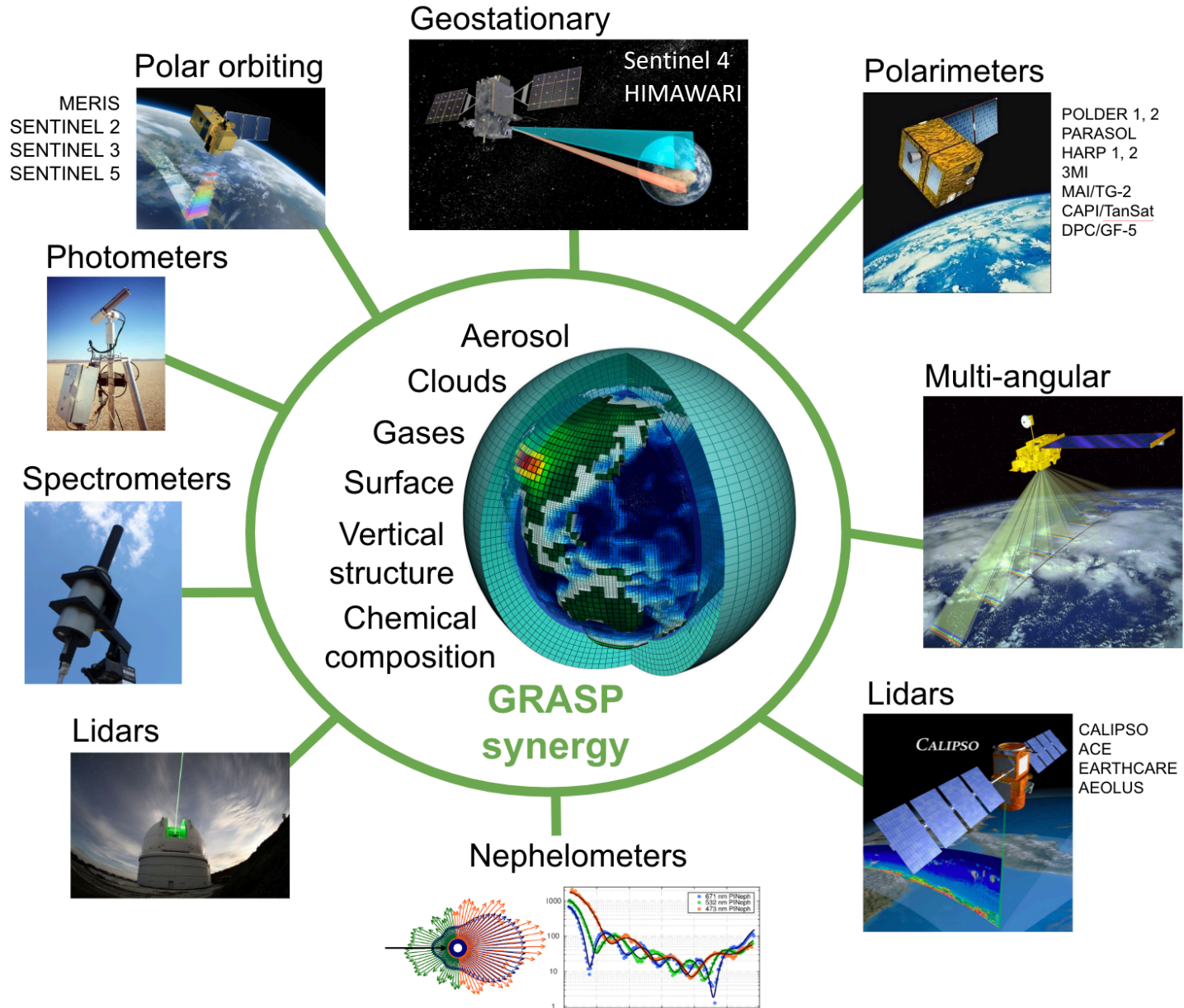


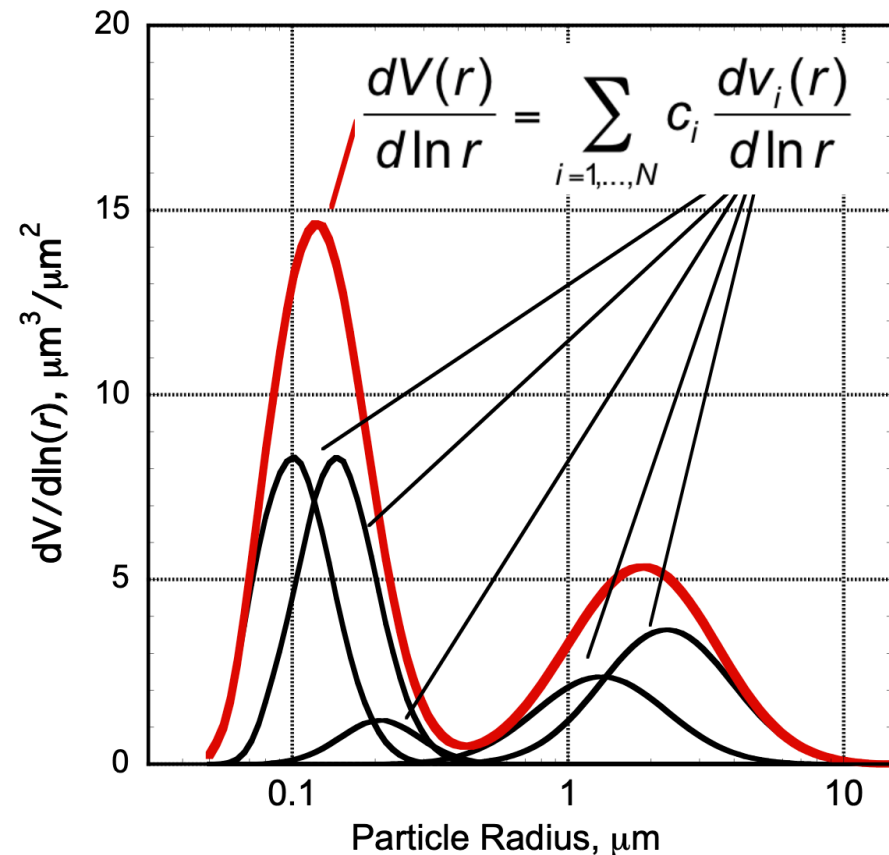
Enhanced Aerosol Characterisation from Synergy of Active and Passive Remote Sensing Observations Using GRASP Algorithm

Anton Lopatin, Oleg Dubovik, G. Schuster, M. Vaughan, T. Lapyonok,
P. Litvinov, B. Torres, D. Fuertes, D. Perez-Ramirez, F. Ducos, Y.
Derimian and Y. Karol

GRASP: a highly versatile algorithm



PARASOL: Aerosol modelling



- SD 5 log normal size bins
- 6 wl complex refractive index
- Spherical particles fraction
- Height parameter

