CN Davies annual report 2017

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Over the past year I have made a great deal of progress towards the aims I originally outlined in my CN Davies application which include: Investigating the role of desert dusts in the atmosphere, which components of desert dust are most important for ice nucleation, and the development of an automated instrument capable of taking measurements of low concentrations of ice nucleating particles (INP).

During August-October I participated in a field campaign at the University of Leeds farm in which we took regular aerosol samples and tested them for their ice nucleating activities to determine the INP concentration at this agricultural site. For the campaign I was heavily involved in sample collection as well as developing a new protocol for the experimental setup and analysis. The data is still being analysed but already shows interesting results. Our data is comparable with previous field studies in different types of location and also shows evidence for a possible new source of INP which is not accounted for by desert dust or marine organics.

In addition to this field study I am currently organising a campaign to Ragged Point, Barbados. This site experiences dust events which originate from Africa. We hope to study the influence of transportation on the activity of the desert dust as it passes over the Atlantic. As well as this the site is situated in such a location that we can see contrasting sources of INP. We will investigate marine, desert dust and local sources to determine the influence of each. The study is to be carried out July-August this year.

I published my first paper showing that K-feldspar is highly active as an INP within desert dust but may be effected by aging processes (Harrison et al., 2016). As scavenging and aging processes may allow other components of desert dust to become influential it is important to study other common minerals found in desert dusts. To better understand this I have sourced specific minerals of the silica group in preparation for a new study. The study shall look at different varieties and polymorphs of quartz to see if there is any effect. The results will not only help us perceive if quartz has the potential to be important in the atmosphere but also improve our knowledge of ice nucleation overall.

My final aim was the development of an automated instrument capable of detecting low concentrations of INP. At present I have developed such an instrument and I am in the process of finalising its design. The Big-NIPPI makes use of an IR camera to take thermal images of a multiwell plate which has aliquots of suspension on the order of 10s-100s of µls. These large volumes of suspension increase the sensitivity to lower concentrations of INP which is crucial for field measurements. I have also written a python code which can interpret the thermal images captured and automatically output the freezing temperatures of wells which can be further analysed to give INP concentrations. The whole system is compact and succinct meaning it is ideal for field work and so I hope to deploy this in the Barbados campaign. I have spent a great deal of time calibrating the IR camera so that I can now begin to collect preliminary data in preparation for a paper in which I will describe the new instrument.

Harrison, A.D., Whale, T.F., Carpenter, M.A., Holden, M.A., Neve, L., apos, Sullivan, D., Vergara Temprado, J. and Murray, B.J. 2016. Not all feldspars are equal: a survey of ice nucleating properties across the feldspar group of minerals. *Atmospheric Chemistry and Physics.* **16**(17), pp.10927-10940.