Short report for the Aerosol Society Undergraduate Bursary

Student - Alice Oliver (University of Birmingham)

Project – Future CO2 – Future bioaerosol concentrations

The undergraduate aerosol society bursary allowed Alice Oliver to undertake fieldwork at the Birmingham Institute for Forest Research (BIFoR) to collect and analyse data relating to biological aerosols (bioaerosols). Alice set up the field research station which included a meteorological station, an aerosol counter (optical particle counter, OPC) and an aerosol fluorescence sensor (AFS) under the forest canopy at the Free Air Carbon dioxide experiment (FACE) in Mill Haft Wood, Staffordshire. The work baselined the aerosol and bioaerosol concentrations present under ambient carbon dioxide concentrations prior to the carbon dioxide enrichment, which is planned for Spring 2017.

Alice visited the BIFoR site weekly, in order to collect data and attend to the instruments. Many meteorological parameters were measured, including wind speed and direction, solar radiation levels, and rainfall. In performing the fieldwork, Alice learnt about the factors that affect the measured aerosol and bioaerosol concentrations. For example, the concentration differences measured between under the forest canopy compared to above the canopy; which can have a large effect on parameters such as wind speed. This needs to be taken into consideration when analysing results, in particular comparing them to other research. On top of this, the field work in the BIFoR FACE facility enabled Alice to understand how much of an impact human activity has on the forest experiment and how to minimise these impacts.

Alice made three hypotheses based upon review of the scientific literature:

1. Increases in soil moisture, measured by volume water content, will be a predictor of increased bioaerosol release.
2. Increases in Relative Humidity will correspond with increases in bioaerosol release
3. Increases in wind speed will pick up more bioaerosols; hence increasing their airborne concentration.

Alice observed that high relative humidity was a good determinant of bioaerosol release. Increases in relative humidity were usually followed by peaks in fluorescent aerosols present. This is suggestive of the role of relative humidity upon aerosol release. She also measured rainfall and ground volume water content (VWC), when rainfall events occurred, VWC increased, and this was generally followed by an increase in fluorescent aerosols. It was unclear whether the water reaching the area and "kicking up" aerosols was the cause or whether the increase in water in the soil caused the plants / fungi to release aerosols. This could be an area for further research. The wind speeds under the canopy were consistently under 2m/s; hence relatively low. This could possibly mean that they are not strong enough winds to pick up the heavy aerosol particles, therefore not having as large an effect as hypothesised. However, UV aerosol concentration when the wind was facing South-West did seem to increase.

The work will form the basis of future research projects being taken on by students in the group of Francis Pope at the University of Birmingham.