PARCS-Climate

PARCS (Pollution in the Arctic System)-Climate

Principal investigator

Kathy Law
kathy.law@latmos.ipsl.fr
LATMOS/CNRS

Areas of contribution

Polar atmospheric processes
Modelling and forecasting
Observations
Outreach
Policy-relevant / cultural aspects

Summary

PARCS-Climate aims to improve the quantification of aerosol and cloud interactions in the Arctic and hence enhance predictive capability of climate change in the Arctic at local and regional scales as well as at global scales. We plan to combine ground-based, airborne and satellite observations with microphysical, regional and global climate modelling to improve our knowledge about Arctic mixed-phase clouds and interactions with local and remote sources of anthropogenic aerosols. New field campaigns are planned for 2018 in northern Scandinavia and Svalbard. The project involves groups from France, Norway and Sweden as well as international collaborators (e.g. USA, Japan, Korea).

Description
The Arctic is a sentinel for global climate change with rapidly rising temperatures and acute visible signs such as declining summertime sea ice. Predictive capability of Arctic climate change is hampered by a lack of understanding about key processes, notably related to mixed-phase clouds that have a large impact on radiative fluxes, and aerosols and their complex interactions with clouds (semi-direct and indirect effects). Our knowledge of Arctic mixed phase (ice-liquid) clouds is very basic and large uncertainties still remain regarding the overall effects of aerosols, or the contributions of anthropogenic versus natural aerosols and of remote (mid-latitude) versus local sources (shipping and oil/gas extraction that may increase as a result of climate warming and socio-economic drivers). Quantification of climate effects is also hampered by difficulties translating observational characterization into realistic representations in models. PARCS-Climate aims to improve quantification of aerosol and cloud radiative impacts in the Arctic and hence enhance predictive capability at local, regional and global scales. It builds on considerable expertise developed during past and on-going projects. PARCS-Climate relies on targeted field campaigns and satellite data analysis coordinated with multi-scale modelling to identify key processes and develop robust parameterizations for regional/global models. It is organised around 3 main research topics:

* Remote pollution impacts on Arctic aerosol-cloud interactions. Combined analysis of ground-based and satellite observations of anthropogenic/natural aerosols and mixed-phase clouds to assess the influence of remote pollution on cloud properties, including precipitation, at different spatial-temporal scales.
* Characterisation of local Arctic pollution impacts on aerosol-cloud interactions. New targeted field measurements of aerosol/cloud properties in northern Norway, where local pollution (shipping, oil/gas, wood burning) is already significant, to characterize fine-scale processes involved in aerosol-cloud interactions.
* Improving climate predictive capability due to aerosols and cloud interactions. Based on analysis of project data, we will evaluate Arctic clouds and representations of aerosol-cloud interactions in mesoscale/global climate models and aim to improve parameterisations of ice clouds, for example. Results will form the basis of improved models for international assessments (AMAP, IPCC).

Coordination and outreach is also planned including data management, link to international initiatives, dissemination of results (e.g. science-policy community, stakeholders), public (e.g. photo exhibition), and educational initiatives involving aerosol measurements with school children.

This project will contribute to the YOPP science objectives by gathering new knowledge about Arctic aerosol-cloud interactions with the aim to reduce uncertainties in regional and global climate models. Results from the project will contribute to YOPP Key Challenges by collecting new data on aerosol-cloud interactions leading to improved prediction of Arctic cloud (esp. mixed phase clouds) and aerosols which are important for the surface energy budget in the Arctic. We also hope to improve our understanding about vertical distributions of aerosols and clouds. PARCS-Climate will greatly benefit from enhanced observations collected during YOPP, particularly in 2018, related to improving weather prediction, atmospheric dynamics, precipitation, clouds and surface (ice/ocean)-atmosphere interactions. PARCS-Climate activities will be coordinated as far as possible with planned YOPP activities. Our project is also making an important contribution to a new international (IGAC/Future Earth/IASC) initiative PACES (air Pollution in the Arctic: Climate, Environment, Societies) and aims to produce improved models for international assessments (AMAP, IPCC, PDRMIP, HTAP).

**Timeline**

2017-01-01 - 2019-12-25
User relevant aspects

Improved model results will be provided to international assessments and policy makers. We also have outreach activities involving the general public and schools.

Regional emphasis

Northern hemisphere: Yes
Southern hemisphere: No

Key project deliverables

* New observational characterization of Arctic mixed-phase clouds, and assessment of the influence of remote and local aerosol pollution on Arctic clouds;

* Improved models treatments of ice clouds and the role of aerosols;

* Improved predictive model capability of aerosol-cloud interactions leading to reduced uncertainties in Arctic/global climate projections.

Data management

Data will be made available via the French data centre AERIS (http://www.aeris-data.fr/) which already hosts the ICARE satellite archive for aerosol and cloud satellite data http://www.icare.univ-lille1.fr/projects/dardar. It is expected that data, which is mainly in the form of data on atmospheric processes, will be delivered in the 2019/2020 timeframe, if not earlier.

Is data provided to WMO Global Telecommunication System

No

Real-time provision

PARCS-Climate will actively explore the possibility to make certain satellite datasets available in near real-time as has been achieved in previous projects via the French AERIS data centre and ICARE, more specifically. We will also investigate the feasibility to make certain parameters available from the field campaigns (investigating
processes) such as meteorological variables in near real-time or soon after the campaigns.

Other information

PARCS-Climate is currently seeking funding from the BNP Paribas Climate call (deadline 23 Sept). Results are expected in November 2016.

Timelines

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<thead>
<tr>
<th>Location</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Start date</th>
<th>End date</th>
<th>Activity</th>
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<td>2019-12-25</td>
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<td>2017-01-01</td>
<td>2019-12-25</td>
<td>Model simulations using microphysical, regional and global models</td>
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