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Distribution of fallout and environmental radionuclides in ice-free areas of King George Island (Western Antarctica)

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Climate change is progressing at a rate which is several times the global average in Western Antarctica. The Antarctic Peninsula region has experienced a rise of ca. 3°C for surface air temperature over the last 50 years; and 87% of 244 glaciers along the west coast of the Antarctic Peninsula have retreated in the last 50 years. Examining the impacts of climate change in Antarctic landscapes, in particular in the soils at the foot of retreating glaciers, can provide a better understanding of the future impacts of climate change on landscape dynamics (including land degradation and resulting changes in land, water and ecosystem quality) in the higher mountainous cold regions of the world.

In this paper, results of an exploratory assessment of soil movement and identification of sediment sources and sediment sinks by investigating the distribution of fallout (FRN's) and environmental radionuclides (ERN's) in ice-free areas of King George Island (Western Antarctica) are discussed. This assessment has been carried in the context of an Instituto Antártico Chileno project, and supported by the IAEA Technical Cooperation, studying land degradation in the cold regions of South America. To this purpose soil profiles were sampled at depth increments at three different control sites. In addition, topsoil (0-1 cm depth) samples were collected from areas identified as potential soil sources and from others identified as sinks of sediments. The soil profiles at the control sites showed distinctive patterns in the depth distribution of the FRN's and ERN's. The 137Cs and 210Pbex activity mass concentration (Bq kg-1) were highest in the topsoil and penetration depth was less than 8 and 25 cm, respectively. The depth distribution of 226Ra and 232Th in the soil profiles was quite homogeneous and greater variation was found for 40K and 238U, possibly related to differences in the mineralogical composition of soils. Average mass activity values of 137Cs and 210Pbex at the source areas were significantly lower than those found at sink areas, suggesting that processes of soil movement are relatively important.

The knowledge gained with this research provided baseline information to establish future sampling strategies intended to ensure minimal intervention in the environment. Furthermore, the values of the areal activity density (Bq m-2) of 137Cs, 210Pbex and 7Be in soils and sediments proved the potential for using FRN's to study the redistribution of soil and sediments associated to the process of glacier retreat.