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Net ecosystem exchange from two vegetation communities in Coppermine Peninsula, Maritime Antarctica

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Antarctic vegetation frequently changes its constitution, size and distribution across the landscape, playing a key role on the nutrient cycling. The carbon cycling and land-atmosphere exchanges under these dynamic conditions remains little studied. The objective of this study was to evaluate the net ecosystem exchange (NEE), based on in situ measurements from different vegetation communities in Coppermine Peninsula, Maritime Antarctica. Mosses patches cover 1.5 ha, representing one of the most important cryptogamic communities in Maritime Antarctica. Two typical vegetation communities were studied: a moss site (hereafter Site 1) and a moss/lichen site (hereafter Site 2). Site 1 represents a low lying marine terrace (20 m asl), highly influenced by ice/snow/permafrost melting from the uplands, mainly constituted by Sanionia uncinata (Hedw.) Loeske, forming a dense carpet with 3-7 cm thickness. Site 2 is located in an elevated basalt ridge (29 m a.s.l.), under local influence of permafrost within 30 cm depth. Vegetation composition is varied , with a dominance of Polytrichastrum alpinum G.L. Smith, and lichens (Psoroma cinnamomeum Malme, Ochrolechia frigida (Sw.). To obtain the NEE data, we used closed automatic chamber system of CO_2 exchange (LI-COR Biosciences, Lincoln, NE, USA) containing an infra-red gas analyzer (model LI-8100A), a multiplexer system (model LI-8150) and one clear chamber (model LI-8100-104C). Three PVC soil collars of 20 cm diameter were placed into the soil prior measurements at each selected site (standard depth of 3 cm), spaced 2 m from each other. NEE at each point were based on a single measurement over 1.5 min, and the concentrations of CO_2 were determined at 3 sec intervals to determinate the current flux of CO_2. Mean values of NEE were obtained from 08th (00:00 h) to January 22th, 2016 (12:00 h). From January 08th to 22th, mean values of NEE were -0.54 ($\pm$0.05) μmol CO_2 m-2 s^{-1} in Site 1 and -0.07 ($\pm$0.02) μmol CO_2 m-2 s^{-1} in Site 2. A total net uptake of 185.29 and 25.25 μmol CO_2 m-2 during the monitored period were recorded in Site 1 and 2, respectively. The sink strength of CO_2 is higher during the day in Site 1 when compared to Site 2. At the moss site, a net gain of CO_2 occurs, mainly due the saturated/hydromorphic status of soil. In the moss/lichen site a sink effect was also noticed, where a shallow permafrost is leading to lower soil temperatures, enhancing ecosystem respiration, resulting in a sink effect. Under the current climate warming scenario, soil temperature will further increase the active layer, turning such areas prone to act as a source of CO_2 to the atmosphere.