

Variability of Ice Supersaturation, Nucleation, and Cirrus in TTL Vertical Layers

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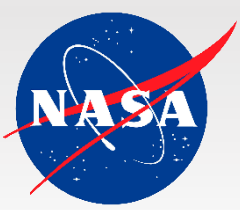
²*NASA Ames Research Center, Mountain View, CA, USA*

³*Science Systems and Applications Inc., Hampton, VA, USA*

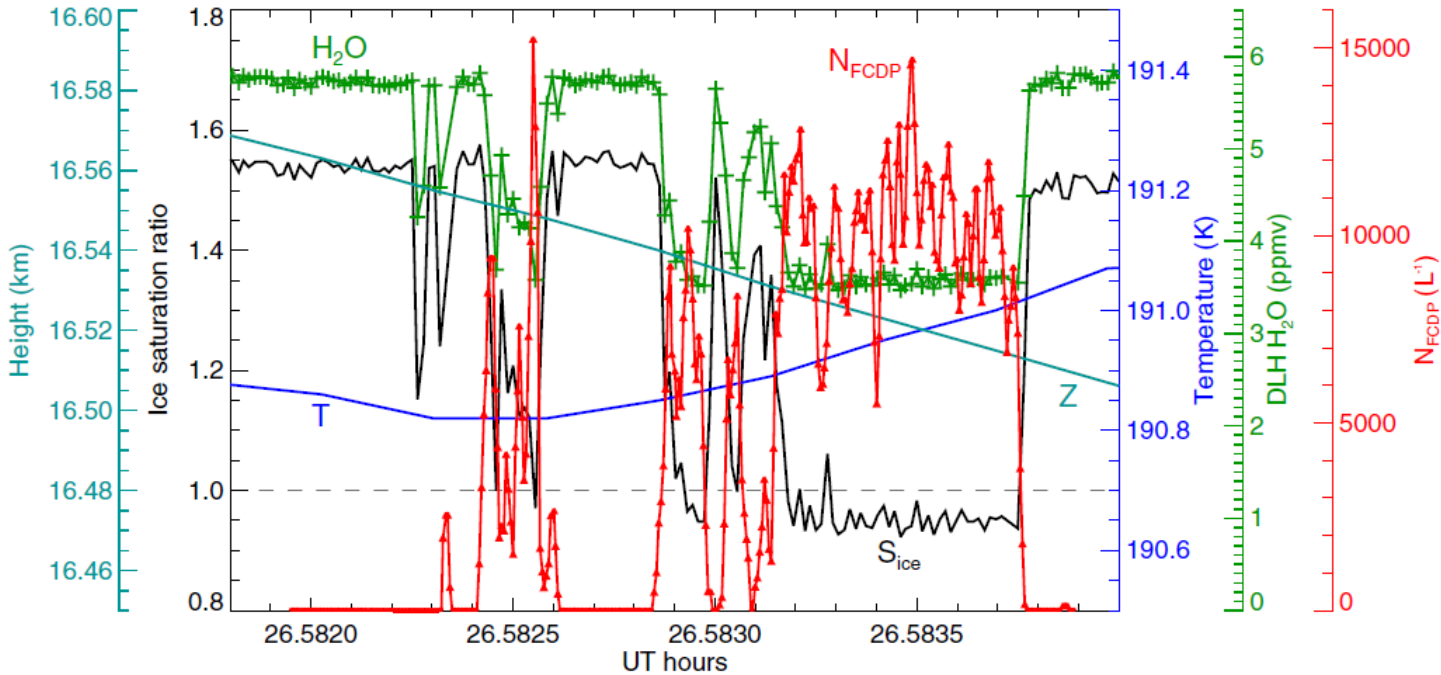
⁴*SPEC Inc., Boulder, CO, USA*

⁵*NOAA Earth Systems Research Laboratory, Boulder, CO, USA*

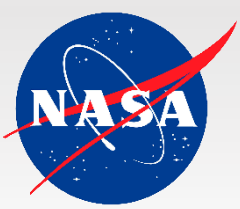
⁶*Cooperative Institute for Research in Environmental Sciences, Boulder, CO, USA*



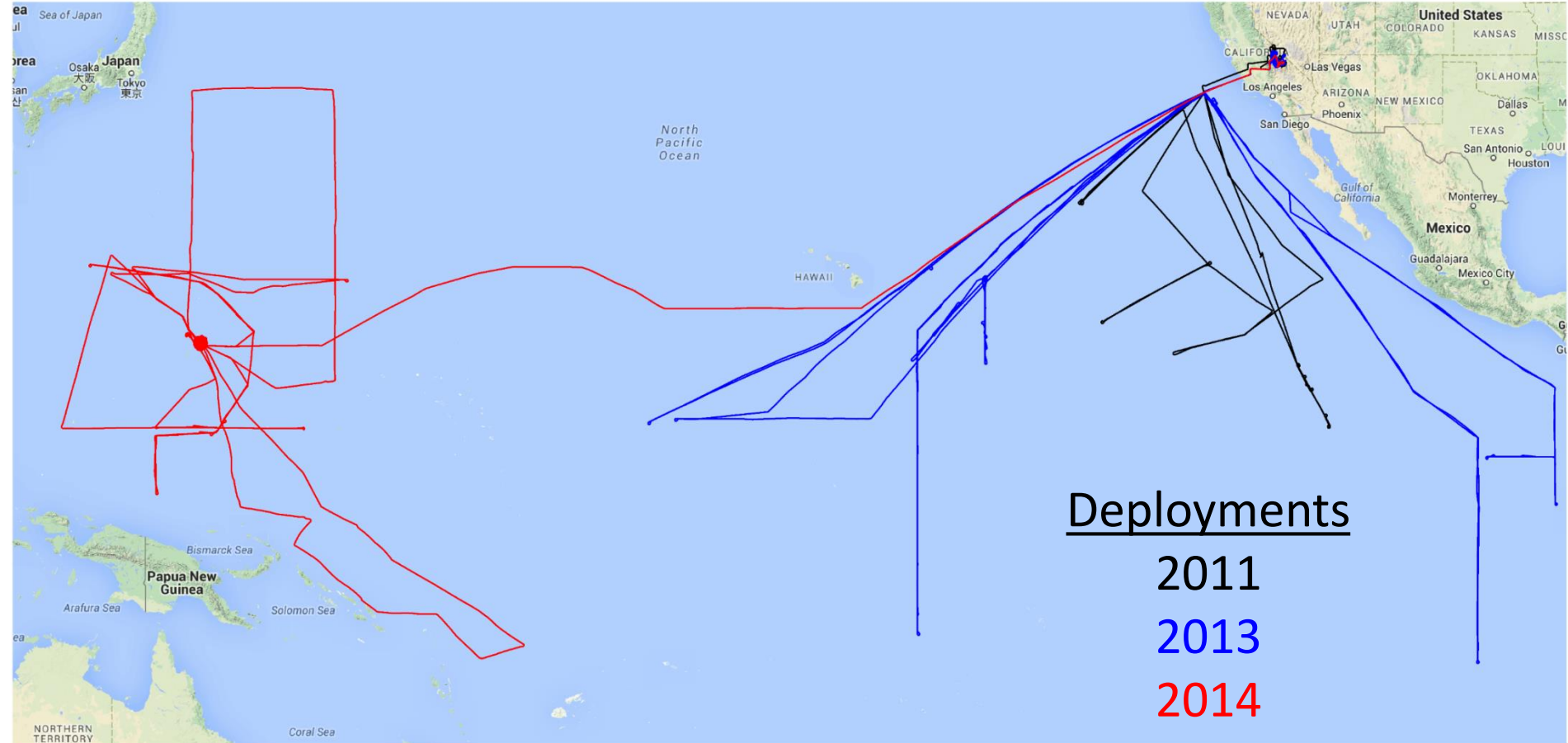
Motivation

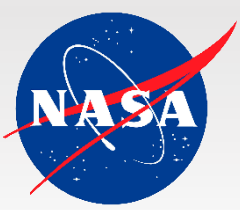


- Jensen et al. (2013) reported dehydrated layers only meters thick
- Layers corresponded to high ice particle concentrations
- Later ATTREX campaigns give chance to examine how common these layers are in the TTL



