

# A Lab with a View: Findings from NASA's Aircraft Bioaerosol Collector



**Blue Marble Night of Science – August 14, 2019**  
**Sonali Verma**

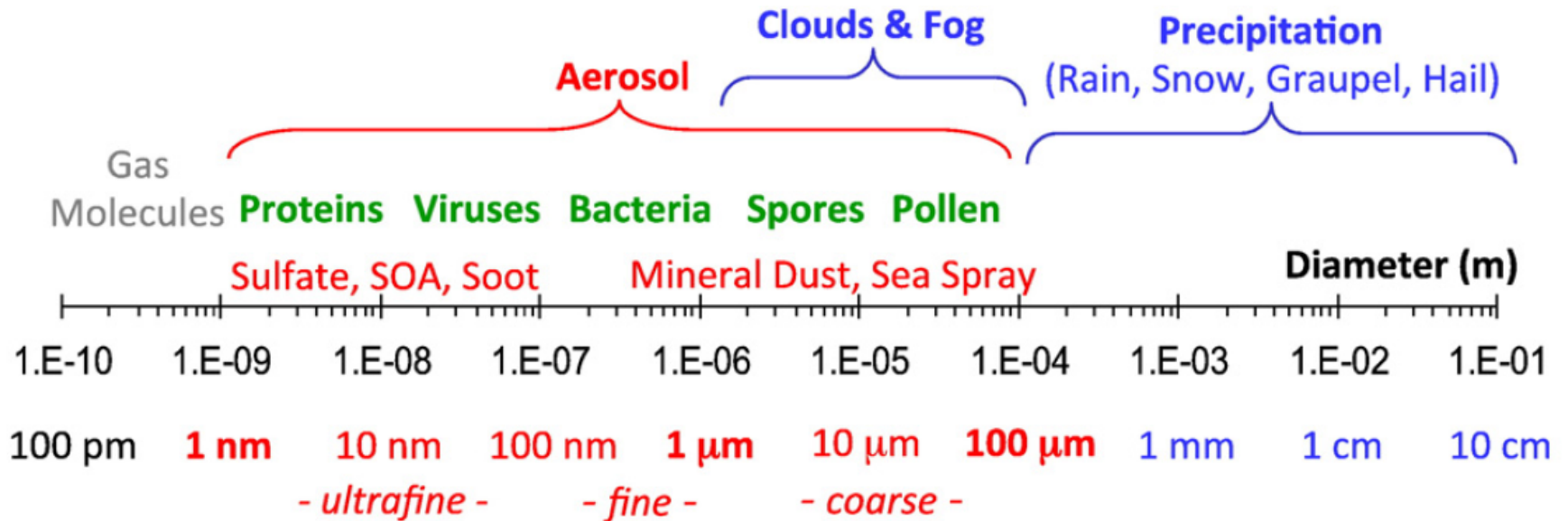
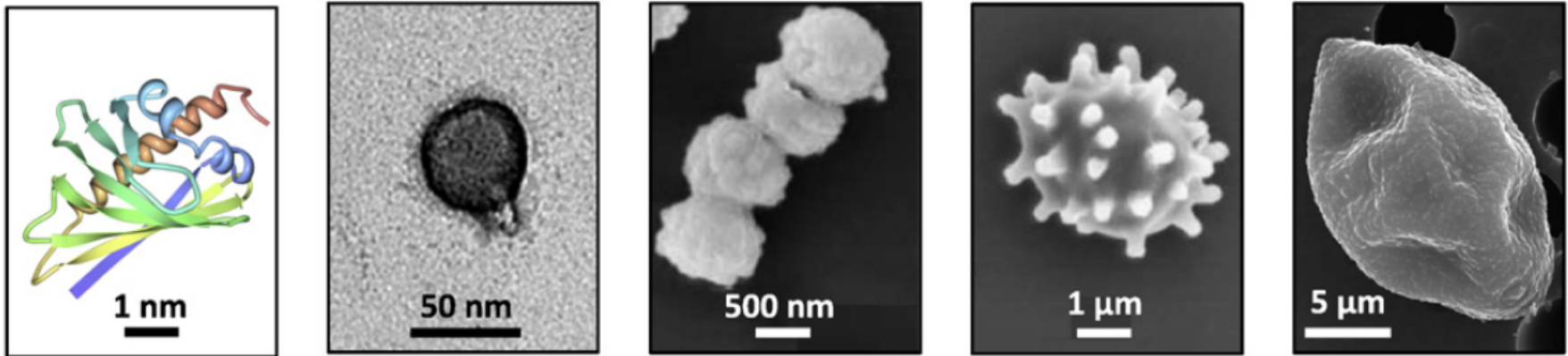
# View From Our "Lab" Window



