In-Situ Stratospheric Size Distribution Measurements over the last 10 years – comparisons with OSIRIS and OMPS extinction, and COBALD backscatter measurements.

Katie Foster[1], Terry Deshler[1], Landon Rieger[2], Jean-Paul Vernier[3], Frank G. Wienhold[4]

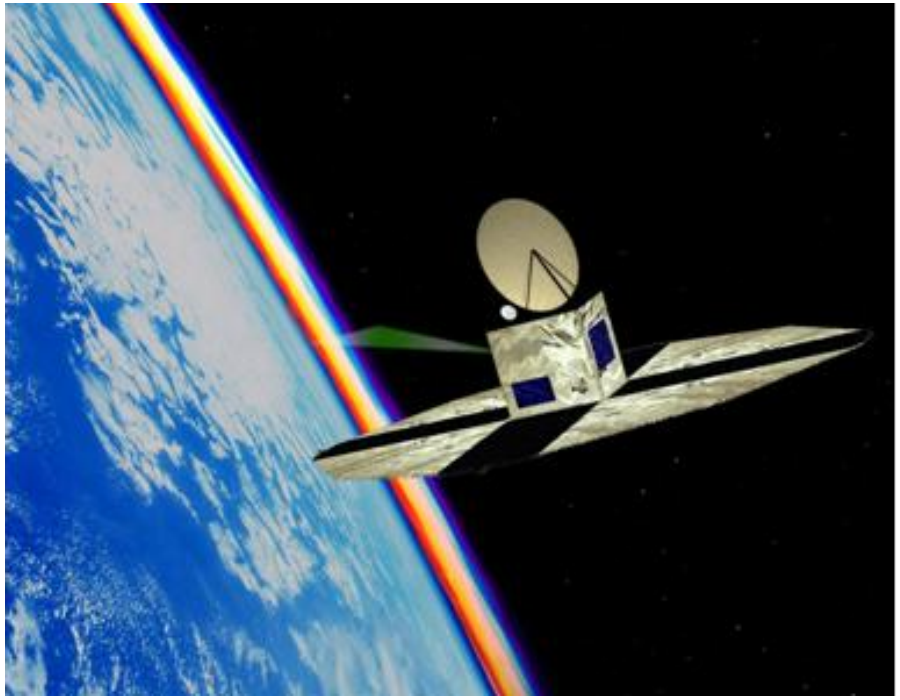
[1]University of Wyoming, USA

[2]University of Saskatchewan, Canada

[3]NASA Langley Research Center, USA

[4]Swiss Federal Institute of Technology (ETHZ), Zurich, Switzerland

University of Wyoming Optical Particle Counters (OPCs) – continuous measurements of stratospheric aerosol since 1971



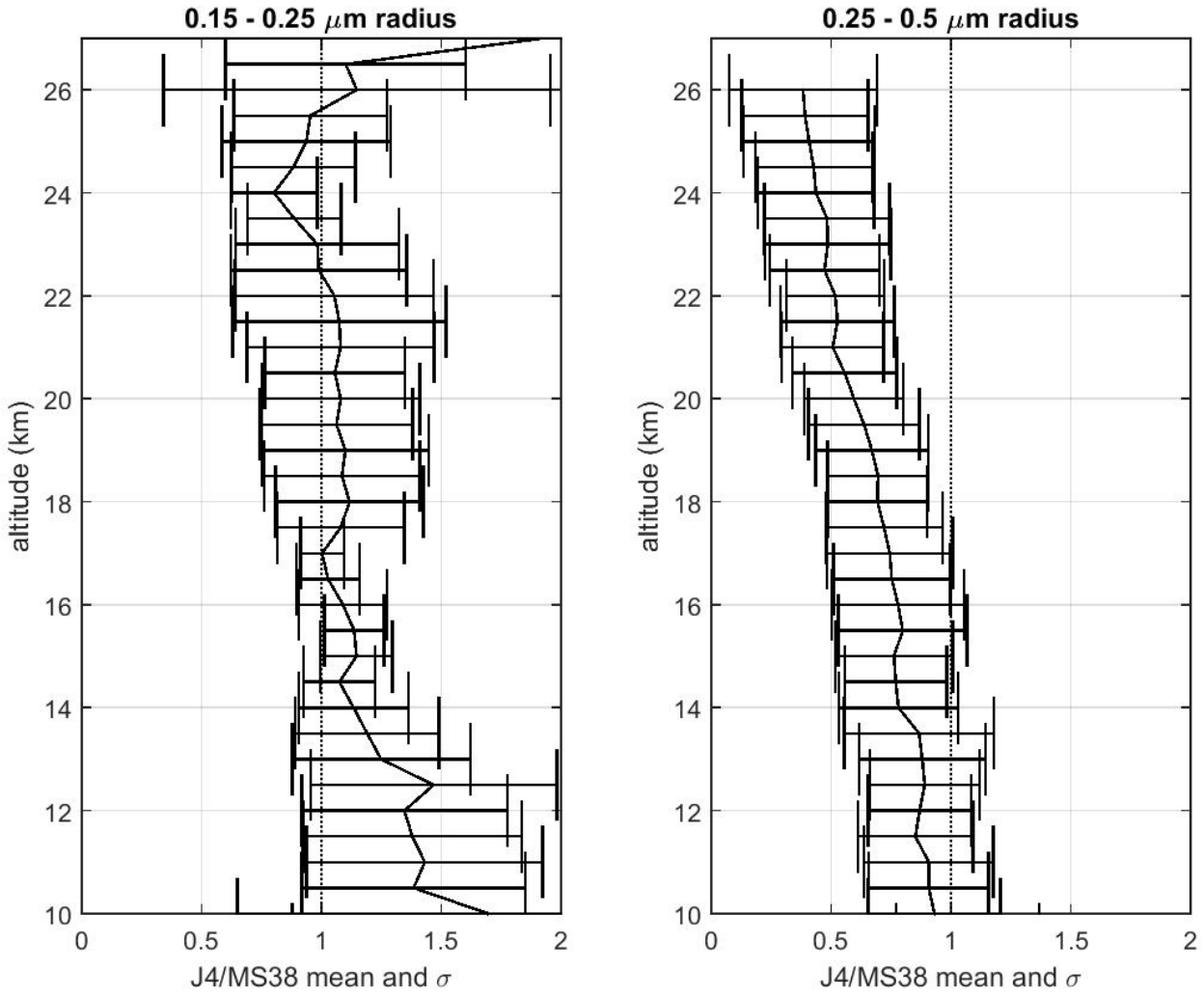
Extinction retrieval from limb scattering

N(r) – Concentration as function of radius

Newest OPC compared to previous generation

10 coincident flights between 2006 – 2013 to characterize performance of latest OPC

new OPC/old OPC = J4/M.