$$c(h) = \frac{1}{H_m} e^{-\frac{h}{H_m}}$$

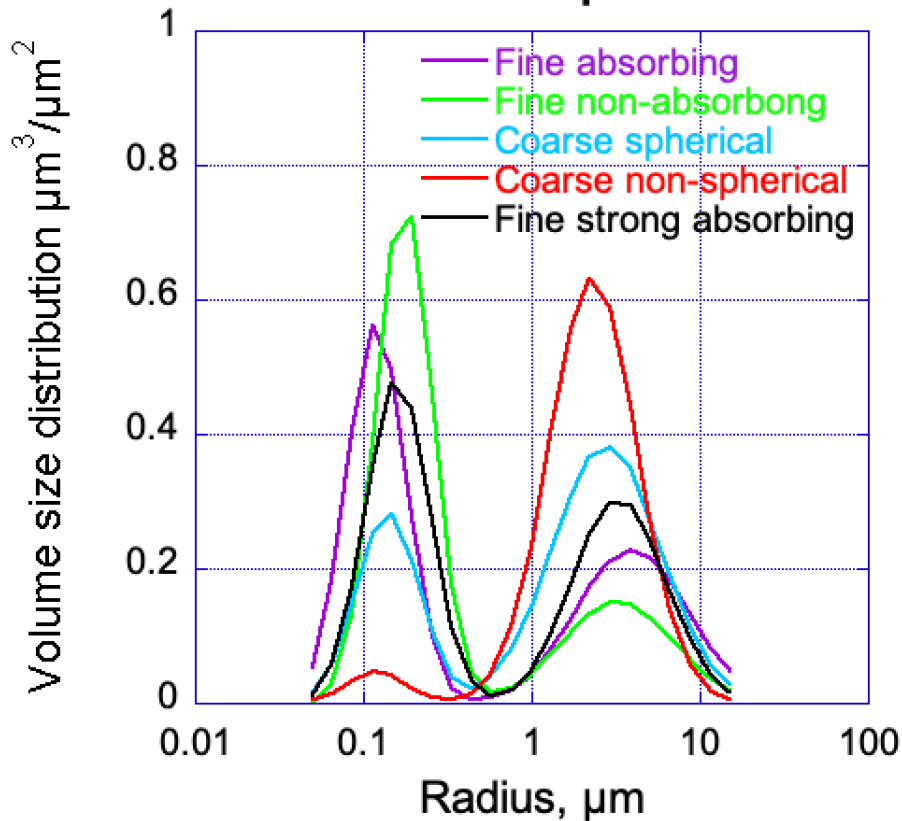
Total: 19 parameters

Available at

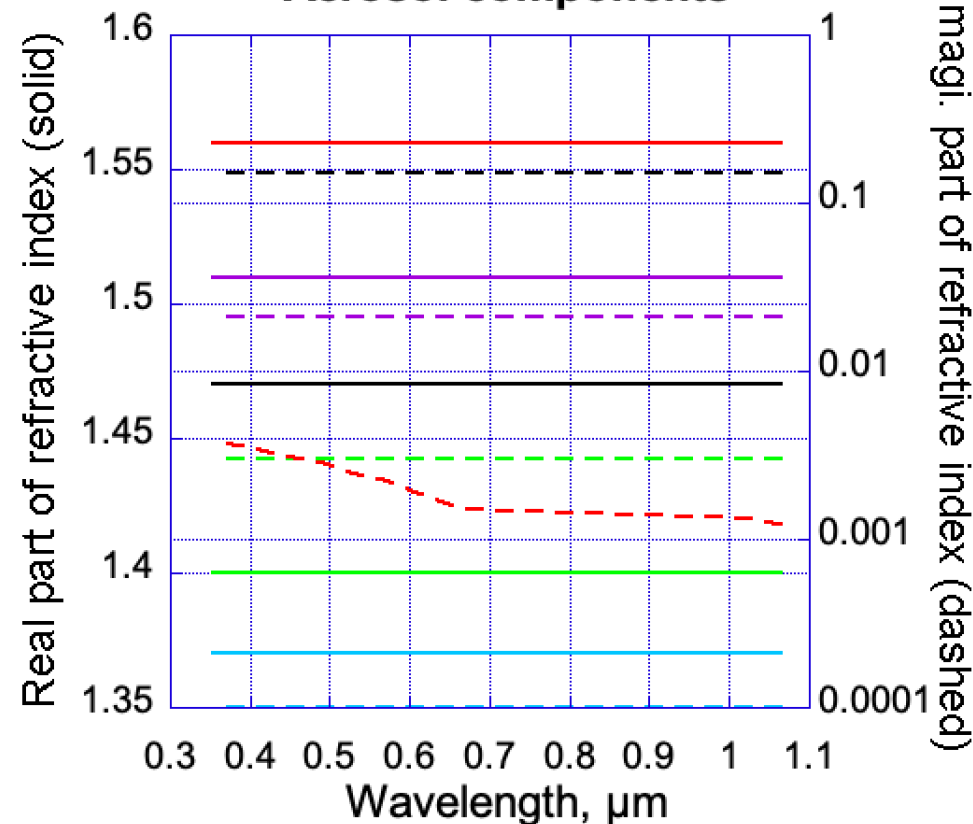
<https://download.grasp-cloud.com/polder/high-precision/>
<https://download.grasp-cloud.com/polder/optimised/>

Where else to get missing microphysics?

Aerosol components



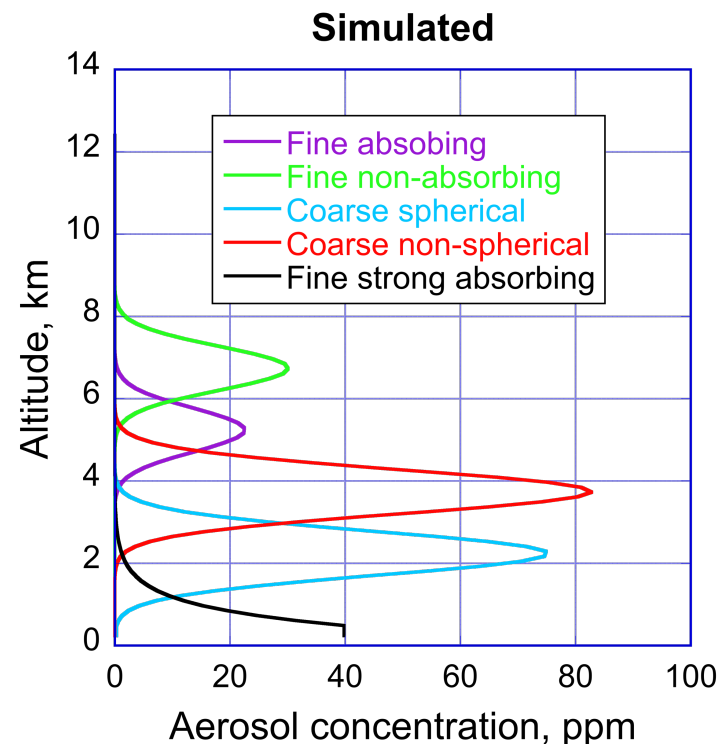
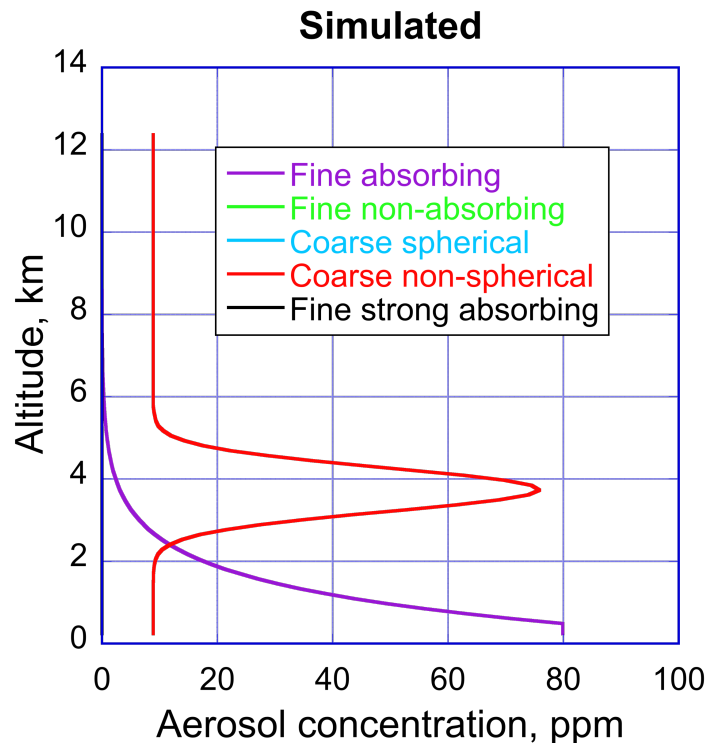
Aerosol components