# Biological Aerosols (Bioaerosols)



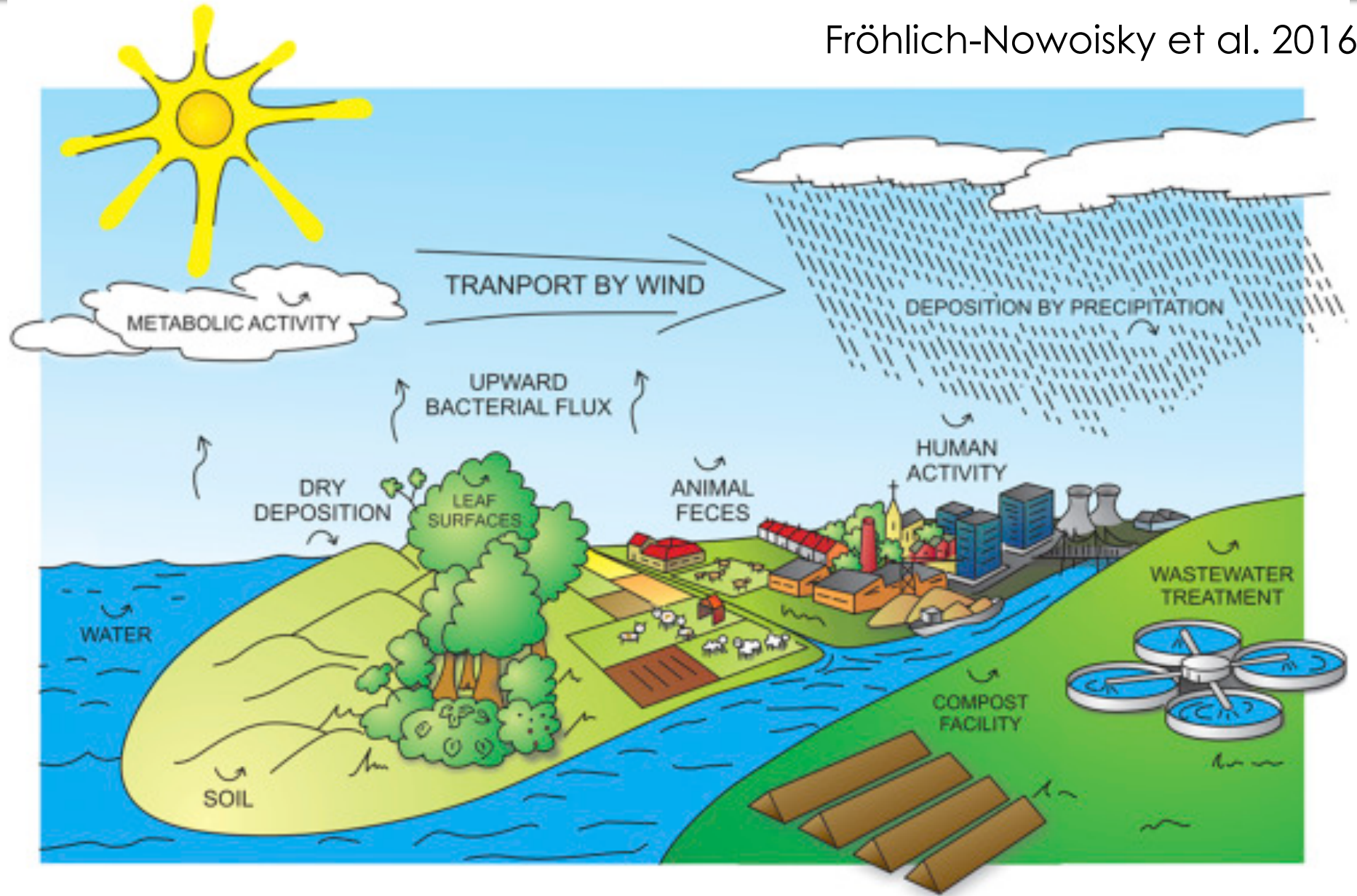
Fröhlich-Nowoisky et al. 2016



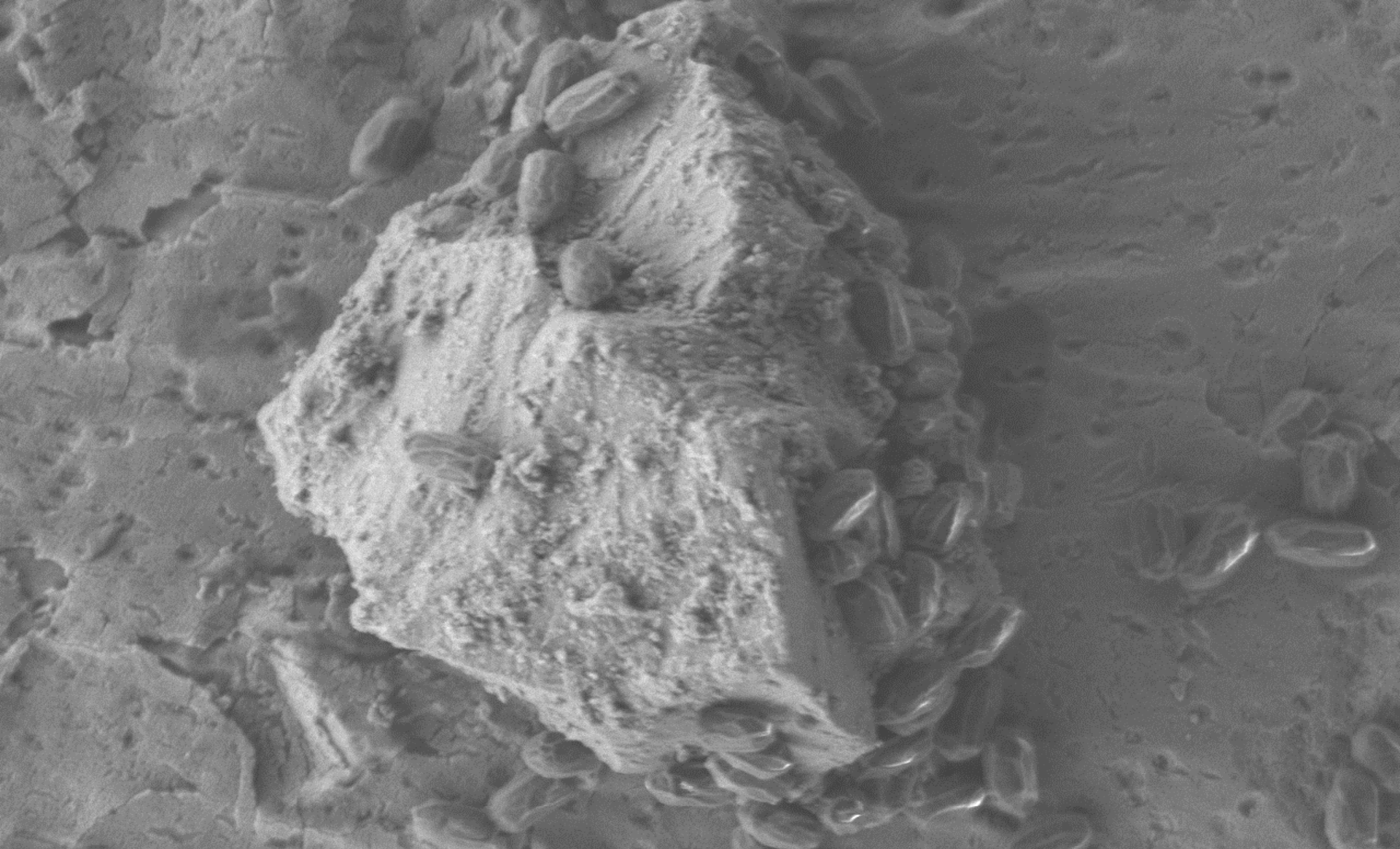


# Bioaerosols: Sources and Sinks

