University of Hertfordshire UH

PhD position in atmospheric physics at the University of Hertfordshire (UK)

A PhD studentship is available in the Centre for Atmospheric and Instrumentation Research (CAIR) at the University of Hertfordshire (UK). The focus of the PhD project is on dynamical controls on fog.

Fog is a significant hazard to transportation, with risk to life. Major health problems can also occur due to severe air pollution events associated with fog (often referred to as smog), which can enhance fog intensity. Also, fog can result in huge costs to the aviation industry by disturbing air traffic. Accurate prediction of fog has been, and remains a long standing challenge for numerical weather prediction models (Steeneveld et al., 2015). Improved fog forecasting is therefore a high priority.

Fog forms typically in aerosol-laden near-surface air that is cooled to the dew point. Fogs are generally composed of a mixture of micron-size haze (unactivated) aerosol particles and activated droplets reaching tens of microns in size (see for instance Pinnick et al., 1978). The microphysics and chemistry of fog have been studied extensively and are relatively well understood (Gultepe et al., 2007, and references therein). The key microphysical processes that determine the microstructure of fog are the activation, diffusion growth of fog droplets, droplet growth related to radiative cooling and differential gravitational settling of drops of different size. The activation and diffusion growth of fog droplets, as well as their radiative characteristics, depend on the physico-chemical properties of aerosol particles (e.g. Bott, 1991).

Despite steady progress in understanding and modelling of the life cyle of fog over the years, as illustrated by the development of the state of the art between reviews of the body of knowledge on fog controls by Willett (1928), Mason (1982) and Gultepe et al. (2007), much still remains to be understood, particularly for radiation fog that are mostly associated with anticyclonic conditions. While convective cloud formation is generally forced by significant vertical motions, which makes air reach saturation [that is 100% relative humidity (RH)], in fog vertical motions are usually very restricted, rendering prediction of fog formation a challenging problem of predicting local RH accurately (say to 1–2%). This challenging problem is exacerbated by the difficulty of forecasting low boundary-layer clouds (such as stratocumulus), which reduce the longwave radiative cooling at the surface, and the surface and stable boundary-layer processes that lead to near-surface thermodynamical conditions suitable for fog formation. Given synoptic weather conditions and aerosol loadings suitable for radiation fog formation at a certain location, the local surface conditions and the orographic features of the area often determine the location and timing of fog formation (e.g. Pilié et al., 1975a,b; Duynkerke, 1991; Golding, 1993).

The PhD project will examine how local is the development and evolution of (primarily) radiation fogs in complex terrain. Dynamical controls on fog will be characterised at the process level using numerical modelling for locations, for which detailed observations are (or will be) available to challenge the model (e.g. the shallow valley of the River Great Ouse around Bedford, UK; deeper valleys in south-west Shropshire, UK; New Delhi, India).

The PhD student will be supervised by Dr Charles Chemel, a research scientist with the National Centre for Atmospheric Science (NCAS) and Senior Lecturer at the University of Hertfordshire. Scientific interactions will be expected and strongly encouraged with CAIR and NCAS. The PhD work will also benefit from well-established national and international collaborations. The PhD project may involve travelling to India to help with planned fieldwork in New Delhi.

The studentship would be based in CAIR and would be funded for a period of three years, covering tuition fees and providing an annual stipend of £14,296.

Applicants are required to have (or be about to receive) a Master degree or a good undergraduate degree (equivalent to UK 1st or upper 2nd class honours degree) in physics, mathematics, or in an area closely related to physical science. Experience with programming and scientific computing is desirable. The closing date for applications is Monday, 28th of November 2016. To apply, please contact Mrs Lorraine Nicholls (l.nicholls@herts.ac.uk) or Emma Thorogood (e.thorogood@herts.ac.uk). Informal inquiries about the PhD project can be made to Dr Charles Chemel (c.chemel@herts.ac.uk).

References

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