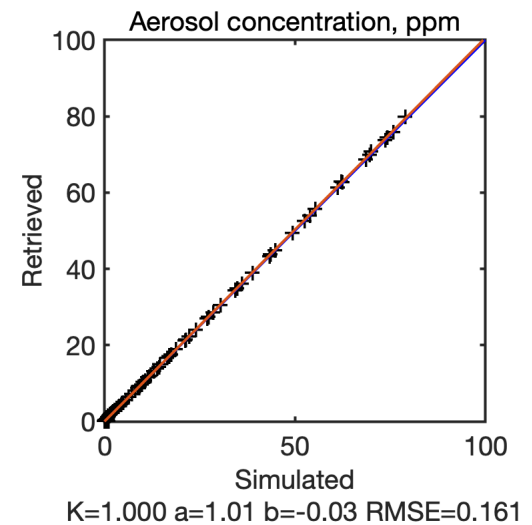
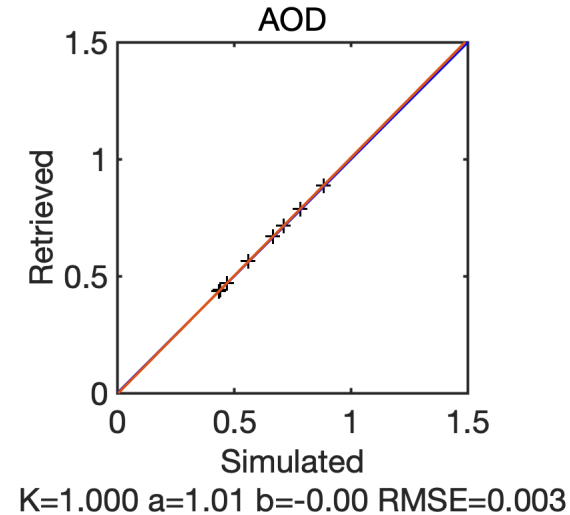
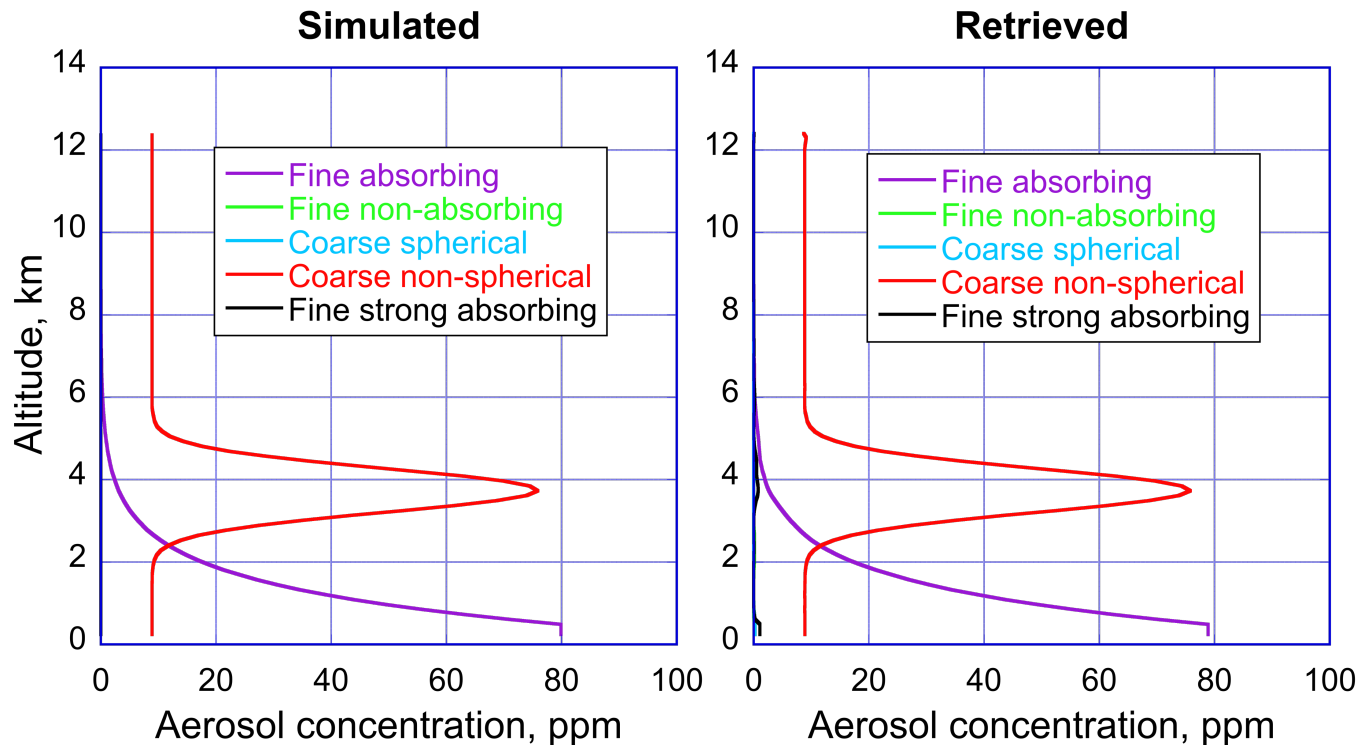
- 5 concentrations of predefined aerosol types
 - 1 to 500 parameters for vertical distributions
- Total: 6 to 505 parameters (6, 105, 205, etc.)

TESTS: Forward modelling

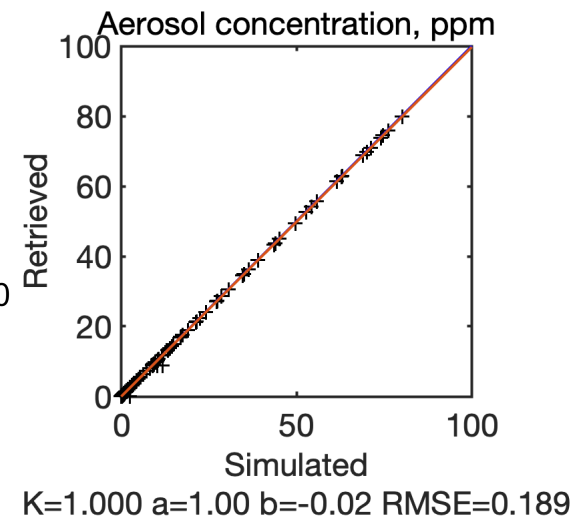
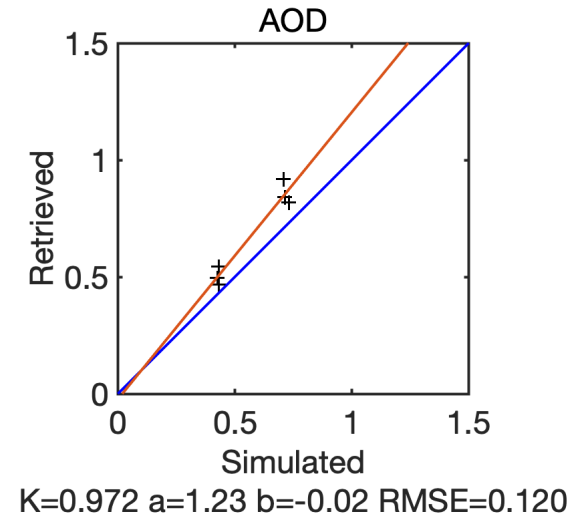
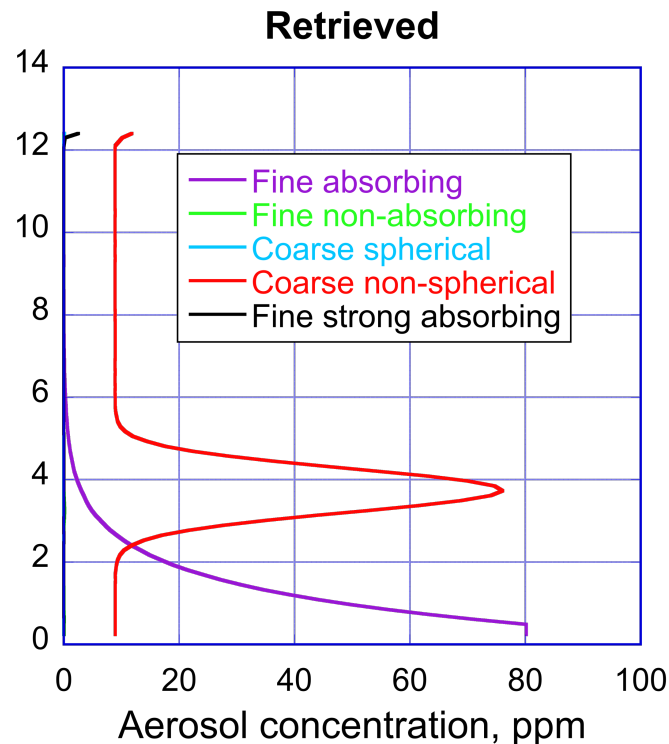
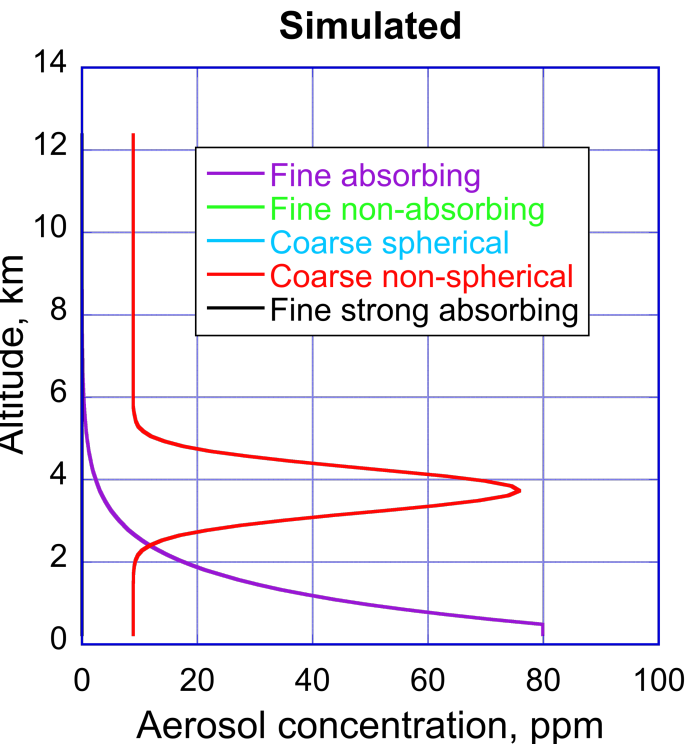
- PARASOL polarimeter ($6I+3U/Q$)
 - CALIOP* spacelidar ($2\beta+1\delta$)
 - Next Gen. Spacelidar ($3\beta+3\delta+2\alpha$)
 - Simple and complex aerosol scenarios
- 4 observation combinations:
- 2 synergy (L&P)
 - 2 stand alone (L)



