In order to investigate the climate variability in the north Antarctic Peninsula region, this work focuses on the relationship between stable isotope content of precipitation and firm, and main meteorological variables (air temperature, relative humidity, sea surface temperature, and sea ice extent) in the North Antarctic Peninsula and South Shetland Islands region. Between 2008 and 2010, precipitation samples and several firm cores from two key sites in this region were collected and retrieved. The samples were later analysed by stable water isotope at the laboratory of the Alfred Wegener Institute in Germany. It is concluded that the deuterium excess oscillation represents a robust indicator of the meteorological variability on a seasonal to sub-seasonal scale. Low absolute deuterium excess values and the synchronous variation of both deuterium excess and air temperature imply that the evaporation of moisture occurs in the adjacent Southern Ocean. The \[^{18}\text{O}\]–air temperature relationship is complicated and significant only at a (multi)seasonal scale. Backward trajectory calculations show that air-parcels arriving at the region during precipitation events predominantly originate at the South Pacific Ocean and Amundsen-Bellingshausen Sea. These results will be used as a calibration for on-going and future research in the area, suggesting that appropriate locations are located above 600 m a.s.l. A high altitude plateau (1000 m a.s.l.), located 20 km to south-east of the Chilean Antarctic Station O’Higgins at the Antarctic Peninsula, present the most promising site for a deeper drilling campaign.