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Active Layer moisture and temperature monitoring at Half Moon Island, Maritime Antarctica.

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Half Moon Island is a minor Antarctic island, lying in the Half Moon Bay, Livingston Island in the South Shetland Islands of the Antarctic Peninsula region. Having the Mc Farlane Strait at its western shore the island was formed by the junction of three smaller islands during the Holocene, altitude at its northern portion can reach 101 m a.s.l. Its surface area is 171 hectares (420 acres). The Argentine Cámara Base is located on the island, the naval base is operational occasionally during the summer, when it's water suply comes from a near by lake. Permafrost spreads over wider areas on higher Holocene beaches being sporadic on the lowest Present-day platforms (López-Martínez et al., 2012), processes related to the presence of permafrost were observed. The mean annual air temperature is near -2°C, and average summer temperatures are higher than 0°C. These conditions allow snow cover melting and freeze-thaw cycles during summer although the annual number of air freeze-thaw cycles reported for the near by Byers Peninsula is low, 14 in summer (Blümel and Eitel, 1989; Qingsong, 1989). The objective of this study was to evaluate soil temperature and moisture content based on in situ measurements from a Cryosol developed on a Holocene beach at Half Moon Island, Maritime Antarctica. The monitoring systems consist of soil temperature probes (Campbell L107E thermocouple, accuracy of $\pm$ 0.2°C) and soil moisture probes (CS656 water content reflectometer, accuracy of $\pm$ 2.5%), placed in the active layer (Turbic Eutric Cryosol 44 m a.s.l., 5 cm, 10 cm, 30 cm, 50 cm and 100 cm, S 62°35′23.8", W 059°55′18.3"). All probes were connected to a Campbell Scientific CR 1000 data logger, recording data at every 1 hour interval. We calculated the thawing days (TD), freezing days (FD) and freezing degree days (FDD); all according to Guglielmin et al. (2008). This system recorded data of soil temperature and moisture from March 2015 to December 2016. Despite the absence of glaciers in the Island the thermal regime of the active layer showed a dominance of freezing conditions (average -1.74 °C at 5 cm and -1.46 °C at 100 cm), thaw days are concentrated February and March (44 from January until November 2016 at 5 cm being missing at 50 cm and 100 cm). At 100 cm the majority of the 642 days are classified as freeze days (192 days). Soil moisture content was very similar for 2015 and 2016, averaging 0.11, m3 m-3 (0.41 max, 0.04 min) and 0.13 m3 m-3 (0.39 max, 0.07 min) at 10 cm and 100, for the whole study period. Considering the cold season 2015 was colder, FDD summed -806 degree days at 5 cm and -674 at 100 cm (-392 and -315 degree days in 2016). Nevertheless active layer thickness reached its maximum of 140 cm in late march 2015 (118 in 2016). During the 2015 summer season the lake that supply's water to Argentine Cámara Base drained, apparently the deepening of the active layer disrupted the drainage impediment provided by the permafrost table. The active layer thermal regime over 642 day period at Half Moon Island shows a preponderance of freezing conditions; although summer data is not available for 2015, the active layer thickness reached its maximum during late march retracting in 2016.