Ice fog observations at the Oliktok Point AMF and in Barrow

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Background and Motivation

- Radiative Impact on Weather and Climate
- Affect on
  - Air Pollution
  - Visibility
- Anthropogenic sources
- Remote sensing: falsely interpreted as ice in polar regions
- Microphysical parameterization schemes typically do not represent ice fog
- Ice fog as proxy for other anthropogenic ice clouds (i.e. contrails)

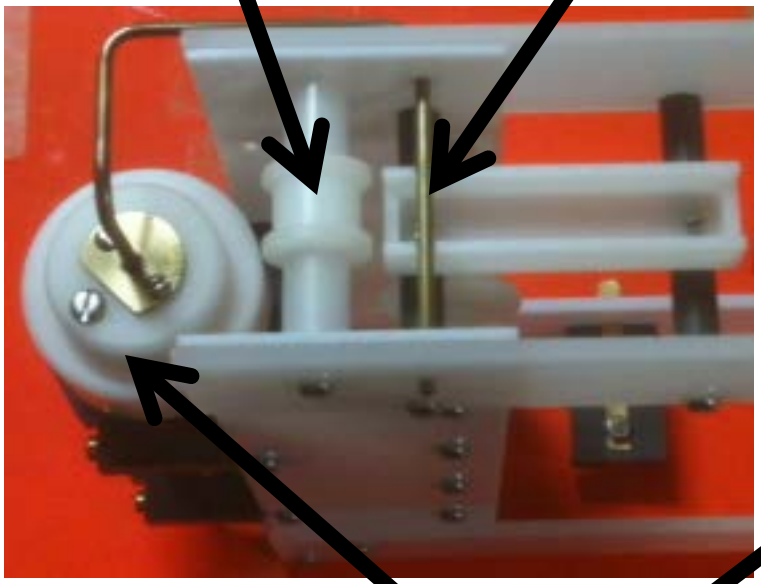
Measurements 1: Formvar Replicator

- Replicator tapes are movie film leader tape pre coated with a thin formvar film.
- Replicator tape moves past a solvent dispenser which softens the formvar.
- Particles landing on the softened formvar are wrapped up by the formvar which dries leaving a perfect cast.
- Replicators are 20 cm high, 5 cm wide, and can be from 20 to 100 cm long depending on application (how much tape is needed).
- Replicators in the format that we will use weight < 1kg.
- Capable to be mounted on a tethersonde