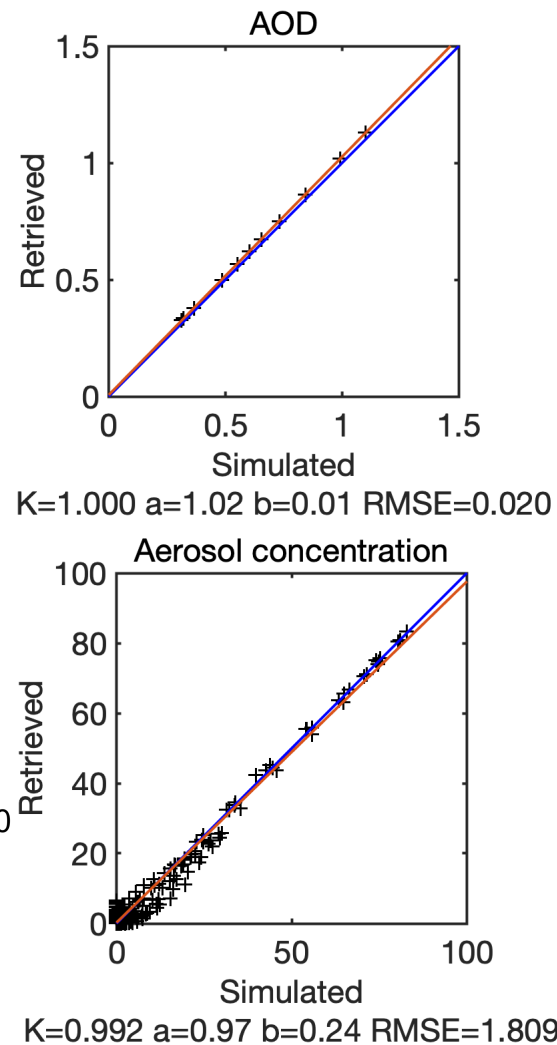
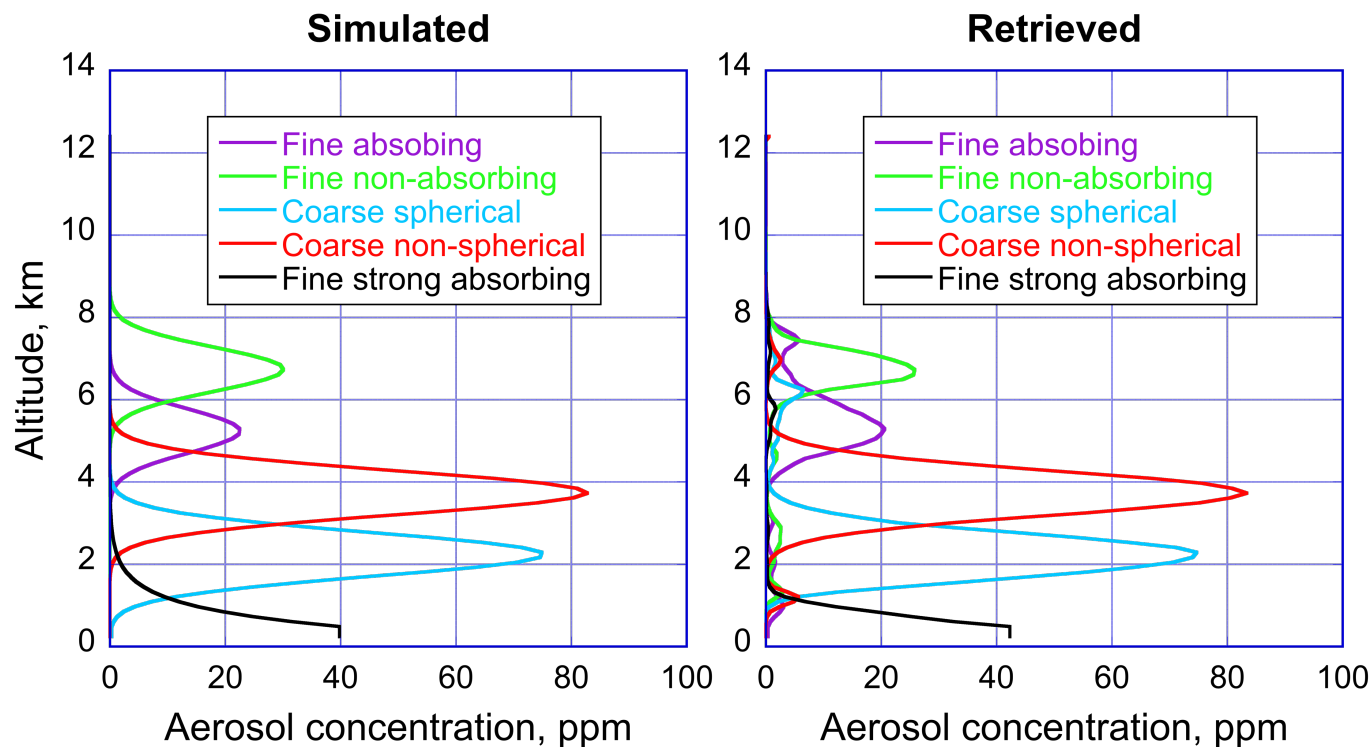
CALIOP+PARASOL: simple case



