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Soil thermal properties at two different sites on James Ross Island in the period 2012/13

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James Ross Island (JRI) is the largest island in the eastern part of the Antarctic Peninsula. Ulu Peninsula in the northern part of JRI is considered the largest ice free area in the Maritime Antarctica region. However, information about permafrost on JRI, active layer and its soil properties in general are poorly known. In this study, results of soil thermal measurements at two different sites on Ulu Peninsula are presented between 1 April 2012 and 30 April 2013.

The study sites are located (1) on an old Holocene marine terrace (10 m a. s. l.) in the closest vicinity of Johann Gregor Mendel (JGM) Station and (2) on top of a volcanic plateau named Johnson Mesa (340 m a. s. l.) about 4 km south of the JGM Station. The soil temperatures were measured at 30 min interval using platinum resistance thermometers Pt100/8 in two profiles up to 200 cm at JGM Station and 75 cm at Johnson Mesa respectively. Decagon 10HS volumetric water content sensors were installed up 30 cm at Johnson Mesa to 50 cm at JGM Station, while Hukseflux HFP01 soil heat flux sensors were used for direct monitoring of soil physical properties at 2.5 cm depth at both sites.

The mean soil temperature varied between -5.7°C at 50 cm and -6.3°C at 5 cm at JGM Station, while that for Johnson Mesa varied between -6.9°C at 50 cm and -7.1°C at 10 cm. Maximum active layer thickness estimated from 0 °C isotherm reached 52 cm at JGM Station and 50 cm at Johnson Mesa respectively which corresponded with maximum observed annual temperature at 50 cm at both sites. The warmest part of both profiles detected at 50 cm depth corresponded with maximum thickness of active layer, estimated from 0°C isotherm, reached 52 cm at JGM Station and 50 cm at Johnson Mesa respectively. Volumetric water content at 5 cm varied around 0.25 m3m-3 at both sites. The slight increase to 0.32 m3m-3 was observed at JGM Station at 50 cm and at Johnson Mesa at 30 cm depth. Soil texture analysis showed distinctly higher share of coarser fraction >2 mm at Johnson Mesa than at JGM Station. Comparison of both sites indicated that mean ground temperature at 50 cm depth was higher by 1.2 °C at JGM station, although the active layer was thicker by 2 cm only. It can therefore be concluded that soil physical properties like texture and moisture may significantly affect thermal regime at boundary between AL and permafrost table during individual thawing seasons.