

Short Visit Grant – Scientific Report

Proposal title: **Setup of a new station for continuous monitoring of CO₂ and CH₄**

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Host:
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Purpose of the visit

The purpose of this research stay was to set up a new station for continuous monitoring of atmospheric carbon dioxide and methane in Ambarchik at the coast of the Arctic Ocean. The rural locality of Ambarchik is currently abandoned except for a weather station with a permanent staff of four. This makes the former village a remote location with little influence from local anthropogenic sources. The data obtained at the site on a long-term basis will be used in future studies of carbon exchange processes between the atmosphere and the Arctic Shelves and the Tundra biome.



Figure 1: The location of the new monitoring station Ambarchik in the context of the panarctic CH₄ monitoring network.

Description of the work carried out during the visit

A 20 m tower with a 7 m extension was erected. On top of the tower, at 27 m a.g.l., an air inlet has been mounted. A secondary inlet has been fixed at 14 m a.g.l. to check the data for local contamination. Equipment for measuring meteorological conditions has been installed, including a 2D sonic anemometer for wind speed and direction, pressure-, temperature- and humidity-sensors.

Tubing and wires connect the gear at the tower with a CRDS analyzer for CO₂, CH₄ and H₂O (Picarro G2301), and a data logger (Campbell Scientific CR3000), which are located inhouse within a temperature-controlled rack.

The measurement system was completed by the installation of an airflow control system (prepared and tested before the trip) for automatic calibration using dry air gas cylinders, with mixing ratios of CO₂ and CH₄ calibrated against WMO standards prior to shipment.

After successful installation, the sampling strategy (frequency of measurements at the secondary inlet) has been adjusted to the observed variability of atmospheric methane and carbon dioxide.

Air samples from the major local contamination sources (Diesel generator and heating) have been measured with the Picarro analyzer to obtain the trace gas signatures of the pollution. This will simplify the identification of local pollution of the measured air.

Our collaborators from the host institution have been introduced to and trained on the maintenance of the system.



Figure 2: Left: the Ambarchik weather station with the newly erected tower. Right: the author installing the calibration gas tanks. In the background: the rack harboring the Picarro analyzer, data logger, air flow control system, etc. Image courtesy of M. Hertel.

Description of the main results obtained

The new monitoring site for atmospheric carbon dioxide and methane has been successfully set up in Ambarchik. The measurement system and the quality control procedures have been verified to function properly. Signatures of local air pollution sources have been obtained to enable discrimination of contaminated air. The first few days of data have been obtained.

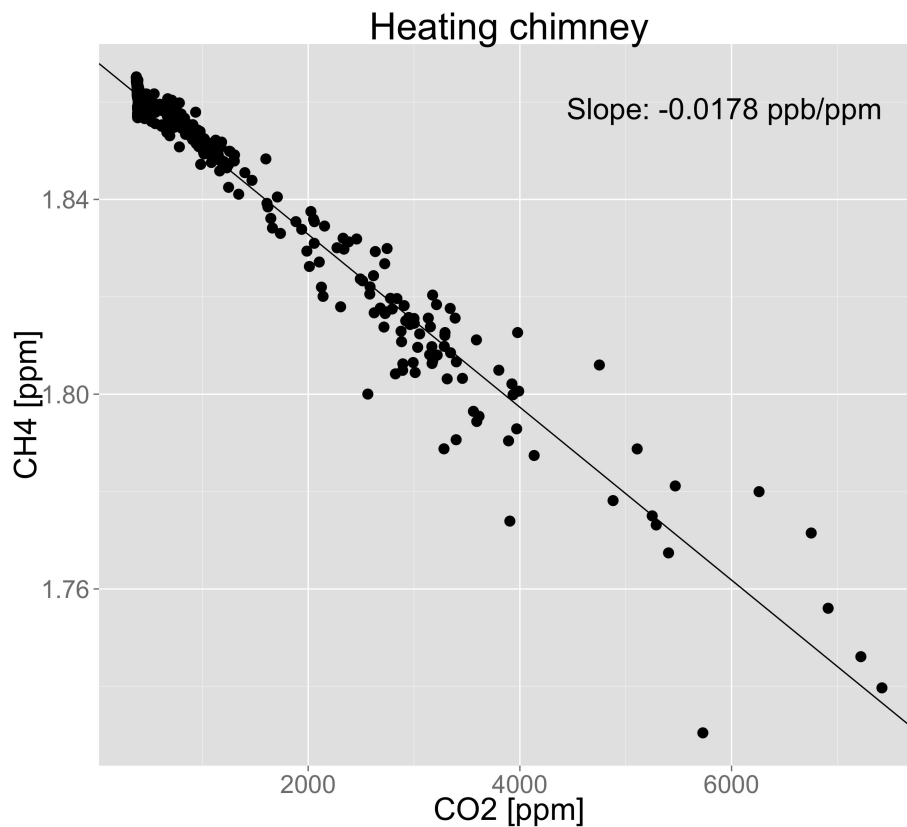


Figure 3: Air sampled from the heating chimney of the Ambarchik weather station. The exhaust air is slightly depleted in CH₄.

Future collaboration with host institution

There will be a permanent collaboration with the host institution to ensure maintenance and data transfer. More visits to the host institution will take place if required. The measurement program might be extended by a flask sampler to measure the isotopic composition of methane.

Projected publications / articles resulting or to result from the grant

The prospective long-term record from the Ambarchik carbon observation station is expected to be used in a number of studies. One application currently planned is to estimate the amount of CH₄ released from the shelves of the Arctic Ocean via an inverse model of atmospheric transport.