Great Western Four+ Doctoral Training Partnership (GW4+ DTP)

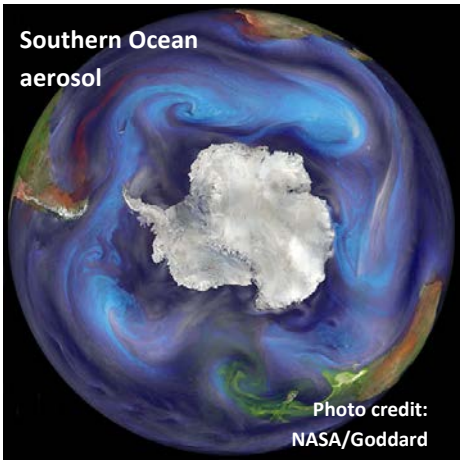
From marine aerosol emissions to global climate change

University Supervisor: **Dr Paul Halloran (p.halloran@exeter.ac.uk) (University of Exeter)**

PML Supervisor: **Dr Tom Bell (tbe@pml.ac.uk)**

Met. Office Supervisor: **Dr Jane Mulcahy (jane.mulcahy@metoffice.gov.uk)**

Background: A key natural aerosol (particulate) found over the ocean is Dimethyl Sulphide (DMS), a biogenic volatile gas produced through biological activity in the surface ocean. The natural background marine emissions of this gas determines how 'dirty' our preindustrial atmosphere is, which subsequently determines how sensitive our climate system is to aerosol particles or aerosol precursors emitted by human activity, from power production to agriculture (Carslaw *et al*., 2013). The atmosphere in the Southern Ocean is the most pristine on our planet - it has the lowest anthropogenic particulate pollutant concentrations ('aerosols') anywhere on Earth. This makes the Southern Ocean highly sensitive to emissions of natural aerosols. We need to know whether these natural aerosols are keeping the Southern Ocean cooler, by enhancing the brightness of clouds, than our models say it should be - and if so how this impacts our global climate system through sea-ice, ocean and atmospheric circulation.



Approach: The state-of-the-art climate model the Met Office and UK scientific community are developing for the next IPCC assessment is showing that the levels of these preindustrial emissions can make the difference between no climate change occurring by the present day, and strong climate change occurring. We will work with the student to:

- Make novel DMS measurements in the Southern Ocean, where the pristine environment provides the best window into our preindustrial atmosphere.
- Use these and existing measurements, along with existing model results and established statistical techniques to estimate, with robust uncertainties, what preindustrial DMS emissions could have looked like.
- Perform new climate model experiments at the Met Office, to quantify how sensitive our climate system is to this DMS emission uncertainty.

This is an exciting multidisciplinary opportunity to make a unique set of measurements, in a rarely visited part of the world. The successful candidate will then use this information to gain fundamental new understanding about how our planet works. By doing this, you will contribute to improved Met Office climate predictions and the IPCC process.

Supervision and person specification: This work is part of an ongoing successful collaboration. At PML the student will benefit from working alongside expert researchers measuring air/sea gas transfer and DMS in seawater. At Exeter and the Met Office, the student will benefit from the expertise of world-leading global climate researchers. We are looking for a student with a 1st class or 2:1 BSc or Masters level degree in Environmental Science, Marine Science or Chemistry (or similar courses) with a genuine passion for marine and atmospheric science. Candidates are encouraged to contact any of the above supervisors with scientific enquiries and for further details.

References:

Carslaw et al (2013) Large contribution of natural aerosols to uncertainty in indirect forcing, Nature, doi: 10.1038/nature12674

Jarníková & Tortell (2016) Towards a revised climatology of summertime dimethylsulfide concentrations and sea-air fluxes in the Southern Ocean, Environmental Chemistry, 13(2), 364-378.