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Thermal regime of active layer at two lithologically contrasting sites on James Ross Island, Antarctic Peninsula.

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Antarctic Peninsula region (AP) represents one of the most rapidly warming parts of our planet in the last 50 years. Despite increasing research activities along both western and eastern sides of AP in last decades, there is still a lot of gaps in our knowledge relating to permafrost, active layer and its thermal and physical properties. This study brings new results of active layer monitoring on James Ross Island, which is the largest island in northern AP. Its northern part, Ulu Peninsula, is the largest ice-free area (more than 200 km2) in the region. Due its large area, we focused this study on sites located in different lithologies, which would affect local thermal regime of active layer.

Study site (1) at Abernethy Flats area (41 m a.s.l.) lies ∼7 km from northern coast. Lithologically is formed by disintegrated Cretaceous calcareous sandstones and siltstones of the Santa Marta Formation. Study site (2) is located at the northern slopes of Berry Hill (56 m a.s.l.), about 0.4 km from northern coastline. Lithology is composed of muddy to intermediate diamictites, tuffaceous siltstones to fine grained sandstones of the Mendel Formation. Data of air temperature at 2 meters above ground and the active layer temperatures at 75 cm deep profiles were obtained from both sites in period 1 January 2012 to 31 December 2014.

Small differences were found when comparing mean air temperatures and active temperatures at 5 and 75 cm depth in the period 2012–2014. While the mean air temperatures varied between -7.7 °C and -7.0 °C, the mean ground temperatures fluctuated between -6.6 °C and -6.1 °C at 5 cm and -6.9 °C and -6.0 °C at 75 cm at Abernethy Flats and Berry Hill slopes respectively. Even though ground temperature differences along the profiles weren't pronounced during thawing seasons, the maximum active layer thickness was significantly larger at Berry Hill slopes (80 to 82 cm) than at Abernethy Flats (52 to 64 cm). We assume this differences are affected by local lithology, especially by the higher proportion of fine particles and more thermally conductive minerals, together with higher water saturation are fundamental for higher maximum active layer thickness found at Berry Hill slopes.