Air Pollution Workshop

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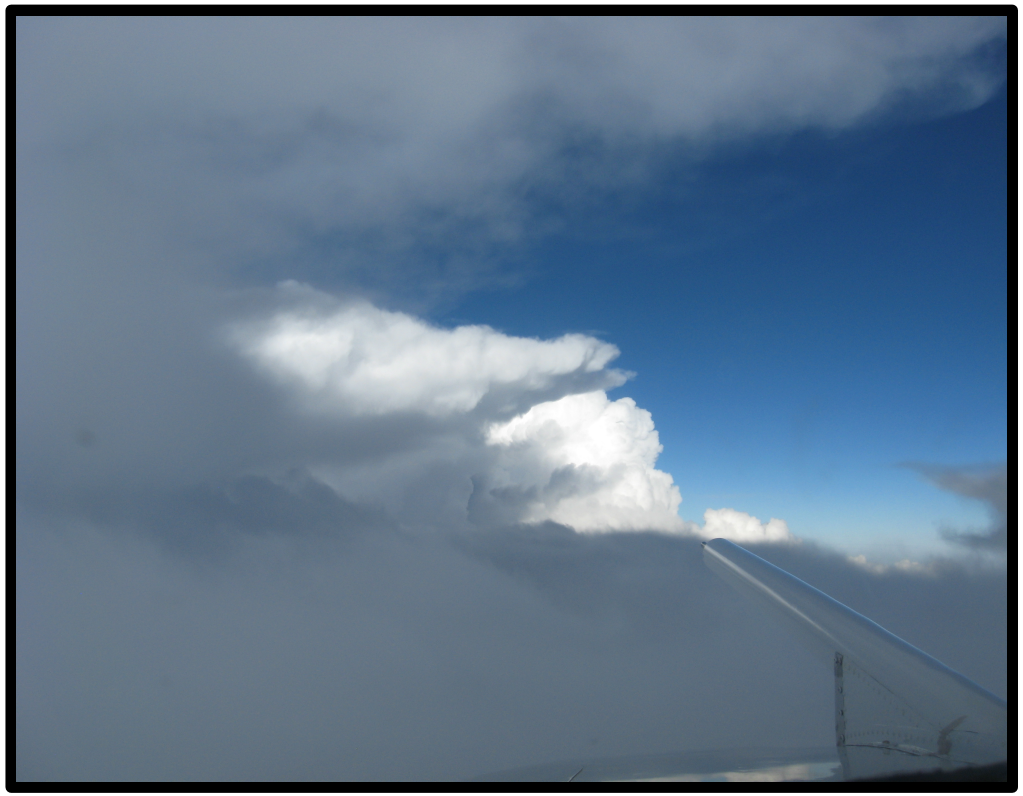
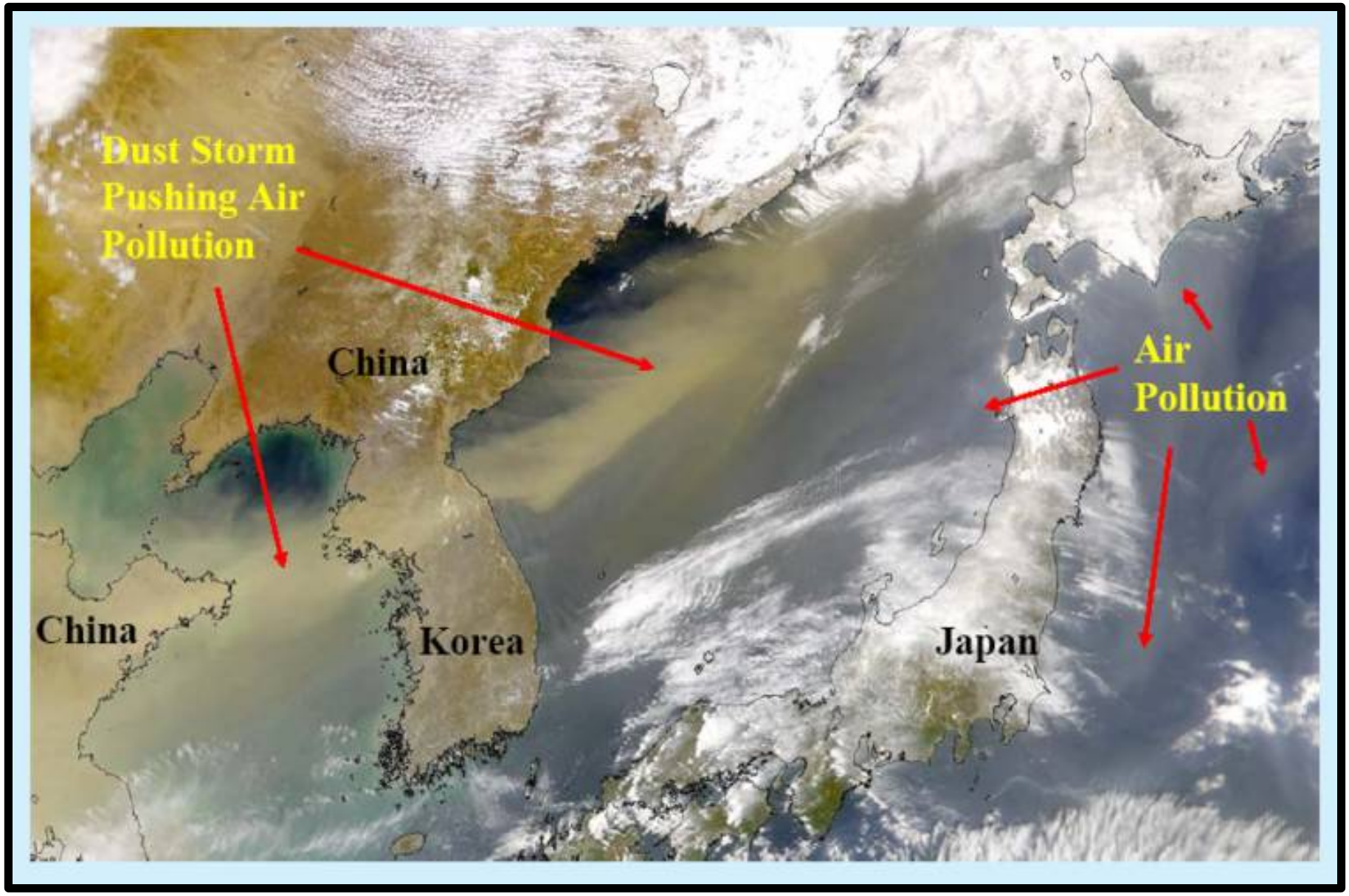
Airborne Atmospheric Measurements



