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Mechanisms for precipitation variability of the Eastern Brazil/SACZ convective margin

Hsi-Yen Ma[†]; Xuan Ji; David Neelin; Carlos Mechoso
[†] Lawrence Livermore National Laboratory, USA
Leading author: ma21@llnl.gov

The present study examines the mechanisms for the connection between the precipitation variability in eastern Brazil and the South Atlantic convergence zone convective margin (eastern Brazil/SACZ convective margin), and the variability of low-level inflow on interannual time scales during austral summer. Our methodology is based on the analysis of observational datasets and simulations by the UCLA atmospheric general circulation model (AGCM) coupled to the Simplified Simple Biosphere Model. It is demonstrated that the inflow variability is associated with the leading mode of wind variability over sub-tropical South America, and the connection is established through the mechanism of an analytic prototype for convective margin shifts proposed in previous studies. Over the eastern Brazil/SACZ convective margin, the weaker (stronger) convection tends to occur together with stronger (weaker) low-level inflows in reference to the mean easterly trades. By changing the "ventilation" effect, stronger (weaker) inflows with low moist static energy from the Atlantic Ocean suppress (promote) convection. The causal relationship is verified by AGCM mechanism-testing experiments performed in perpetual-February mode, in which low-level, nondivergent wind perturbations are imposed in a region overlapping eastern Brazil and the western Atlantic Ocean. With solely the imposed-wind perturbations acting on the moisture advection in the model equation, the AGCM can reproduce the precipitation variability in the eastern Brazil/SACZ convective margin. The capability of the AGCM in capturing such precipitation sensitivity to the low-level inflow variability also suggests that the mechanism can be applied to other regions of convective margins or to other time scales.