Fröhlich-Nowoisky et al. 2016



# Hitchhiking Microbes



X 6,500

2.00kV LEI

1µm

SEM

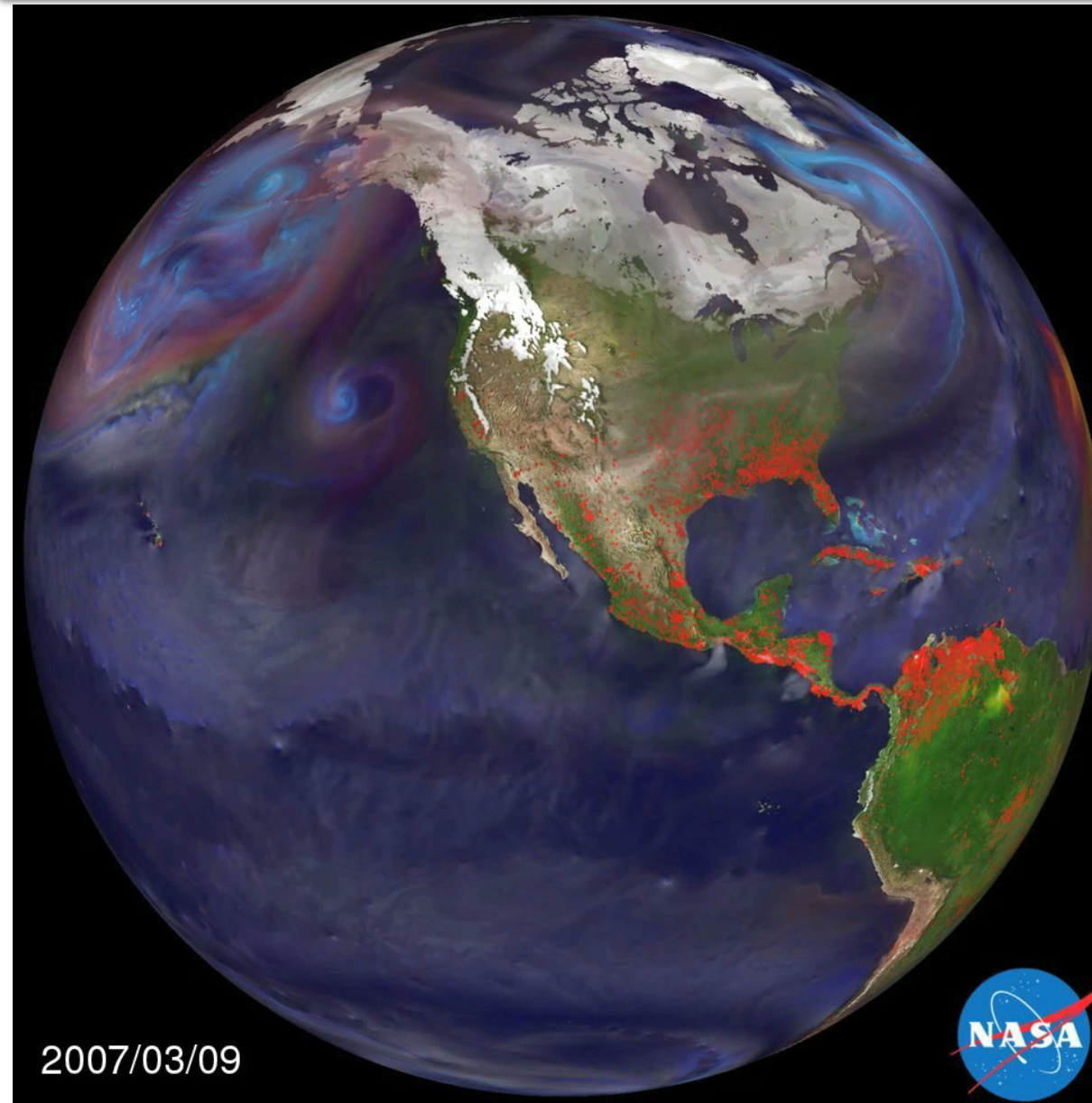
NASA

WD 8mm

8/21/2009

1:02:27