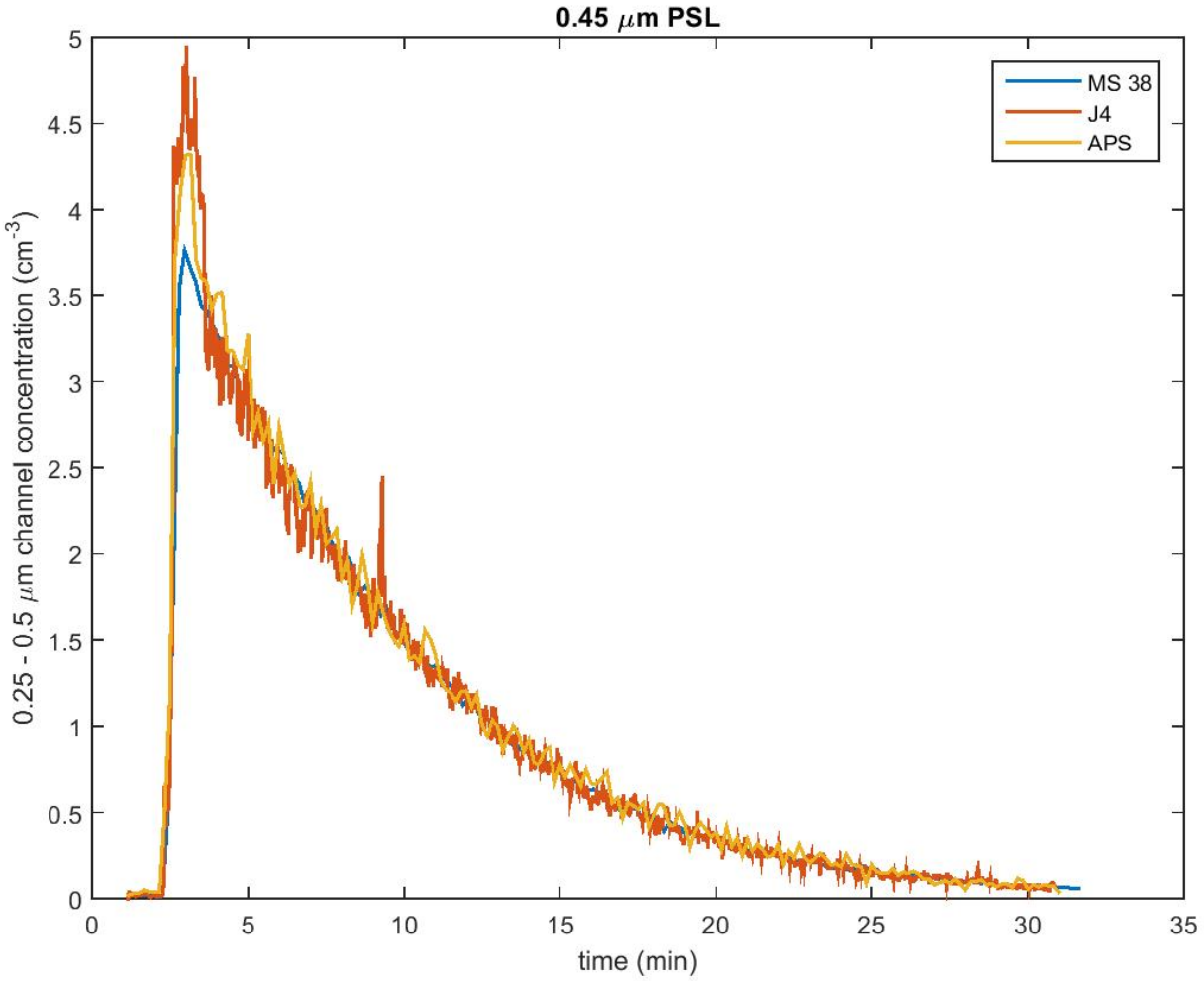


Comparisons between 2 different UW OPCs

0.45 µm radius PSL

This is upper end of the channel with a discrepancy (0.25 – 0.5 µm)

Aerodynamic Particle Sizer as ground truth



From size distributions to extinction

1. OPC measures N(r) in 8 size bins
2. Bimodal lognormal size distribution is fit to N(r) (Deshler, 2003)

$$N(>r)=\sum i \int_{r}^{\infty} N_i / \sqrt{2\pi}\, ln\sigma_i \; exp(-ln^2 [a/r_i]/2ln^2 \sigma_i)dlna$$

3. Apply Mie theory to calculate extinction coefficient (Q) as a function of particle radius, wavelength, and index of refraction