View from the front of the Citation Research Aircraft on July 14, 2011 flight.

Citation's right wing taken over Lake Superior, with Isle Royale in the background, on March 3, 2012

Importance of Aerosols



Satellite image of Asian dust storm and air pollution (April 2001).

Definitions

Aerosols

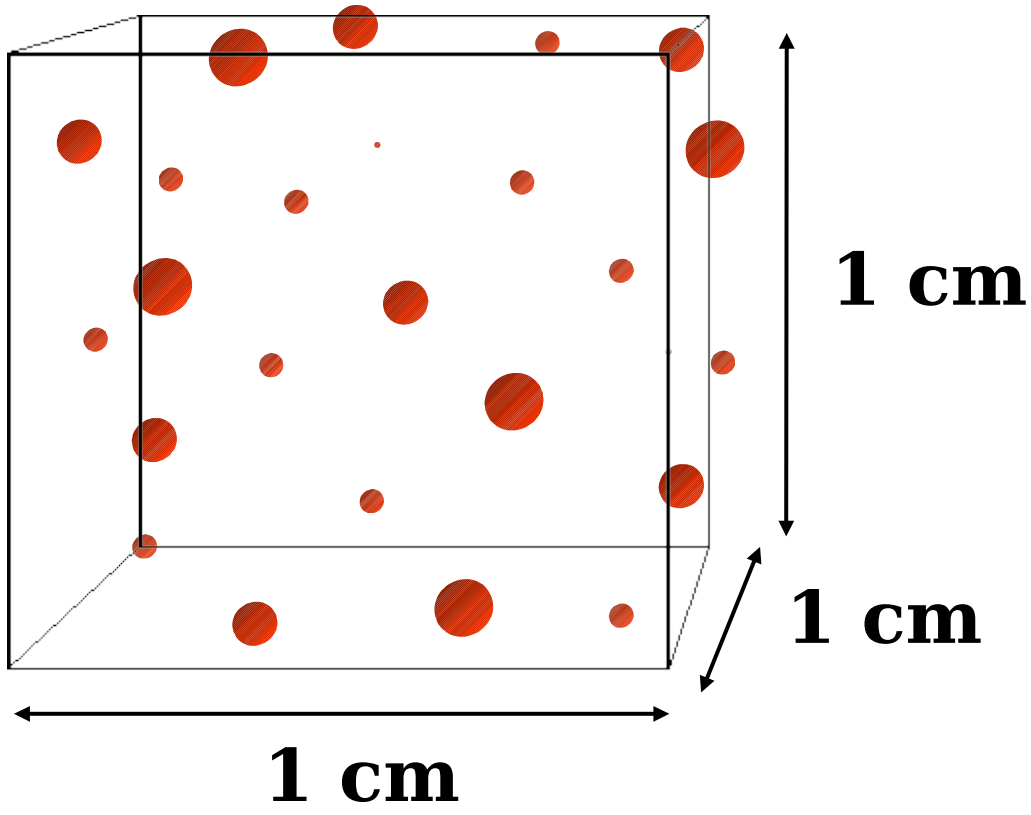
- Suspended solid or liquid matter
- Small settling velocity

