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The low frequency variability of CAPE and CIN, and the interpretation of its forcing mechanisms

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CAPE (Convective Available Potential Energy) is a promising parameter to determine the variability of convective precipitation. The potential occurrence of convection is restricted by CIN (Convective INhibition), which is determined in the lower boundary layer. CAPE and CIN are based on the vertical profiles of temperature and specific humidity. We compare daily high resolution ERA-40 reanalysis data (T106) with general circulation models: ECHAM5/MPI-OM (T63), Planet Simulator (T42 and T21).

The variability is determined on intra-annual and inter-annual (low frequency variability) time scales using the Detrended Fluctuation Analysis (DFA), spectral and correlation analyses. The global memory properties of CAPE and CIN are attributed to the contributions of temperature and specific humidity. The memory increases towards the tropics where it reaches nonstationary $1/f$ scaling in all ocean basins on time scales extending from days to several years.

The variability of CAPE, CIN, and convective precipitation is interpreted in terms of Hoskings infinite memory fractionally differenced processes (FD) characterised by the Hurst exponent, which is obtained by DFA. The FD processes describe the observed scaling behaviour of the low frequency variability as an amplification of a presumed white noise forcing. Our results suggest that the high frequency forcing is located in the tropics aligned along the ITCZ with a double ITCZ structure in the Indian Ocean.