# CASE STUDIES

# SEASONALITY MONITORING IN SWEDEN & FINLAND
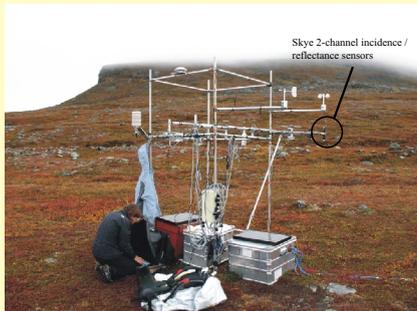


Figure 1 ABACUS instrument tower showing Skye sensors at one of the Abisko sites in Northern Sweden. Picture courtesy of Dr Ana Prieto-Blanco, UCL.

Northern high latitudes have been under close scrutiny by environmental researchers over the past few years. Such areas are particularly sensitive to changing climate, but we know relatively little about how they will respond, particularly in terms of the carbon and water cycles. Over the past two seasons, including the International Polar Year (IPY) in 2007-8, members of ABACUS (Arctic Biosphere-Atmosphere Coupling Across Multiple Scales), a multi-disciplinary team of researchers from Durham, Edinburgh, Sheffield York, University College, London (UCL), Macaulay, Stirling and CEH Wallingford, have been carrying out research at Abisko in Sweden, and Kevo in Finland.

The ABACUS project is exploring the links between the carbon and water cycles, and what the controls on these processes are at a range of scales. This work requires a wide range of measurements and models describing things such as vegetation amount and type, $CO_2$ and $CH_4$ fluxes from plants and soil, and detailed physiological processes controlling plant growth. The picture below shows one of four ABACUS instrument sites, two each in Sweden and Finland, which have been in place since 2006-7. This picture was taken in late August, when the vegetation is shutting down photosynthetic activity for the long winter ahead.

The second picture shows the same site, with a large reindeer encroaching onto the experimental plot. The Abisko area is part of the migratory grazing route for the reindeer herds of the indigenous Sami people who live across the region.

Figure 3 shows the results from Skye sensors mounted at two locations in Abisko in 2007 and 2008, one a mountainous tundra site (seen in figures 1 and 2), and one at a lower, forested site. The sensors measure incident and reflected radiation in visible red and near-infrared channels corresponding to those of the Landsat satellite. From these measurements we can calculate Normalised Difference Vegetation Index (NDVI), which is related to the amount and greenness of vegetation. The graphs illustrate the different seasonal responses of the tundra and forest vegetation and the rapid green-up of the tundra following snow melt in late May (where NDVI is close to zero), compared with the slower, later development of the forested site. There are also subtle changes in the timing of these events from 2007 to 2008.



Figure 2 ABACUS instrument site, looking out over Torneträsk, one of the largest lakes in Sweden. Picture courtesy of Dr. Ana Prieto-Blanco, UCL.

These measurements are being combined with airborne and satellite data and other ground-based measurements to give a broader picture of the biophysical response of these landscapes through the seasons.
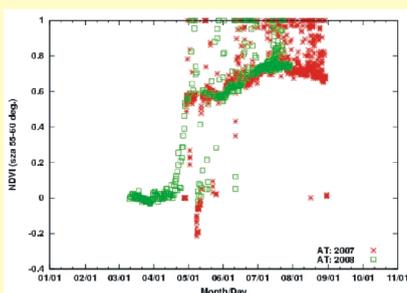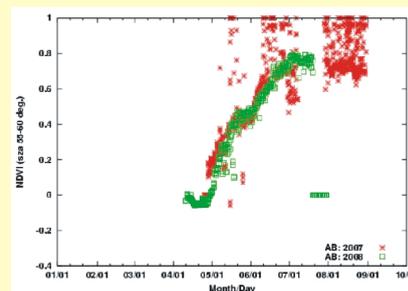


Figure 3 Seasonal trajectories of NDVI from Abisko, Sweden measured using the Skye Instruments 2 channel sensors at a mountain site (left) and a lower, forested site (right). Data courtesy Dr. M. Disney/ABACUS.



Thanks for this article to Dr. M. Disney and Dr. A. Prieto-Blanco, UCL Department of Geography, Gower St., London, WC1E 6BT. ABACUS is funded by the Natural Environment Research Council (NERC). More information on the ABACUS project can be found at www.abacus-ipy.org.

The Equipment Used
Skye design & manufacture a range of light sensors for a wide range of applications. Dr Disney is using a pair of Skye 2-channel light sensors for measuring incident & reflected light. Dr Disney decided the wavebands he wanted to measure & Skye supplied the sensors with the required filtering. Skye can supply these 'custom sensors' between 280 and 1100nm, and with a choice of bandwidths. Skye also have 4-channel sensors for applications where 4 channels of light need to be measured at the same time. Further details at: www.skyeinstruments.com/2channel.htm