

In Situ Measurements Of Stratospheric Aerosol Size Distributions During The Post Pinatubo Period And In Preparation For The Next Major Volcanic Eruption.

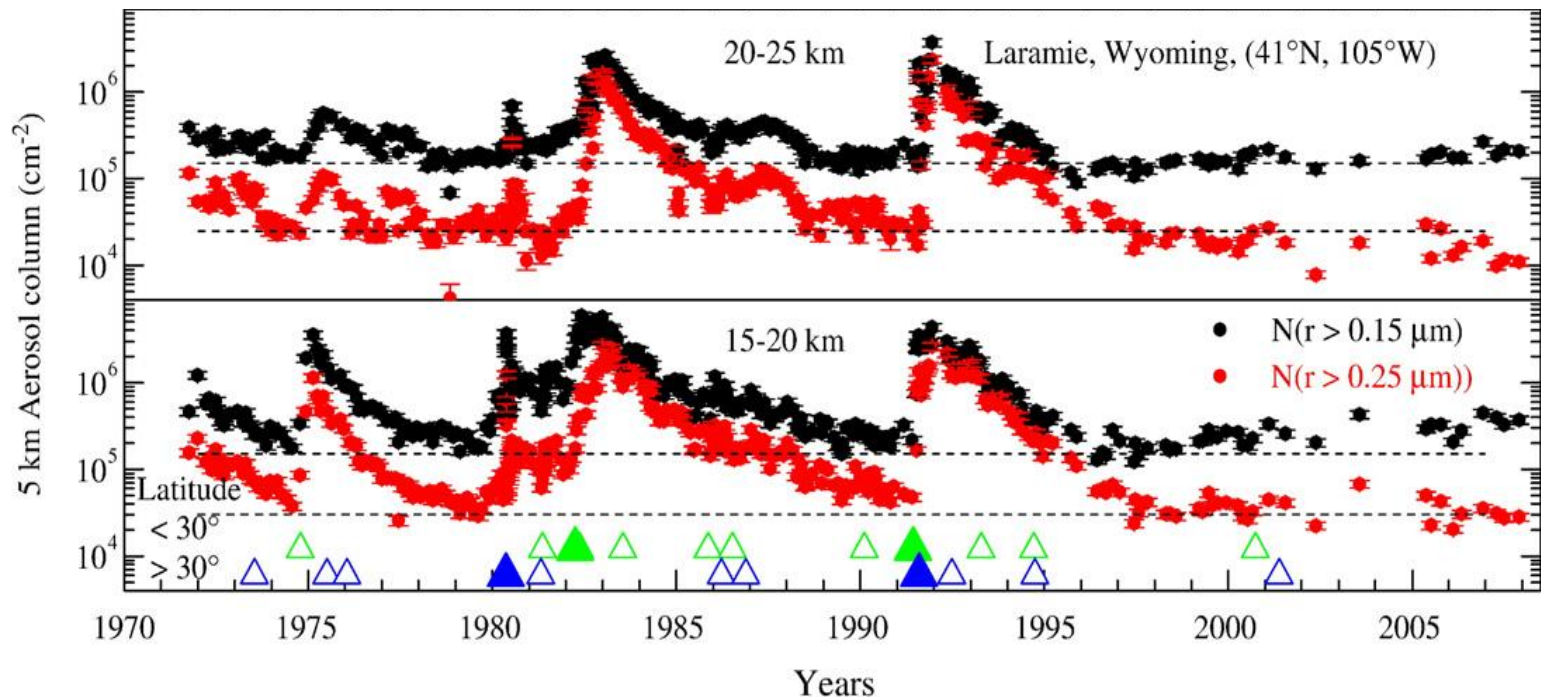
Lars Kalnajs and Terry Deshler

*Laboratory of Atmospheric and Space Physics, University of
Colorado at Boulder*

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Award #1619632

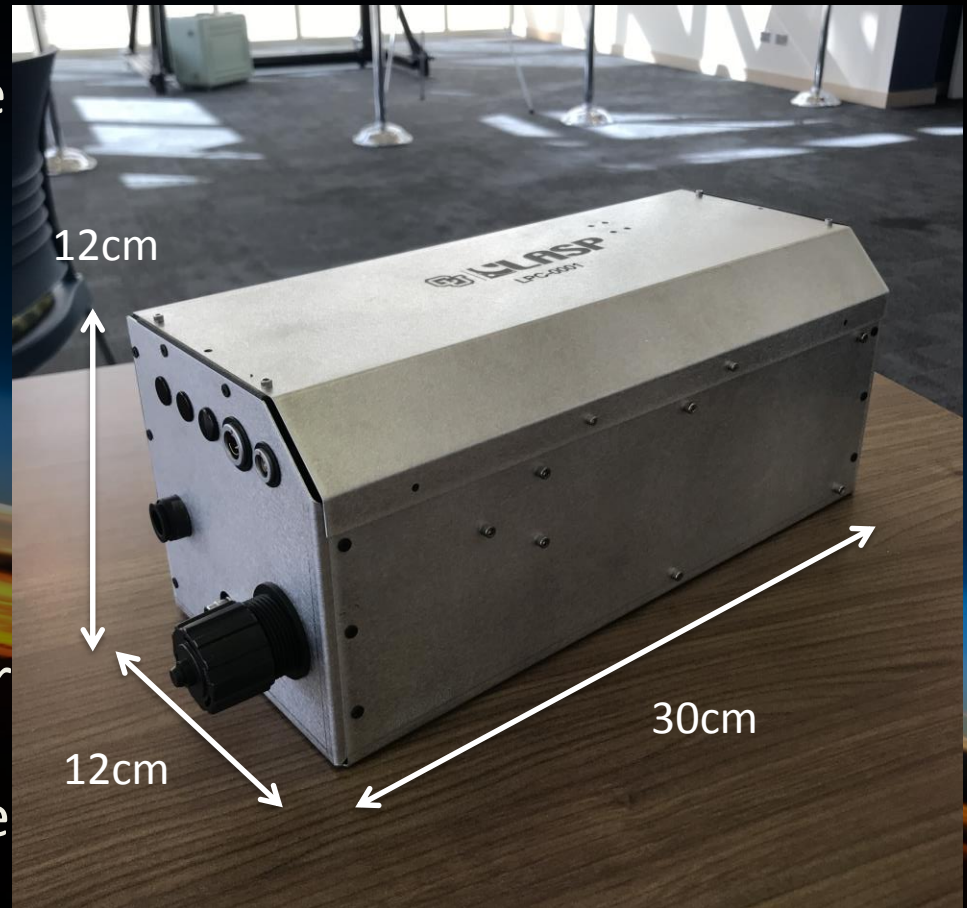
47 Year *In Situ* Record of Stratospheric Aerosols



Deshler et al., 2008

A new Generation of *In Situ* Instruments

- Developed a new generation of balloon borne Optical Particle Counters and Condensation Particle (CPC or CN) Counters at LASP / U. Colorado
- Building on the WY heritage, same measurement principles
- New technologies for higher performance in a smaller, lighter and cheaper package