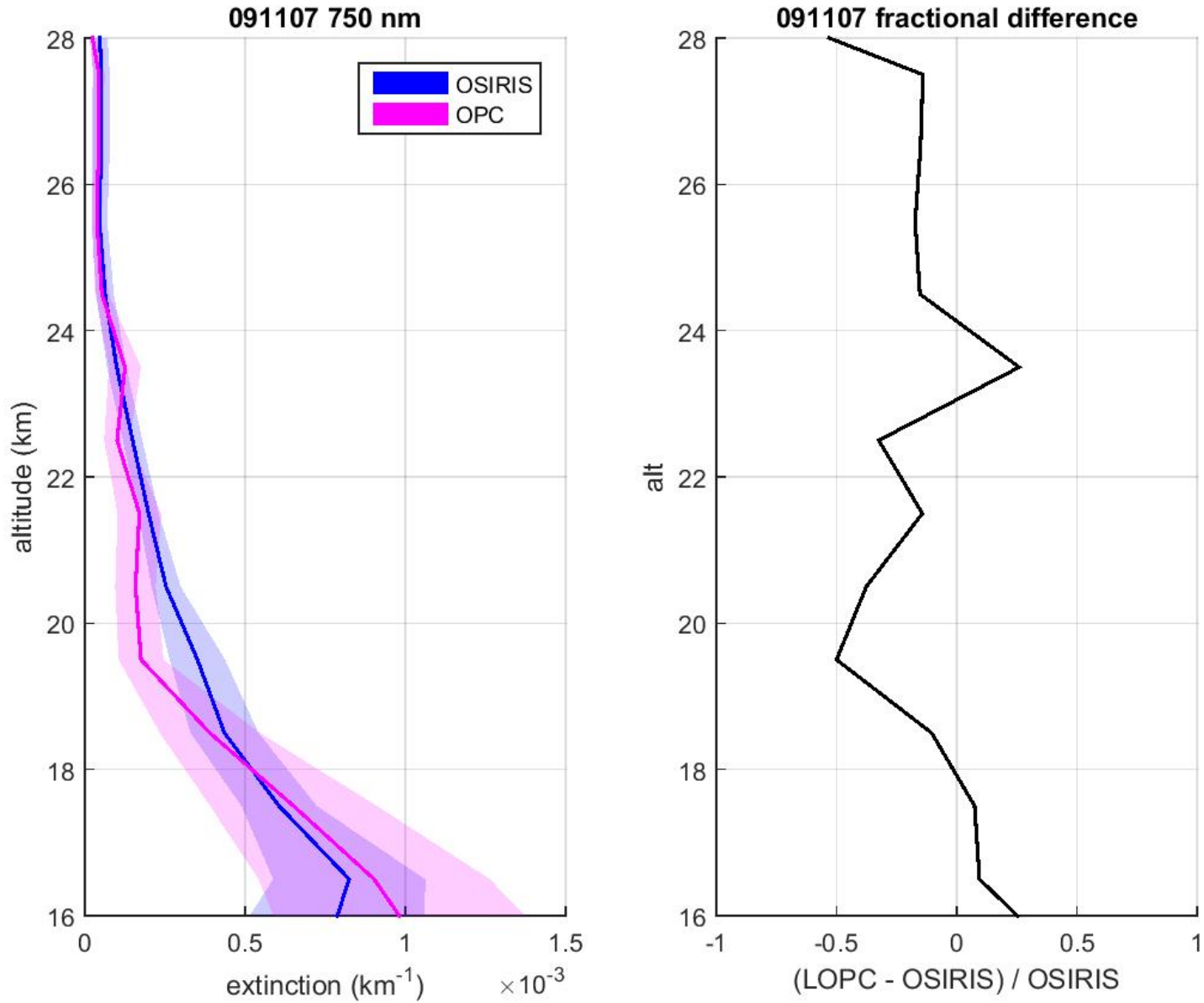
m = 1.45 - 0i

$$\beta_\lambda = \int_0^{\infty} \pi r^2 Q(r,\lambda,m) dn(r)/dr\, dr$$

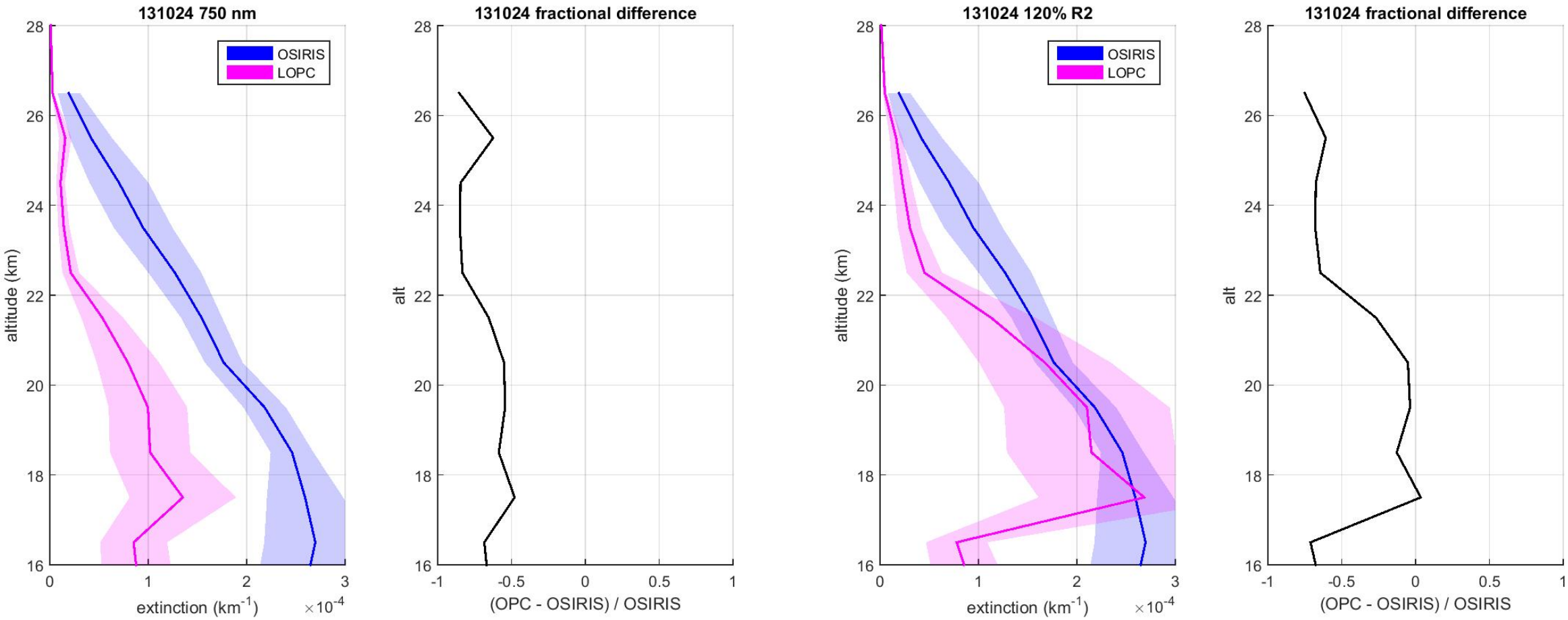
Comparisons to OSIRIS: 8 flights from 2006 - 2013

