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Progress in American monsoon research: Intraseasonal oscillation in the South American monsoon produced by surface-atmosphere interaction?

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In central-east South America dry (wet) springs tend to be followed by wet (dry) summers, the opposite anomalies being most visible in November and January. Diagnostic and modeling analyses have shown that this inversion of anomalous precipitation can be due to surface atmosphere interactions, triggered by previous precipitation anomalies in spring that produce soil moisture anomalies. These can be effective in altering temperature, since soil moisture is not saturated in this region in spring, contrary to other regions. Near surface temperature anomalies lead to pressure and circulation anomalies. This chain of interactions is very much influenced by the topography in the region, as shown by modeling studies. Previous spring SST anomalies off the southeastern Brazilian coast seem to also influence the evolution of the precipitation but are not necessary to produce them. The study of the relationship between precipitation in the early and the peak monsoon season in that region is here extended to the analysis of the precipitation behavior within the peak monsoon season and the relationship between the peak and the late season. Significant connections are disclosed between the first interannual variability modes of monthly precipitation in November, January, February and March, all of them with great components over central-east South America. All these modes are dipole-like, with opposite anomalies in central-east and southeast South America associated with a rotational anomalous circulation 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). The inversion of this rotational anomaly determines the inversion of the dipole orientation. The disclosed connections show that, besides the inverse relationship already determined between November and January, persistence dominates during the peak of the season (January and February), and inverse relationship prevails between the peak and the demise of the monsoon (February and March). This is further demonstrated by the evolution of precipitation in central-east South America associated with the extreme phases of each of these modes. The analysis of climatological soil moisture, expressed as percentage of soil water storage capacity, for each month of the monsoon season, indicates that the inversion from spring to peak summer and from peak summer to early autumn can be explained by the same mechanisms.