Geophysical Research Abstracts
Vol. 19, EGU2017-707, 2017
EGU General Assembly 2017

Monitoring of active layer thermal regime and depth on CALM-S site, James Ross Island, Eastern Antarctic Peninsula

Filip Hrbáček (1), Michaela Kňažková (1), Daniel Nývlt (1), Kamil Láska (1), Carsten W. Mueller (2), and Jakub Ondruch (1)

(1) Department of Geography, Masaryk University, Brno, Czech Republic (hrbacekfilip@gmail.com), (2) Lehrstuhl fur Bodenkunde, TU Munchen, Freising-Weihenstephan 85356, Germany

Active layer thickness and its dynamic are considered one of the key parameters of permafrost-affected ground. They variability are very sensitive to specific local conditions, especially climate, vegetation, snow cover or soil texture and moisture. To better understand the local variability of active layer thickness in Antarctica, the original Circumpolar Active Layer Monitoring protocol (CALM) was adapted as its southern form (CALM-S) with respect to specific conditions of Antarctica. To date, almost 40 CALM-S sites were registered across the Antarctic continent with the highest density on western Antarctic Peninsula (South Shetlands) and Victoria Land in East Antarctica (McMurdo region).

On James Ross Island, CALM-S site was established in February 2014 as the first CALM-S in the eastern Antarctic Peninsula region. The CALM-S site is located near the Johann Gregor Mendel Station on the northern coast of James Ross Island. The area delimited to 80 $\times$ 70 m is elevated at 8 to 11 m asl. Geologically it consists of a Holocene marine terrace ($\sim$80% of CALM-S area) with typical sandy material and passes to lithified to poorly disintegrated sedimentary rocks of Cretaceous Whisky Bay Formation ($\sim$20% of CALM-S area) with a more muddy material and a typical bimodal composition. For both geologically different parts of CALM-S site, ground temperature was measured at two profiles at several levels up to 200 cm depth using resistance thermometers Pt100/8 (accuracy $\pm$ 0.15 °C). The air temperature at 2 m above surface was monitored at the automatic weather station near Johann Gregor Mendel Station using resistance thermometer Pt100/A (accuracy $\pm$ 0.15 °C). Data used in this study were obtained during the period from 1 March 2013 to 6 February 2016. Mechanical probing of active layer depth was performed in 72 grid points at the end of January, or beginning of February in 2014 to 2016.

During the whole study period, mean annual air temperature varied between -7.0 °C (2013) and -6.7 °C (2015), while the mean annual ground temperature at 5 cm ranged from -5.6 °C (2013) to -5.3 °C (2014). Thawing season started in mid-November between 17th (2013/14) and 24th (2014/15) and ended at the end of February (22nd in 2014/15) and beginning of March (7th in 2013/14). The maximum active layer thickness determined from 0°C isotherm varied from 86 to 87 cm at profile 1, while it reached only 51 to 65 cm at profile 2. The mean probed active layer depth varied between 66 cm (2013/4) and 78 cm (2014/15). The maximum probed active layer depth increased from 100 cm in 2014 to 113 cm in 2016.

High variability of active layer depth across CALM-S site was caused by different ground thermal properties of Holocene marine terrace sand and Cretaceous clayey sandstones. These results differ significantly from another CALM-S sites in Antarctica, where the main factors affecting thawing depth variability were snow cover and topography. These results confirmed previous observation from James Ross Island, where variability of active layer depth was related primarily to different ground properties (texture, moisture, physical characteristic) then local climate or snow cover.