ATTREX

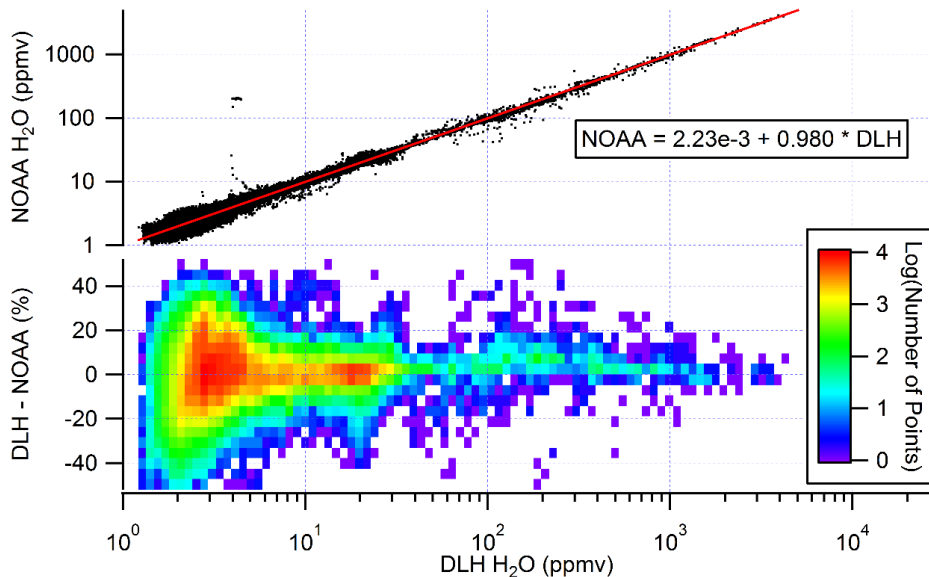
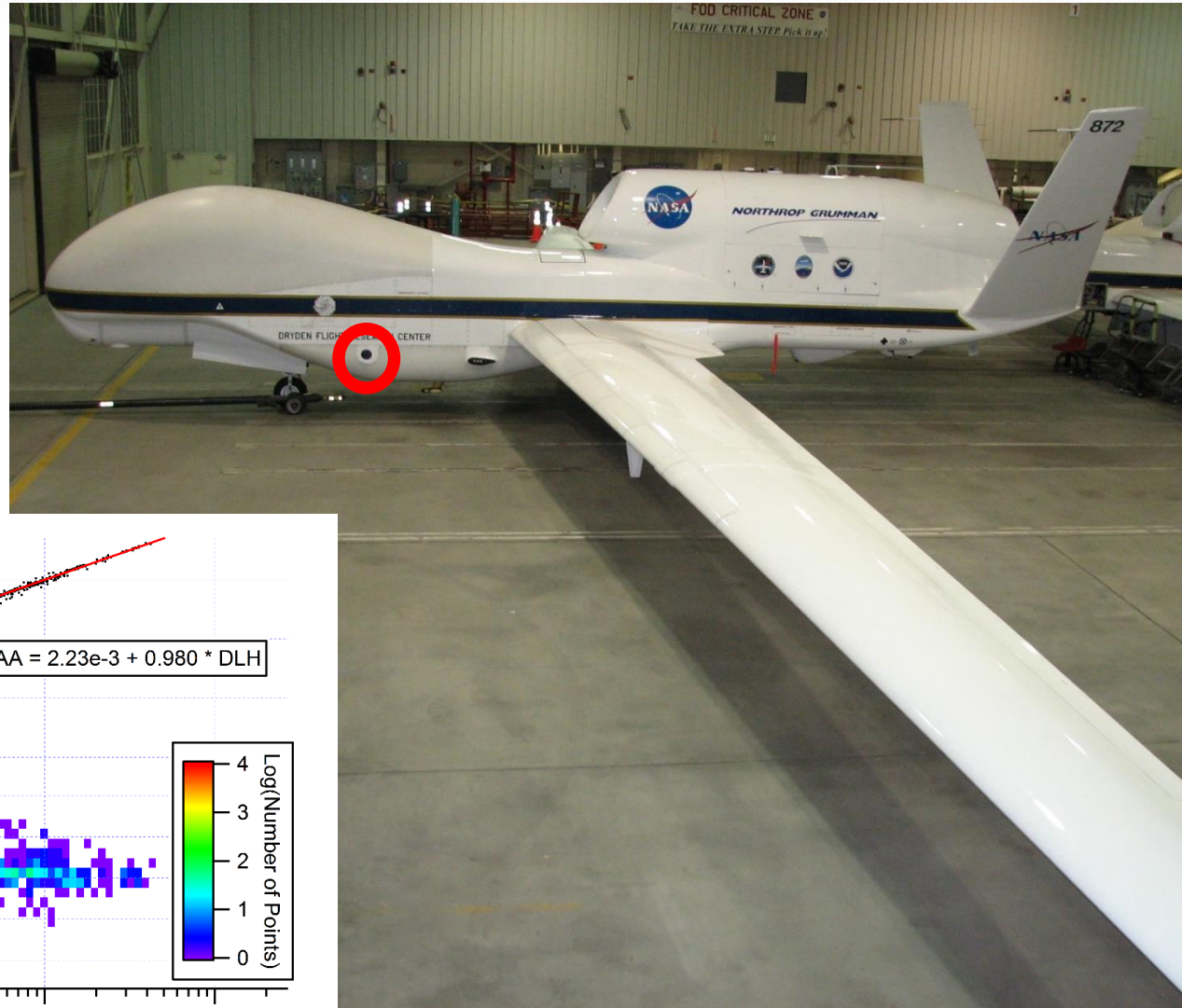


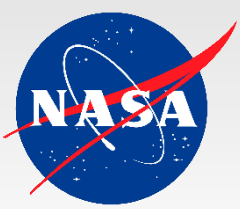


Diode Laser Hygrometer



- Participated in ATTREX 1, 2, & 3
- Open-path measurement
- 100 Hz sampling
- < 1 m vertical res.

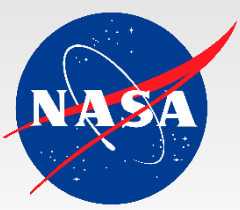




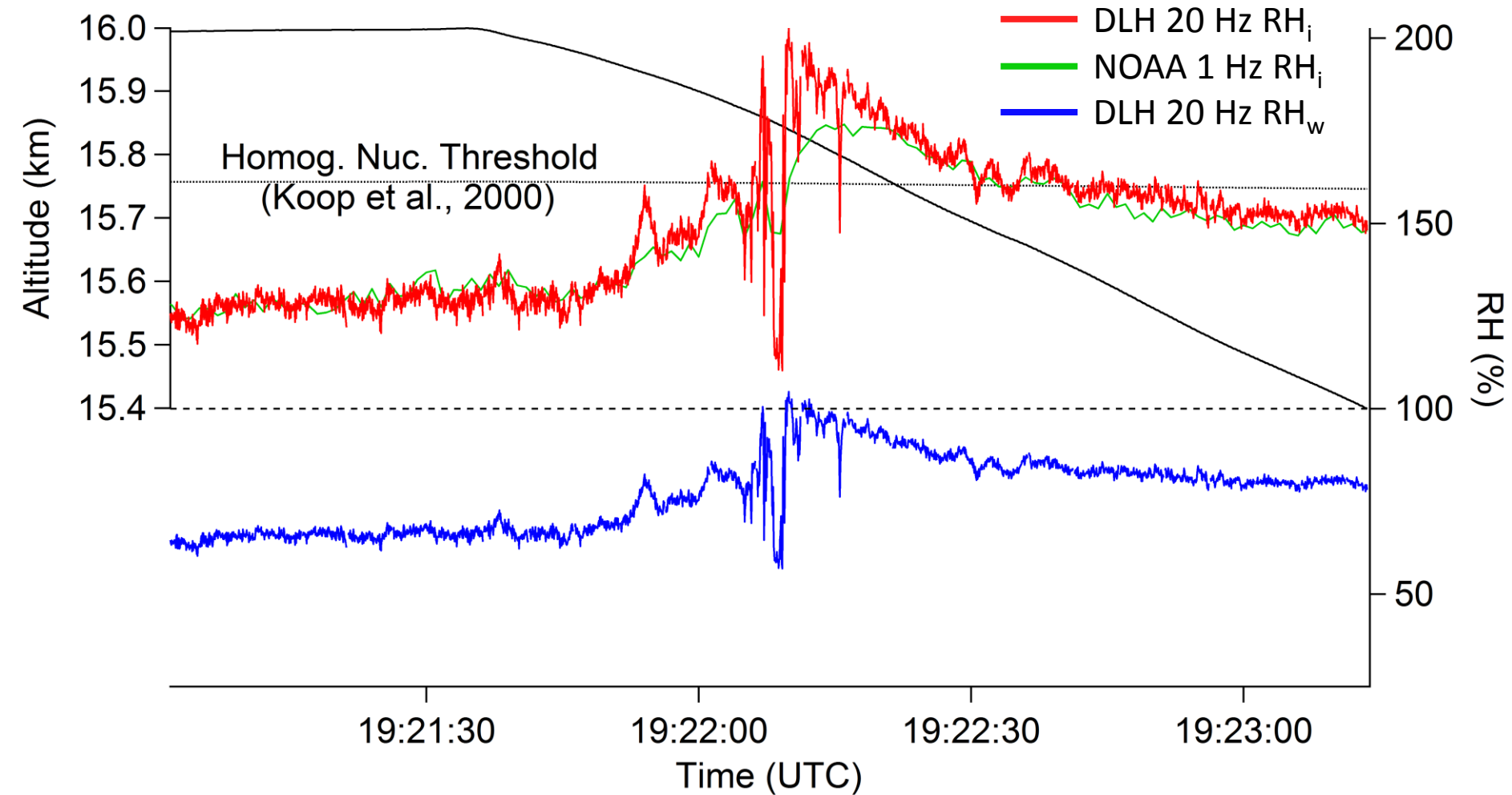
Outline

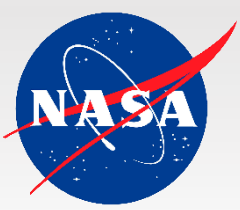


- Case Study: 16 February 2014
- Case Study: 09 March 2014
- Thin Layer Distribution and Statistics

