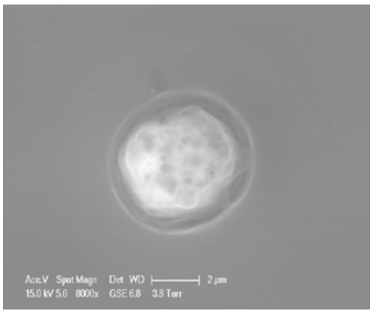
Project Description

Title - Determining the role of fungal spores in cloud formation
Supervisors - Dr Francis Pope (School of Geography, Earth and Environmental Sciences) and Prof. Robin May (School of Biosciences)

Understanding cloud formation is a major issue for climate, atmospheric and hydrological science. Fungal spores could influence cloud formation and precipitation by forming cloud condensation nuclei (CCN) which are the precursors to cloud droplets. This project will provide the laboratory data required to assess the ability of fungal spores to form CCN. This data will be incorporated into cloud process models and hence the interaction between clouds and fungal spores will be determined for different geographical regions. Special attention will be paid to the biological rich and diverse Amazon. If spores do significantly affect cloud processes then a previously hypothesized feedback between the atmosphere and biosphere will be proven, with major consequences for how fungi are viewed within the Earth system.

Fungi represent one of the main evolutionary branches of multicellular organisms and are classified with their own kingdom - the Eumycota. They are ubiquitous over the surface of the Earth with an estimated number of species in excess of 1.5 million. They are capable of colonizing all regions of the Earth including areas that are otherwise barren of life. In common with the other kingdoms there is a particularly high abundance and wide speciation within tropical forests (e.g. the Amazon). Fungi are a key component of the Earth system through their role in nutrient recycling. This project will determine whether they are also important within the hydrological cycle. The reproduction of fungi, and the colonization of new areas, is commonly achieved via sporulation, in which the parent fungi releases small micron sized (one thousandth of a millimetre) particles into the atmosphere. These particles are taken by the wind and dispersed to new regions; under favourable conditions new colonies will establish after spore deposition. This dispersal mechanism results in significant fungal spore concentrations in the atmosphere. For example, in the suburban UK background there is typically an average concentration of ca. 1000 spores per m3. During a sporulation event this concentration can increase dramatically by orders of magnitude.

For spores to be able to influence cloud processes they need to be able to take atmospheric water onto their surface, i.e. they need to be hygroscopic. This allows them to act as CCN and hence form cloud droplets. If the particles are hygroscopic then they are very likely to be good CCN, compared to other particles in the atmosphere, because of their large size which makes the thermodynamics of water condensation more favourable. The implication is that spores could have a disproportionately large effect on cloud processes even though their number concentration is low compared to the background aerosol. This project will study a representative selection of fungal species found in a wide range of geographies. Laboratory measurements will investigate the hygroscopic ability of spores under in-cloud and out-of-cloud conditions. The laboratory data will be parameterized using pre-existing theories and will be incorporated into numerical models. In particular two processes will be assessed: the ability of the spores to activate clouds, and their ability to coalesce existing droplets into precipitation.



Fungal spore (*Apophysomyces elegans*) imaged with an environmental scanning electron microscope (image taken by Mr Cragg working in the group of Dr Pope).

For more information please contact Dr Francis Pope - f.pope@bham.ac.uk

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