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Implementation of a density current parametrization in the LMDZ4 GCM

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Density currents are key elements of deep convection organization and propagation. Although it is less advertised, they also play an important role in the diurnal cycle of deep convection over land: by growing during the afternoon, they provide the lift necessary for the continuation and growth of convection in the late evening and during the night. It is this last feature, which is addressed in the present study.

We propose a first GCM implementation of a density current parametrization coupled to the Emanuel convective scheme. The cold pool (or wake) is assumed to have vertical walls and a flat horizontal top. Prognostic energy and moisture budget equations for the wake and for the undisturbed area are solved on the model vertical grid, yielding vertical profiles of temperature and humidity. Vertical velocity is diagnosed as a function of the wake potential energy (WAPE). Wake propagation between model cells is not represented.

We present simulation results for short periods of the 2006 summer AMMA SOP. We use the LMDZ4 GCM with a grid zoomed over West Africa (cell size of the order of 70 km) and nudged towards NCEP analysis. The behaviour of deep convection over West Africa is analysed. Emphasis is put on the diurnal cycle and especially on late evening convection.