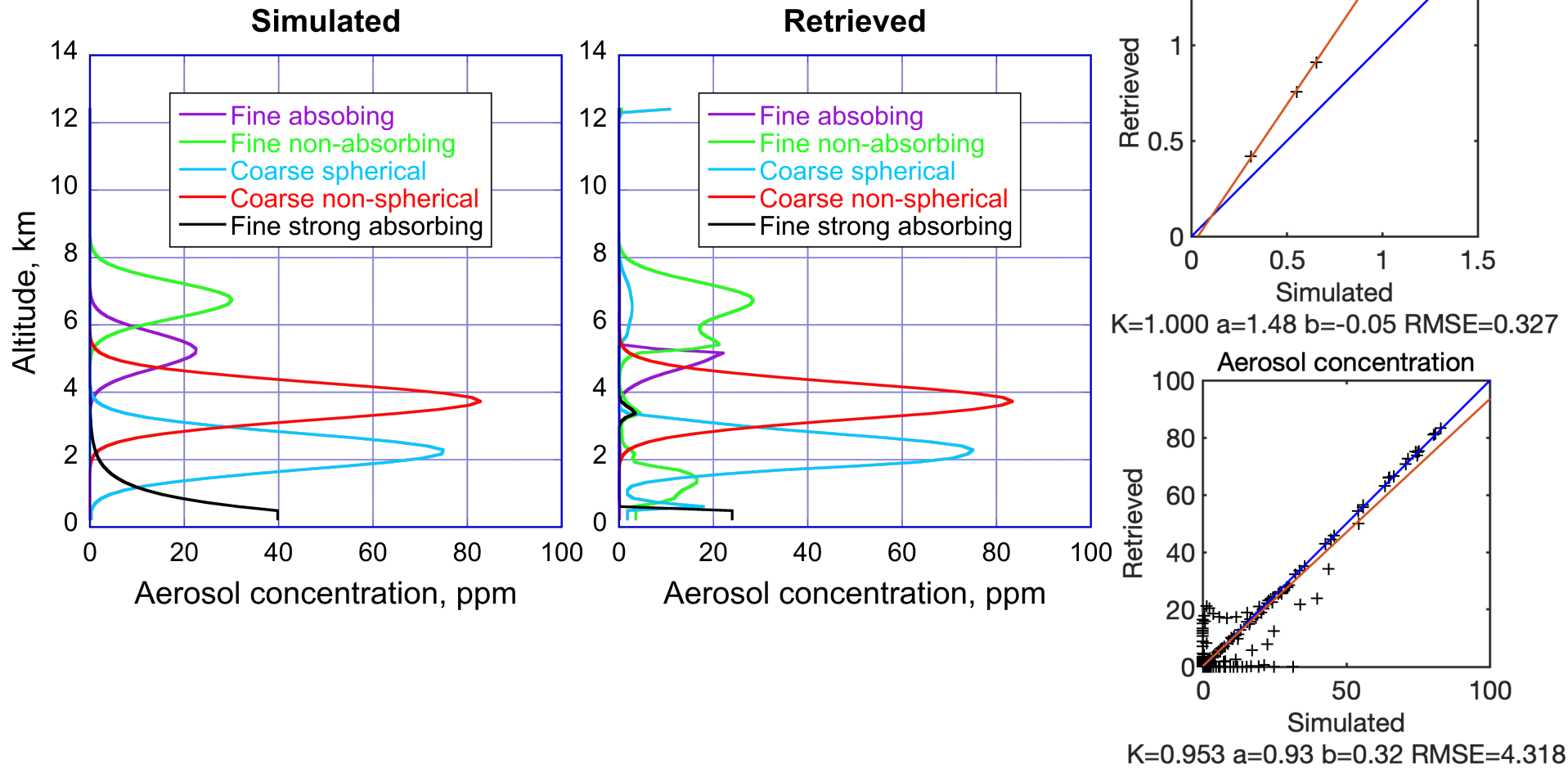
CALIOP: simple case



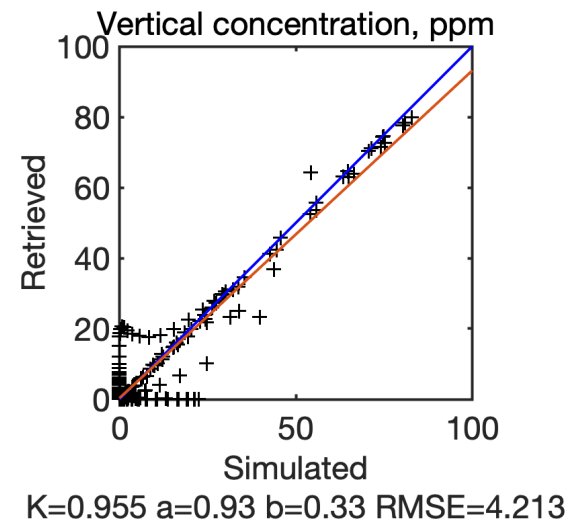
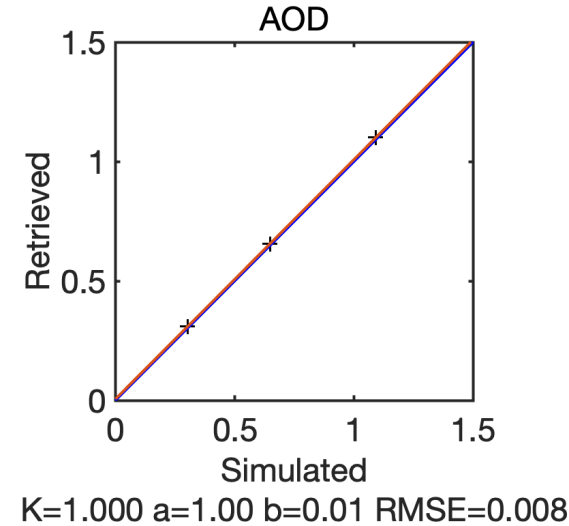
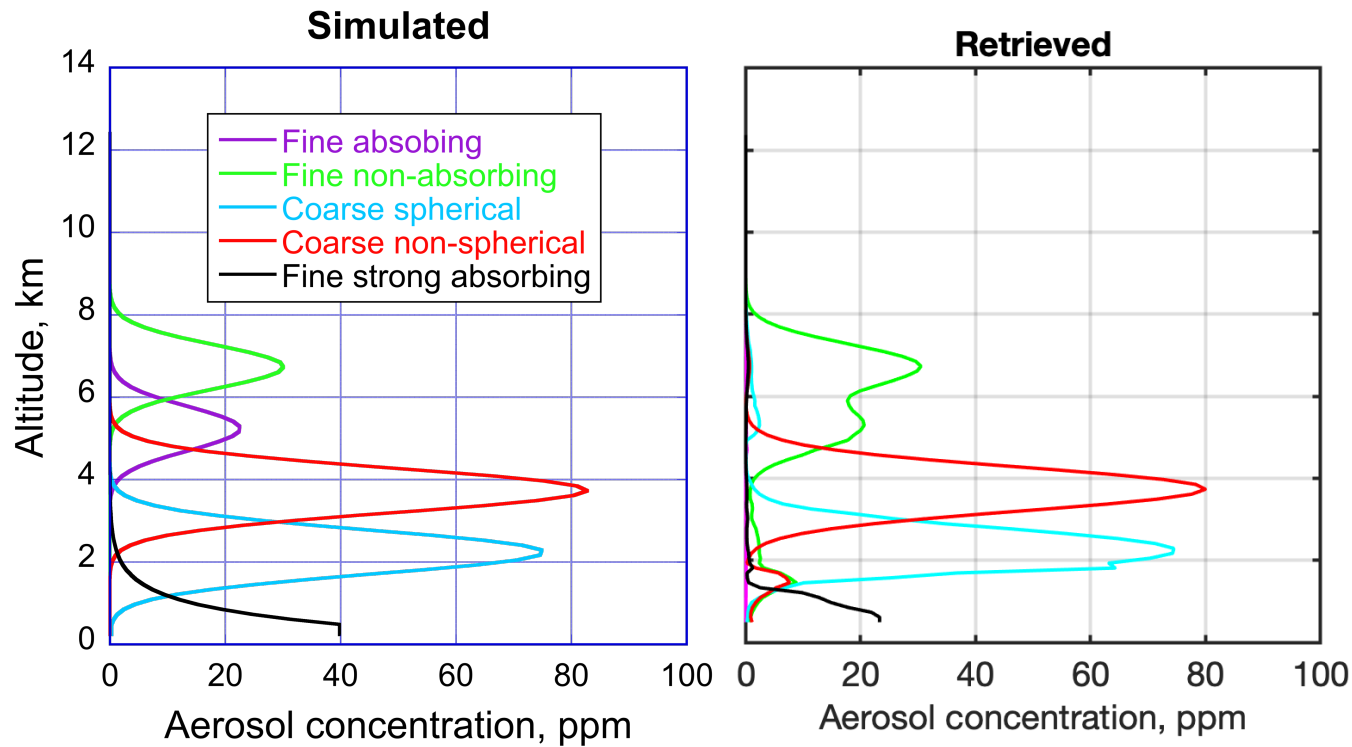
PARASOL+NEXTGEN LIDAR: complex case