Instrument Specifications

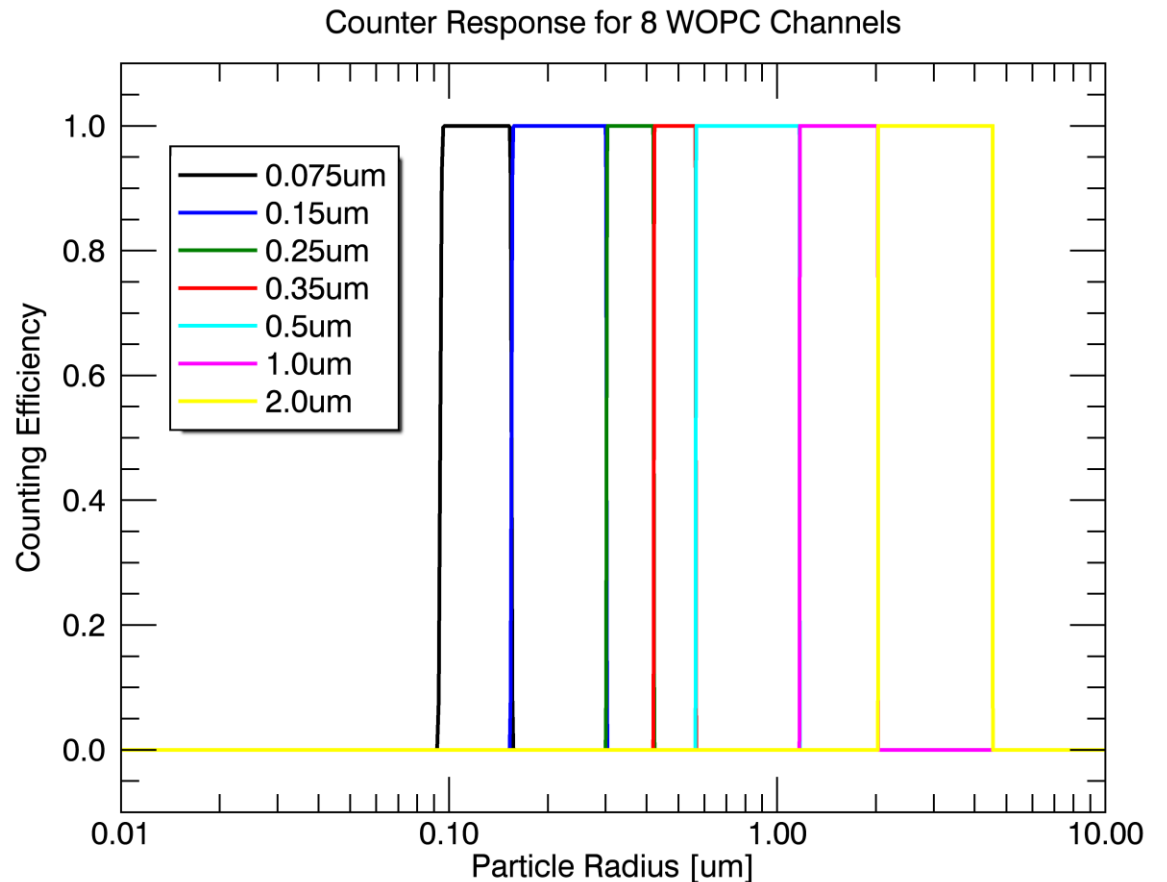
Optical Particle Counter

| | |
|--------------------------------|--|
| Size Range (radius) | 0.125 – 10μm |
| Size Bins | 2048 Raw, 1000 Effective, 16 – 100 reported |
| Flow Rate | 15 LPM (250 cm³ per sample at 0.5Hz) |
| Concentration Range | 10⁻³ – 10³ cm⁻³ (at 0.1Hz) |
| Dimensions | 30cm x 12cm x 12cm |
| Mass | 2.4Kg (including battery) |
| Cost | ~\$5K (component cost) |

Condensation Particle Counter

| | |
|-----------------------------|--|
| Minimum diameter | > 0.01μm |
| Flow Rate | 1 LPM (33 cm³ per sample at 0.5Hz) |
| Sensitivity | 10⁻² – 10³ cm⁻³ (at 0.1Hz) |
| Dimensions | 40cm x 10cm x 18cm |
| Operation Time | 4 hours |
| Mass | 2.5Kg (including battery) |
| Cost | ~\$4K (component cost) |

