

Objective of the project

Geographical isolation and extreme meteorological conditions in Antarctica make it one of the most virgin regions on Earth. In terms of chemical pollution, however, it is not completely free from human activities. Over the years, the intensity of tourism and activities in this area, which may be a local source of pollution, has increased. However, global processes such as transporting pollutants over long distances in the atmosphere are more important and seawater that cause pollution to reach Antarctica from distant areas. The extreme climatic conditions characteristic of the Antarctic area affect the environmental fate of pollution in various elements of the environment. In addition, the intense climate change observed over recent decades has favored the release of pollutants stored in permafrost.

The main purpose of the planned research is to check to what extent compounds classified as pollutants re-emitted from secondary sources such as snow cover or glaciers can significantly affect the concentration of these chemical compounds in freshwater and sea water, and what are the possible impacts : seasonal (during summer thaws) or long. This goal can be achieved through the following research tasks:

1. Estimation of natural sources (e.g. volcanic phenomena, weathering of rocks, presence of penguin colonies) and anthropogenic (e.g. maritime transport, station infrastructure) for water chemistry taking into account meteorological and spatial conditions at the western shore of Admiralty Bay.
2. Performing tests and collecting data on the concentration of organic and inorganic impurities in individual types of samples
3. Analysis of obtained data using statistical methods, geological and hydrological analysis, as well as modeling of pollutants emission in the studied area.

Research to be carried out

The sampling area is located by the western shore of the Admiralty Bay on King George Island (South Shetland Islands, Maritime Antarctica). Freshwater, sea water and snow samples will be collected as part of the project. In order to identify chemical compounds from selected groups in Antarctic samples and determine their concentrations, the most modern analytical techniques and effective methods of sample preparation before analysis will be used e.g. extraction. Sampling and subsequent testing will enable gathering an unique database. After carrying out chemical analyzes and interdisciplinary data analysis using appropriate tools (e.g. statistical, geological, climate and weather analysis), it will be possible to determine the impact of permafrost degradation and glacial recession on the modification of surface water chemical composition in areas with negligible anthropogenic activity. Comprehensive analysis will also determine the impact of the release of pollutants accumulated in snow and ice on surface water chemistry in Antarctica.

Reasons for choosing the research topic

The implementation of this project will assess whether and how the re-emission of pollutants deposited in snow and glaciers affects the chemistry of polar regions. This is particularly important in the context of climate change. In addition, this project will also determine the contribution of each of the natural and anthropogenic sources to the pollution of various elements of the environment, as well as broaden knowledge about the fate of pollutants in a cold climate environment. The assumptions of the project include determination of the concentrations of selected chemical pollutants in some elements of the environment at the western shore of Admiralty Bay (Maritime Antarctica), not yet sufficiently researched in this respect (snow, sea water, freshwater). This extensive, valuable and yet unprecedented data sets on chemical compounds in the Antarctic, could be used to validate existing environmental fate models and identify threats to local fauna. Such studies have not been described in the world literature yet.