NEXTGEN LIDAR: complex case



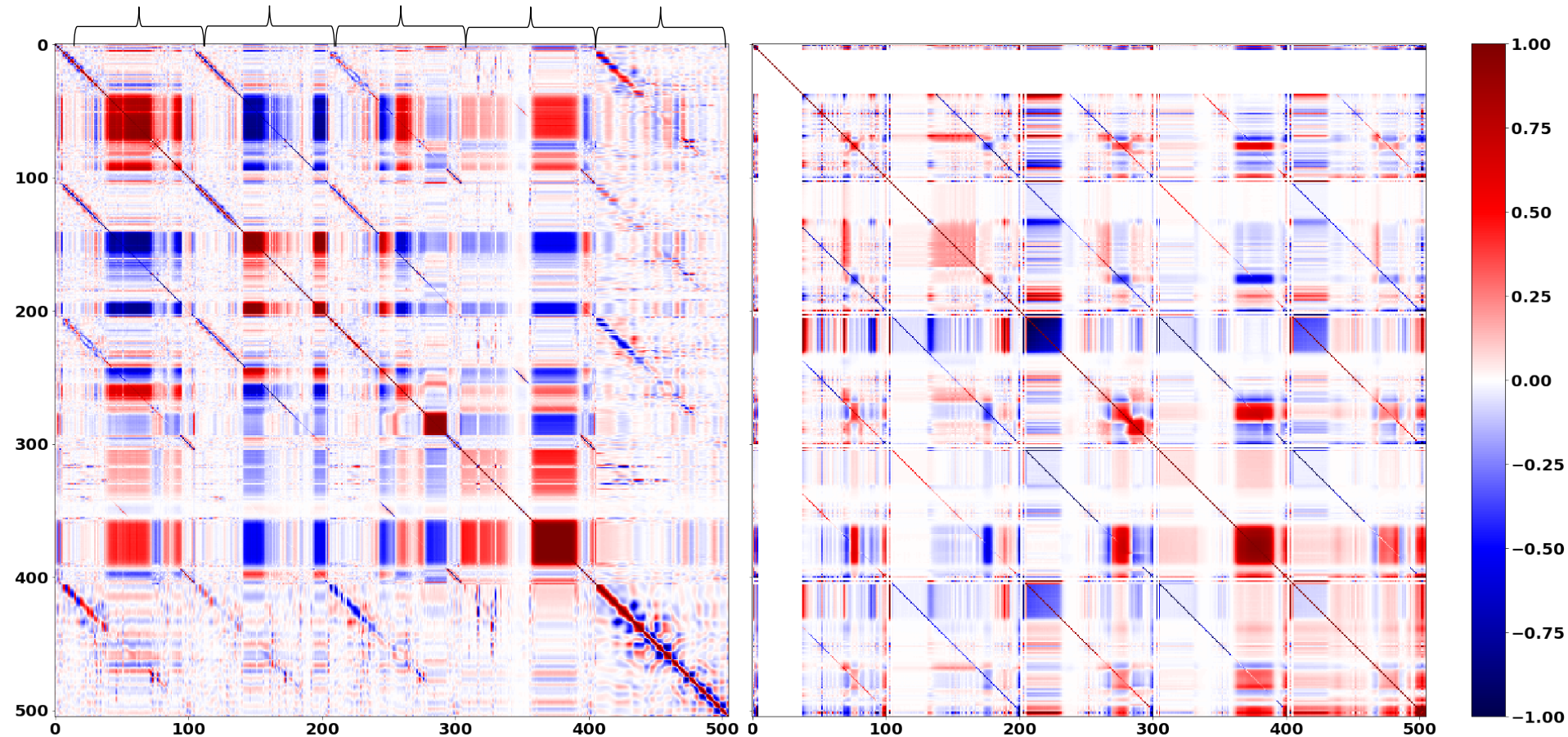
NEXTGEN HSRL LIDAR: complex case



LIDAR vs HSRL: the correlation matrices

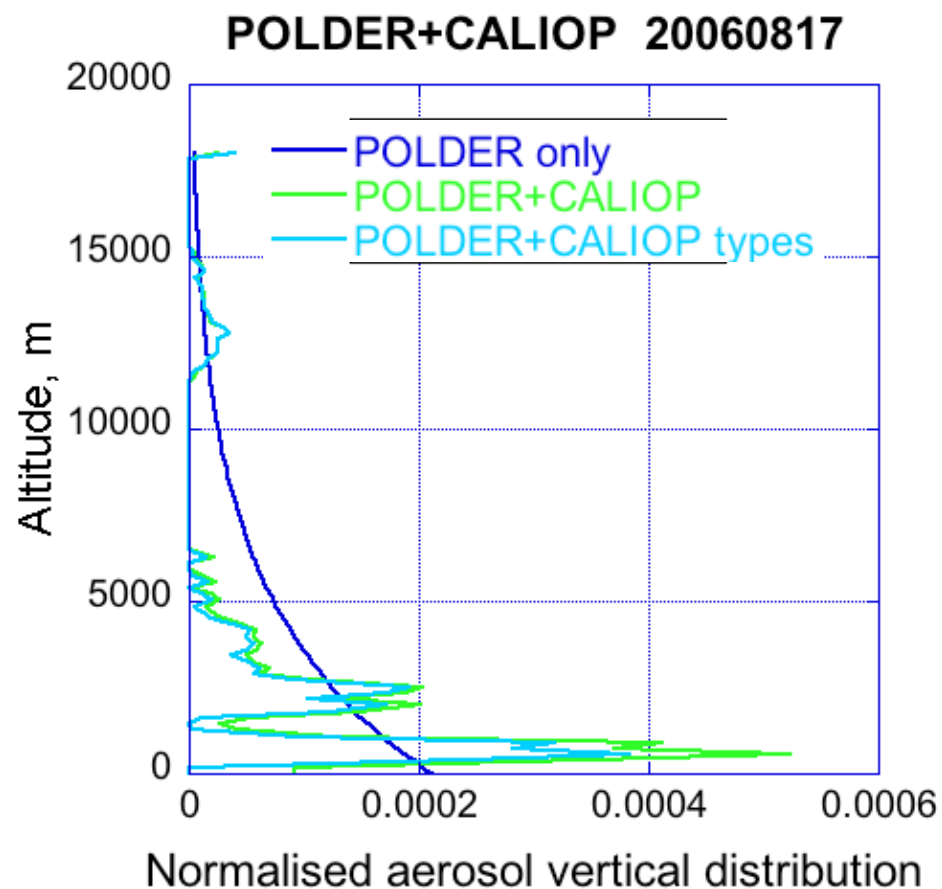
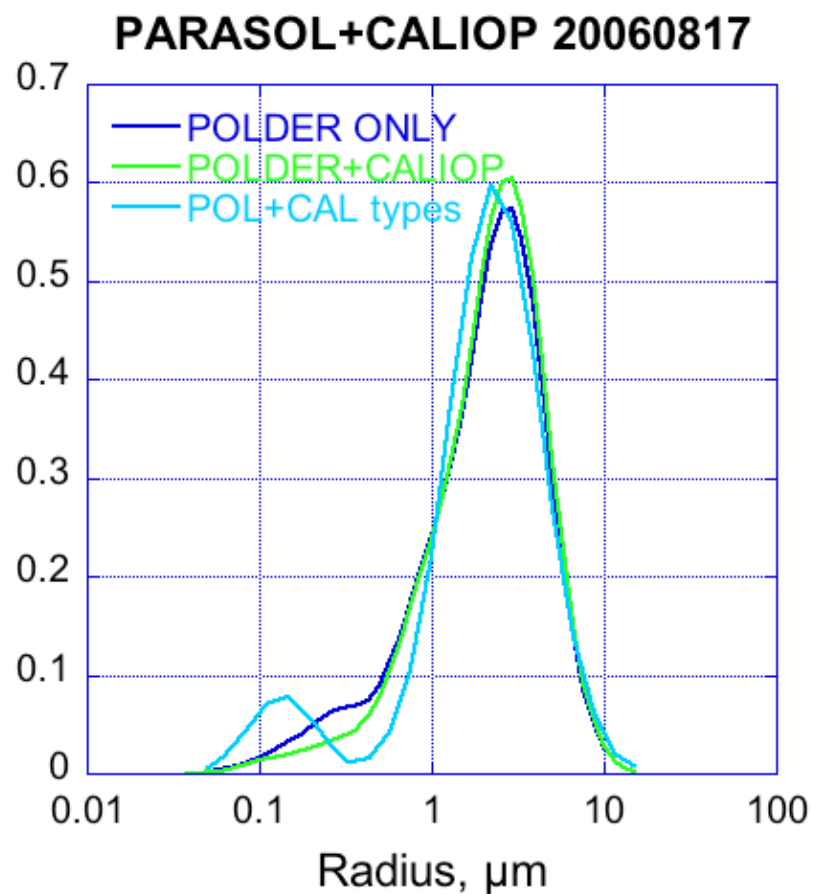
$$\beta(h) \exp \left[-2 \int_{h_{min}}^h \alpha(h') dh' \right]$$

