

The South Atlantic Convergence Zone: intensity, form, persistence, relationships with intraseasonal to interannual activity and extreme rainfall

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Abstract

The characteristics of intensity, geographical location and persistence of the South Atlantic convergence zone (SACZ) during the austral summer are investigated. Intensity and spatial features of the SACZ are identified by performing a factor analysis of structural properties of outgoing long-wave radiation (OLR) data. The first two leading factors explain 65% of the total variance of convective activity and characterize the SACZ according to intensity and location (oceanic versus continental). An index is constructed based on the magnitude of the factor scores to identify intense/weak and oceanic/continental SACZ. Intense SACZ category is associated with negative OLR anomalies over a large area of tropical South America, extending from the western Amazon to the Atlantic Ocean. Weak SACZ is observed with positive OLR anomalies over tropical South America and negative OLR anomalies over southeastern South America. Oceanic and continental aspects of the SACZ are related to a mid-latitude wave train pattern. Madden-Julian Oscillation (MJO) modulates intense SACZ events with persistence greater than 3 days. Investigation of interannual variability of persistent intense/weak events indicates that the ratio of intense to weak SACZ depends on the phase of El Niño/Southern Oscillation (ENSO). Occurrence of extreme rainfall in Brazil is discussed in the context of variations in the SACZ, MJO and ENSO. Intense (weak) SACZ are related to high frequency of extreme precipitation over central (southern and northwestern) Brazil. Oceanic SACZ increases the frequency of extremes over southeastern Brazil whereas continental has no clear signal. The MJO phase characterized by suppression of convective activity over Indonesia and enhancement over central Pacific increases the frequency of extreme rainfall over eastern Brazil. La Niña (El Niño) episodes are linked to high frequency of extremes over eastern-northeastern (southern) Brazil with important impact on the semi-arid region.