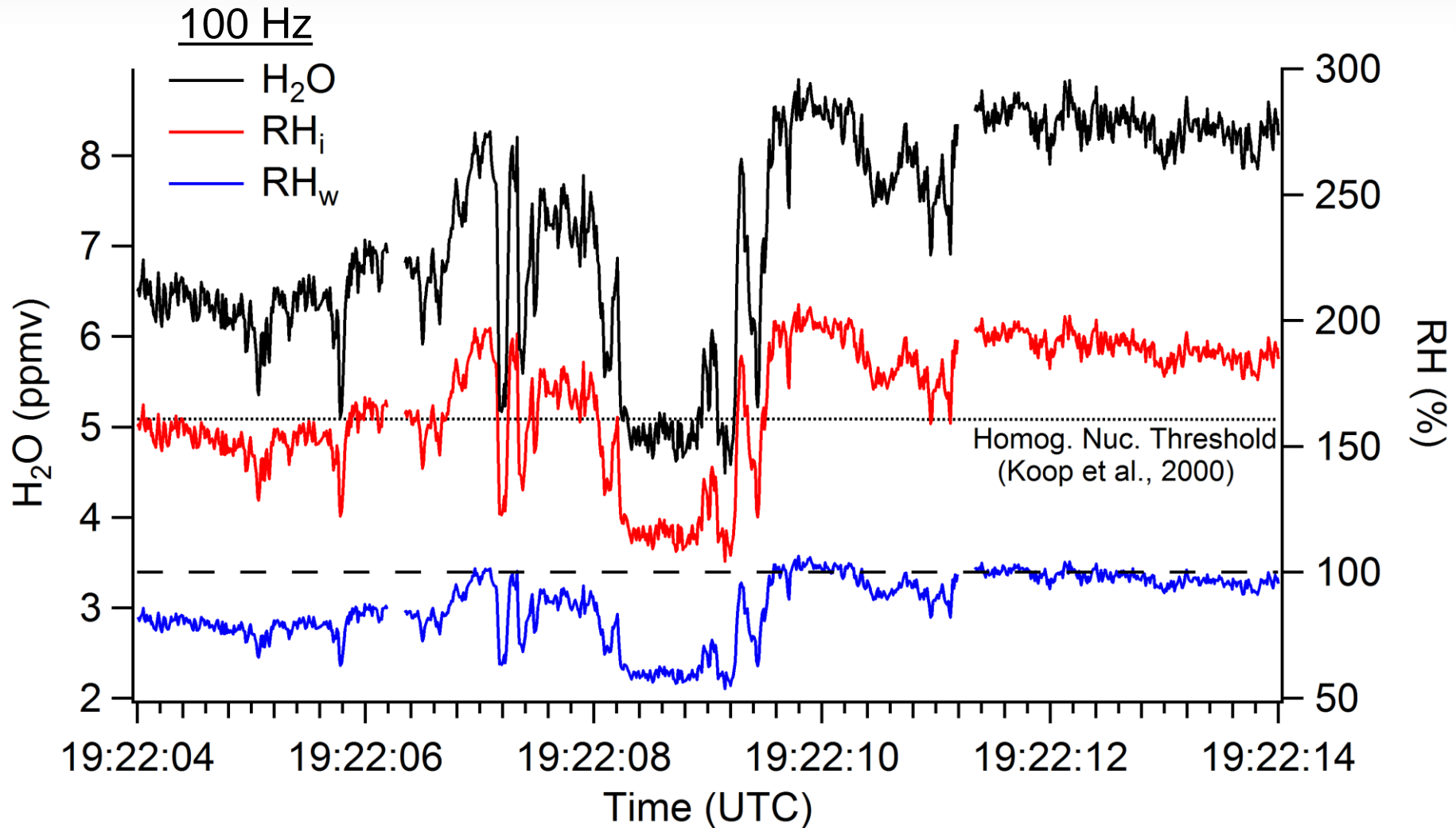


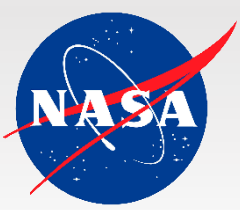
Case Study: 16 Feb 2014



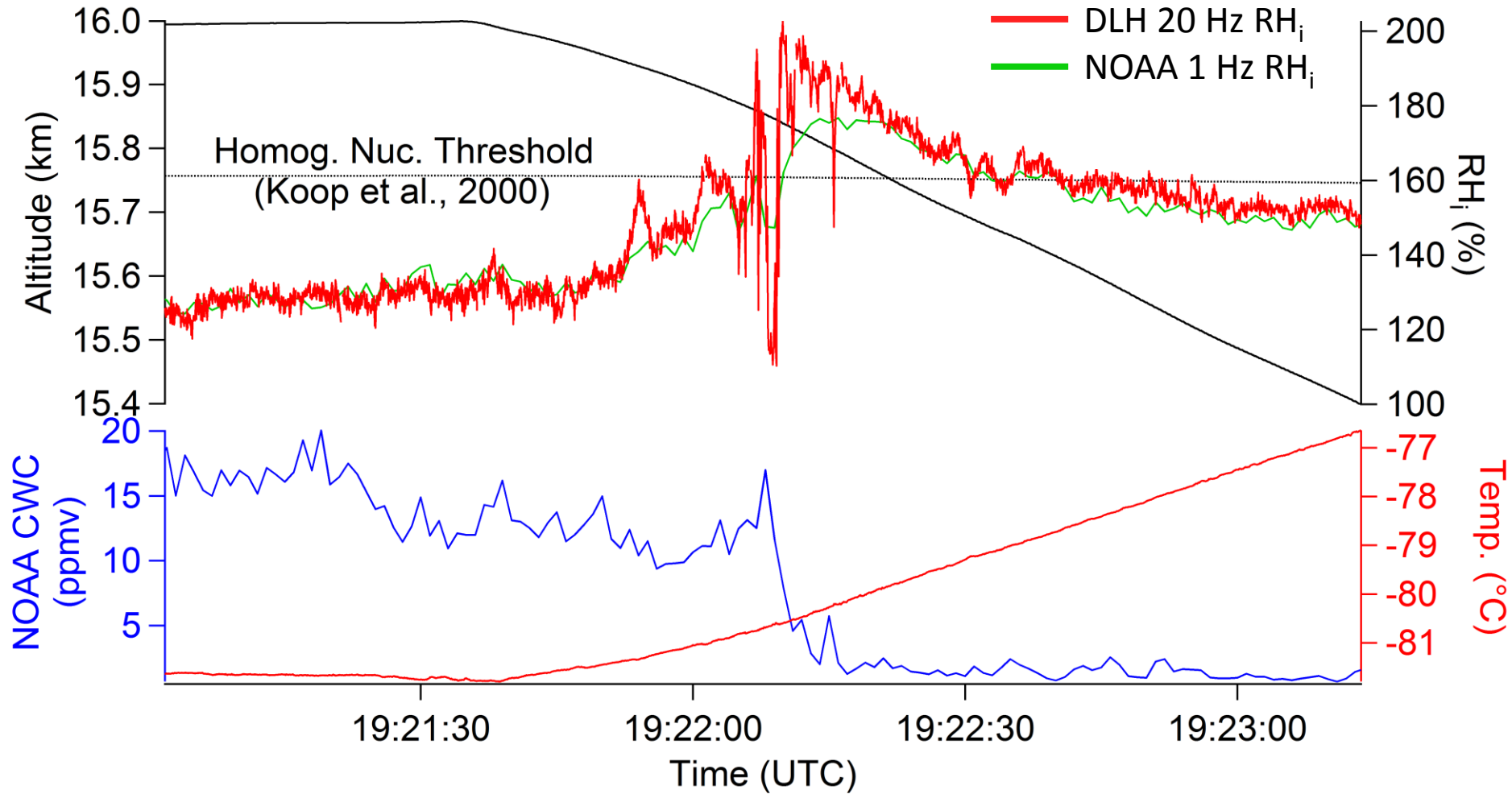


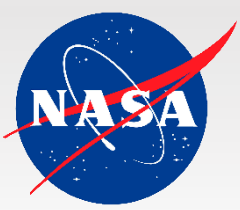
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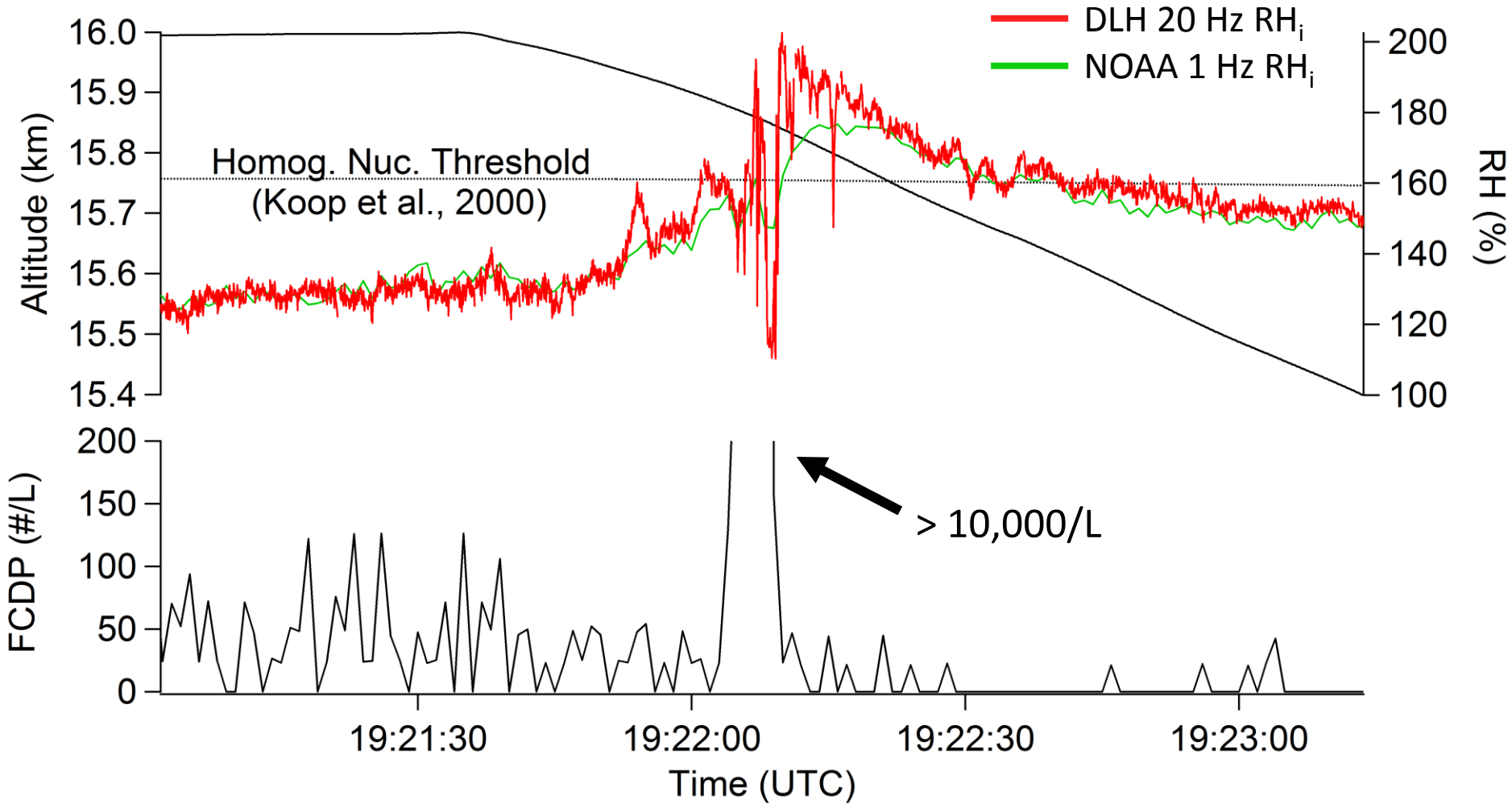