Large variability in extinction during this time

OPC vs. OSIRIS

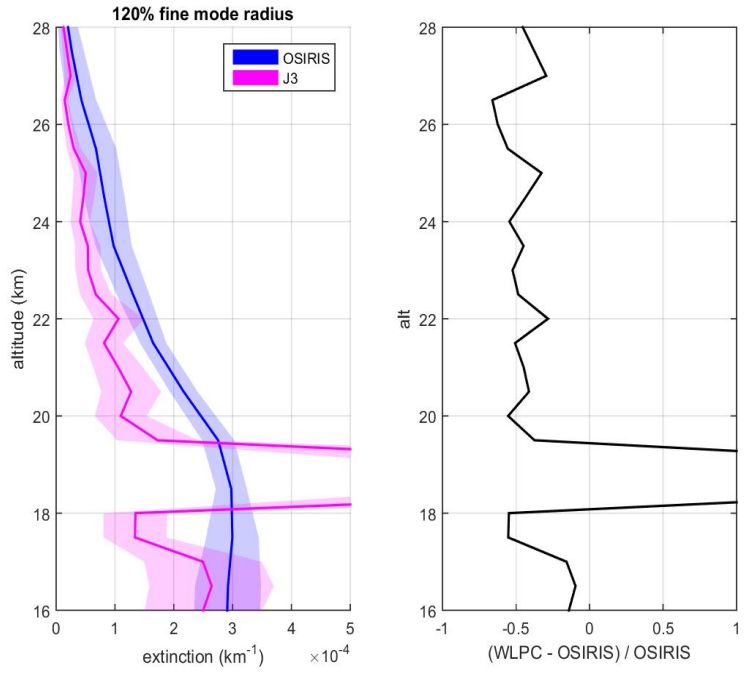


OPC vs. OSIRIS

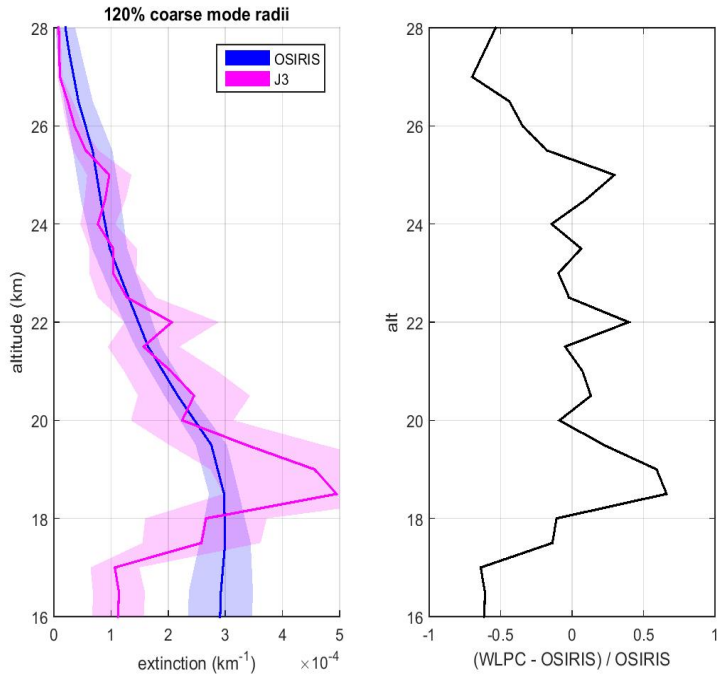


OPC vs. OSIRIS

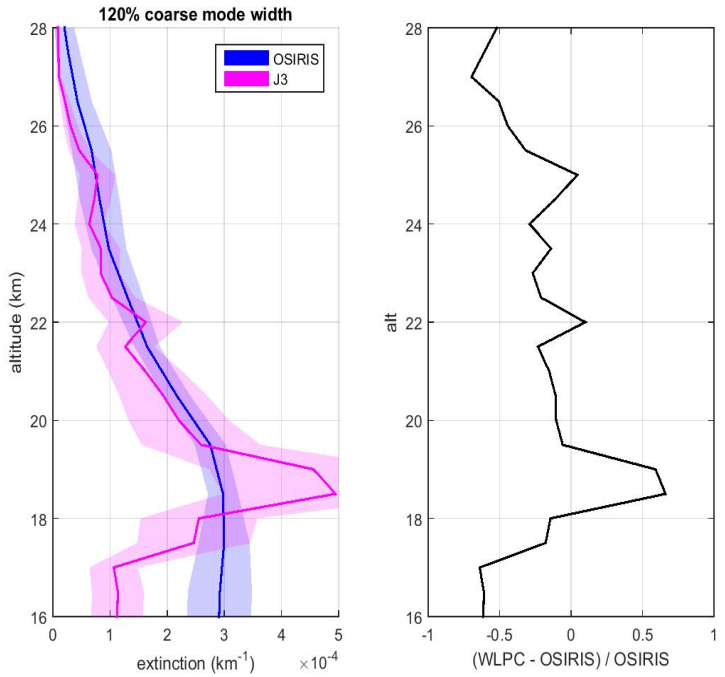
Increase fine mode width by 20%