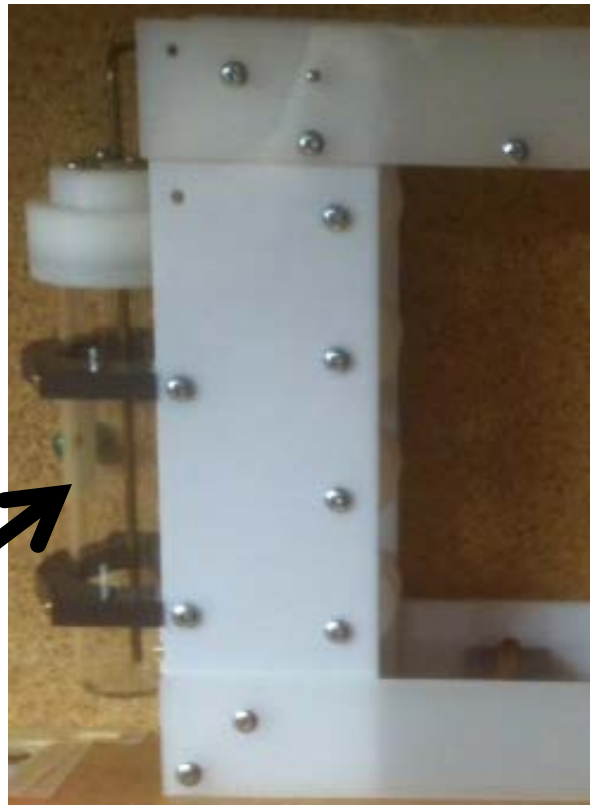
  or a small hexacopter UAS

Guide wheel for tape

Solvent dispenser



Solvent container

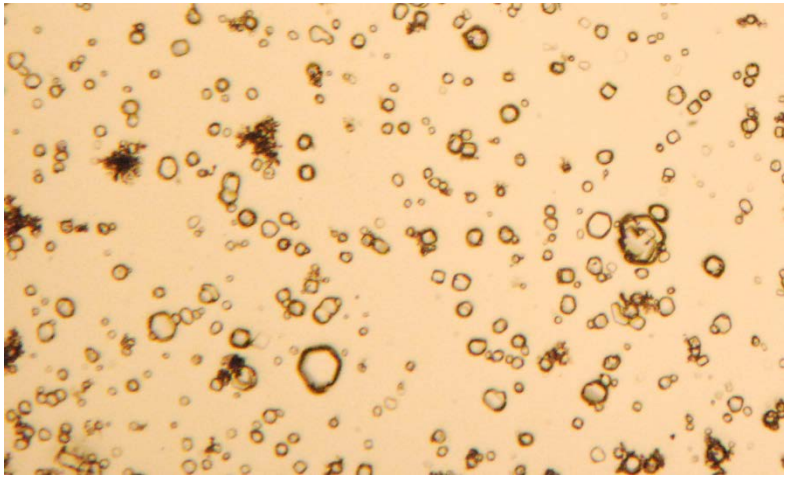


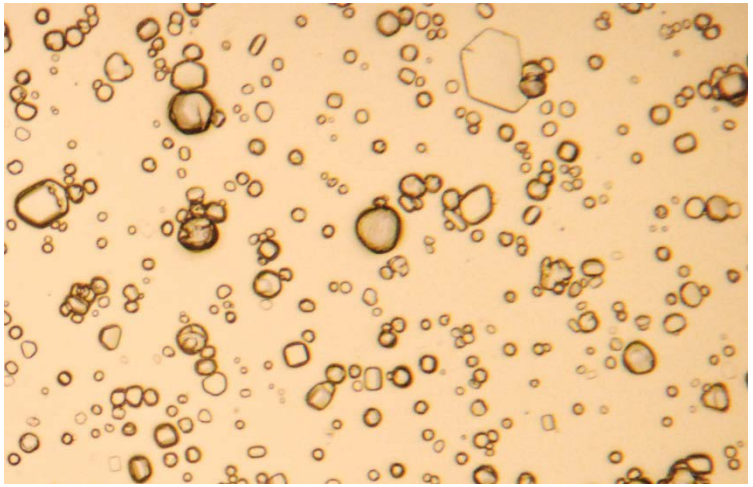
Full Replicator

Tape loops back and forth several times

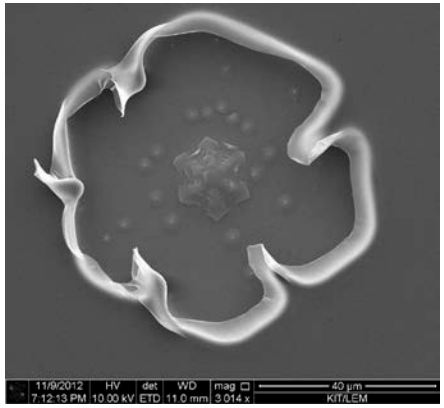
Replicas from Fairbanks Ice fog

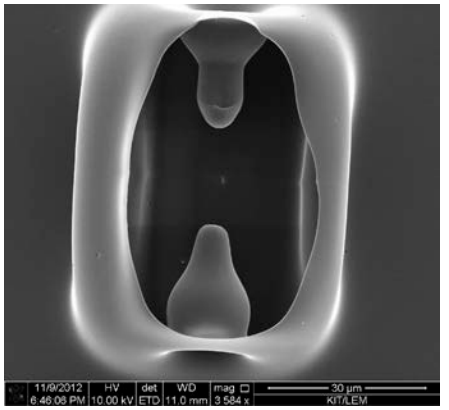
Visual Microscope

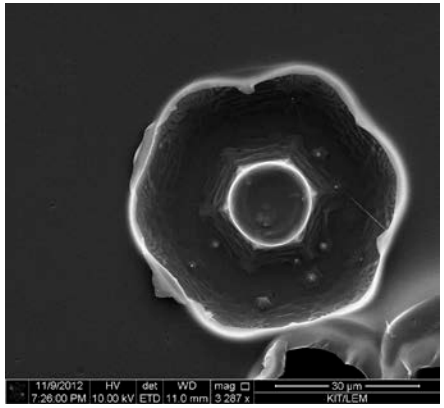


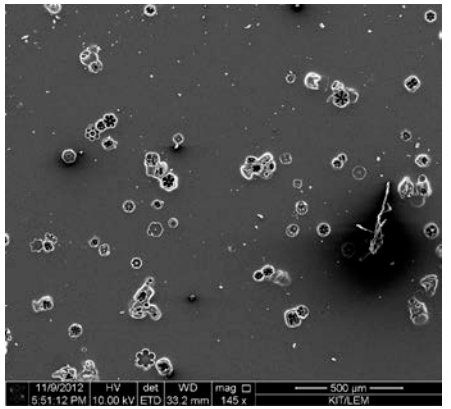


Electron Microscope



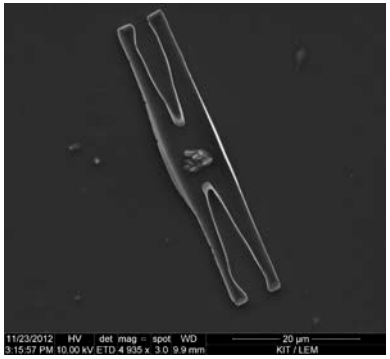


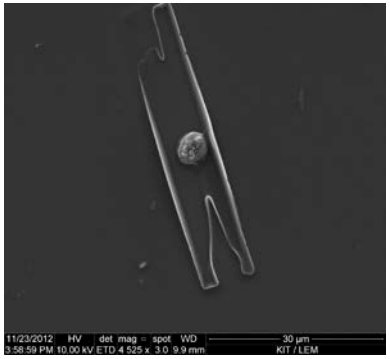


