

1. Motivation

- To quantify atmospheric INP using a droplet freezing assay
- To make measurements of INP concentrations in UK and Ethiopia

2. Background

- Ice crystal formation in clouds is typically observed when cloud droplets contain particles known as ice nucleating particles (INPs) that act as surfaces for ice crystal nucleation and growth.
- INPs impact cloud properties such as lifetime and whiteness, that can in turn affect the climate.
- INPs include Mineral dusts, biological materials, carbonaceous combustion aerosols and Volcanic ash¹.
- Attention has been drawn recently to the paucity of data concerning INP sources.

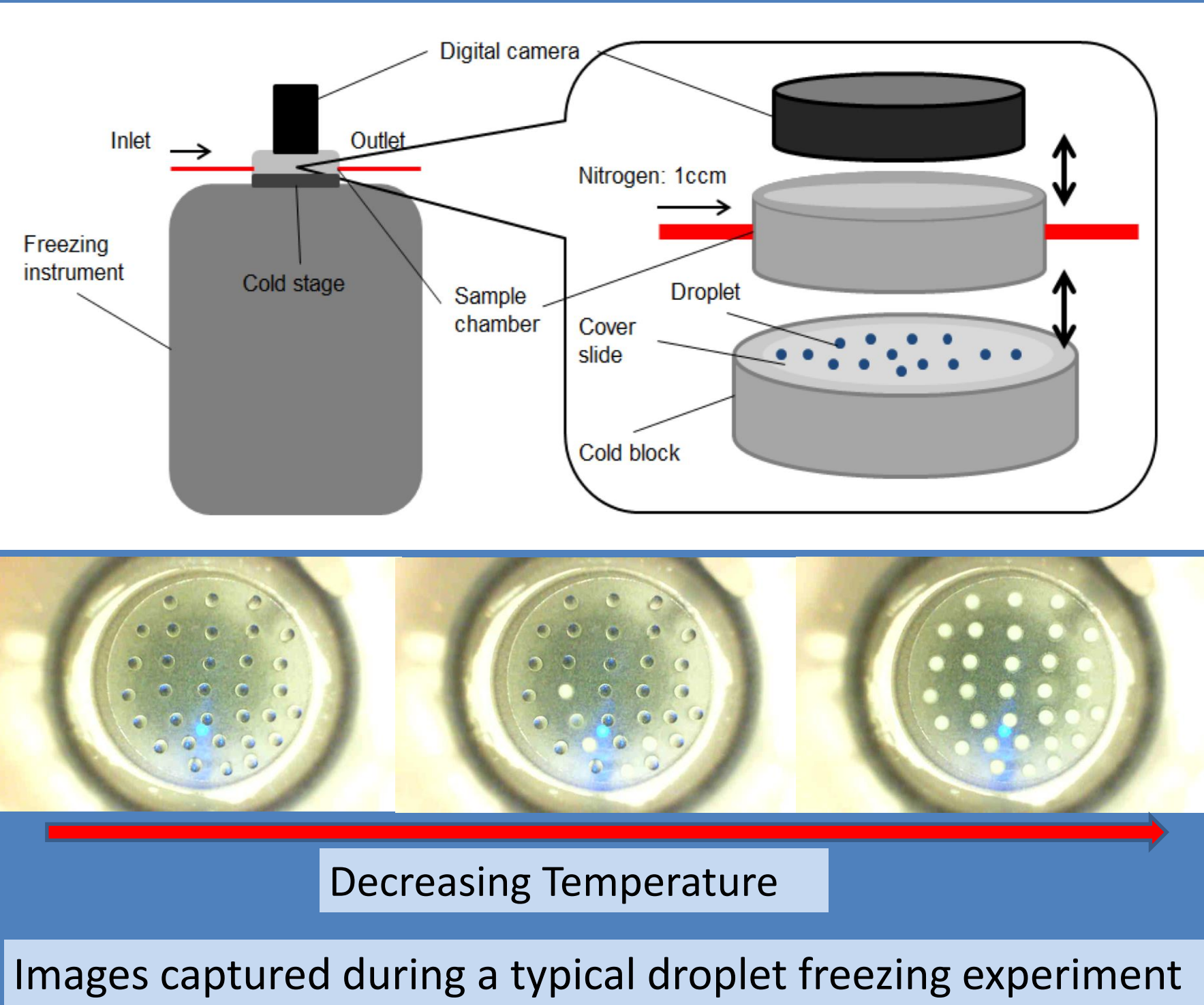
3. INP sampling: SKC Biosampler



SKC Biosampler

- Aerosol impinger
- Collects aerosol into water or other liquid medium
- Samples at 12.5 litres min⁻¹
- Requires vacuum pump
- Needs topping up every hour due to evaporation