Atmospheric Aerosols

- Suspended material in the Earth's atmosphere that have residence times of days, to a few weeks.
- Atmospheric Aerosols are sometimes referred to as “particles”

Aerosol Number Concentration

Number of Aerosols per unit Volume



24 particles / 1 cm^3 = 24 cm^{-3}

Airborne Instrument Size Range

10^{-9}m to 10^{-3} m

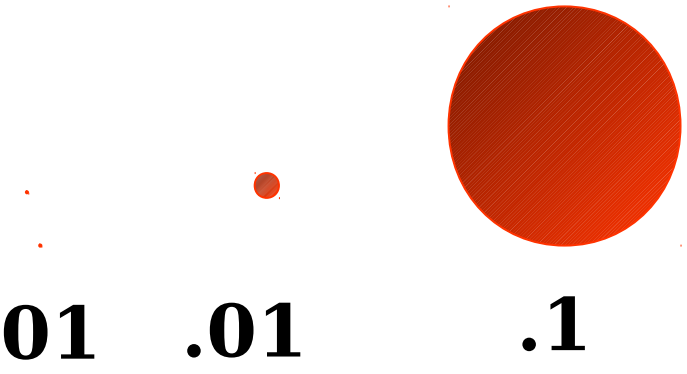
(.001 µm to 1,000 µm or 1 nm to 1,000,000 nm)

Wavelength of Visible Light?

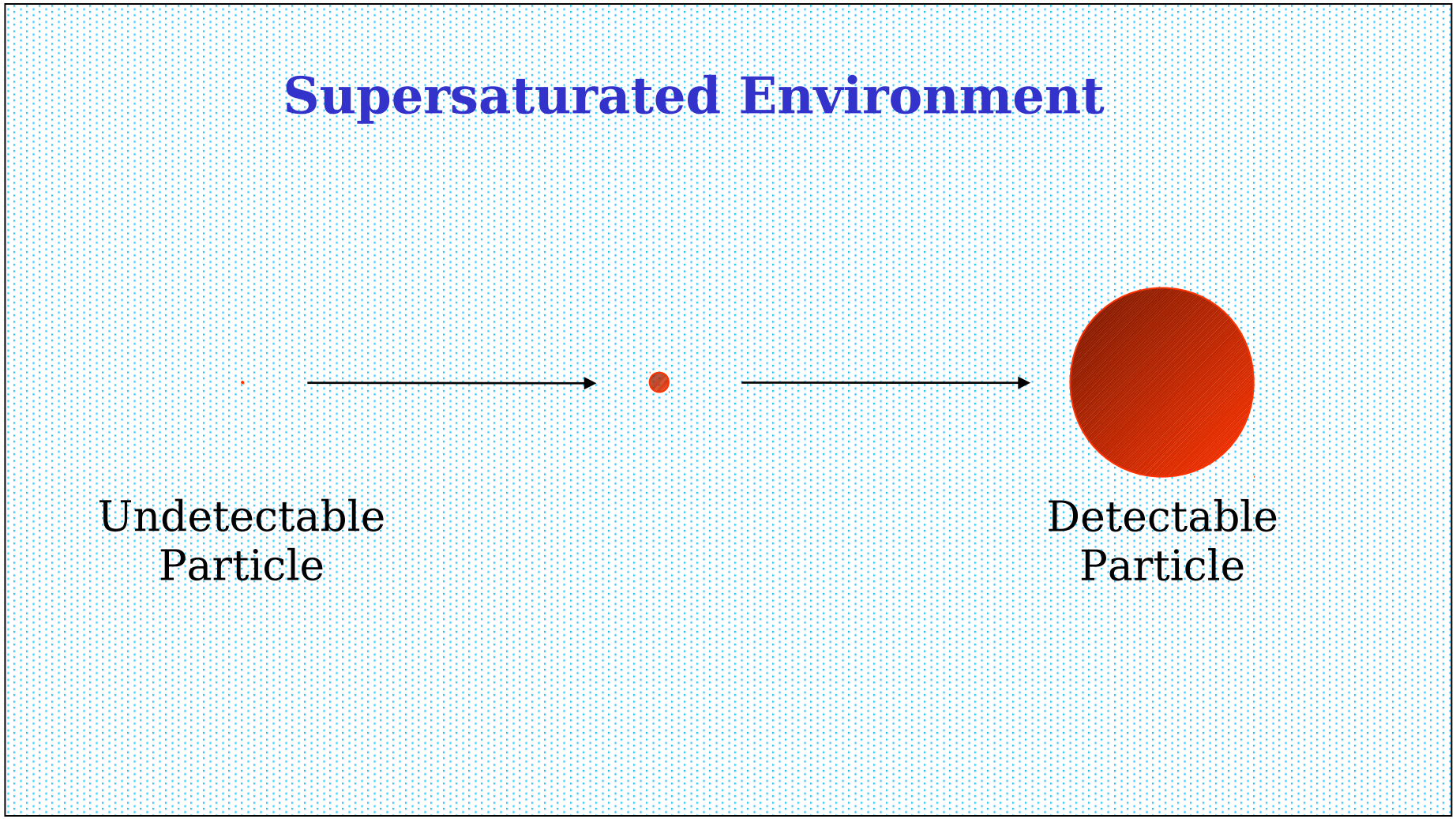
Size of cloud droplet?