Increase coarse mode radius by 20%



Increase coarse mode width by 20%

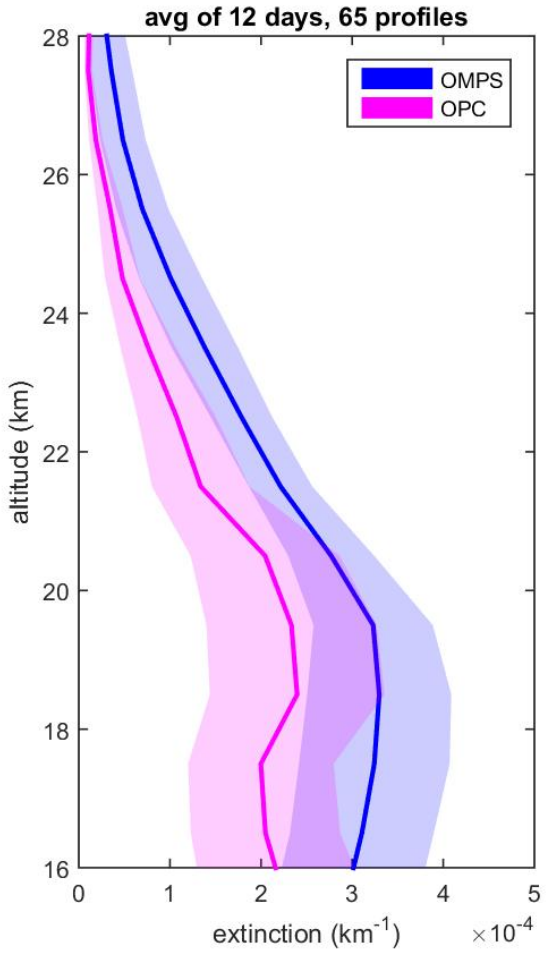


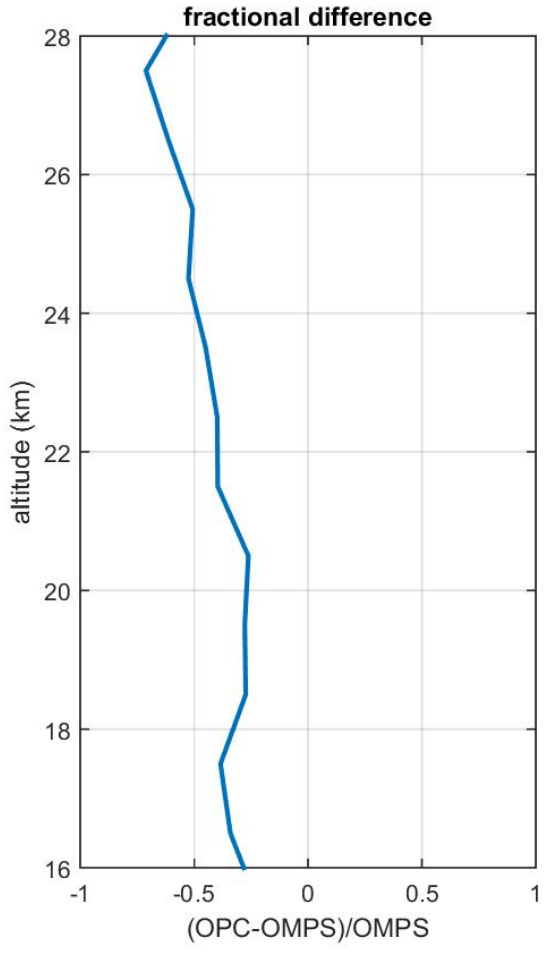
Coarse mode more important than fine mode

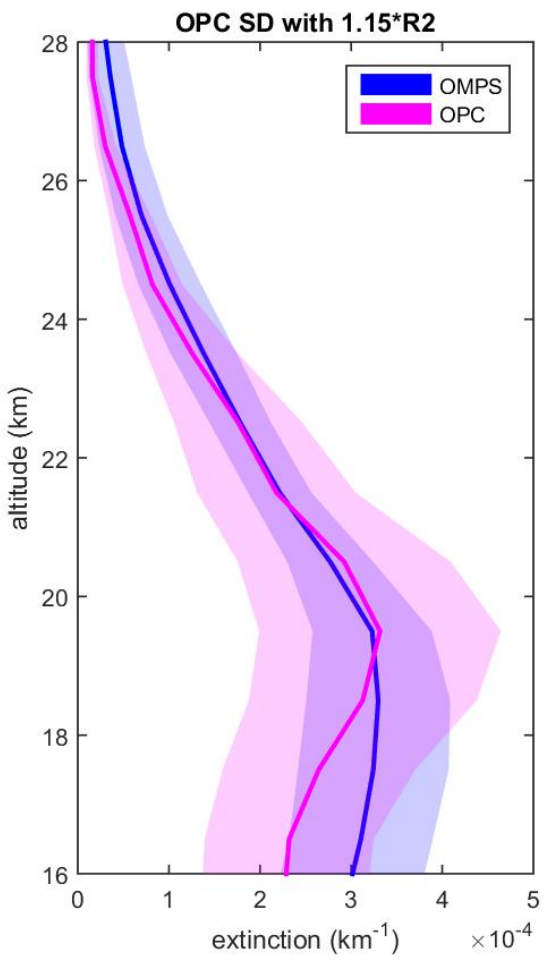
Coarse mode radius = ~ 200 nm
Fine mode radius = ~65 nm