# Global Circulation of Aerosols



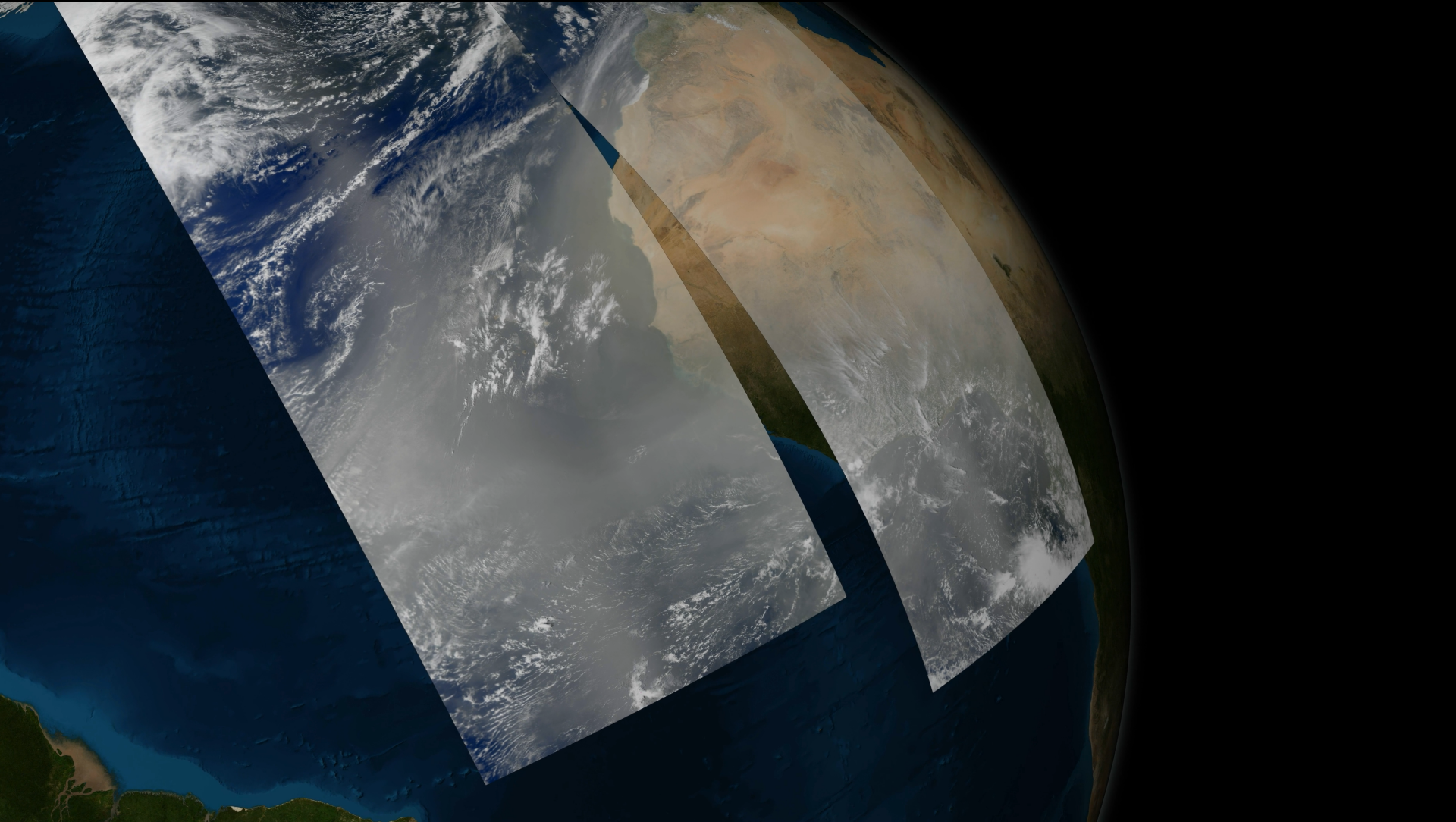
**dust = orange/red**  
**sea salt = blue**  
**carbon = green/yellow**  
**sulfates/ash = brown/white**  
**burning = yellow + red dots**