Size of a rain drop?

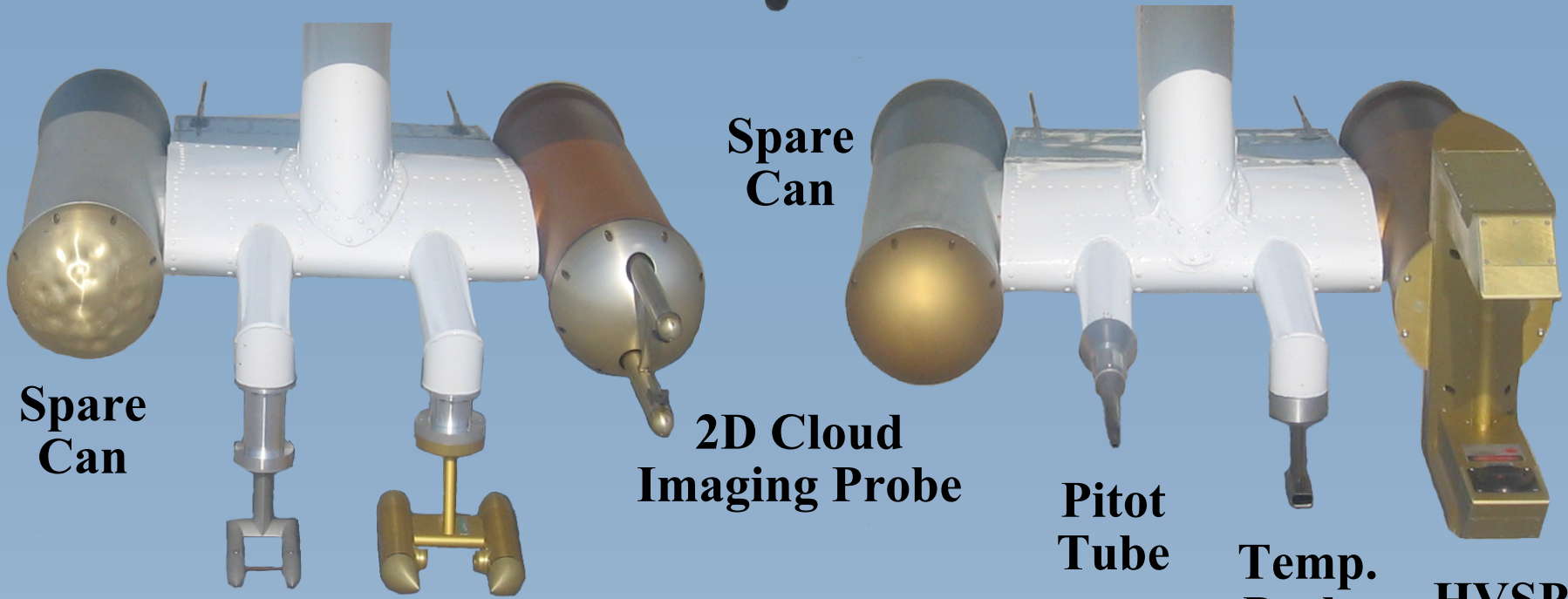
Size of a human hair?



