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Active layer thermal monitoring at Fildes Peninsula, King George Island, Maritime Antarctica

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International attention on the climate change phenomena has grown in the last decade, intense modelling of climate scenarios were carried out by scientific investigations searching the sources and trends of these changes. The cryosphere and its energy flux became the focus of many investigations, being recognised as a key element for the understanding of future trends. The active layer and permafrost are key components of the terrestrial cryosphere due to their role in energy flux regulation and high sensitivity to climate change (Kane et al., 2001; Smith and Brown, 2009). Compared with other regions of the globe, our understanding of Antarctic permafrost is poor, especially in relation to its thermal state and evolution, its physical properties, links to pedogenesis, hydrology, geomorphic dynamics and response to global change (Bockheim, 1995, Bockheim et al., 2008). The active layer monitoring site was installed in the summer of 2008, and consist of thermistors (accuracy ± 0.2 °C) arranged in a vertical array (Turbic Eutric Cryosol 600 m asl, 10.5 cm, 32.5 cm, 67.5 cm and 83.5 cm). King George Island experiences a cold moist maritime climate characterized by mean annual air temperatures of -2°C and mean summer air temperatures above 0°C for up to four months (Rakusa-Suszczewski et al., 1993, Wen et al., 1994). Ferron et al., (2004) found great variability when analysing data from 1947 to1995 and identified cycles of 5.3 years of colder conditions followed by 9.6 years of warmer conditions. All probes were connected to a Campbell Scientific CR 1000 data logger recording data at hourly intervals from March 1st 2008 until November 30th 2012. Meteorological data for Fildes was obtained from the near by stations. We calculated the thawing days, freezing days; thawing degree days and freezing degree days; all according to Guglielmin et al. (2008). The active lawyer thickness was calculated as the 0 °C depth by extrapolating the thermal gradient from the two deepest temperature measurements (Guglielmin, 2006). Interannual variability of the active layer shows parallel behaviour despite contrasts between different years, the temperature at 10.5 cm reaches a maximum daily average (4.06 °C ± 0.46) in early January, reaching a minimum (-8.03 °C ± 1,36) between late July and early August. At 83.5 cm maximum temperature (0.30 °C ± 0.24) occurs in late March and the minimum reading (-4.06 °C ± 0.98) was recorded around mid August. Disparities can be noticed when comparing the different years; 2008 had a mild winter (21 freezing days and -0,88 freezing degree days at 83.5 cm in July) contrasted by a severe winter in 2011 (31 freezing days and -80,00 freezing degree days at 83.5 cm in July), the summer of 2009 was considerably warmer (31 thawing days and 64,77 thawing degree days at 10.5 cm in January) compared to the summer of 2010 (17 thawing days and 21,15 thawing degree days at 10.5 cm in January). Active layer thickness varied between 67 cm (max of 2012, March) and 101 cm (max of 2009, March). The active layer thermal regime in the studied period for both soils was typical of periglacial environments, with extreme variation in surface during summer resulting in frequent freeze and thaw cycles. Despite the variability when comparing temperature readings and active layer thickness over the studied period no trend can be identified.