Observing aerosol-cloud interactions in a changing Arctic

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Clouds are central to the Earth's global radiative budget, both cooling the Earth by reflecting solar radiation and warming it by trapping longwave radiation. They are also critical for understanding the surface radiation budget in the Arctic, with clouds typically warming the surface, in contrast to the cooling effect they have at the top of the atmosphere (Kay et al., 2016). Atmospheric aerosols have significant but uncertain effects on cloud properties at lower latitudes, but even the sign of the impact on Arctic clouds (warming/cooling) is uncertain (AMAP, 2021). Even where there is a cooling effect from aerosols, recent work has suggested that this cooling effect might weaken as the Arctic warms (Murray-Watson and Gryspeerdt, 2022). As the Arctic is one of the fastest-warming regions of the planet, this is becoming increasingly important as sea-ice loss leads to an increase in industrial and shipping activity in the region.

In this project, you will target this uncertainty surrounding aerosol-cloud interactions at high latitudes, focussing on the temporal development of clouds from both natural and artifical aerosol perturbations. satellite datasets to build a complete picture of the aerosol cloud system across the Arctic. The Arctic is one of the most intensely observed regions on Earth by satellites, combining this with new aircraft and in-situ measurements for the large number of recent measurement campaigns (MOSAIC, AC3, COMBLE), will allow you to improve our understanding of important cloud processes. By investigating the temporal development of Arctic clouds under a range of environmental conditions, you will produce one of the first observation-based constraints on the radaitive impact of aerosol-cloud interactions in the Arctic.

You will join a group in the Physics department studying a wide range of cloud physics and climate aspects. This project will also involve collaboration with the Arctic modelling teams at CNRS/LATMOS (Paris) and CNRS/IGE (Grenoble), using modelling results to improve the understanding and use of observational products in the Arctic as well as providing important constraints for simulations of clouds in the Arctic, vital for future climate projections in the region.

For further details, please contact Edward Gryspeerdt (e.gryspeerdt@imperial.ac.uk)

References

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