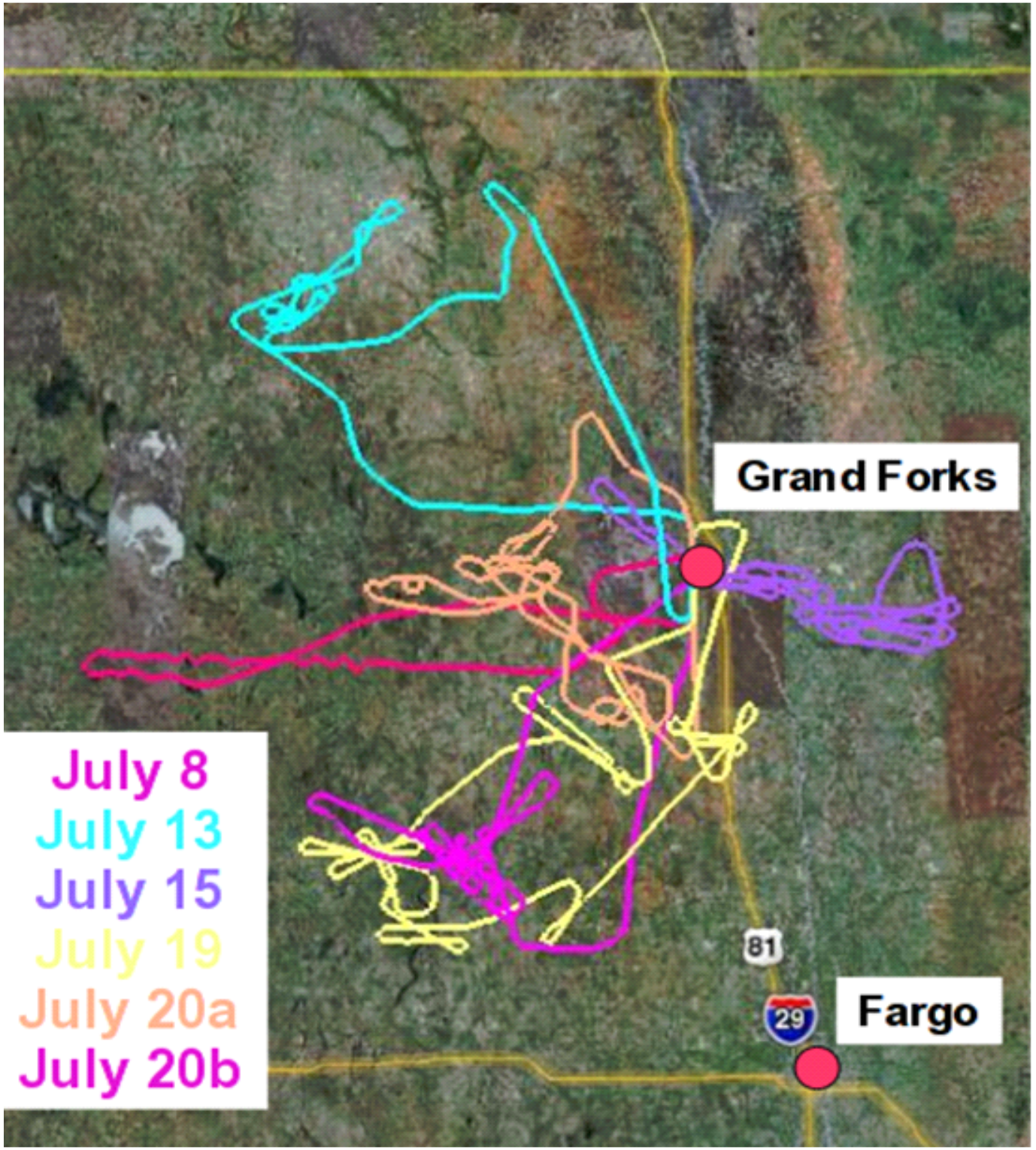
Grow Small Aerosols to Detectable Size