Fine absorbing Fine non-absorbing Coarse spherical Coarse non-spherical Fine strong absorbing

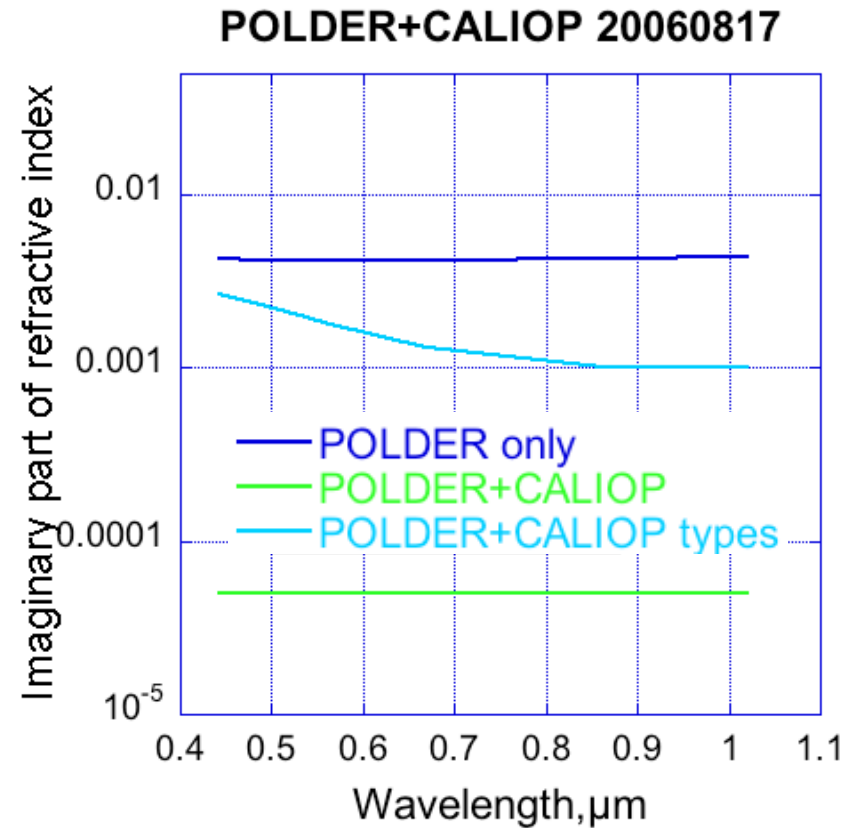
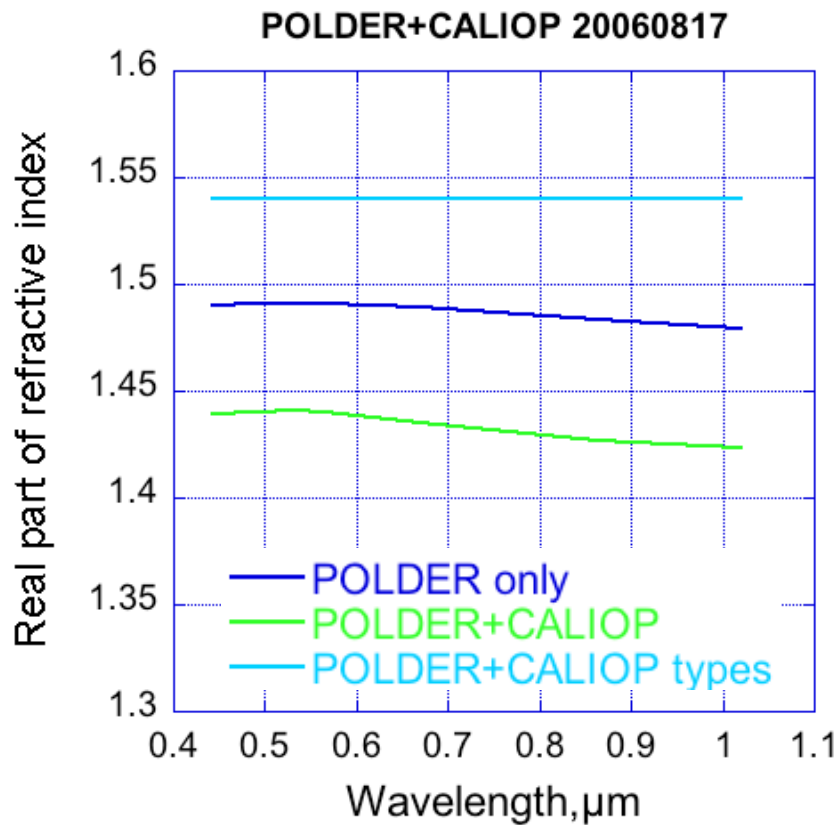


POLDER+CALIOP 532

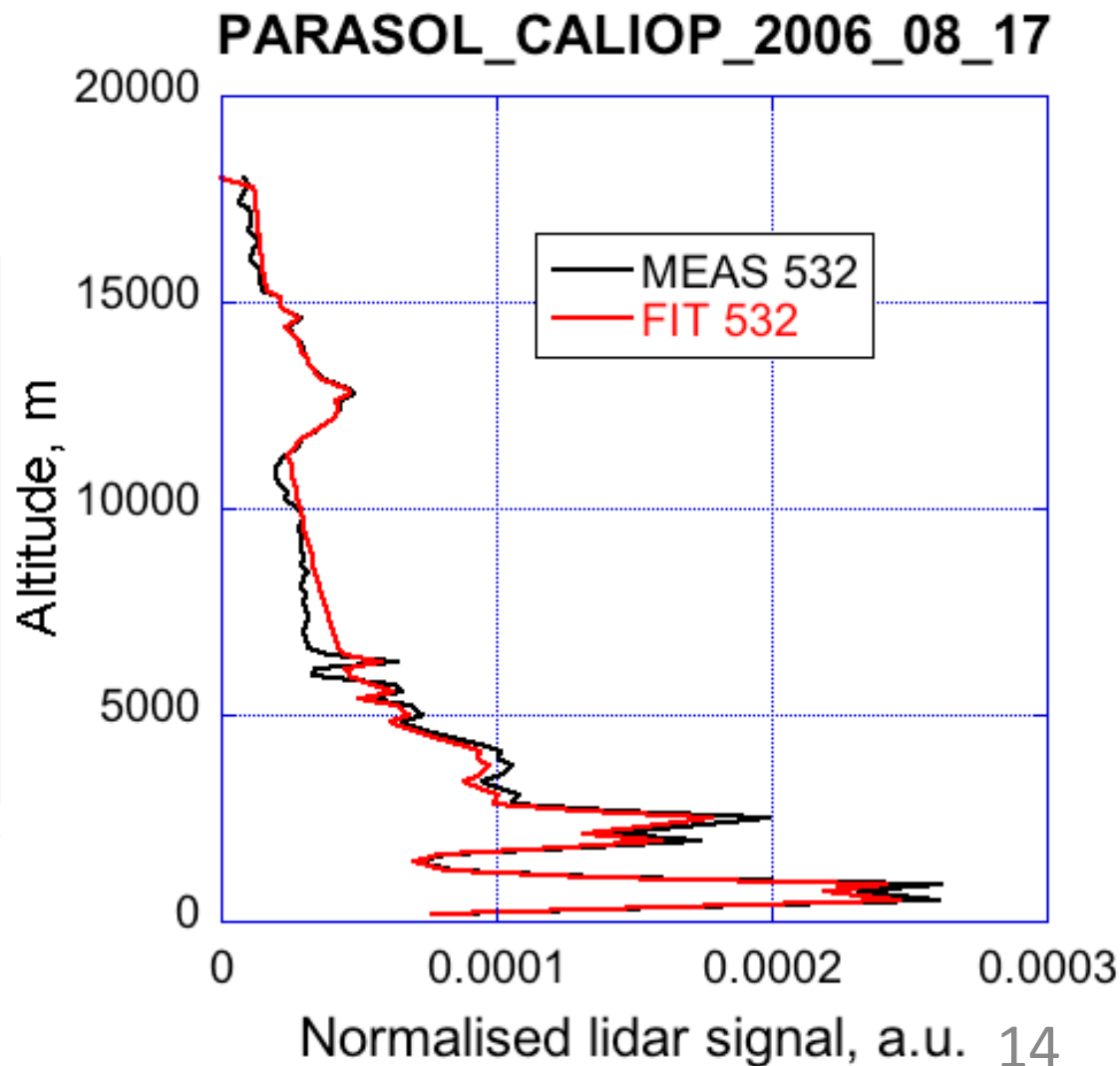
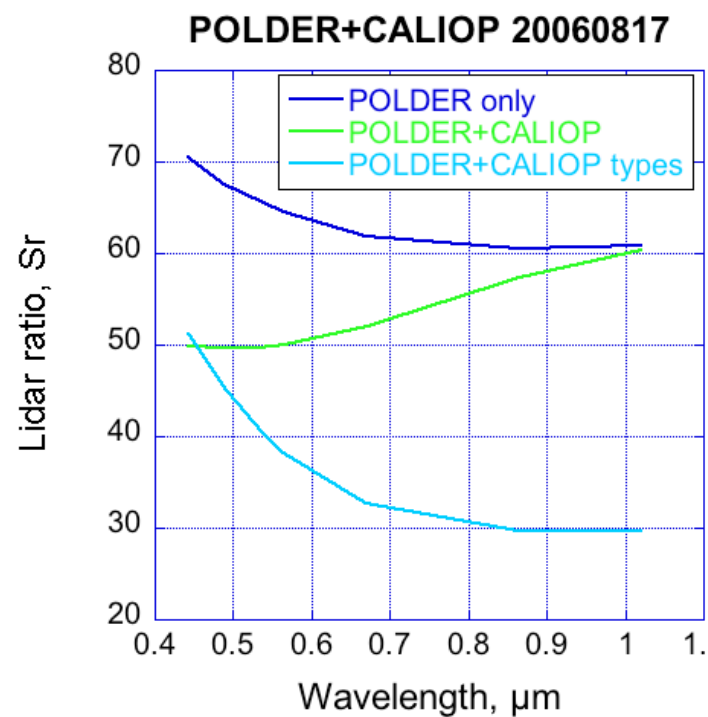
Normalised volume size distribution, $\mu\text{m}^3/\mu\text{m}^2$



