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SourcE and impact of greeNhousE gasses in AntarctiCA: the Seneca project

Livio Ruggiero[1], Alessandra Sciarra[1], Adriano Mazzini[4], Claudio Mazzoli[3], Valentina Romano[2], Maria Chiara Tartarello[2], Fabio Florindo[1], Massimiliano Ascani[1], Gary Wilson[5], Bob Dagg[5], Richard Hardie[5], Jacob Anderson[5], Rachel Worthington[5], Matteo Lupi[7], Sabina Bigi[2], Giancarlo Ciotoli[6], Stefano Graziani[2], Federico Fischanger[8], and Raffaele Sassi[3]

[1]INGV, National Institute of Geophysics and Volcanology, Rome, Italy
[2]Sapienza University, Earth Science Department, Rome, Italy
[3]University of Padova, Geoscience Department, Italy
[4]Centre for Earth Evolution and Dynamics (CEED), University of Oslo, Norway
[5]GNS Science, Otago University, New Zealand
[6]CNR-IGAG, National Research Council, Institute of Environmental Geology and Geoengineering, Rome, Italy
[7]University of Geneva
[8]Geostudi Astier

Current global climate changes represent a threat for the stability of the polar regions and may result in cascading broad impacts. Studies conducted on permafrost in the Arctic regions indicate that these areas may store almost twice the carbon currently present in the atmosphere. Therefore, permafrost thawing may potentially cause a significant increase of greenhouse gases concentrations in the atmosphere, exponentially rising the global warming effect. Although several studies have been carried out in the Arctic regions, there is a paucity of data available from the Southern Hemisphere. The Seneca project aims to fill this gap and to provide a first degree of evaluations of gas concentrations and emissions from permafrost and/or thawed shallow strata of the Dry Valleys in Antarctica. The Taylor and Wright Dry Valleys represent one of the few Antarctic areas that are not covered by ice and therefore represent an ideal target for permafrost investigations.

Here we present the preliminary results of a multidisciplinary field expedition conducted during the Antarctic summer in the Dry Valleys, aimed to collect and analyse soil gas and water samples, to measure CO_2 and CH_4 flux exhalation, to investigate the petrological soil properties, and to acquire geoelectrical profiles. The obtained data are used to 1) derive a first total emission estimate for methane and carbon dioxide in this part of the Southern Polar Hemisphere, 2) locate the potential presence of geological discontinuities that can act as preferential gas pathways for fluids release, and 3) investigate the mechanisms of gas migration through the shallow sediments. These results represent a benchmark for measurements in these climate sensitive regions where little or no data are today available.