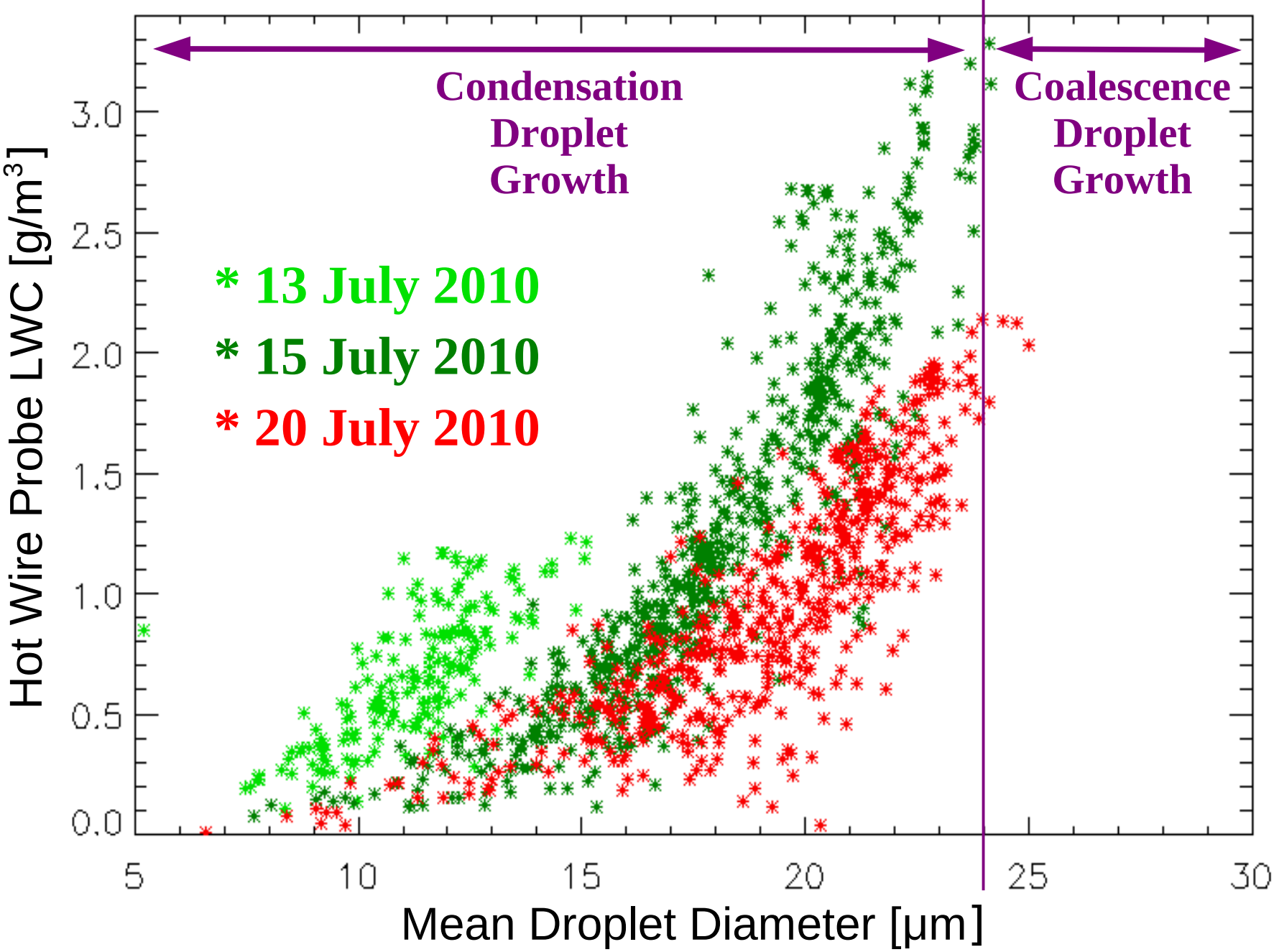


UND Cessna Citation Research Aircraft

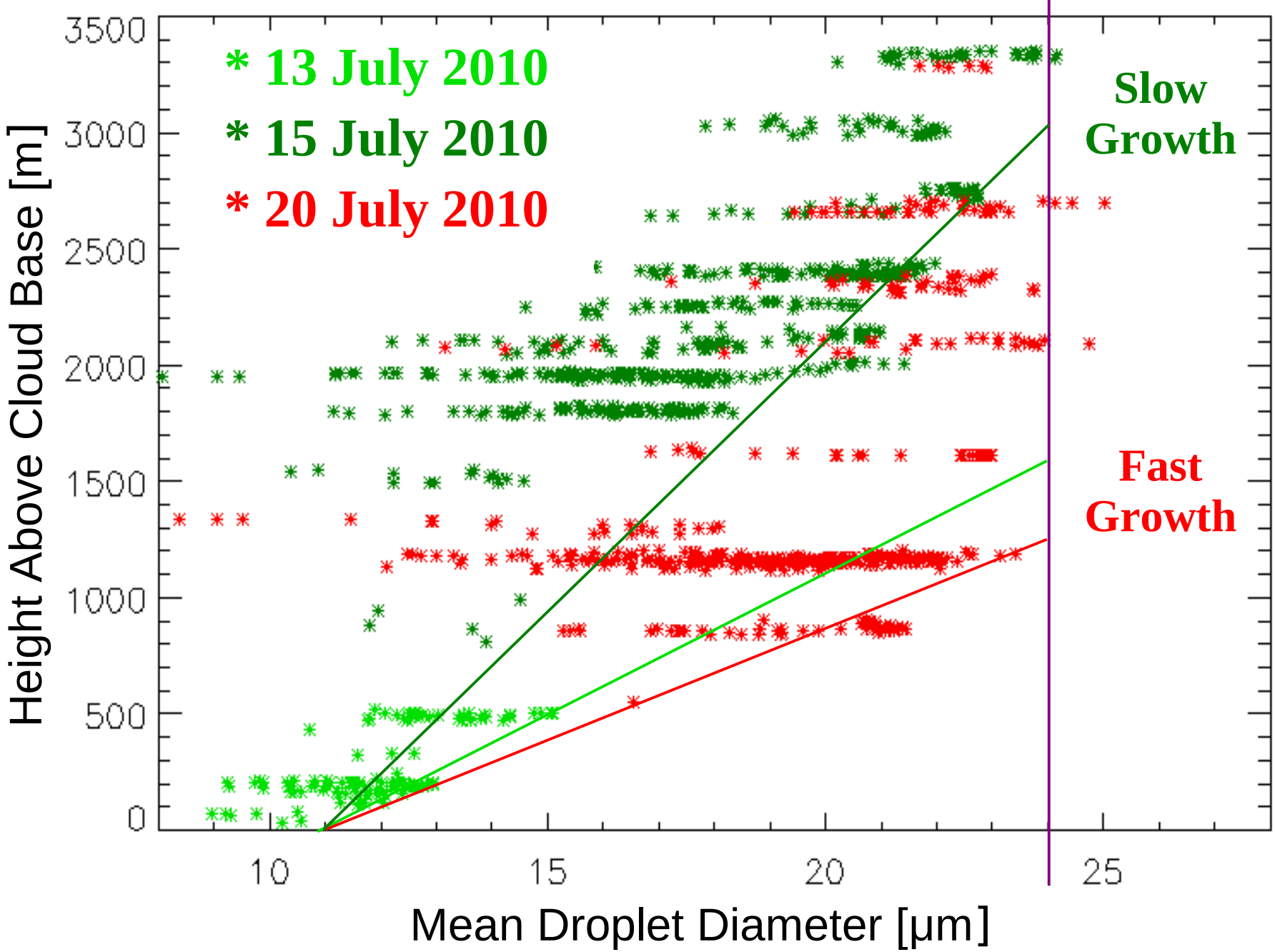


University of North Dakota Cessna Citation Research Aircraft Flights During the Summer of 2010



