



**Scenario**  
DOCTORAL TRAINING PARTNERSHIP

**NERC**  
SCIENCE OF THE  
ENVIRONMENT

## Exploiting the UK and Global COSMOS Soil Moisture Sensor Network to Provide Space Weather Alerts for Aviation and Critical Infrastructure

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Solar storms can generate sudden surges of neutrons which travel right through the atmosphere and reach the ground. Known as Ground Level Events (GLEs), they create radiation risks to aircraft and safety-critical ground systems. Recent evidence from ice cores and tree rings shows that extremely large GLEs have occurred in the historical record e.g. AD774. Hence a reliable observation and alert system is required but traditional large ground level neutron monitor stations are hard to maintain: the UK closed its only station in the 1980s. This project explores a potentially more cost effective approach by exploiting the global Cosmic Ray Soil Moisture Observing System (COSMOS): this system measures soil moisture by detecting the quiet-time cosmic-ray generated neutrons 'reflected' from the ground. There have not been any significant GLEs during the COSMOS operational life so far but it is known to be affected by the modest cosmic ray flux variation over the solar cycle. Hence it is predicted that COSMOS should be capable of measuring GLEs, potentially with unprecedented spatial resolution on a global scale. Thus the aim of this project is to investigate, understand and predict the response of the COSMOS system to space weather events, and determine if it can be the basis of a new GLE alert and measurement system.



*The growing network of COSMOS soil moisture sensor stations located in the UK and around the globe (left) provides exciting new space weather observing opportunities.*

### **Training opportunities:**

The student will be based at the University of Surrey but will undertake a placement (6 months) with the NERC Centre for Ecology and Hydrology which runs the COSMOS-UK network. Time will also be spent with the UK Met Office to understand the space weather user requirements.

### **Student profile:**

The student will have a strong degree in physics (or closely related subjects) and a keen appetite for working on environmental observations, instrumentation, data analysis, radiation physics and space weather. The student will need a flexible and open-minded approach to tackle this highly cross-disciplinary project.

<http://www.reading.ac.uk/nercdtp>