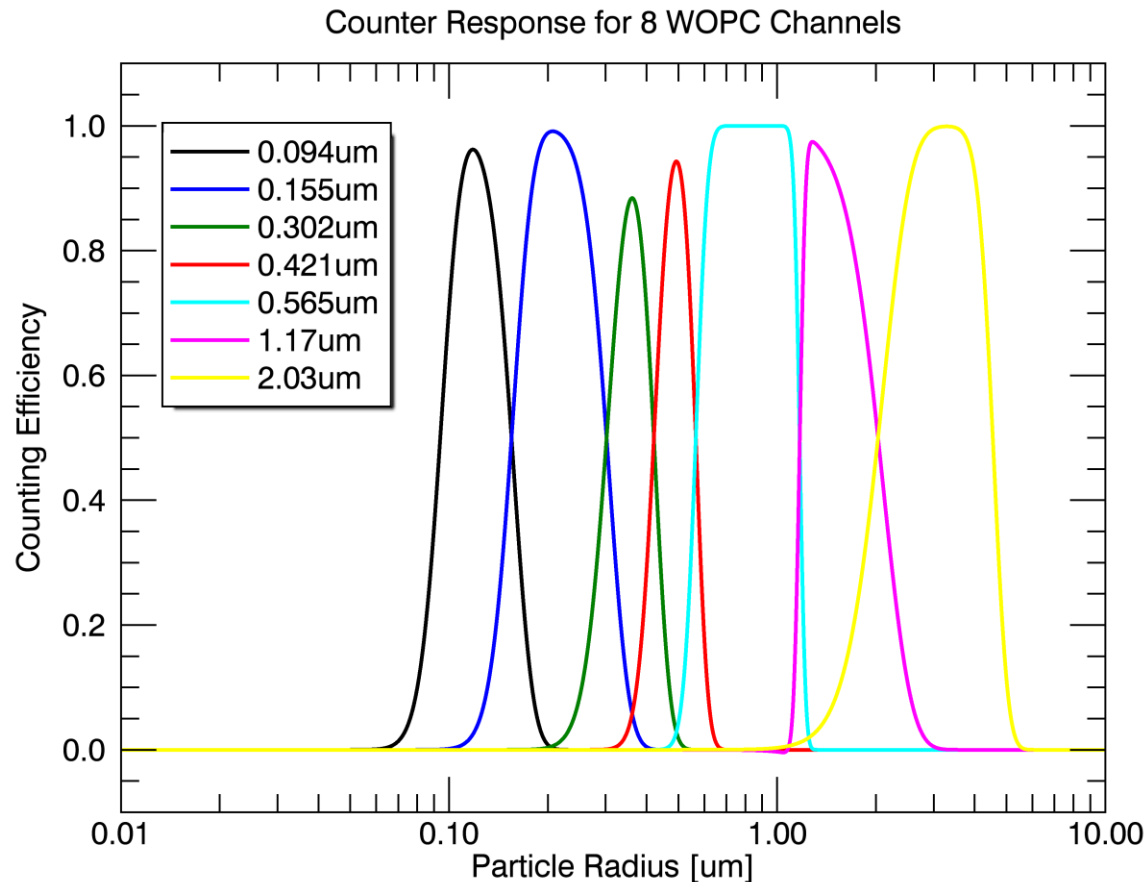
Recent Improvements to the Wyoming Data Set



Pre-2017 Model

AGU Chapman Meeting March 2018