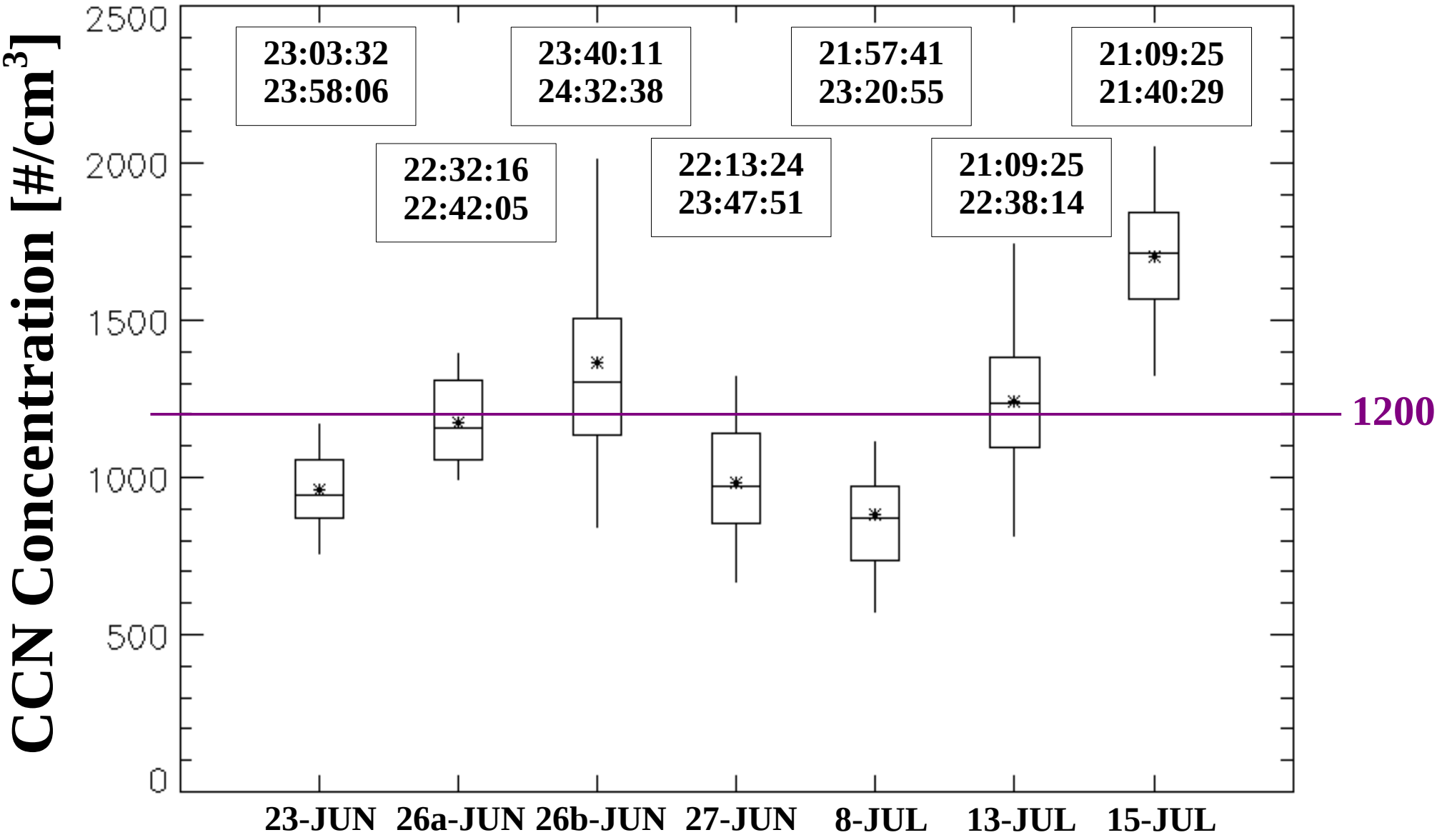


The Cloud Droplet Probe (CDP) mean droplet diameter versus the King Probe Hot Wire Probe Liquid Water Content (LWC) for aircraft flights during POLCAST3 near Grand Forks, North Dakota. Only measurements with CDP concentrations about 140 cm^{-3} are presented.



The Cloud Droplet Probe (CDP) mean droplet diameter versus the height above cloud base for aircraft flights during POLCAST3 near Grand Forks, North Dakota. Only measurements with CDP concentrations about 140 cm^{-3} are presented.

Cloud Base



Statistical distributions near cloud base of 30 s 1 % supersaturation Cloud Condensation Nuclei (CCN) adjusted to standard temperature and pressure during the 2010 POLCAST3 field project conducted near Grand Forks, North Dakota. The solid circle is the mean value, the horizontal line is the 50th percentile, the top of the box is the 75th percentile, the bottom is the 25th percentile, and the top and bottom of the whiskers are the 95th and 5th percentiles, respectively.

Summary

- Aerosols are suspended particles in the atmosphere that affect the scattering and absorption of sunlight and affect cloud and participation process.
- To understand precipitation formation require airborne measurements with many instruments.
- Conducting measurements to learn about the atmosphere can be a lot of fun; however, it takes a lot of planning and work to achieve new understanding such as the type of precipitation formation in a region.


Thanks for Listening
Any Questions