Bacteria in Thunderstorm Anvils

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Overview

Bacteria may be an important source of ice nuclei which affects the microphysics of clouds. This project's objective is to determine the abundance of different bacterial types in top of tropical thunderstorms. Bacteria samples are planned to be collected via aircraft flights in Florida in July 2019.

Aircraft Sampling

Aerosol and cloud samples can be collected via an airborne research aircraft. A good place to collect this data is in Florida, where the ocean waters help fuel thunderstorm activity on a frequent basis. Funding was approved for a research project during the summer of 2019 using the North Dakota Citation Research Aircraft (N555DS), owned by Weather Modification International (WMI) in Fargo, ND. The aircraft will be flown to Space Coast Regional Airport in Titusville, FL (KTIX). It will fly research missions for approximately 30 hours, or 2 weeks during the month of July. The aircraft will fly research missions at altitudes of up to 43,000 ft MSL. It is capable of flying up to 4 hours at speeds of up to 340 knots, and sampling speeds of up to 160 knots. The bacteria for this experiment will be collected at the top of thunderstorms.

Cloud Water Sampling

Name	Technique	Size Range	Reference
CSU-NCAR Airborne Cloud Water Collector	Axial Flow Cyclone	Up to 50 µm.	Straub and Collett, 2004
Brechtel Counterflow Virtual Impactor	Counterflow Virtual Impaction	Controllable Cut Size 7-15 µm.	Glantz et al., 2003
Axial Cyclone Cloud water Collector (AC3)	Axial Cyclone	> 10 µm.	Crosbie and Coauthors, 2018

Sampling Methodology

- Collect aerosol and cloud water samples.
- Culture the samples to grow bacteria for DNA sequencing.
- Collect samples at different altitude and on different days.

Inlet Design

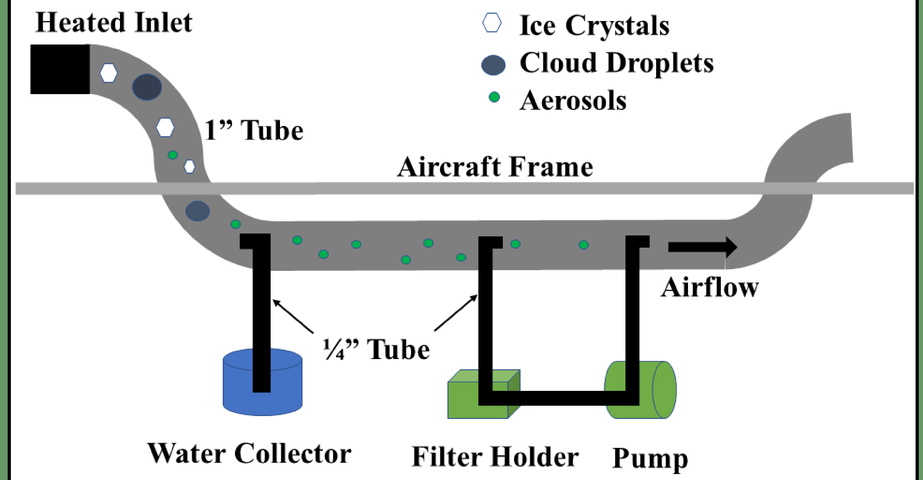
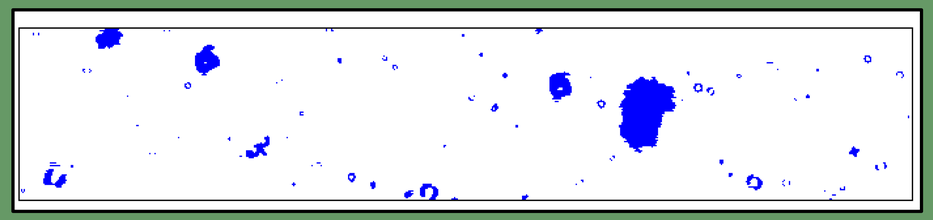


Diagram of the proposed inlet system on Citation Research Aircraft.

2D-S Image Buffer

The two-dimensional stereographic cloud imager (2D-S) image is a cross section of the ice crystals collected by the Citation Research Aircraft (N555DS) during the CAPE project on 1 August 2015 at 20:21:22.71 UTC. The aircraft was flying at an altitude of 11.6 km (38,000 ft) with a temperature of -46.7 ℃. The small pixels are approximately 10 µm, with the larger ones estimated to be ~500 µm.



References

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