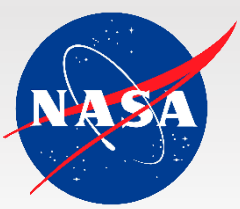
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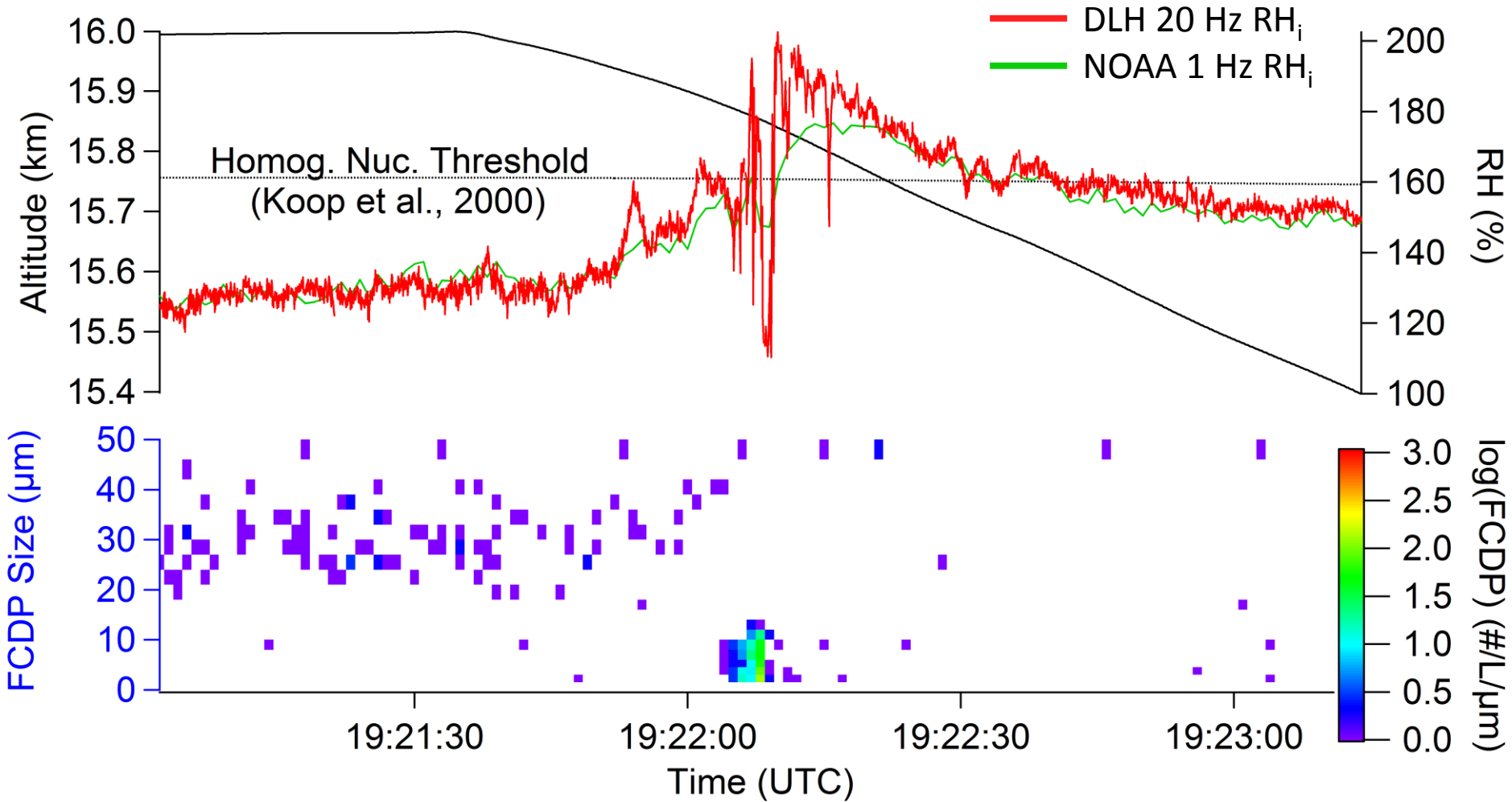


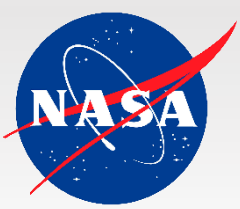
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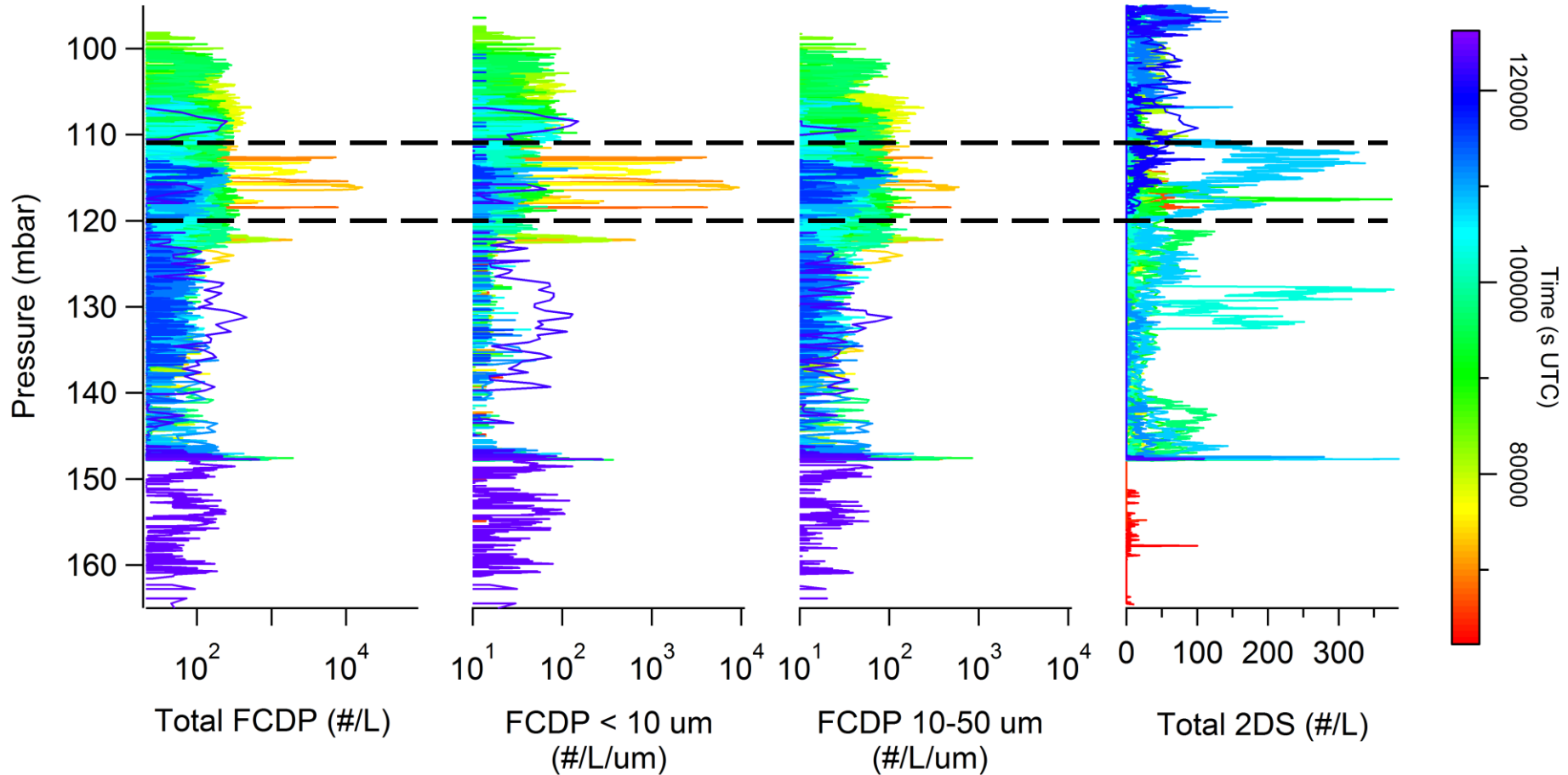


