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Impact of Atmospheric Blocking on South America in Austral Summer

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In this study, we investigate atmospheric blocking over east South America in austral summer for the period of 1979-2014. Our results show that blocking over this area is a consequence of propagating Rossby waves that grow to large amplitudes and eventually break anticyclonically over subtropical South America (SSA). The SSA blocking can prevent the establishment of the South Atlantic Convergence Zone (SACZ). As such, years with more blocking days coincide with years with fewer SACZ days and reduced precipitation. Convection mainly over the Indian Ocean associated with Madden-Julian Oscillation (MJO) phases 1 and 2 can trigger the wave train that leads to SSA blocking whereas convection over the western/central Pacific associated with phases 6 and 7 is more likely to lead to SACZ events. We find that MJO is a key source of long-term variability in SSA blocking frequency. The wave packets associated with SSA blocking and SACZ episodes differ not only in their origin but also in their phase and refraction pattern. The tropopause-based methodology used here is proven to reliably identify events that lead to extremes of surface temperature and precipitation over SSA. Up to 80% of warm surface air temperature extremes occur simultaneously with SSA blocking events. They are also responsible for the warming of western South Atlantic. The frequency of SSA blocking days is highly anti-correlated with the rainfall over southeast Brazil. The worst droughts in this area, during the summers of 1984, 2001 and 2014, are linked to record high numbers of SSA blocking days. The persistence of these events is also important in generating the extreme impacts.