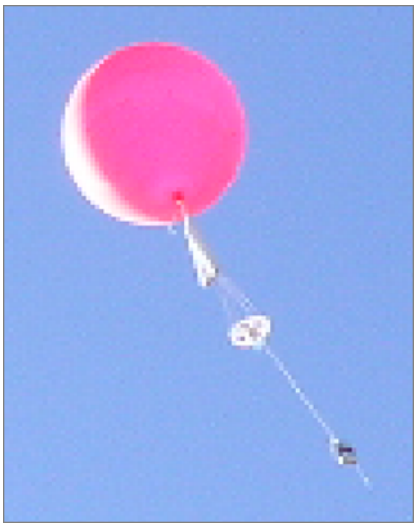
Comparison of weather-balloon observations of turbulence and clouds with model predictions
(Science areas: Atmospheric observations and theory)

Supervisors: Giles Harrison, Paul Williams

Project summary:
Atmospheric turbulence and convective clouds are common and important features of the terrestrial atmosphere, but in severe weather they can present a dangerous hazard to aircraft. Turbulence is potentially predictable using numerical atmospheric models, by applying various diagnostics to identify the destabilised regions that are particularly susceptible.

New radiosonde sensors have been developed recently at Reading, which can detect the turbulence and cloud encountered during routine weather balloon flights. New turbulence diagnostics have also been developed recently at Reading. In this project, weather balloons carrying the new instrumentation will be launched regularly from a UK site, to create an unprecedented data set of measurements of atmospheric turbulence and cloud properties. As well as analysis of the measurements obtained, the project will also compare the positions of turbulence and clouds measured by the new sensors with theoretical predictions, in order to test and refine the models.



Photograph of a weather balloon, taken shortly after launch. The balloon, which carries turbulence and cloud sensors, reaches heights of around 30 km. The turbulence and cloud measurements, along with standard meteorological measurements and GPS co-ordinates, are transmitted to a ground-based receiver via UHF radio.

Research impacts:
Each year, clear-air turbulence (CAT) alone costs airlines around $100,000,000 and injures hundreds of passengers, sometimes fatally. Advances in our understanding of atmospheric turbulence are rare, but this project will bring together two promising developments each pioneered recently at Reading, on the observational (Harrison) and theoretical (Williams) sides. Therefore, the results of this project are expected to be of great interest to the international aviation turbulence community, and more widely.

Skills developed:
The student will develop skills in making atmospheric observations, analysing and visualising the data using computer models, and interpreting them using various turbulence theories. These skills are highly sought-after by employers in the scientific research sector and beyond.

Student profile:
This project is suitable for students with a degree in mathematics, physics or a closely related physical or environmental science. It would especially suit students who wish to develop skills in both the practical and the theoretical aspects of atmospheric science.