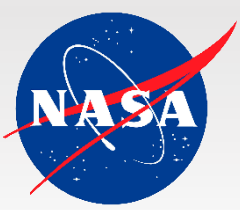
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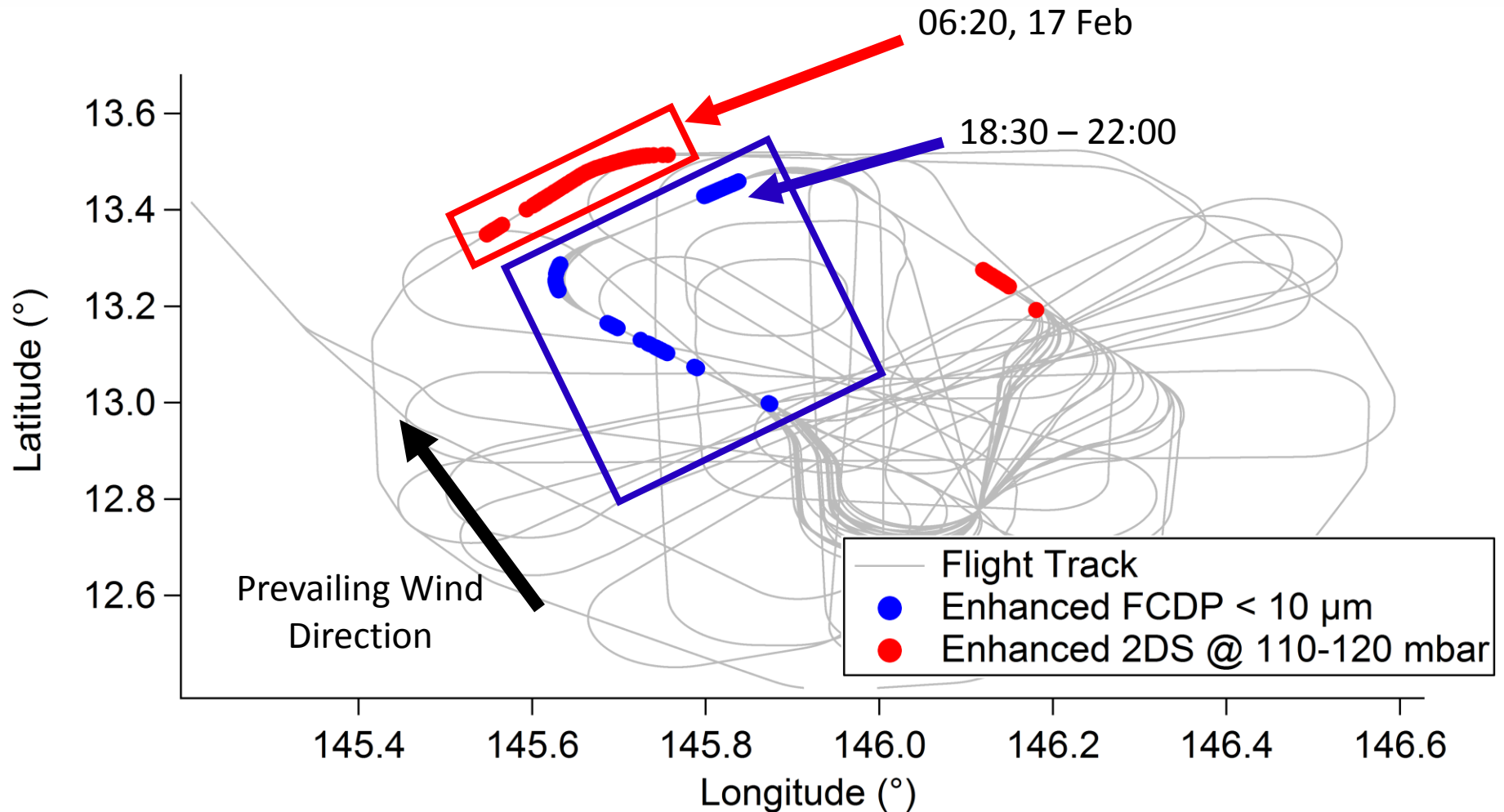


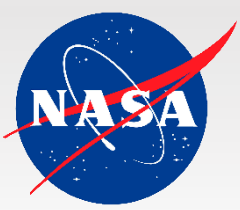
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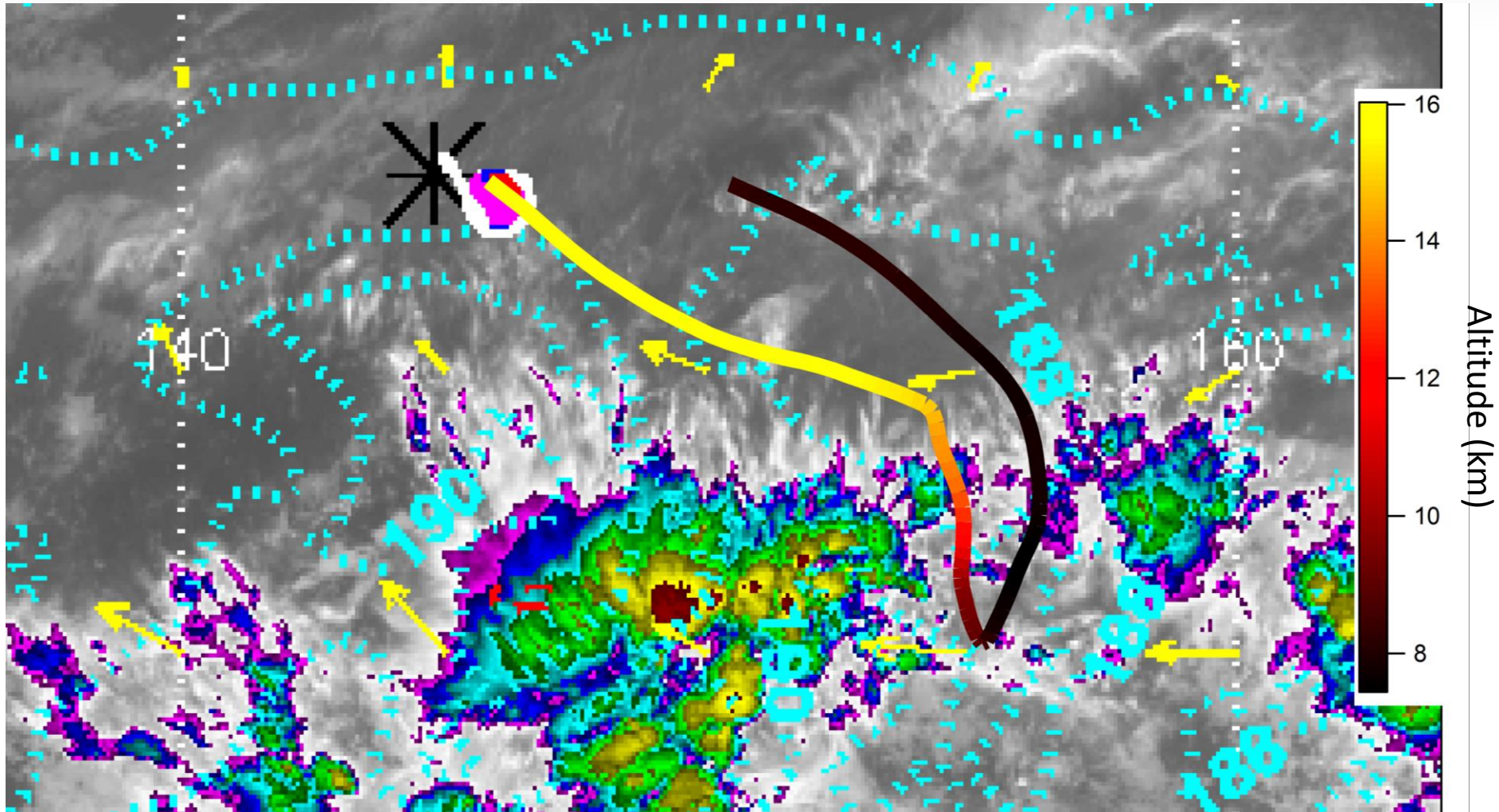