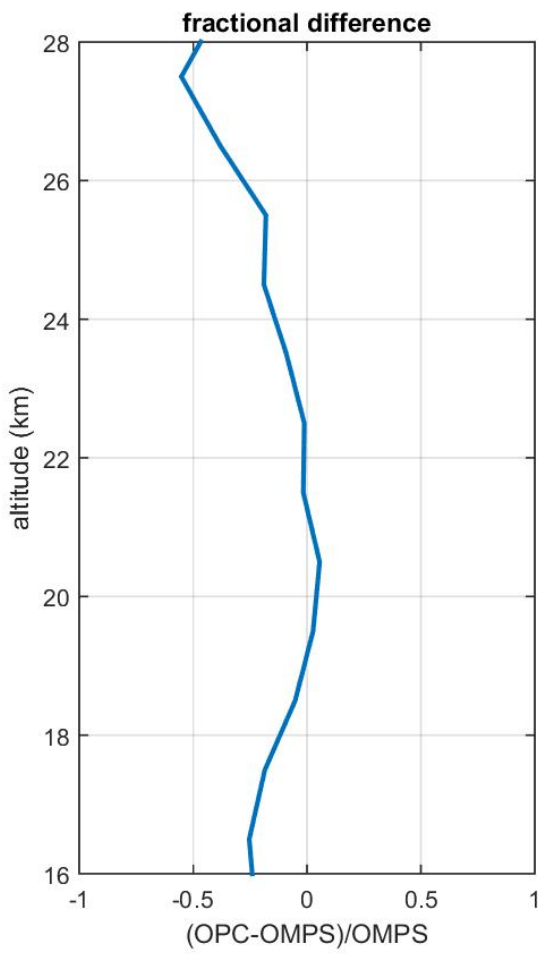
Comparisons to OMPS

Increase coarse mode width by 15%



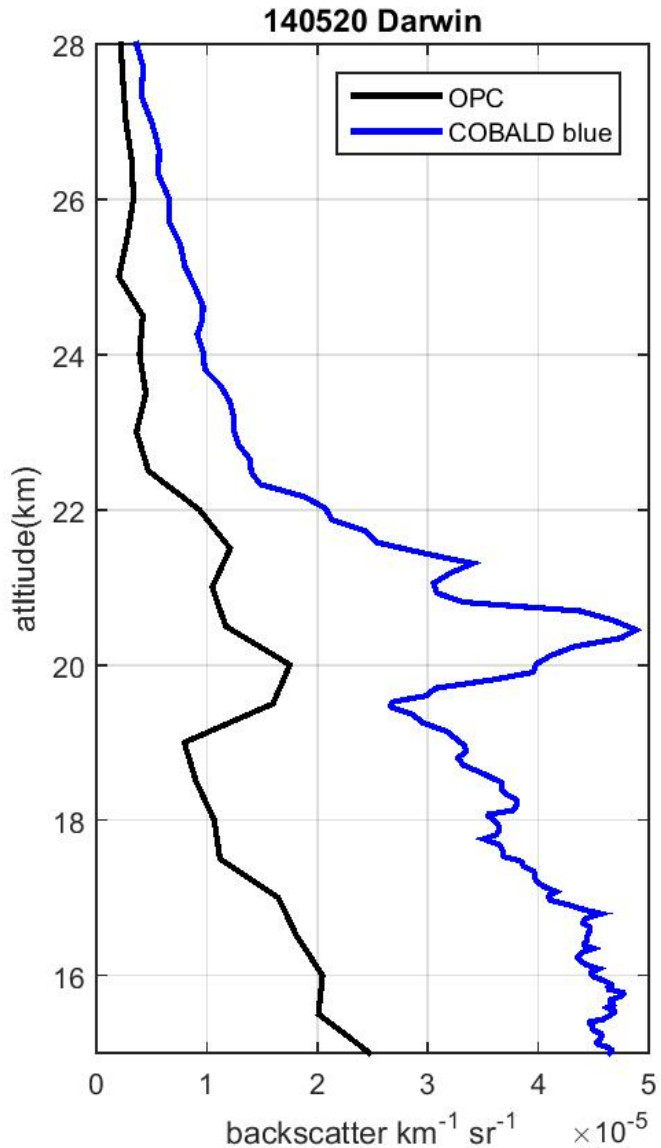


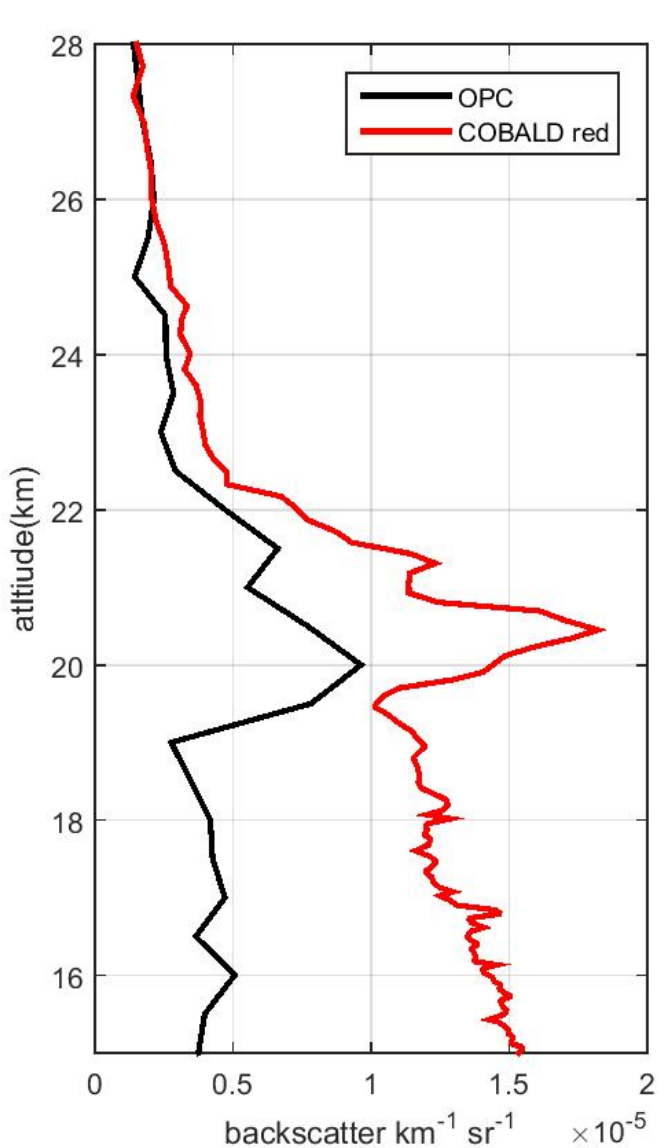


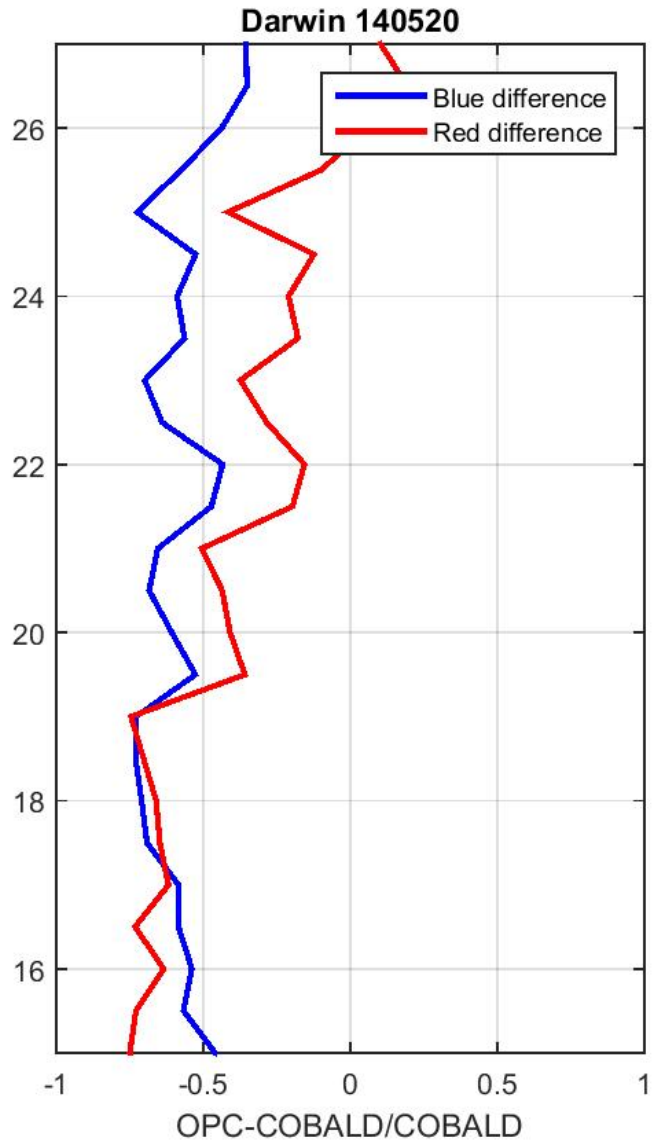


Coincident profiles from March 2012 - January 2015