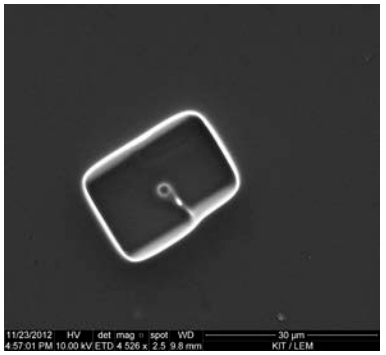


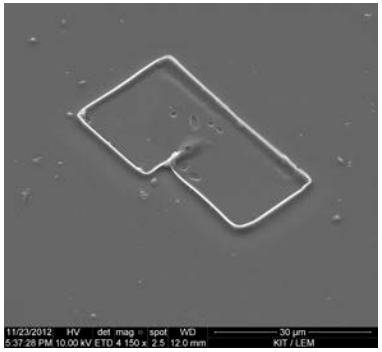
Largest crystals ~30 µm

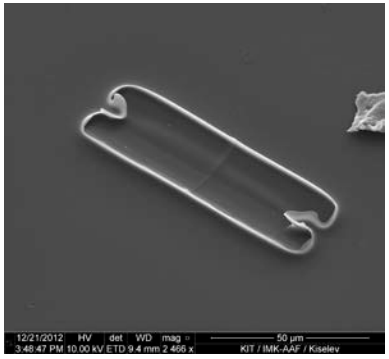
Replicas from AIDA cloud chamber

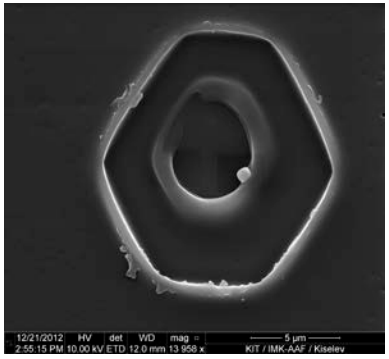






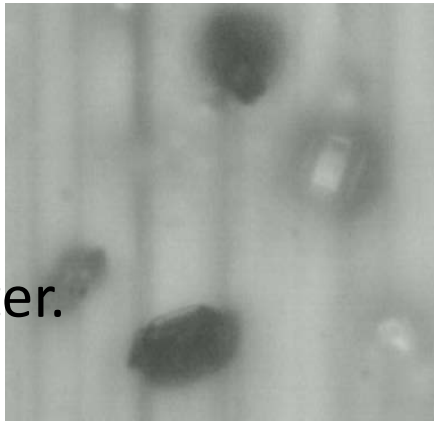


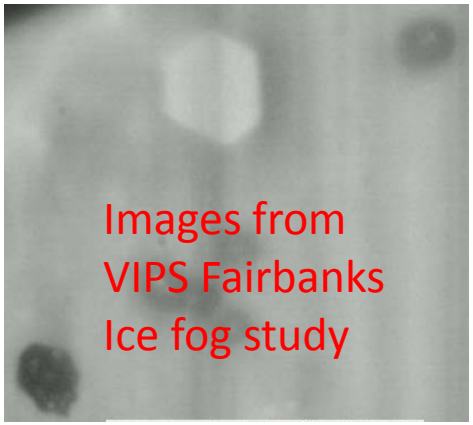




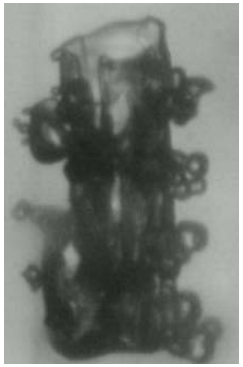
Measurements 2: Video Ice Particle Sampler (VIPS)

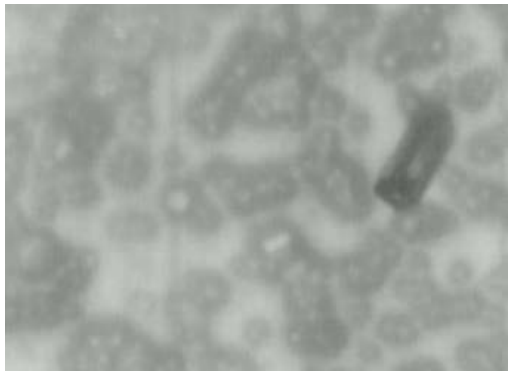
- Clear tape is coated with oil.
- Particles stick to the oil.
- Particles on tape pass in front of microscope objective with attached video camera.