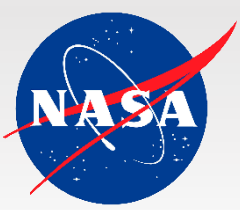
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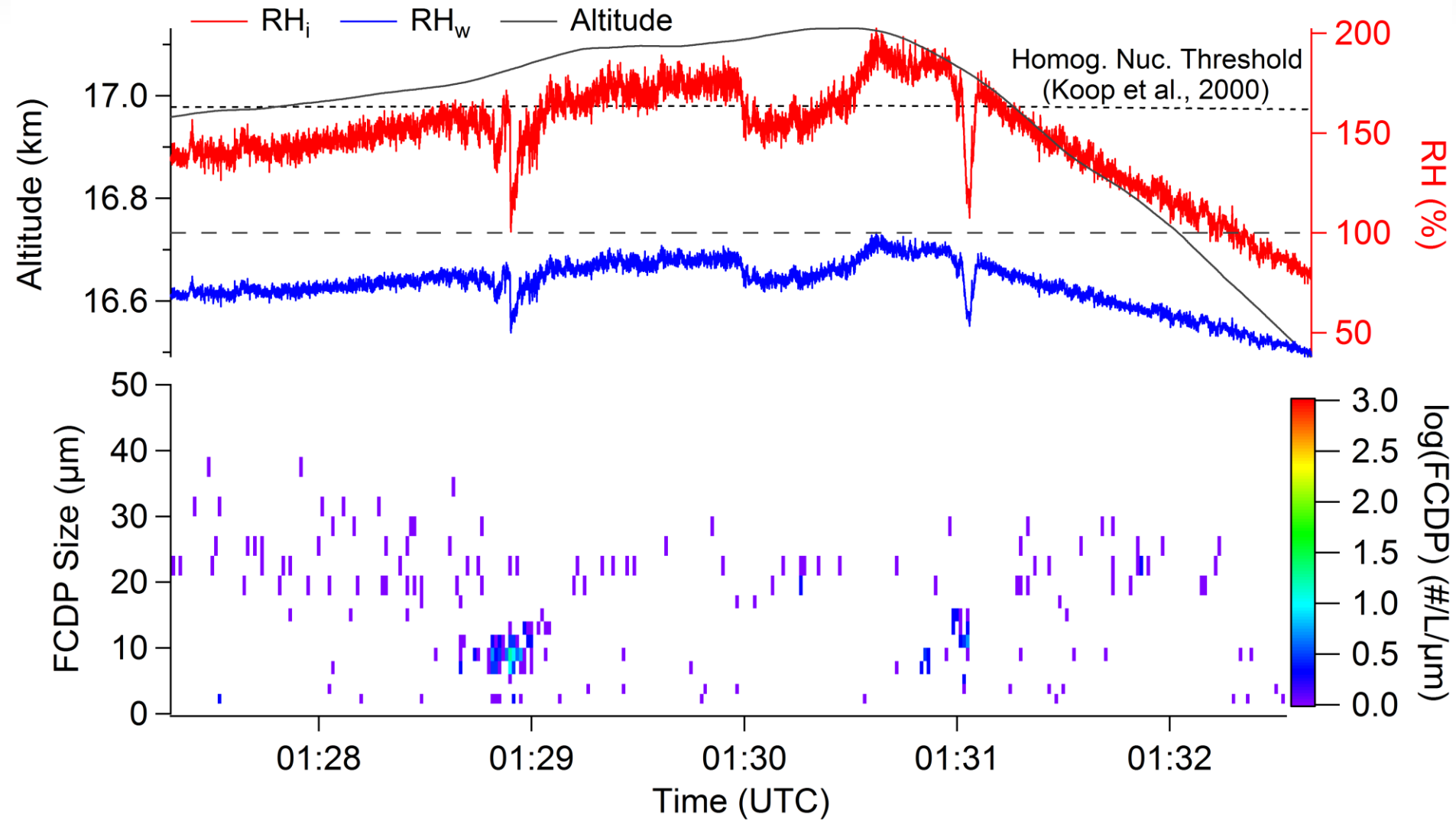


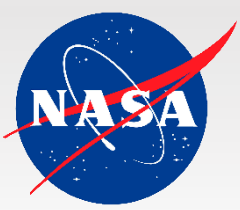
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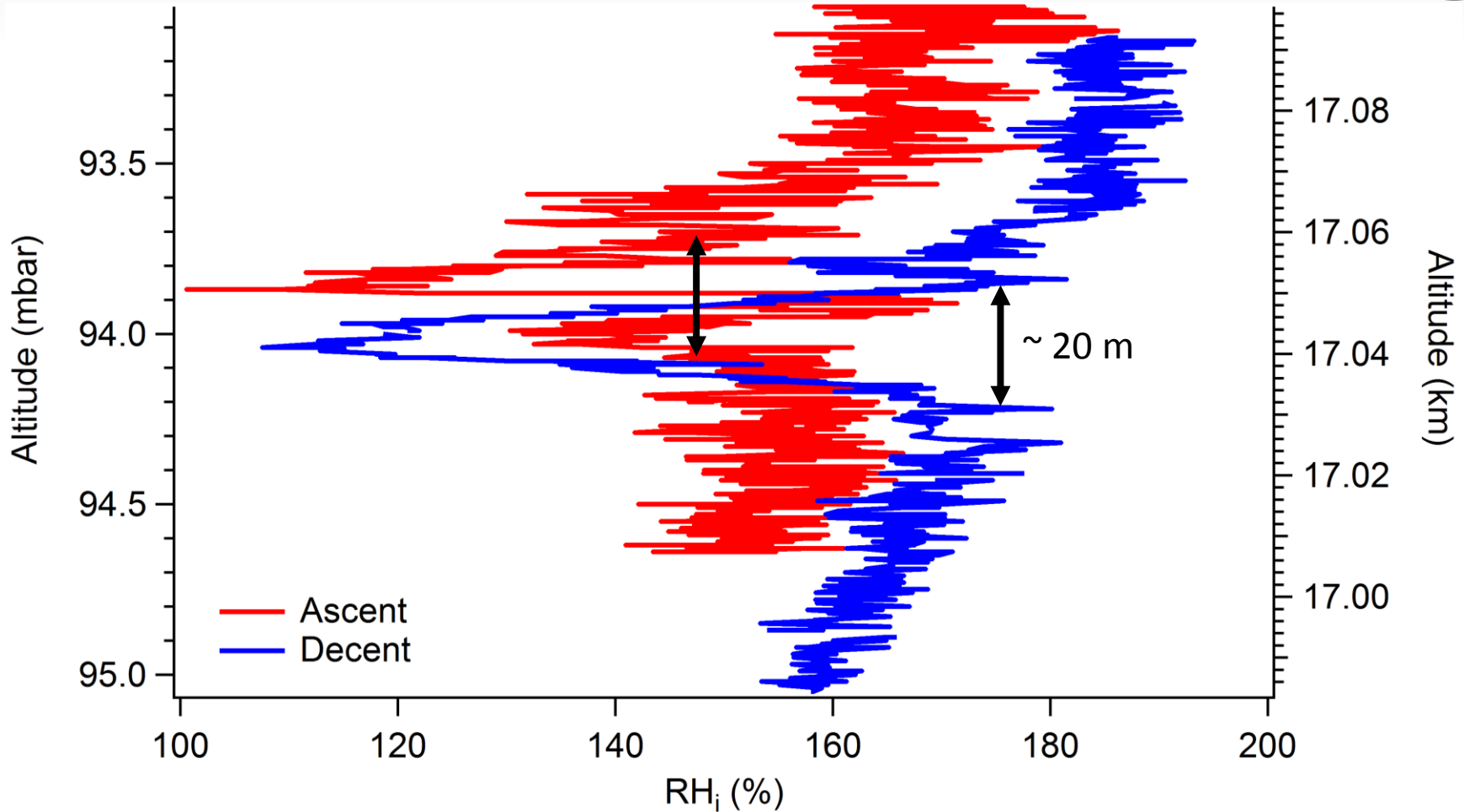


