

## **Soil thermal regime on ice-free areas in Livingston Island and James Ross Island, Antarctic Peninsula region**

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Permafrost and active layer are considered prominent components of the Cryosphere, which react very sensitively to small climate variations. The Antarctic Peninsula (AP) region is considered as one of the fastest warming regions on Earth, where mean annual air temperature locally increased more than 2.5°C over the last 60 years.

Significant climate differences are found between the eastern and western sides of the AP. While mean annual air temperatures (MAAT) oscillate around -1 to -2 °C and precipitation reach 800 mm w.e. year<sup>-1</sup> in the western AP, the MAAT in the eastern AP are below -6 °C and precipitation does not exceed 500 mm. These differences determine different permafrost thickness and spatial distribution in these two regions, as well as diverse patterns of active layer dynamics. With the purpose to better understand the factors controlling the soil thermal regime in maritime permafrost environments, we examine data from 2014 acquired from several sites in Livingston Island (western AP) and James Ross Island (eastern AP).

The study sites show similar characteristics in terms of topography (slope < 7°) and altitude (50 to 100 m a.s.l.). Air temperature, soil thermal regime at 5 cm and 75 cm depth, as well as active layer thickness and its evolution were analysed. Mean air temperature over the study period varied between -2.6 to -2.7 °C on the different monitoring sites in Livingston Island, while in James Ross Island ranged from -7.0 to -7.9 °C. Mean soil temperature at 5 cm depth was slightly higher than air temperature in both areas: -0.7 to -1.3 °C in Livingston Island and -6.2 to -6.3 °C in James Ross Island; the same occurred for soil temperature at 75 cm: -0.4 to -0.7 °C in Livingston Island and -6.0 to -6.6 °C James Ross Island.

Significantly lower values of mean daily amplitude of soil temperature at 5 cm depth and the freezing n-factor values observed during the freezing season on Livingston Island suggest a pronounced insulating effect of snow cover in this area in comparison to James Ross Island. The mean daily amplitude of soil temperature at 5 cm ranged from 0.9 to 1.7 °C in Livingston Island, while it reached 3.0 to 4.0 °C in James Ross Island. The freezing n-factor reached 0.33 and 0.63 on Livingston Island, while 0.88 and 0.98 were estimated on James Ross Island.

The active layer thickness (ALT) varied between 85 and 130 cm on Livingston Island while in James Ross Island oscillated between 52 and 85 cm. The fact that active layer in James Ross Island could reach a similar thickness than the observed in Livingston Island despite much lower MAATs suggest that local factors (e.g. topography, soil thermal properties, snow distribution and thickness) must be taken into account to better understand soil thermal regime in permafrost environments of the AP region.