**Video file courtesy of NASA  
Goddard Space Flight Center**  
<http://gmao.gsfc.nasa.gov/>

2007/03/09



# Aerobiology: Follow the Dust



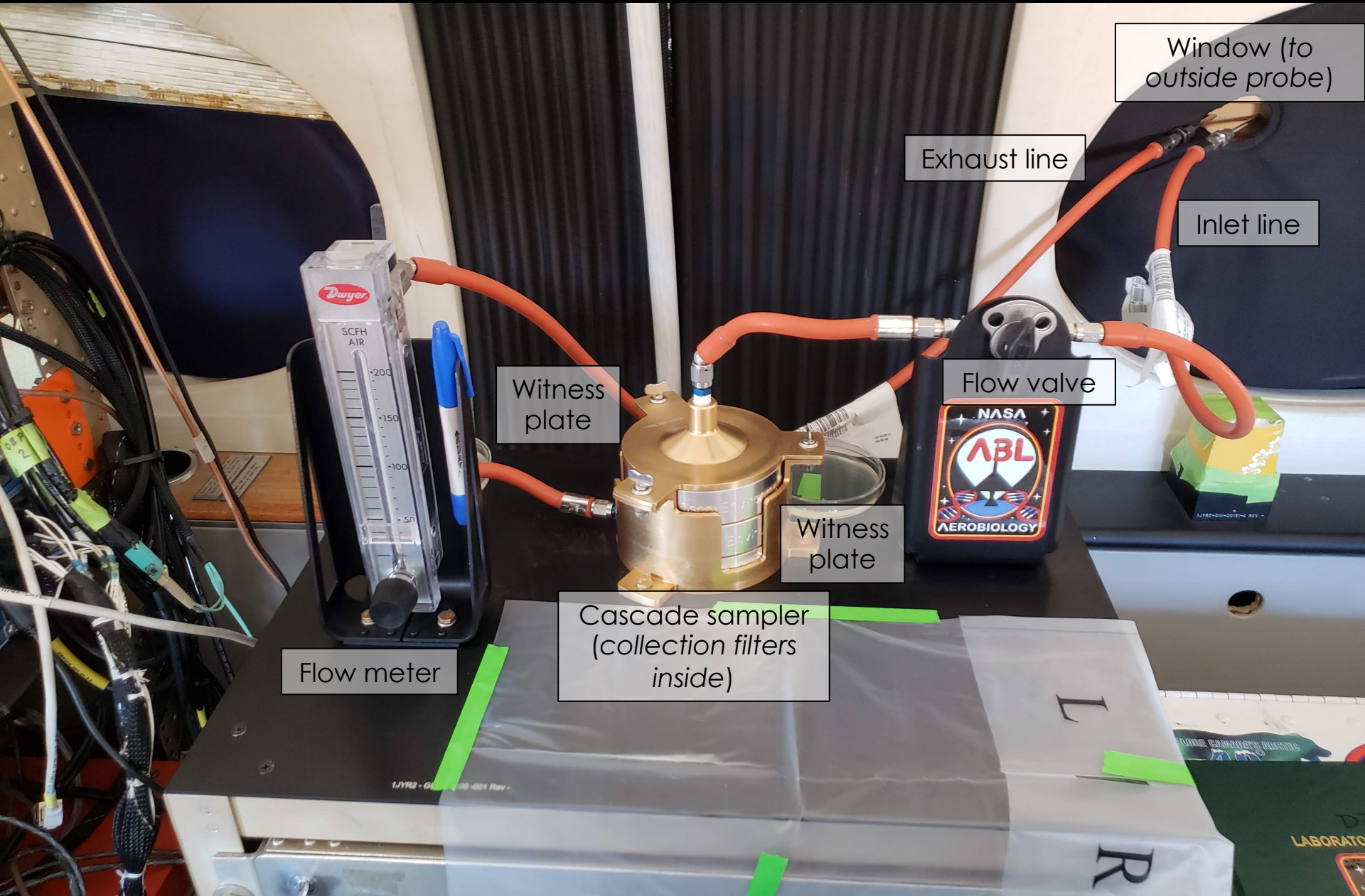
Courtesy of Goddard Scientific Visualization Studio (SVS) using CALIPSO data  
Yu et al. (2015)

# C-20A at NASA AFRC





# Inside the C-20A



Window (to outside probe)

Exhaust line

Inlet line

Flow valve

Witness plate

Witness plate

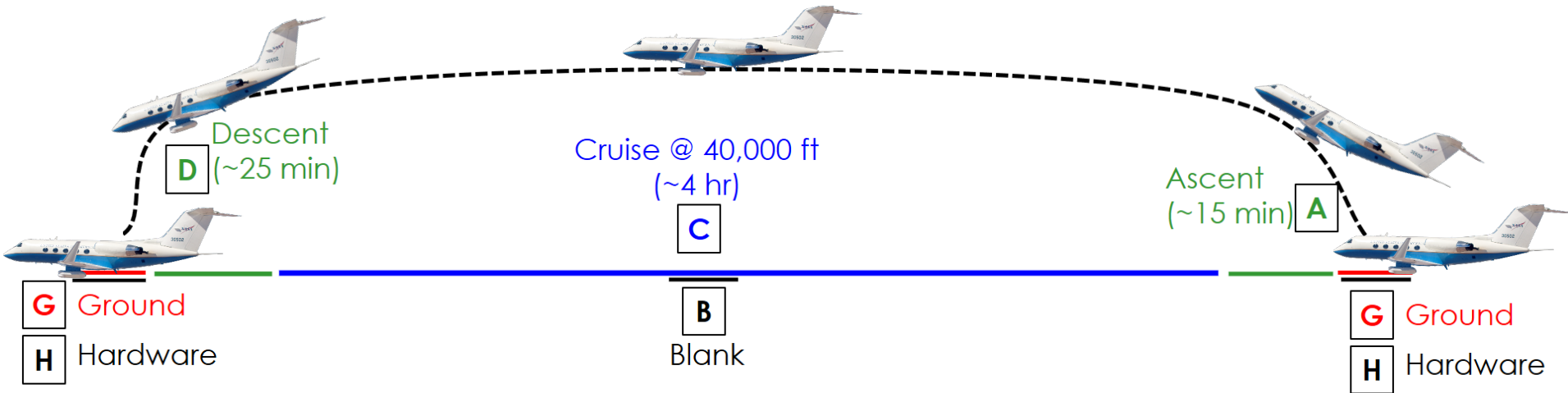
Cascade sampler  
(collection filters inside)

Flow meter

1/VR2 - 001 Rev -

LABORATO

# ABC-1: Experimental Design



**Ground (G)** – Exterior surfaces on C-20A upstream of probe. Swabbed before/after take-off & landing

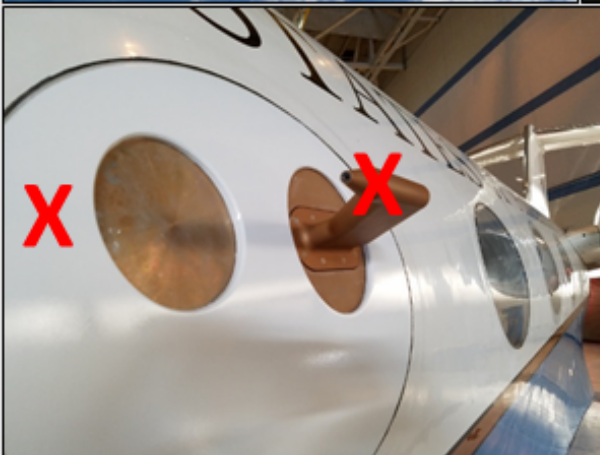
**Ascent (A) / Descent (D)** – Air collected from 1,000 ft above surface and up to tropopause (on ascent); reverse for descent. Ascent and Descent samples pooled.