Case Study: 09 Mar 2014

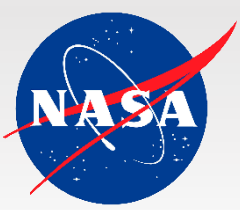




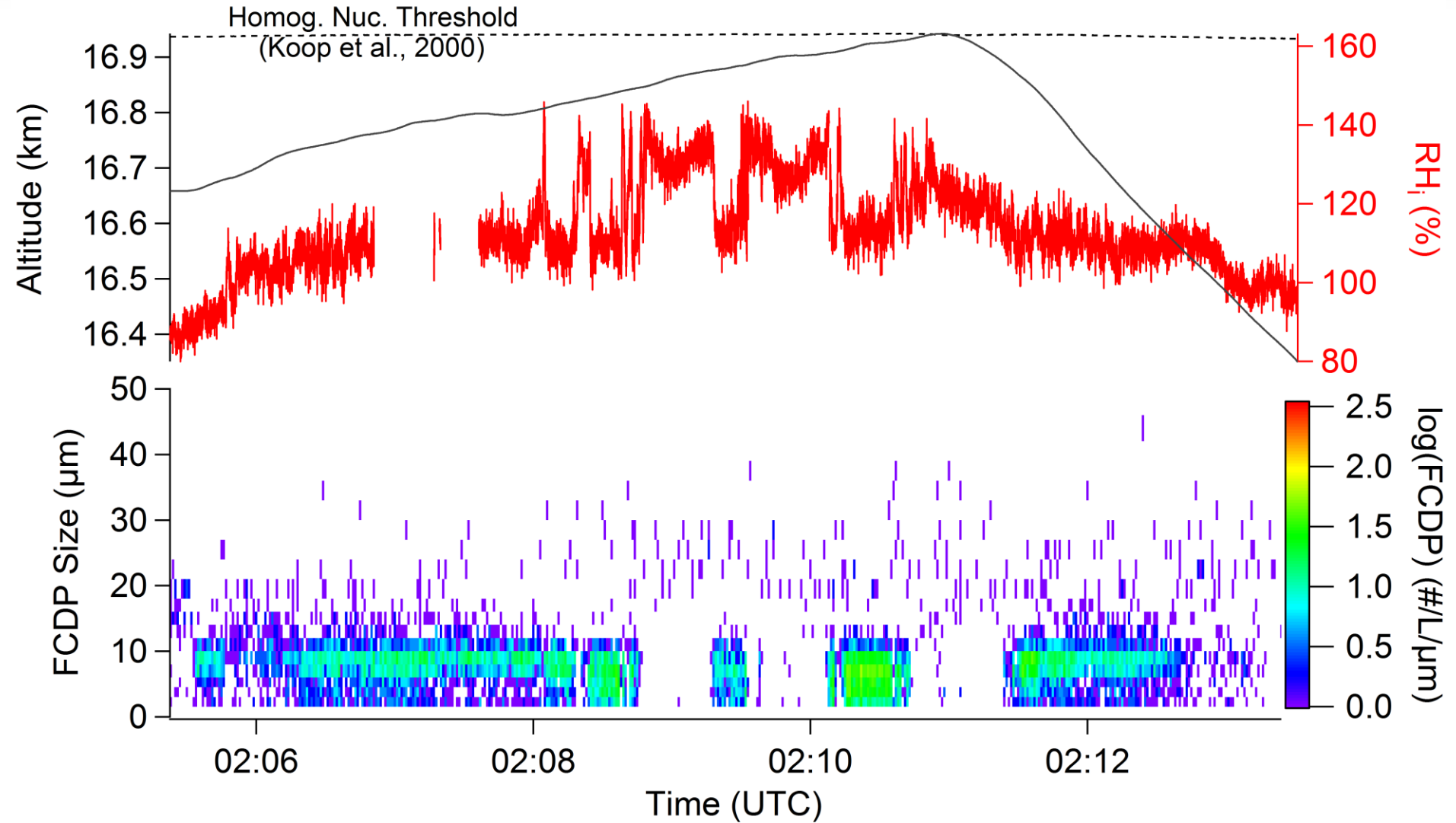
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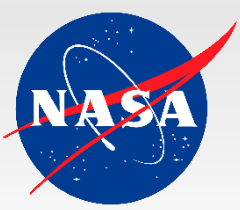


- Altitude and depth similar – likely same feature
- Horizontal extent: ~ 20 km

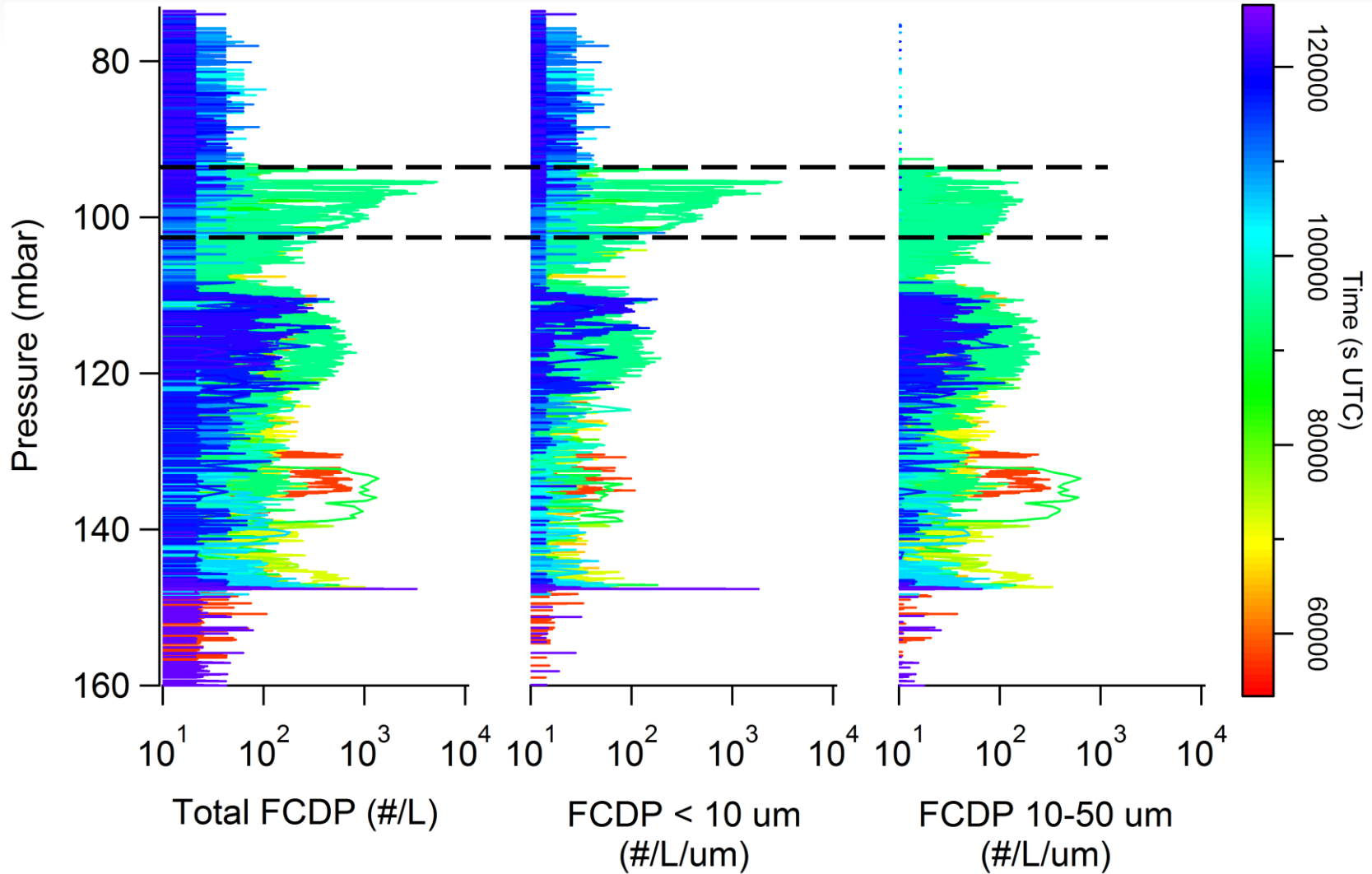


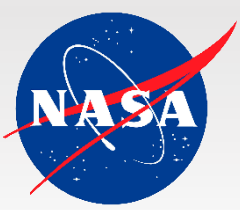
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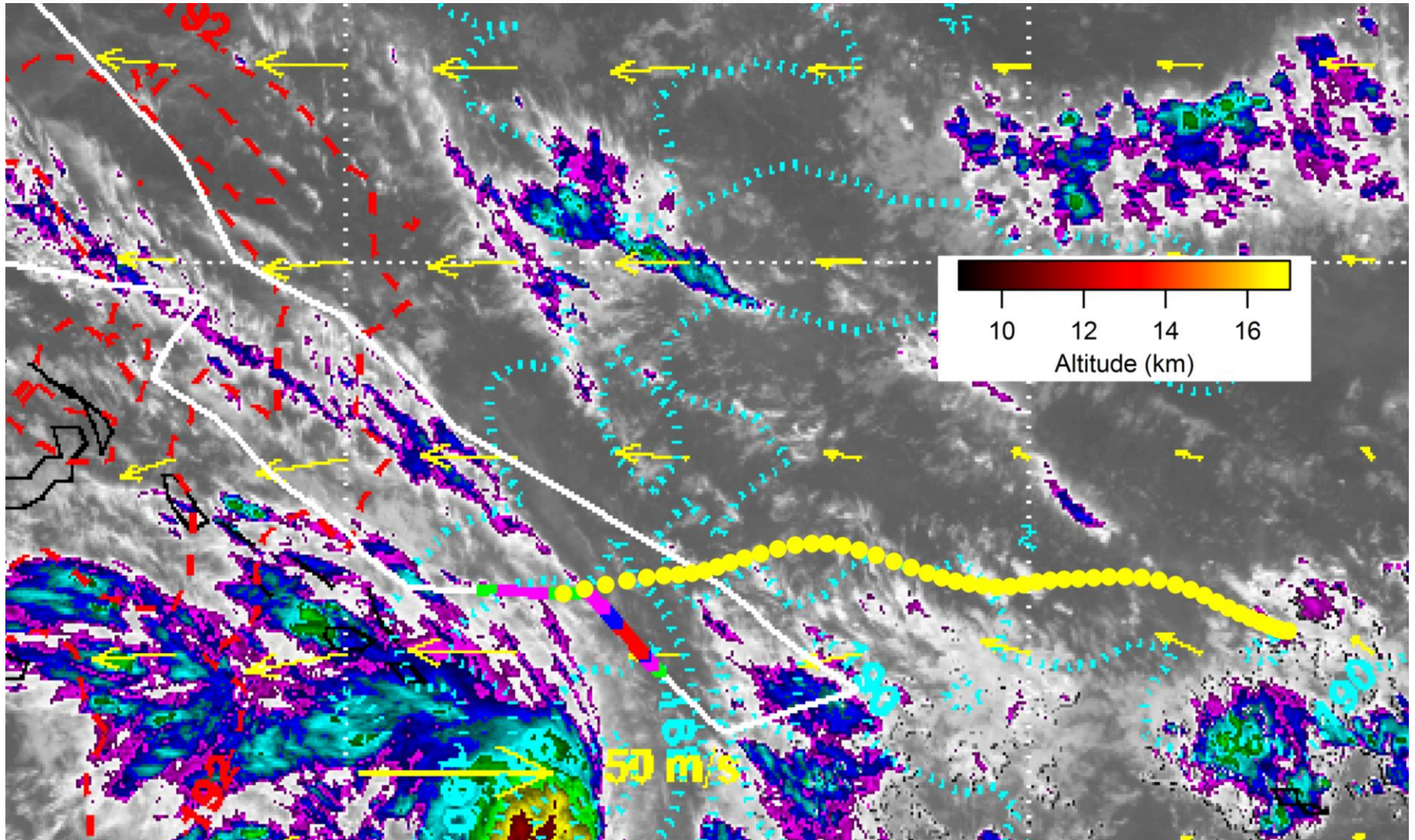


