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Black Carbon and Light-absorbing impurities in Snow in the Southern Andes

Raul Cordero (1), Penny Rowe (1), Alessandro Damiani (1,2), Jaime Pizarro (1), Gino Casassa (3), Jorge Carrasco (3), Roberto Rondanelli (4), Nicolas Huneeus (4), Fabrice Lamber (5), and Francisco Fernandoy (6)

(1) Universidad de Santiago de Chile, Department of Physics, Chile (raul.cordero@usach.cl), (2) Center for Environmental Remote Sensing, Chiba University, Chiba, Japan, (3) Universidad de Magallanes, Punta Arenas, Chile, (4) Universidad de Chile, Blanco Encalada 2002, Santiago, Chile, (5) Universidad Catolica de Chile, Santiago, Chile, (6) Universidad Andres Bello, Vina del Mar, Chile

Black carbon (BC) plays an important role in Earth's cryosphere due to its strong absorption of visible light. Direct absorption of solar radiation by BC leads to atmospheric warming, while BC deposition on snow increases the fraction of solar energy absorbed accelerating in turn melting. Although Andean snowpacks are directly exposed to BC emissions associated to large cities like Santiago (Chile), few measurements of BC existed in this area.

In this context, we focused our efforts on the measurement of the atmospheric aerosol properties (required for estimating BC direct radiative forcing), and the measurement of the BC concentration in snow (needed for estimating the effect of the BC on the snowpack melting).

During the last two years, we sampled BC and other light-absorbing impurities in the snow across a north-south transect of almost 3000 km of the Chilean Andes: from Nevados de Tarapacá (18° S) to Campos de Hielo (50° S).

As expected, we found significant geographical differences in the BC-equivalent content. For surface snow, the estimate of BC mass loading was found to be 14 $\pm$ 18 ng/g in northern Chile (latitude lower than 33°S), 29 $\pm$ 32 ng/g near Santiago (around 33°S), and 10 $\pm$ 7 ng/g in southern Chile. Our measurements also showed that the relative contribution to absorption of dust (vs. BC) decreased as we went south. Our measurements around Santiago confirmed that this city is a BC-rich source (i.e. major source of BC) significantly impacting the Andes nearby.