**Cruise (C)** – Air collected at cruising altitudes in the lower stratosphere.

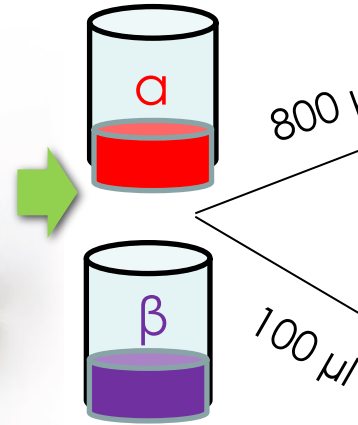
**Blank (B)** – Filters loaded/removed into sampler with plumbing lines closed.

**Hardware (H)** – Outside probe and window plate swabbed before/after flight.

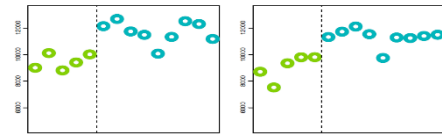
# ABC-1: Experimental Design



# Sample Processing

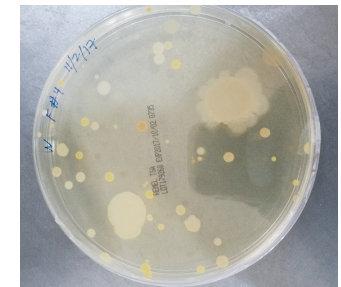


**16S (V4) DNA-based analysis**  
for identification & relative abundance



**Culture-based analysis**

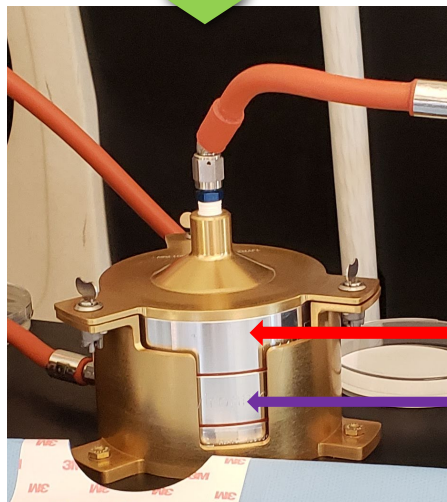
for identification with 16S (Sanger sequencing)



- ½ of each filter processed
- Samples concentrated into 1 mL tubes with Tris buffer

α = top stage (5.8 to 9 µm)

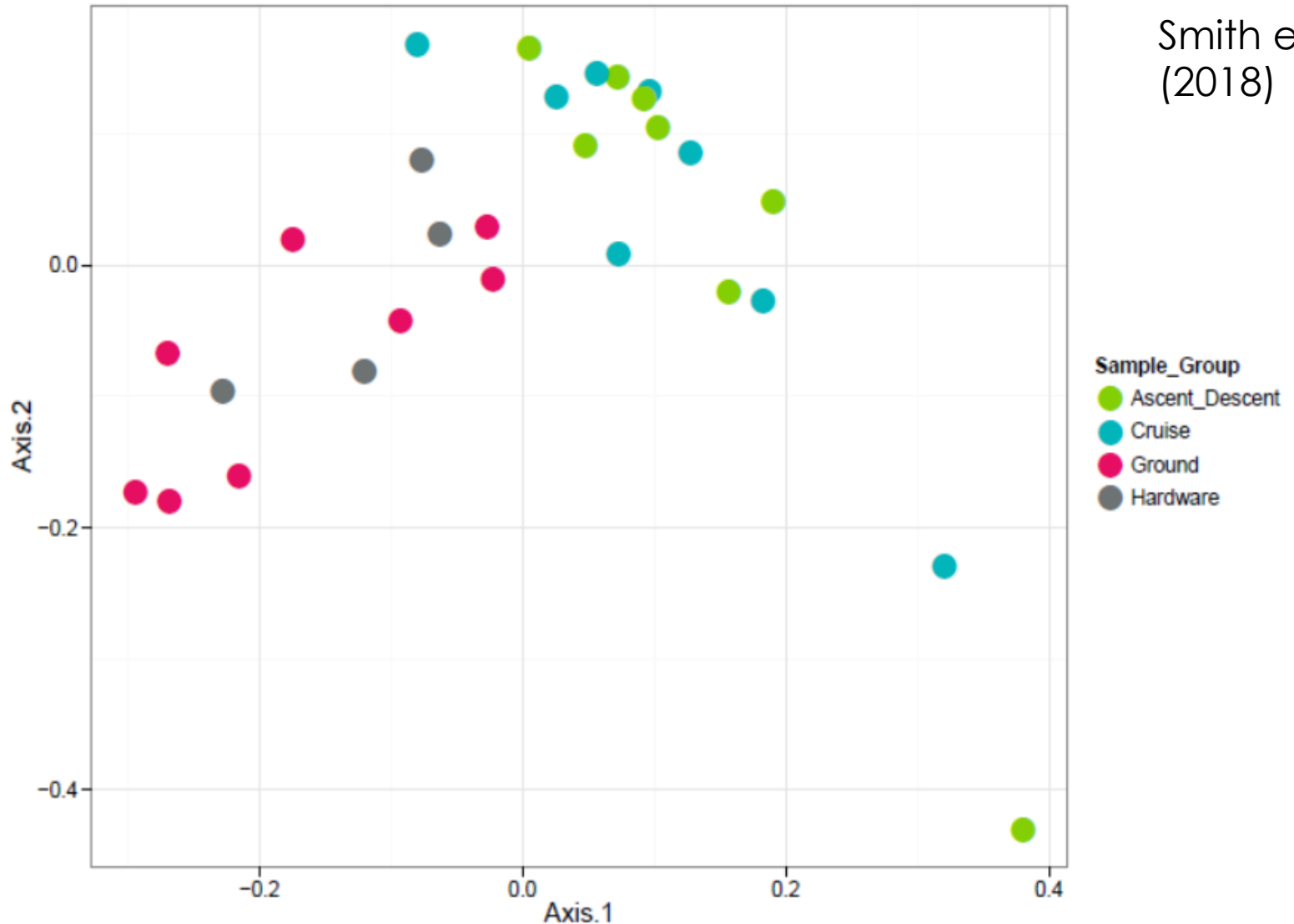
β = bottom stage (0.7 to 1.1 µm)