Comparisons to COBALD Backscatter-Sonde







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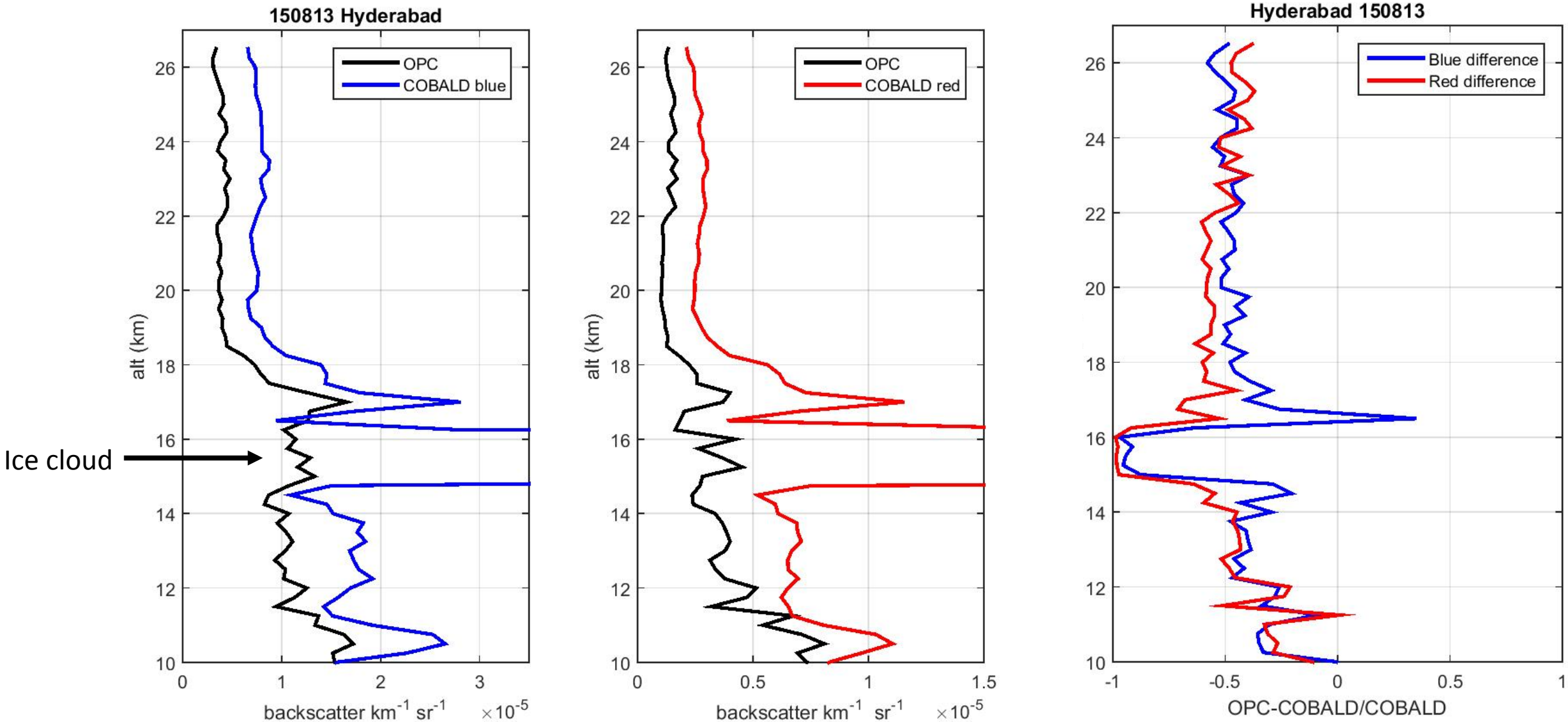

Conclusions

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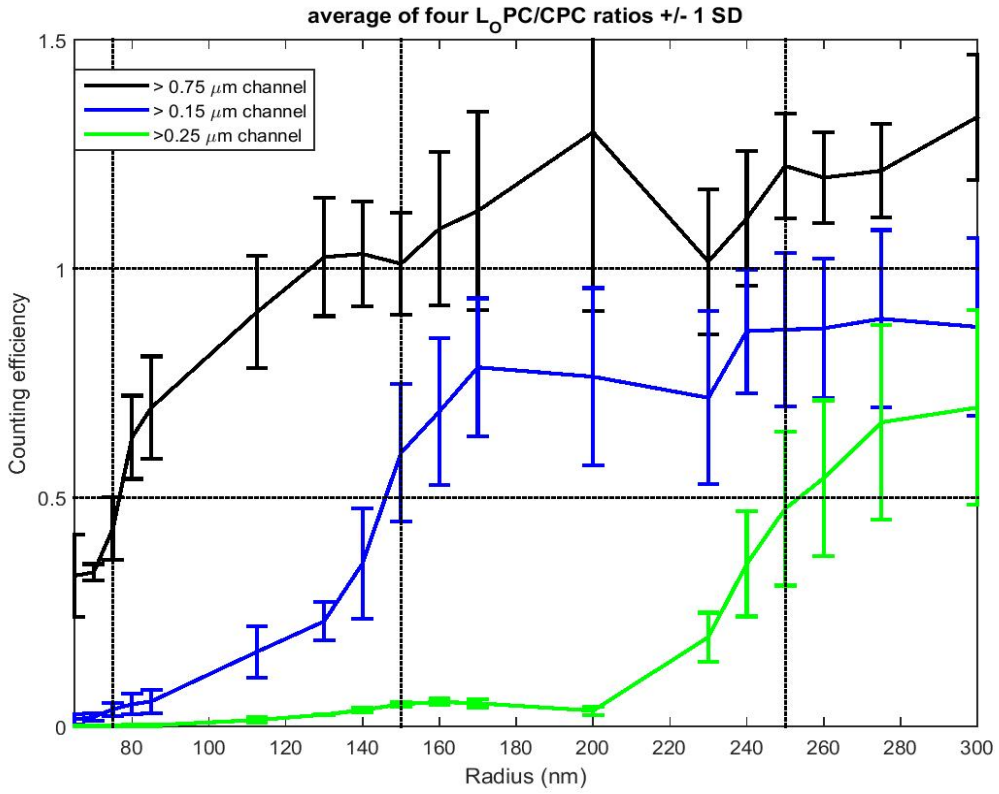
2^{nd} mode dominates