- Current VIPS is approximately 1.5kg. New version under development is significantly lighter.



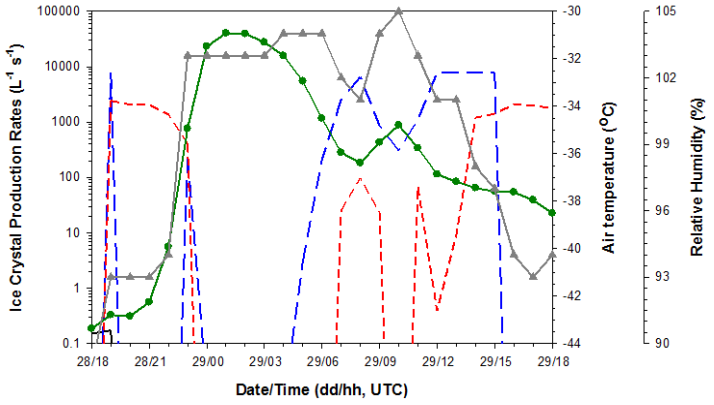


Images from VIPS Fairbanks Ice fog study





Improved Ice Microphysics for Arctic and Subarctic



⇒ Ice Crystal Production rate from:

- ✓ **deposition** (black solid line),
- ✓ **homogeneous freezing** of supercooled liquid water (blue long-dashed line) and haze droplets (red short-dashed line),

T (green solid line with circle)

RH (gray solid line with triangle).

Ice fog - Ice Water Content IWC with (a) anthropogenic and without (b) anthropogenic sources