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Interannual variability and seasonal evolution of summer monsoon rainfall in South America: role of local and remote forcing

A. Grimm and M. Zilli

Department of Physics and Post Graduate Program on Water Resources and Environmental Engineering, Federal University of Parana, Curitiba, Brazil (grimm@fisica.ufpr.br / Fax 55 41 3361-3418 / Phone: 55 41 3361-3097)

The analysis of interannual to interdecadal variability of the South American monsoon rainfall is carried out separately for austral spring and summer (and for November and January), based on a 40-year station gauge dataset. Relationships between modes of variability in these seasons show the influence of antecedent conditions in spring (or November) on the evolution of the monsoon rainfall in peak summer (or January). In spring the first mode is dipole-like, with opposite loadings over central-east and southeast South America. It is connected with ENSO. The second mode shows highest loadings a little south of the South Atlantic Convergence Zone. The leading mode of summer also features dipole-like oscillations between central-east and southeast South America, but is not strongly connected with ENSO. The second mode represents the impact of ENSO, and the third is modulated by SST anomalies in southern tropical Atlantic.

Significant relationships are disclosed between the first dipole-like modes of spring and summer rainfall and thus between the rainfall in spring and summer over central-east South America, which is part of the monsoon core region. These dipole-like modes are associated with a rotational anomaly over southeast Brazil that either conveys moisture flux into central-east Brazil (if it is cyclonic) or into southeastern South America (if it is anticyclonic). In spring this anomaly seems to be remotely forced, but after strong rainfall anomalies over central-east Brazil in spring, it tends to re-

verse sign in peak summer, inverting the dipole-like rainfall anomalies. This reversal is hypothesized to be locally forced by surface-atmosphere feedback triggered by the spring anomalies, as weaker teleconnections in summer allow local processes that are stronger in summer to overcome remote forcing. SST and circulation anomalies associated with the first modes in spring and summer and also the relationship between the first summer mode and surface temperature in spring are consistent with that hypothesis.