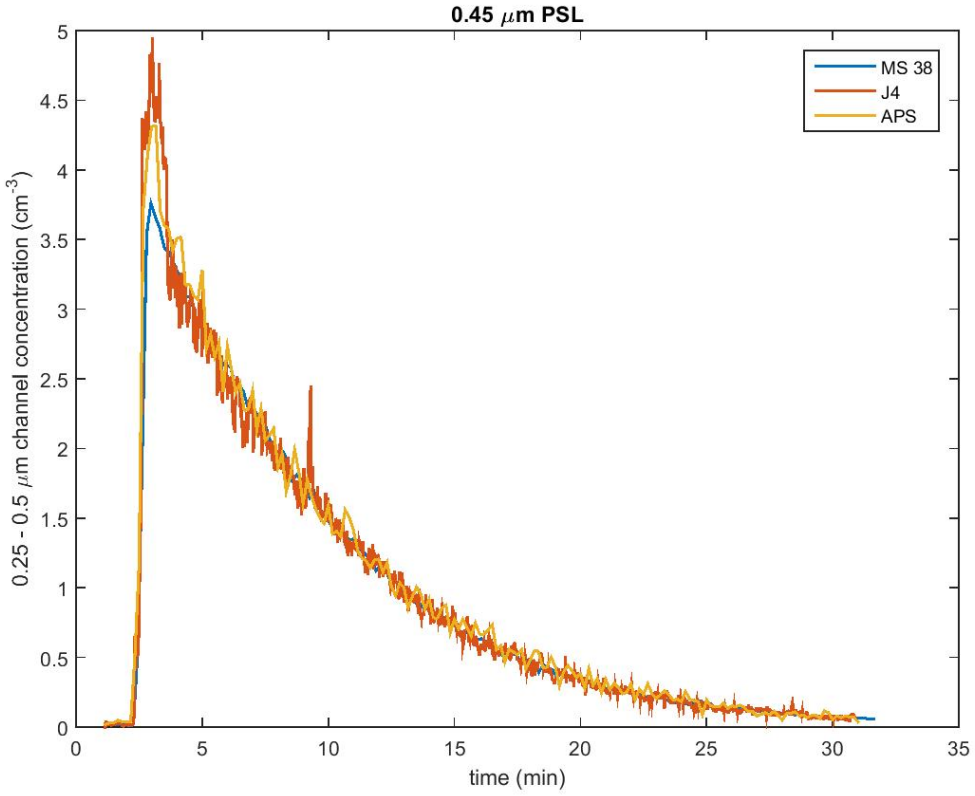
Agreement with COBALD follows similar pattern

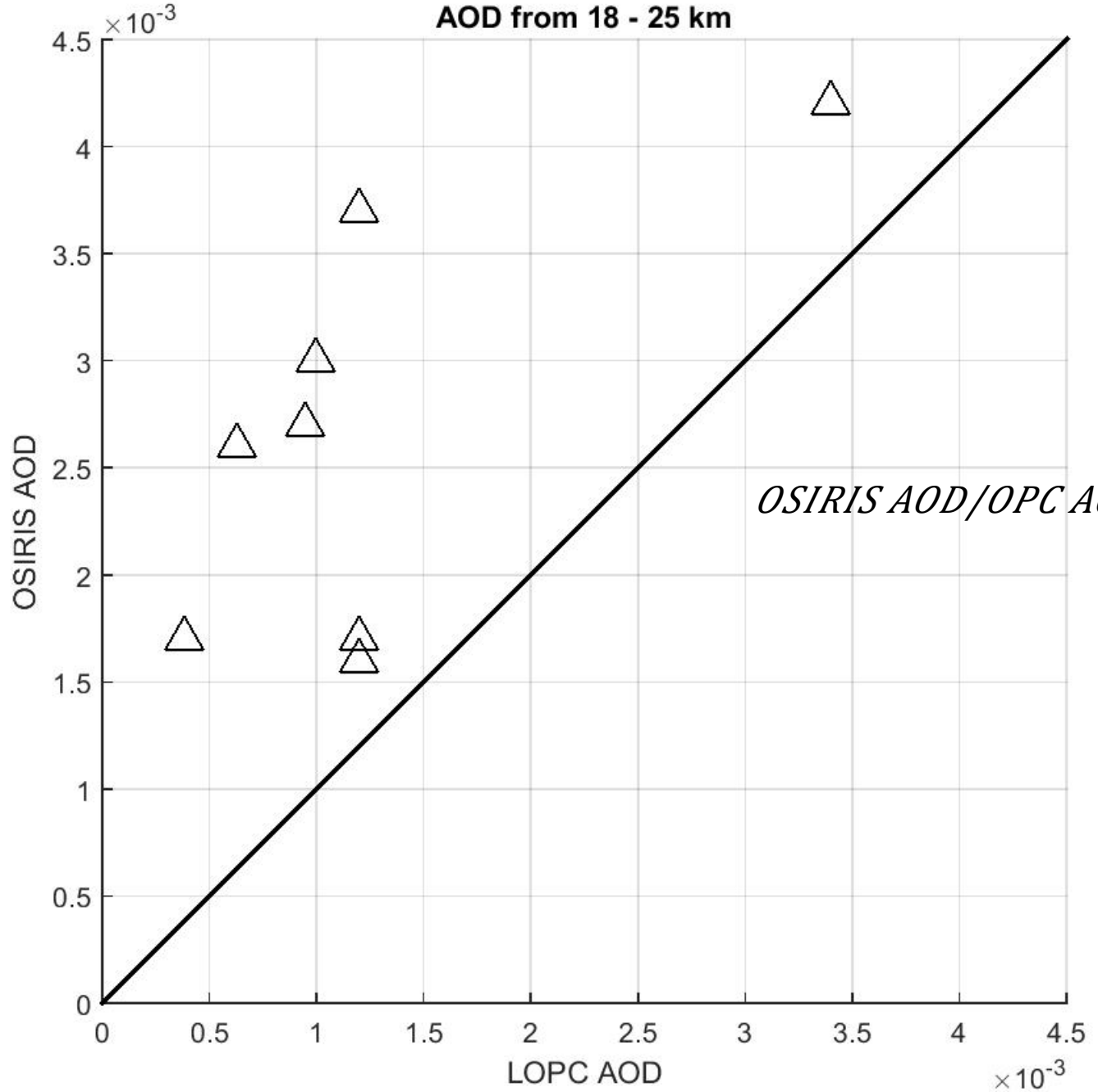
Thank You

- OSIRIS team: Landon Rieger, Adam Bourassa
- COBALD team: Jean Paul Vernier, Frank Weinhold
- OMPS contact Ghassan Taha
- Terry Deshler

Comparisons between 2 different UW OPCs







$OSIRIS\ AOD/OPC\ AOD$ = 2.68