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Atmospheric blocking patterns around the Antarctic Peninsula and their influences on temperature and moisture transport

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This study analyzes the seasonal evolution and trends of atmospheric blocking and their influences on temperature and moisture transport around the Antarctic Peninsula for the period 1979-2020. A geopotential height-based method based on the ECMWF's ERA5 and its predecessor ERA-Interim was applied over two domains, one located to the west (150-90W, 50-70S) and the other over and to the east (90-30W, 50-70S) of the Antarctic Peninsula. Spatial patterns of geopotential heights on days with blocking feature well-defined ridge axes over and west of much of South America, and days with the most extreme blocking (above the 99th percentile) show upper-tropospheric ridge and cut-off low features that have been associated with extreme weather patterns. Blocking days are found to be more frequent in the first half of the period (1979-1998) than the second (1999-2018) in all seasons in the west domain, whereas they seem to be more common over the eastern (Peninsula) domain in 1999-2018 for austral winter, spring, and autumn, although all these differences are not statistically significant. Meteorological observations in the Antarctic Peninsula indicate colder conditions than the observed climatology in the Antarctic Peninsula during blocking days over the western domain. On the contrary, mean blocking days over and to the east of the Peninsula yield warmer conditions than the climatology. Similar to the observed pattern, ERA5 also shows colder and warmer conditions during blocking days over the western and eastern domains, respectively. A further analysis with ERA5 indicates that blocking days over the Drake Passage and to the east of the Peninsula are associated with positive moisture transport anomalies towards the Peninsula coinciding with atmospheric river events, which trigger warm and humid conditions over the Peninsula, particularly in austral autumn. These results suggest that blocking patterns around the Antarctic Peninsula can have notable impacts on moisture transport and extreme temperature events affecting the cryospheric processes, particularly over the leeward side of the Peninsula and Larsen C Ice Shelf.