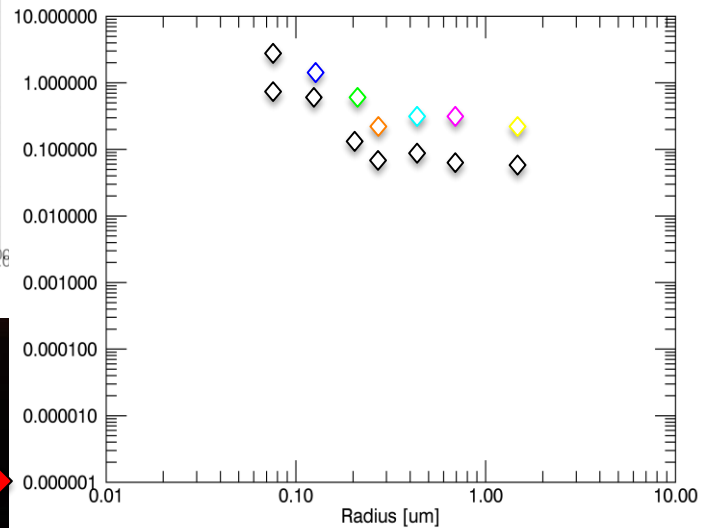
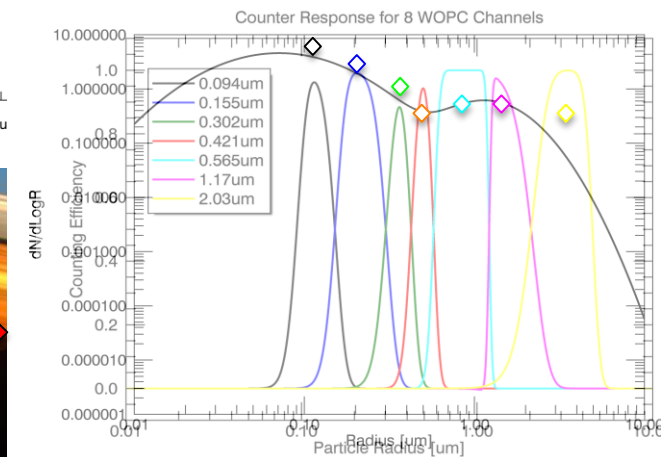
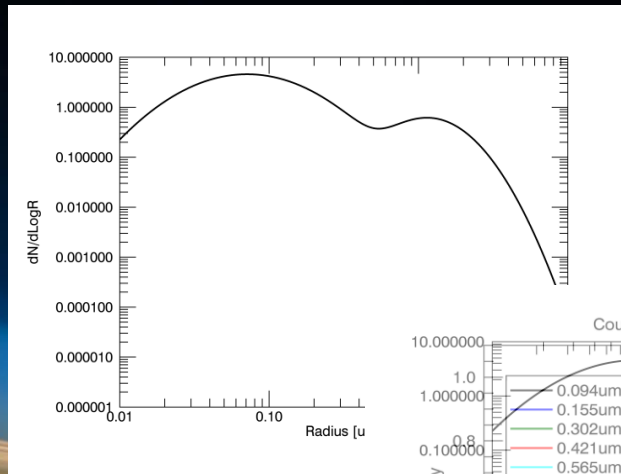
Recent Improvements to the Wyoming Data Set



