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Black Carbon deposition on snow from Antarctic Peninsula

Francisco Cereceda-Balic[1,2], Maria Florencia Ruggeri[1], Victor Vidal[1,2], and Humberto Gonzalez[3]
[1]Centre for Environmental Technology, Universidad Tecnica Federico Santa Maria, Valparaiso, Chile (francisco.cereceda@usm.cl)
[2]Chemistry Department, Universidad Técnica Federico Santa María, Valparaíso, Chile
[3]Centro FONDAP-IDEAL, Universidad Austral de Chile, Punta Arenas-Valdivia, Chile

Atmospheric Black carbon (BC) strongly affects direct radiative forcing and climate, not only while suspended in the atmosphere but also after deposition onto high albedo surfaces, which are especially sensitive, because the absorption of solar radiation by deposited BC accelerate the snowpack/ice melting. In the Southern Hemisphere, the BC generated in the continents can be transported through the atmosphere from low and mid-latitudes to Antarctica, or it can be emitted in Antarctica by the anthropogenic activities developed in situ. To assess the potential origin of the BC deposited in the snow of the Antarctic, and establish a possible relationship with the human activities that are carried out there, snow samples were taken in different sites from the Antarctic peninsula during summer periods: Chilean Base O'Higgins (BO), 2014; La Paloma Glacier 2015 and 2016 (at a distance of 6 km separated from BO); close to Chilean Base Yelcho (BY), 2018 and away from Chilean Base Yelcho 2018 (at a distance of 5 km separated from BY). Shallow snow samples were collected in Whirl-Pak (Nasco) plastics bags from the top of the snowpack, in an area of 1 m^2 and 5 cm thick layer, using a clean plastic shovel and disposable dust-free nitrile gloves. Sample weighed around 1500-2000 g, and they were kept always frozen (-20 °C), during transport and storage, until they could be processed in the laboratory. BC concentration in the snow samples was determined by using a novel methodology recently developed, published and patent by the authors (Cereceda et al 2019, https://doi.org/10.1016/j.scitotenv.2019.133934; US 16/690,013-Nov, 2019). The methodology consisted of a filter-based optical method where snow samples were microwave-assisted melted, then filtered through a special filtration system able to generate a uniform BC spot on Nuclepore 47 mm polycarbonate filters (Whatman, UK). BC deposited in filters was analyzed using a SootScan™, Model OT21 Optical Transmissometer (Magee Scientific, USA), where optical transmission was compared between the sample and a reference filter at a wavelength of 880 nm. The BC mass concentration was calculated using a 5-points calibration curve, previously prepared using real diesel BC soot as standard. Results showed a BC concentration in snow of 1283.8 ± 1240 μg kg^{-1}. Snow from O'Higgins Base presented the highest BC concentration (3395.7 μg kg^{-1}), followed by snow from the site close to Yelcho Base (1309.2 μg kg^{-1}), snow from La Paloma Glacier 2016 (745.9 μg kg^{-1}), snow from the site away from Yelcho Base (734.5 μg kg^{-1}) and snow from La Paloma Glacier 2015 (233.6 μg kg^{-1}). BC values observed in Antarctic snow were higher than others previously reported in the literature (Cereceda et al 2019) and showed the influence that anthropic activities have in the study area, considering that the two

highest values of BC concentration in snow were found at sites near the bases, which presented levels comparable to those found in snowy sites in the Andes, continental Chile (Cereceda et al 2019).