# Bacterial Diversity across Groups

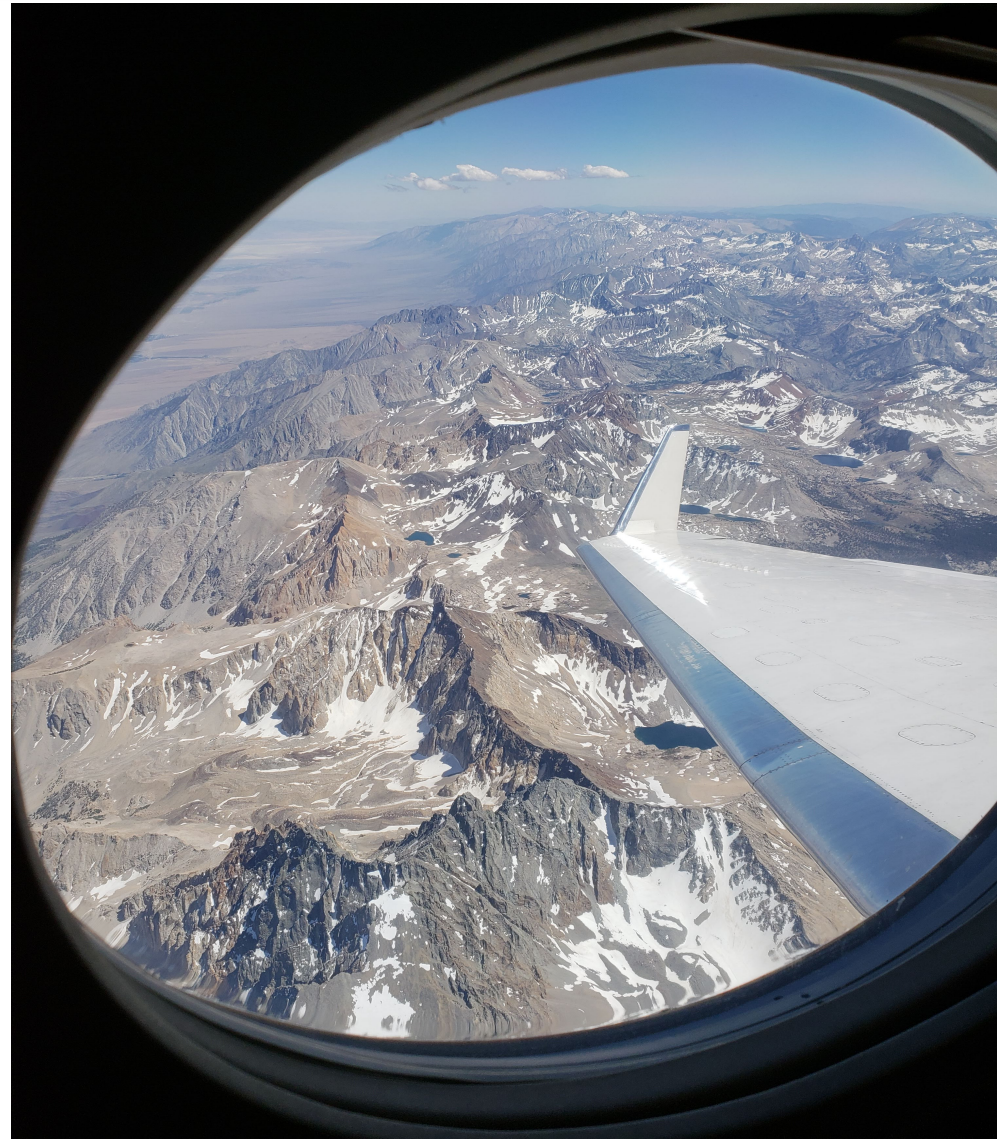
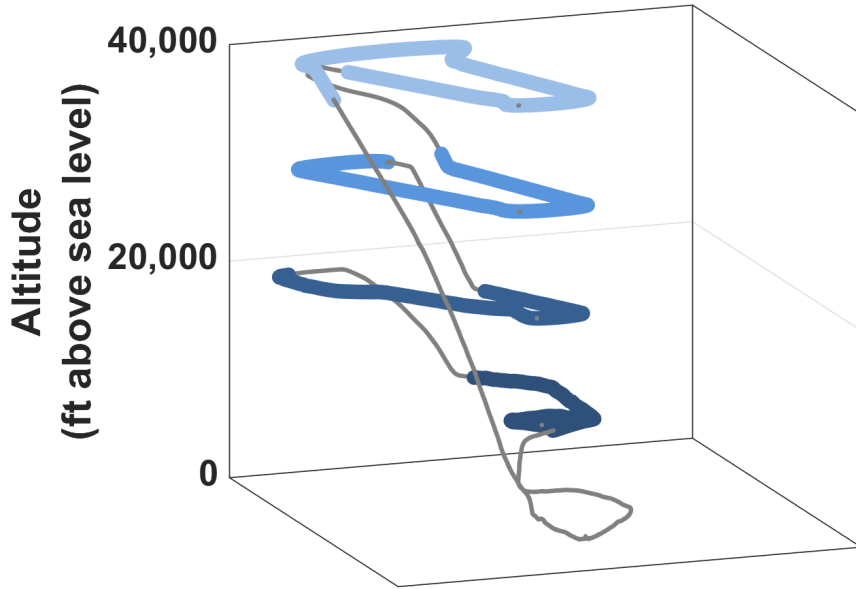


