ENSO and SAM influence on the generation of long episodes of Rossby Wave Packets during Southern Hemisphere Summer

Iago Perez¹, Marcelo Barreiro¹, and Cristina Masoller²
¹Department of Atmospheric Sciences, School of Sciences, Universidad de la República de Uruguay, Montevideo, Uruguay (iagopf93@gmail.com)
²Physics Department, Universitat Politécnica de Catalunya, Barcelona, Spain

Rossby Wave Packets (RWPs) are key to the improvement of long-range forecasting and for the prediction of sub-seasonal extremes. Several studies have focused on their properties, such as time duration, trajectory, areas of detection and dissipation as well as interannual variability in the northern hemisphere, but only a few of them have focused in the southern hemisphere. Here we study the influence of low-frequency climate modes on RWPs during southern hemisphere summer using NCEP DOE 2 Reanalysis data. Focusing on long-lived RWPs, which we define as RWPs with a lifespan above 8 days, we determine how El Niño-Southern Oscillation (ENSO) and the Southern Annular Mode (SAM) modify their frequency of occurrence and their main areas of detection and dissipation. We found that during El Niño and negative SAM years, the number of long-lived RWPs is maximum. In addition, years with the highest amount of long-lived RWPs show a zonally symmetric and narrow upper level jet that is shifted northward from its climatological position. On the other hand, when the jet is shifted southward, particularly in the southeastern Pacific, during positive SAM phases, only a small number of long-lived RWPs is detected. Therefore, negative SAM conditions provide a background mean flow that favours the occurrence of long-lived RWPs while positive SAM conditions have the opposite effect. The dependence on ENSO phase is not as symmetric: while El Niño sets atmospheric conditions that favour the formation of long-lived RWPs, La Niña years present high interannual variability in the frequency of occurrence. Furthermore, in El Niño events the main formation area is between 61-120°E and the main dissipation area between 300-359°E. During La Niña events, the main formation area is located by 241-300°E and no main dissipation area is identified. In the case of positive SAM two main formation areas appear at 61-120°E and 241-300°E and two main dissipation areas within 121-180 and 301-359°E. Lastly in the case of negative SAM one main formation area at 241-300°E is detected and no main dissipation area is detected. The robustness of the results was tested repeating the analysis using data from the ERA5 Reanalysis and supports the finding that the maximum number of long-lived RWPs occur during negative SAM and El Niño years.