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Integrated assessment of the processes in the critical zone in the surroundings of the Comandante Ferraz Antarctic Station

JULIANA G. FREITAS[1], JULIA TALIARI[1], STELA COTA[2], CARLOS ALBERTO CARVALHO FILHO[2], ALEXANDRE M. BARBOSA[3], SHEILA A. C. FURQUIM[1], CRISTINA R. NAKAYAMA[1] AND RICARDO G. PASSOS[2]

[1]Universidade Federal de São Paulo
[2]Nuclear Technology Development Center
[3]Technological Research Institute (IPT)

Within Antarctica, King George Island, in the South Shetland Islands, has been previously identified as being particularly sensitive to climate change. It is the most densely occupied region in Antarctica, with more than ten research stations, including the Brazilian research station, Comandante Ferraz. This dense occupation also makes it more vulnerable to anthropic pressures. The processes occurring in the critical zone in the surroundings of Comandante Ferraz Antarctic Station (EACF) are being assessed through a combination of methods. Soil temperature monitoring using sensors have shown greater variability at shallower depths and relatively stable temperatures close to the water table (~2 m), with no indication of permafrost in the study zone. Although the soil contains more than 55% gravel and in general presents high hydraulic conductivity, groundwater recharge is hindered by some low hydraulic conductivity horizons (as low as 10^{-6} cm/s) in the unsaturated zone, which create significant runoff and horizontal subsurface flow. Groundwater flow in the saturated zone was found to be fast and contribute to the lakes recharge, which supply water for the station operation year-round. Soil physical and chemical properties were significantly impacted by anthropic activities, including compaction and contamination. The soil has a slightly alkaline pH at shallower depths, decreasing to neutral close to the saturated zone, consistent with the groundwater pH around 7. Major ions in the waters are related to the proximity to the sea, showing predominance of sodium and chlorine, as well as sulphates from local sulphatic rocks. Assessments of microbiological taxonomical and functional diversity are being integrated with hydro and geochemical data to better understand the more significant processes in the critical zone. This will create a baseline to monitor changes and model future scenarios associated with climate change.