Smith et al.  
(2018)



An unweighted ordination (based on presence or absence) depicted non-significant but noticeable differences across groups using Jaccard distance ( $p$ -value = 0.097). 13

# Next Missions (ABC-2)



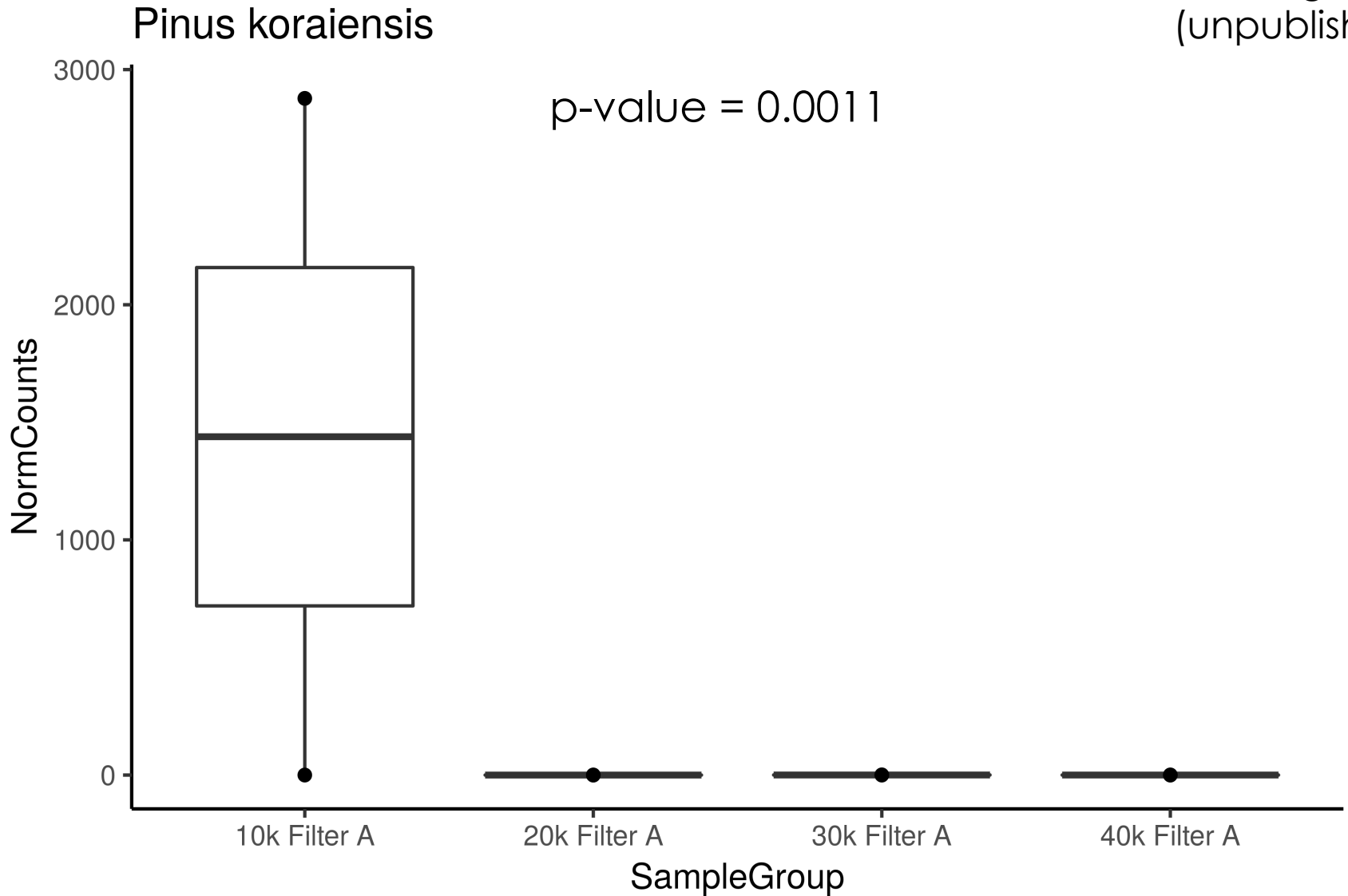
June 20, 2018  
June 21, 2018

Jaing et al. (unpublished)

# ABC-2: Species Standouts



Jaing et al.  
(unpublished)



# Acknowledgements



## Funding Sources

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## Co-Authors & Collaborators

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