Post 2017 Model

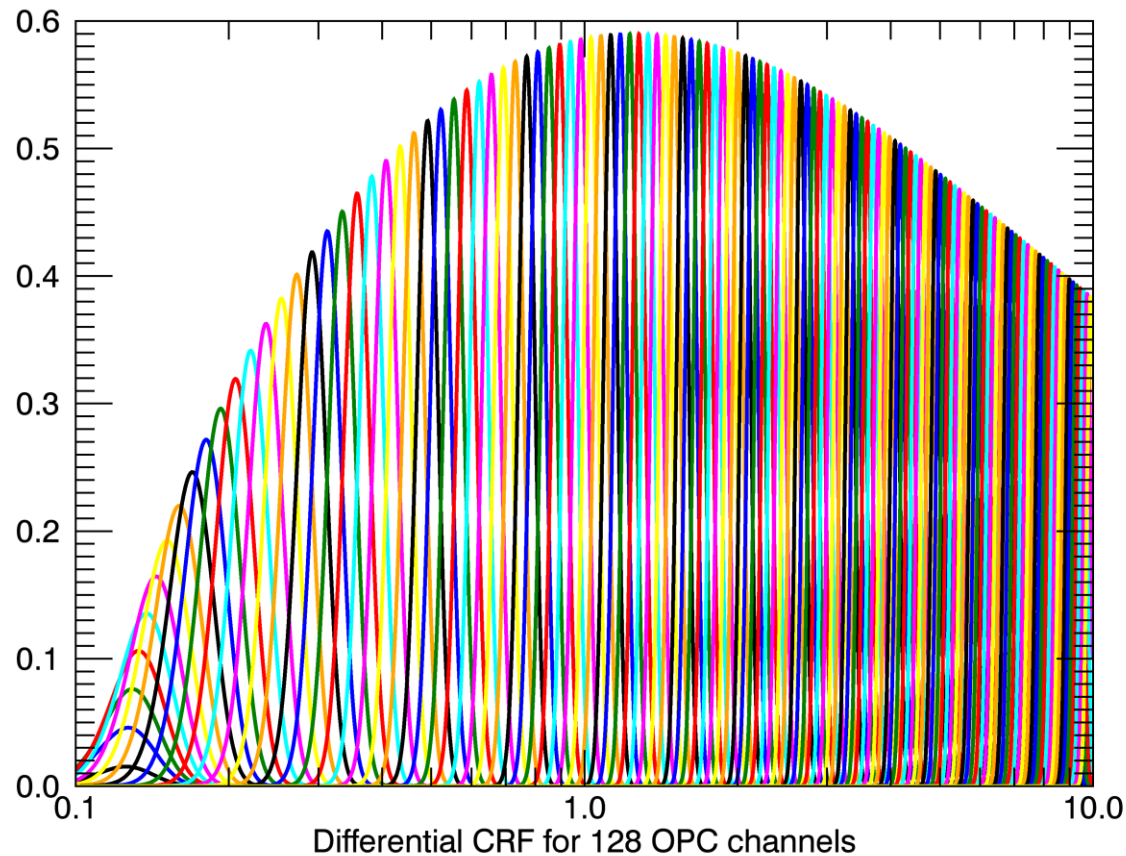
AGU Chapman Meeting March 2018

Inverse Model Solution



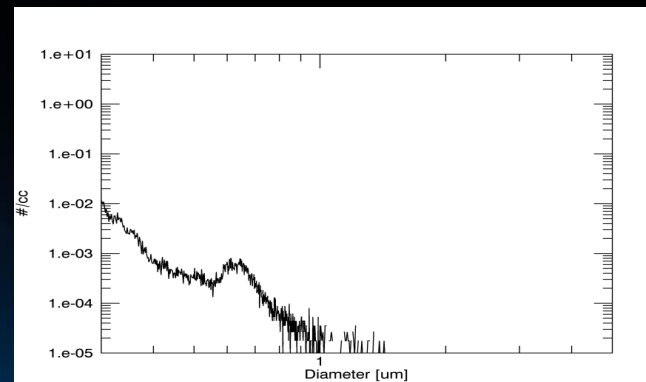
See: Terry's Poster
Deshler et al., 2018 (soon)
For more details

High Resolution Direct Digitizing OPC

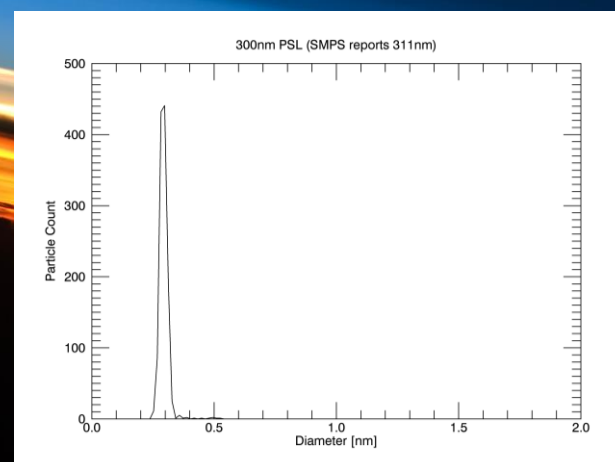


Advantages of Direct Digitization Approach

- Direct measurement of size distribution – no need for an iterative approach
- Not limited to unimodal/bimodal log normal size distribution (although we will still provide these).
- Far simpler calibration
- More versatile – can re-bin data in post flight processing.



Example 'raw' number density distribution from lower stratosphere.



Laboratory response to 300nm calibration particles.