POLDER+CALIOP 532



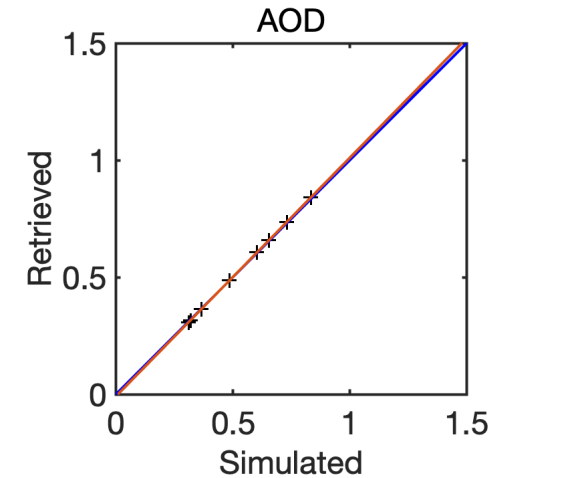
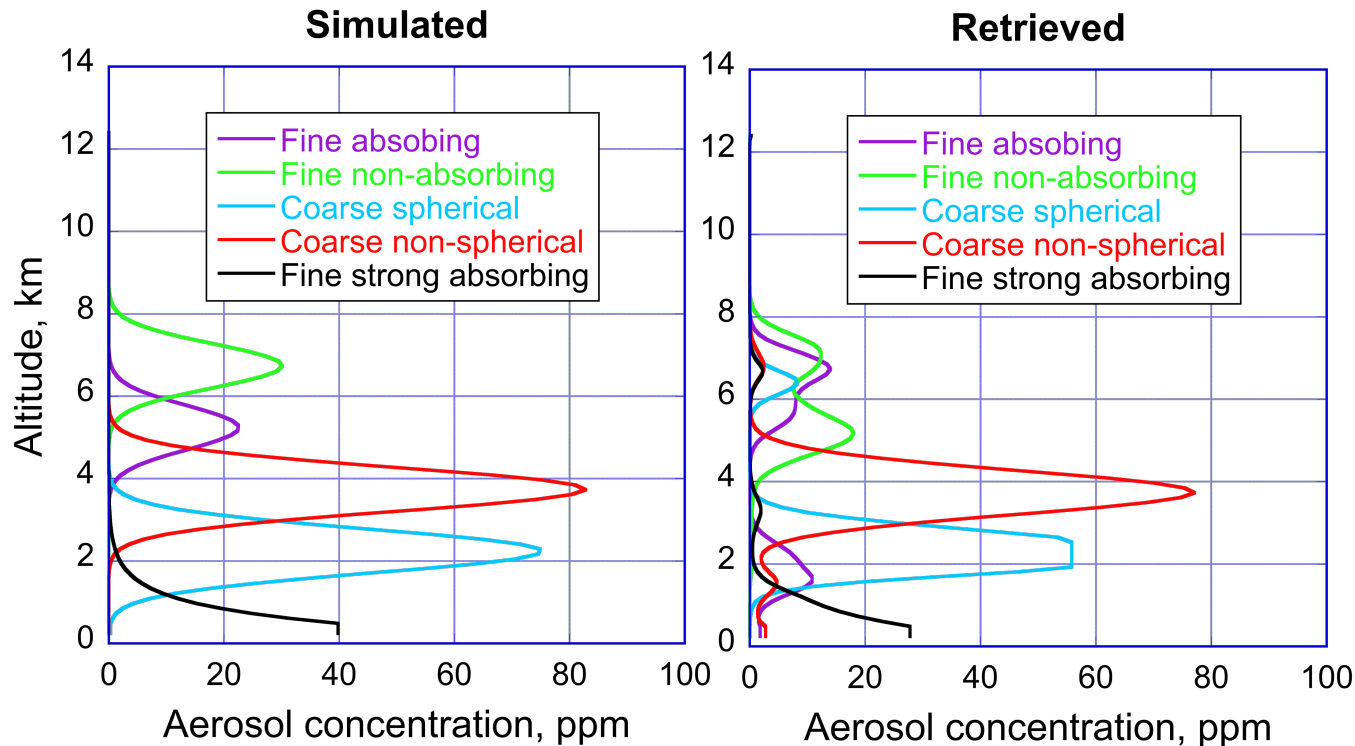
POLDER+CALIOP 532



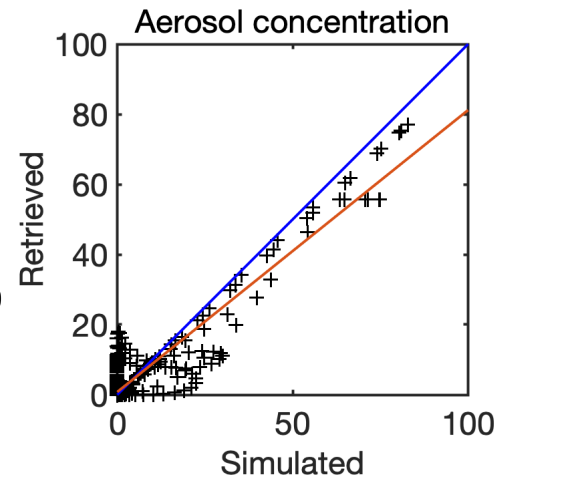
Thank you!

Backup

CALIOP+PARASOL: complex case



$K=1.000$ $a=1.02$ $b=-0.01$ $RMSE=0.004$



$K=0.942$ $a=0.80$ $b=0.79$ $RMSE=4.924$

CALIOP: complex case