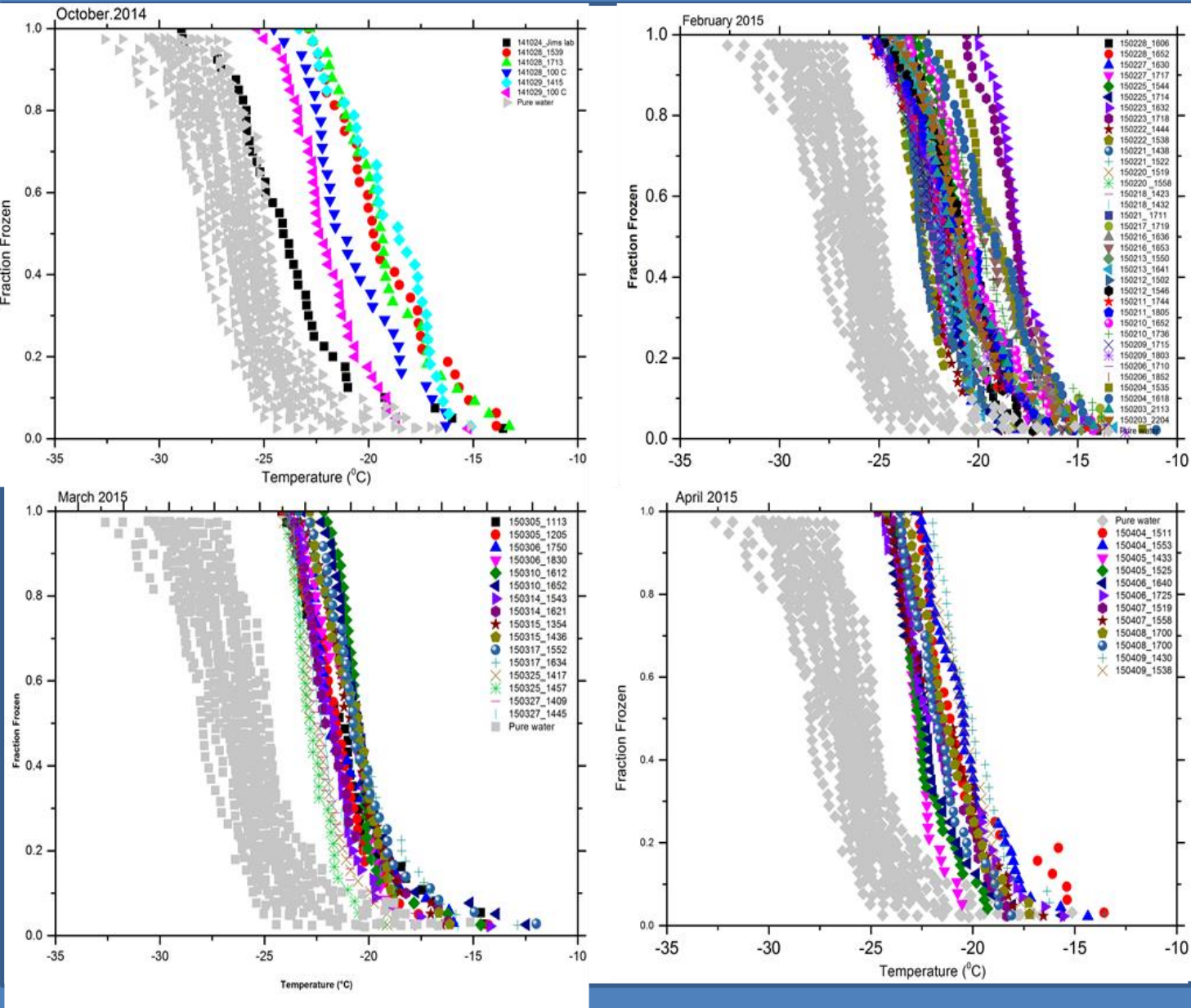
4. Sample analysis: Drop assay



Decreasing Temperature

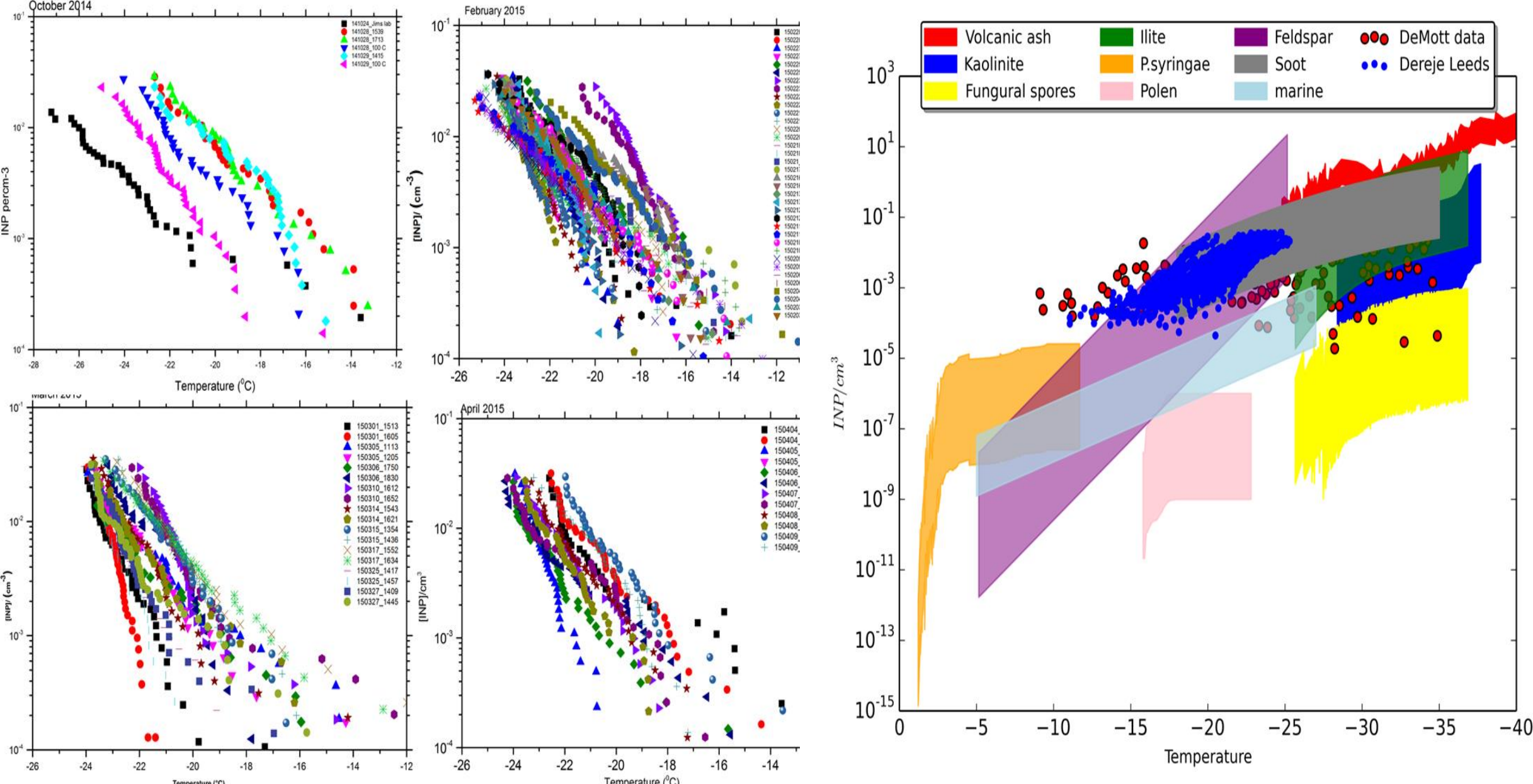
Images captured during a typical droplet freezing experiment

5. Results: FIRST INP MEASUREMENT IN LEEDS!!!



- Freezing assay 1μl droplet experiments were performed on water samples immediately after sampling.
- samples were found to be enriched in INP compared to pure water.
- Freezing was observed at temperatures of around as -20°C, indicating the presence of INP in Leeds.
- Some loss of activity on heating: biological?

Atmospheric INP concentrations compared



7. Future Work Plan:-Ethiopia

- There also no INP measurements in Ethiopia
- We will measure atmospheric INP concentrations in the Ethiopian atmosphere.
- Compare the local concentrations of INP in Addis Ababa with the other environments e.g. Mountains, forests, existing meteorological stations.
- Build up a longer term data set (months) to investigate the impact of different air masses



References:

- B. J. Murray ,et al (2012) , ,Ice nucleation by particles immersed in supercooled cloud droplets, Chem. Soc. Rev., **41**, pp. 6519-6554, DOI: 10.1039/c2cs35200a, 2012.
- T. W. Wilson, et al (2015), A marine biogenic source of atmospheric ice nucleating particles, Nature, 525, 234–238, doi:10.1038/nature14986, 2015.
- T. W. whale, et al (2015), A technique for quantifying heterogeneous ice nucleation in microlitre supercooled water droplets, Atmos. Meas. Tech., **8**, 2437-2447, doi:10.5194/amt-8-2437-2015, 2015.