with variable resolution as an option [1]. The model includes the parameterization package of subgrid-scale processes from the French operational model ARPEGE/IFS [2]. The deep convection scheme is based on [3] but includes numerous developments (parameterization of dowdraught fluxes, redistribution of momentum, etc). Currently the resolution of the model is 1.40625x1.125 degrees lon/lat, and 28 vertical levels. It was found that for this (and coarser) resolution, the Kuo closure for deep convection parameterization works well in midlatitudes, while the closure based on CAPE (convective available potential energy) is better suited for tropics.

It is proposed to use a combination of these two closures, depending on average temperature near the surface. This idea was tested in the framework of the SL-AV model. The temperature which activates CAPE closure instead of Kuo closure is chosen to be 302.1 K. Obviously, this threshold can be used for tuning the parameterization.

On Fig. 1 we present zonal mean temperature trend averaged over 12 five-day forecasts starting from 15th of each month 1996, 0000 UTC (ECMWF data) for each type of closure and for combined closure. One can see that the use of combined closure reduces cold bias in upper troposphere in tropics with respect to "pure Kuo" case, but does not produces excessive warm bias near the surface, as "pure CAPE" does. There is also a small improvement in RMS scores for combined closure.

References

[1] M.A. Tolstykh, Semi-Lagrangian high resolution model of the atmosphere for numerical weather prediction, *Russian Meteorology and Hydrology*, N4, 1-9 (2001). (Russian and English)

[2] J.-F. Geleyn, E. Bazile, P. Bougeault *et al*, Atmospheric parameterization schemes in Meteo-France's ARPEGE N.W.P. model. In *Parameterization of subgrid-scale physical processes*, ECMWF Seminar proceedings (1994), 385-402.

[3] P. Bougeault, A simple parameterization of the large-scale effects of cumulus convection, *Mon. Wea. Rev.* **113** 2108-2121 (1985).
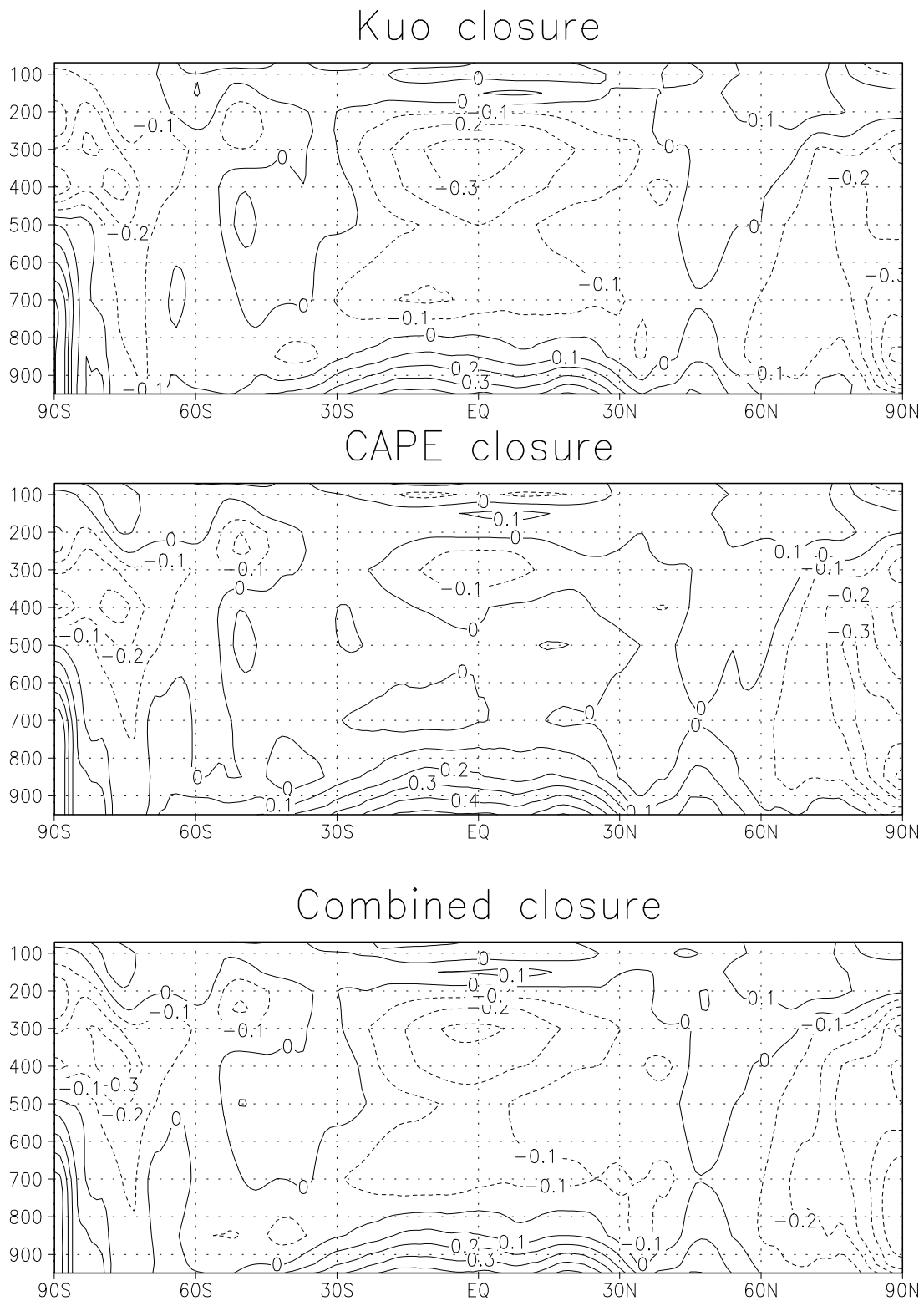
Kuo closure

CAPE closure

Combined closure

Рис. 1: The zonal mean temperature tendencies averaged over 12 cases for different closures (K/day)