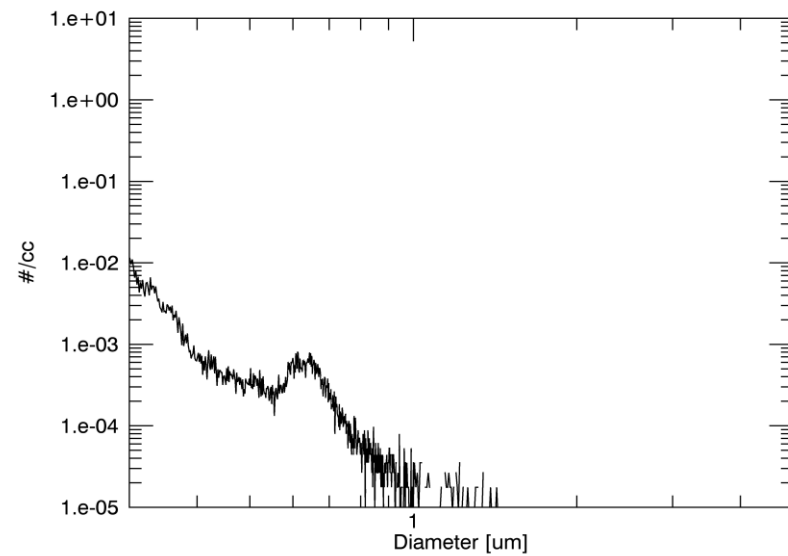
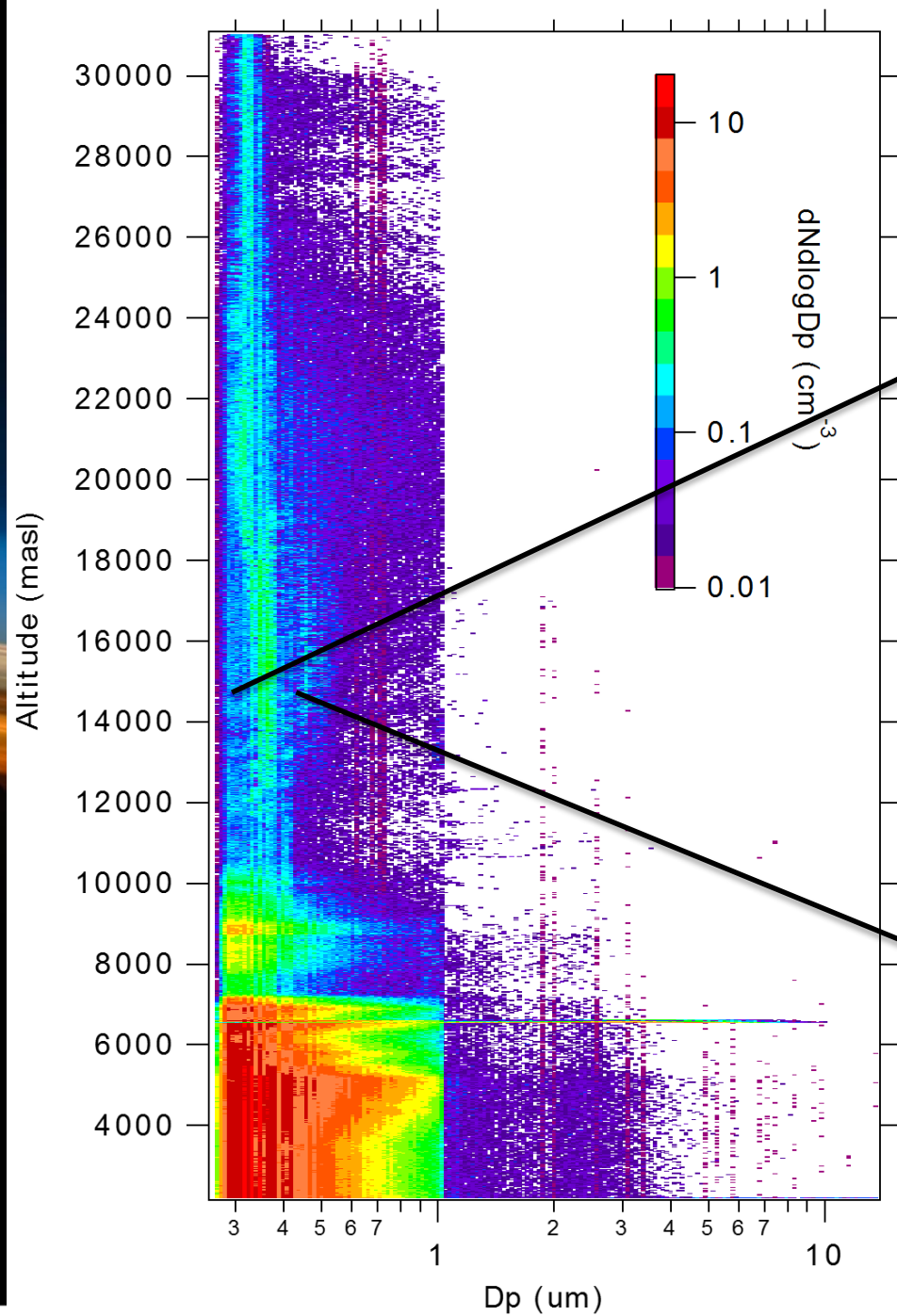


Figure Courtesy of
Doug Goetz

March 2018

Instruments for Volcanic Response

- Immediately following a volcanic event, balloons provide the only in situ measurement option.
- Low cost – can afford to launch without the possibility of recovery.
- Lightweight – OPC and CPC are below 2.5kg –can be launched on a ‘weather balloon’ without special ICAO/ATC coordination and clearance.
- Iridium satellite telemetry option – transmit reduced data without ground based receiving station.
- Currently could respond to an eruption within 6 weeks, hope to shorten response to weeks.

Extra Slides



<https://www.gettyimages.es/>