PhD course "Aims and methods of the study
of atmospheric particles in the Arctic"

SYLLABUS

1 Lecturer information

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2 Title of the course
Aims and methods of the study of atmospheric particles in the Arctic

3 Course program
The Arctic is a very sensitive environment to global climate variations and is currently warming with a much higher rate than the global average. Among the climatic forcings that most influence this region, atmospheric particulate matter (PM) is one of the most important. During the course, an introduction will be made on climate change, deepening its consequences in the Arctic region, and reporting, among the most significant results, the latest IPCC report to understand why the research in this region is of extreme interest. In particular, the study of the chemical composition of the atmospheric particulate is of fundamental importance in order to understand which are the sources (both local and long range, coming from the lower latitudes) that most affect the Arctic region. During the course, the sampling process and the sample treatment techniques will be covered together with the most suitable analysis methods to get the chemical composition of this type of sample. Finally, the methods for identifying and quantifying the sources will be covered.

4 Course content detailed per lesson of two hours (possibly with dates and room real and virtual)
Lesson 1 – Introduction to the course. Climate change and the results in the latest IPCC report. Climatic forcings and the effect of atmospheric particulate matter (PM) on the climate: direct and

indirect effects, the role of its chemical composition and its main sources. Effects of climate change on the Arctic: the Arctic amplification; current situation and future scenarios.

Lesson 2 – The sampling of the Arctic PM: the importance of site locations and long time data series. Particulate matter sampling instruments and the measurement of its physical properties. Handling of samples before the analysis.

Lesson 3 – Methods for the analysis of the chemical composition of the PM: which ones are the best for the low mass concentrations of the samples collected in remote sites.

Lesson 4 – Data analysis of the chemical composition of the Arctic PM. Use of receptor models for the identification and quantification of the aerosol sources. Use of air mass transport models (back-trajectories calculations) for the identification of the emission regions.

5   Suggested reading
None

6   Learning Objectives
Provide students with insight into the warming situation in the Arctic and the role of particulate matter emissions at lower latitudes.

7   Knowledge and Skills to be acquired
Understanding of which analysis techniques are most suitable for the determination of the chemical composition of the aerosol in samples characterized by low concentrations and which are the methods used for the identification of the emission sources.

8   Prerequisites
Minimum knowledge of the main techniques of chemical analysis

9   Teaching Methods
☐ MODE 1 - Pre-recorded lessons uploaded on the moodle platform (a meeting must be organized with PhD students in order to clarify eventual doubts)

X MODE 2 (preferred) - Lessons delivered in-person and in remote with simultaneous recording by the WEBEX platform

(The lessons must be recorded and available to all the students that cannot take part to the lessons in streaming. The Webex platform must be used. All course content should be uploaded to the Moodle

platform on the Chemical Sciences PhD page "Courses and Seminars of the PhD in Chemical Sciences 2022-2023")

10 Further information

11 Type of Assessment

Students will be asked to discuss an article which presents long time series of measurements at remote sites.

The final evaluations will have to be validated maximum 1 month after the end of the course

12 Period

January and February 2024