# InSAR as a Tool to evaluate Peatland Sensitivity to global change

The aim of this project is to validate a new and transformative remote sensing method to address the goals of the soil security programme by providing an improved and predictive understanding of; the ability of peat to perform multiple functions in different landscape and climate settings on a wide range of scales; the ability to peat to resist, recover and adapt to climate perturbations. This will be achieved by measuring the vertical motion of the surface of peatland, a direct indicator of mass (water, gas or organic matter) gained or lost from a peat body and powerful indication of peat soil condition.

Peat accounts for 1/3 of Earth's terrestrial carbon, a quantity equivalent to the amount of carbon in the atmosphere. Peat contains up to 95% water and 5% organic matter so peatland and its associate ecosystems are highly vulnerable to both economic and societal pressure and climate change. As peatland degrades erosion and organic matter loss have a detrimental impact on flood regulation, and water quality. Consequently, protecting peatland is a priority and considerable effort is being expended on its management and restoration. To understand the threats to peatland and effectively manage peatland requires us to consider peat over long periods of time and large areas. Due to the extent of peatland both globally and within the UK, continuous field monitoring required to answer large scale research questions is both difficult and expensive. Alternative methods are urgently needed.

A satellite technique known as InSAR uses radar waves to measure vertical land surface motion. Established InSAR techniques provide only patchy coverage over rural areas and where therefore ineffective over peatland. What we are going to test is a new transformative InSAR technique which unlike previous techniques provides near continuous coverage across all land surfaces irrespective of ground cover. This new approach therefore has the potential to reduce long termmonitoring cost and guide peatland management decisions by enabling 1) targeted management of degrading areas of peat 2) evaluation of restoration methods 3) data to enable effective management plans for large areas.

The accuracy of this new InSAR technique been demonstrated over solid slow moving surfaces however to realise the potential that InSAR offers over peat the field validity of the results needs to be demonstrated. This is essential as the unusually dynamic peat surface can move rapidly over short periods of time in response to changes in water budget, gas content, compaction and drainage. The challenge validating by either approach is that there are currently not enough monitored sites of sufficient extent to validate the satellite data over peatland. This mismatch of scale arises because a single pixel on an InSAR map represents an area 100x100m a scale rarely replicated by field monitoring.

In this proposal we will determine the validity of the InSAR measurements by addressing the following two research questions:

1) Is the ground motion measured by InSAR a true indicator of the magnitude and direction of the ground motion?

2) Does the InSAR indicate the general condition of the peatland?

These questions will be answered by collecting data on soil condition and surface motion from two sites in Scotland's Flow Country the single largest soil carbon store in the UK and the largest blanket bog in Europe. Field sites have been chosen to complement other projects and maximise the impact of the research and the potential for collaboration