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South Pacific wave propagation and summer temperature anomalies in northernmost Antarctica Peninsula

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The present work aims to analyze the tropospheric circulation in the Southern Hemisphere (SH) associated to anomalously cold summer (ACS) and anomalously warm summer (AWS) for the warm season from December to February over northernmost Antarctic Peninsula (AP) in the period 1981-2010. The quartile criterion is applied to the frequency distribution of a temperature index in order to identify the anomalous summers. Additionally, a wave-activity flux for stationary quasi-geostrophic (QG) eddies on a zonally varying basic flow, that was derived by Takaya and Nakamura (2001), is used as a diagnostic tool to study wave-train propagation. The coldest summer in the period is 2010, reason by which this summer is excluded for the estimation of the ACS tropospheric circulation composite. Thence the 2010 summer is further compared with the ACS composite. The SH circulation patterns are distinctly different between ACS and AWS composites. The ACS composite is characterized by eastward propagation of barotropic quasi-stationary waves (QWSs) extending from lower troposphere to lower stratosphere in the South Pacific, from a region of anomalous convection extending from northern Australia to New Zealand. The eatward propagation reaches southern South America and the AP, resembling a Pacific-South America (PSA)-like pattern. This propagation leads to quasi-stationary cyclonic anomalies to the northwest of the AP inducing anomalous easterlies, together with negative insolation anomalies, over northernmost AP during ACSs. Instead, the AWS composite is characterized by a SH annular mode (SAM)-like pattern throughout the troposphere. Unlike ACS composite, the coldest summer of 2010 shows QSW propagation from the southeast of South Pacific towards southern South America and the AP leading to similar quasi-stationary cyclonic anomalies to the north of the AP. No PSA-like propagation is observed. Positive Sea Surface Temperature (SST) anomalies in the southeast of South Pacific could be responsible for QSW propagation by favouring positive mean flow baroclinicity anomalies resulting in increased transient activity. These SSTs anomalies could probably be induced by a PSA-like propagation during the previous spring.