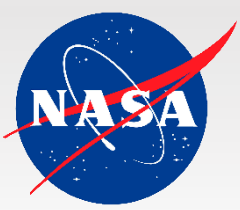
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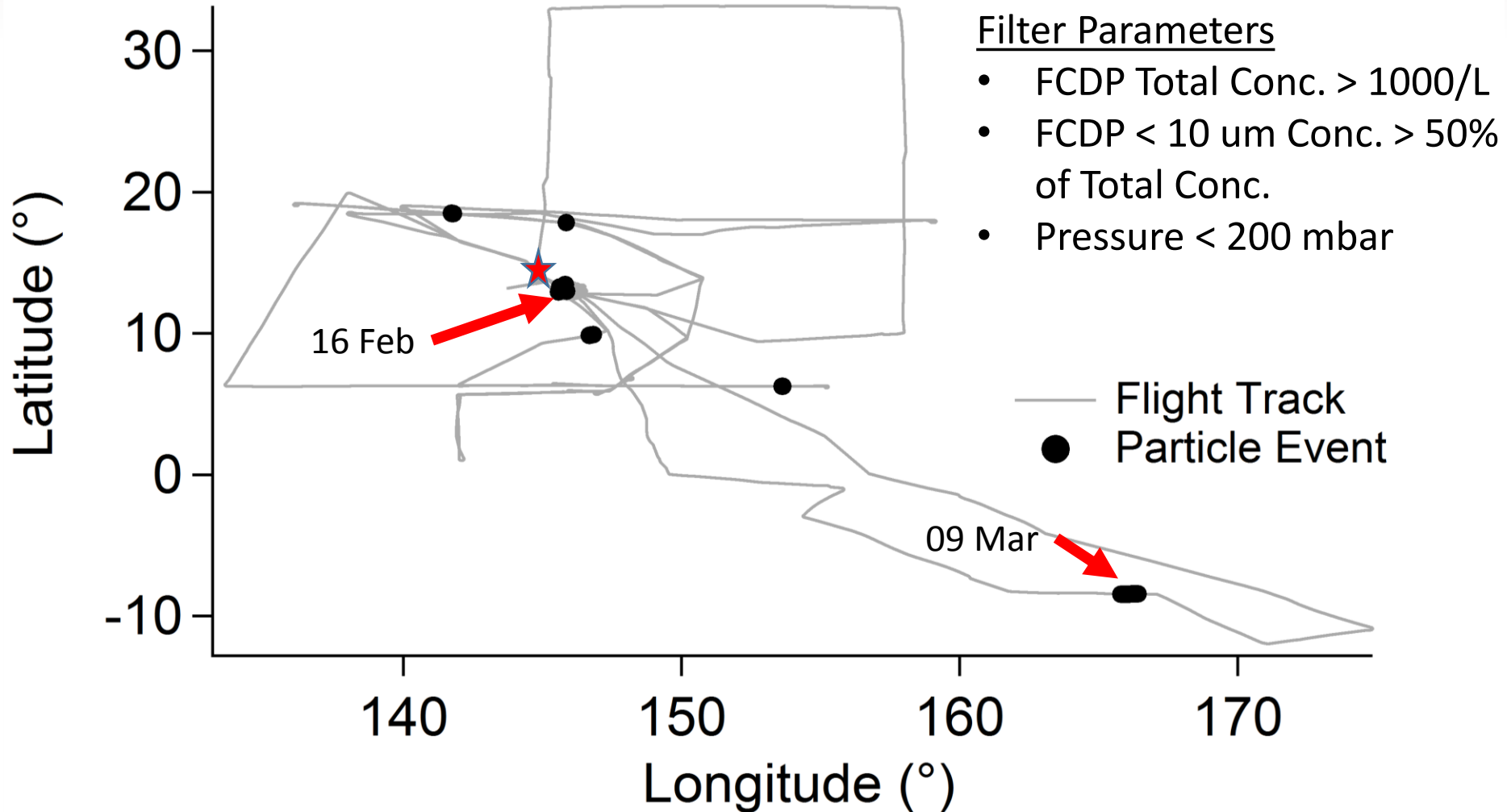


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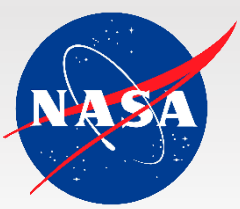


Layer Distribution & Stats

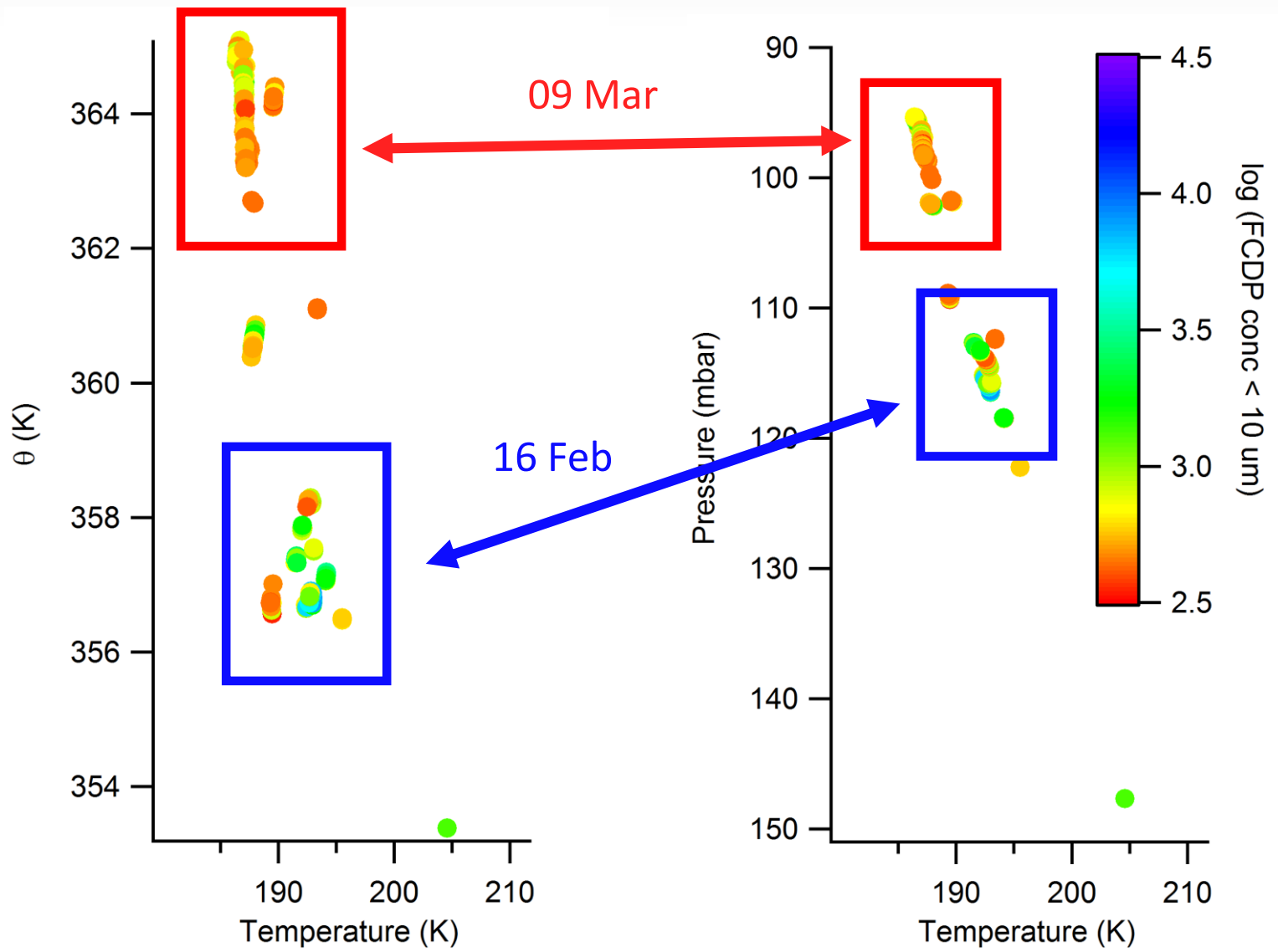


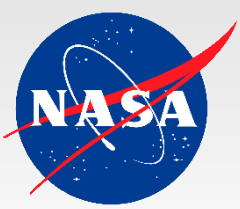
- 0.5-3.5% cloud sampling, 18-26% of ice particles*

*only FCDP statistics



Layer Distribution & Stats





Summary



- Further evidence of thin dehydrated layers with large ice particle concentrations
 - Particle sizes typically $< 10 \mu\text{m}$ in these layers
- Recent convection does not seem to play a role in layer frequency
- Layers existed for 0.5-3.5% of cloud sampling, but contributed 18-26% of ice particles
- Fast (sub 1 Hz) measurements of other tracers would help investigate layer airmass origin
- Future Work
 - Investigate convection tracers to further explore source
 - Explore influence of gravity waves
 - Examine statistics of layer vertical thickness
 - Repeat analysis with 2013 ATTREX deployment