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# Quantifying internal variability in a regional climate model. A case study in Southern Africa

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This study aims at separating the reproducible and irreproducible parts of seasonal and intraseasonal climate variability over Southern Africa (south of 15°S), during an austral summer rainy season representative of the climatology. To that end, a 30-member ensemble simulation is performed using WRF laterally forced by ERA40 reanalyses. Diverse and complementary methodologies are used to disentangle internal and external variability, including the analysis of weather regimes, signal-to-noise ratio, inter-member standard deviation and coefficient of variation.
At the seasonal timescale, simulated rainfall amounts generally show a strong reproducibility, except in the subtropics and over the southern part of the Mozambique Channel. There, the number of rainy days is roughly similar in all members, while their average intensity varies extensively. At the intraseasonal timescale, the chronology of weather regimes, derived from the 500hPa geopotential height, is highly reproducible. This approach is also useful to downscale the model seasonal mean biases, which appear therefore to be modulated by lateral synoptic forcings. Due to its noisier character, rainfall variability is much less reproducible, especially in the central parts of the domain and near its outflow boundaries. Analysis of a South African regional index nonetheless indicates that wet and dry spells tend to be accurately simulated, the main uncertainties concerning the basic morphological features of rain-bearing systems (i.e. their spatial extension, location and propagation speed).
Internal variability is lastly related to the lateral forcings provided by ERA40. An objective classification of inflow/outflow mass fluxes allows identification of the recurrent synoptic configurations that favor strong or weak regional reproducibility.