Improvement of fog forecasting using atmospheric electricity

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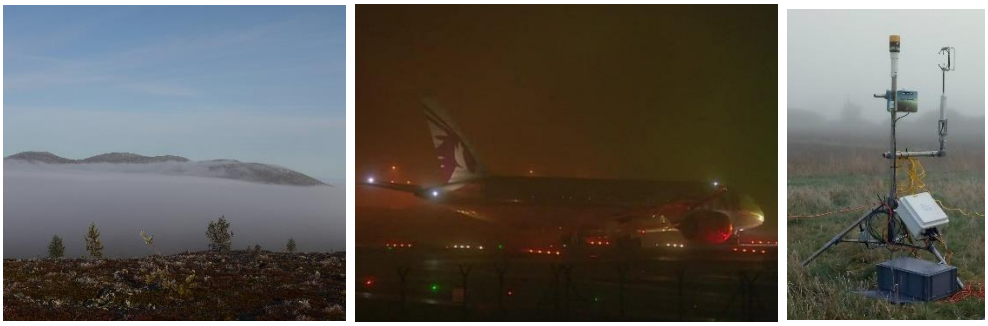
Fog causes flight cancellations and lengthy days at airports around the world on a regular basis. Accurate forecasting of fog can minimize such disruption, but this presents a significant challenge for numerical weather prediction models. An underexplored area, which may help to improve the predictability of fog, is atmospheric electricity. The atmospheric electric field, which is always present globally, is extremely sensitive to the presence of fog and cloud droplets and often shows marked changes up to several hours before the onset and dissipation of fog. Electrical effects are also known to affect the behaviour of water droplets (such as increasing the rate at which small droplets grow), which may affect properties such as fog duration and thickness of the fog layer. New developments in sensor technology now mean that we can study such processes in detail and improve our understanding of whether electrical effects can be used for fog forecasting, and fog dissipation methods.



Left: Orographic fog in a valley in Finland; centre: aircraft grounded at Heathrow airport in fog during 2017 (BBC news); right: Atmospheric electric field sensor and meteorological mast during fog.

This project will utilise newly developed miniature sensors for cloud droplets and atmospheric electric field measurements to investigate the spatial and temporal variability of electrical variations in fog and low stratus clouds, using surface measurements and sensors carried on tethered and radiosonde balloons. These novel measurements will be used to determine whether atmospheric electrical variables can provide enhanced prediction capabilities for fog, beyond what is possible with standard meteorological measurements.

Training opportunities:

This experimental project will provide training and experience in instrumentation and fieldwork, and data analysis informing improvements in numerical models. There will be international fieldwork opportunities.

Student profile:

A background in meteorology, engineering, or physics, particularly experimental physics is desirable, with a good appreciation of laboratory experimental work, computer programming and data processing.

References:

Harrison et al. (2015) On the microphysical effects of cloud edge charging, *Q.J.Royal Met. Soc.*,141, 2690-2699.

https://research.reading.ac.uk/scenario/