



The South Pacific Anomaly, a Ross Sea forced SST explaining non-ENSO precipitation episodes and trends of SW South America

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Precipitation variability at the arid and semiarid Andes has been a matter of concern due to their potential impact of the important economic activities at the lowlands. The ENSO phenomena does explains some large positive precipitation anomalies but many like the year 2005 remain unexplained. The clear centennial trend of decreasing precipitation does not fit the global warming trend that should increase humidity transport and further deposition at high-altitude Andes Mountains. The combined revision of equatorial and polar sea surface anomalies (SST) that affects this part of the Andean humidity transport systems suggest that both play an alternating role in affecting the observed variability of precipitations. The analysis of unfiltered precipitation and SST records demonstrated that most of the non-ENSO precipitation anomalies can be explained by a positive winter (June-July) SST anomaly located at the southern Pacific Ocean. This “South Pacific Anomaly” (SPA), would affect the humidity load carried by the polar air fronts active during winter, which are the main responsible for snow precipitation events at the high arid cordillera, and rainy events at the Chilean semiarid Precordillera & Coastal ranges. Although this anomaly partly coincides with the ACW (Antarctic circumpolar wave), our analysis of its formation suggest that it is mainly formed at the front of the Ross Sea, and then it is slowly transported by the Antarctic Circumpolar Current (AAC). Our interpretation of this SST anomaly connects it to a climate-independent sea temperature regulator that would be the irregular input of shelf-ice fragments detached from the Ross Sea. This ice-shelf is widely known as one of the most important iceberg-producers of the world, due to the presence of the marine West Antarctic Ice Cap and its ice-streams. Different correlations are obtained between the SPA and ENSO-detrended precipitation records. Using the Ovalle and La Serena precipitation records, maximum correlation is obtained when June-July SPA is

used, but it does not correlate at all if southern summer months are considered. The SPA has also a specific geographic boundaries and best correlations were obtained by limiting SST sampling between 60°S-70°S, and 90°W-110°W, clearly within the realm of the AAC. Using this time & space definition of the SPA, the decreasing precipitation trend observed in both Central (arid & semiarid) and southern Andes (humid), are well explained by the centennial trend of this anomaly to be more negative. This proves that PDA is not related to shorter period climate cycles (like ACW, ENSO or the Pacific Decadal Oscillation). Instead, and due to its possible independent formation from climate, it may affect or modulate other southern hemisphere climate cycles.