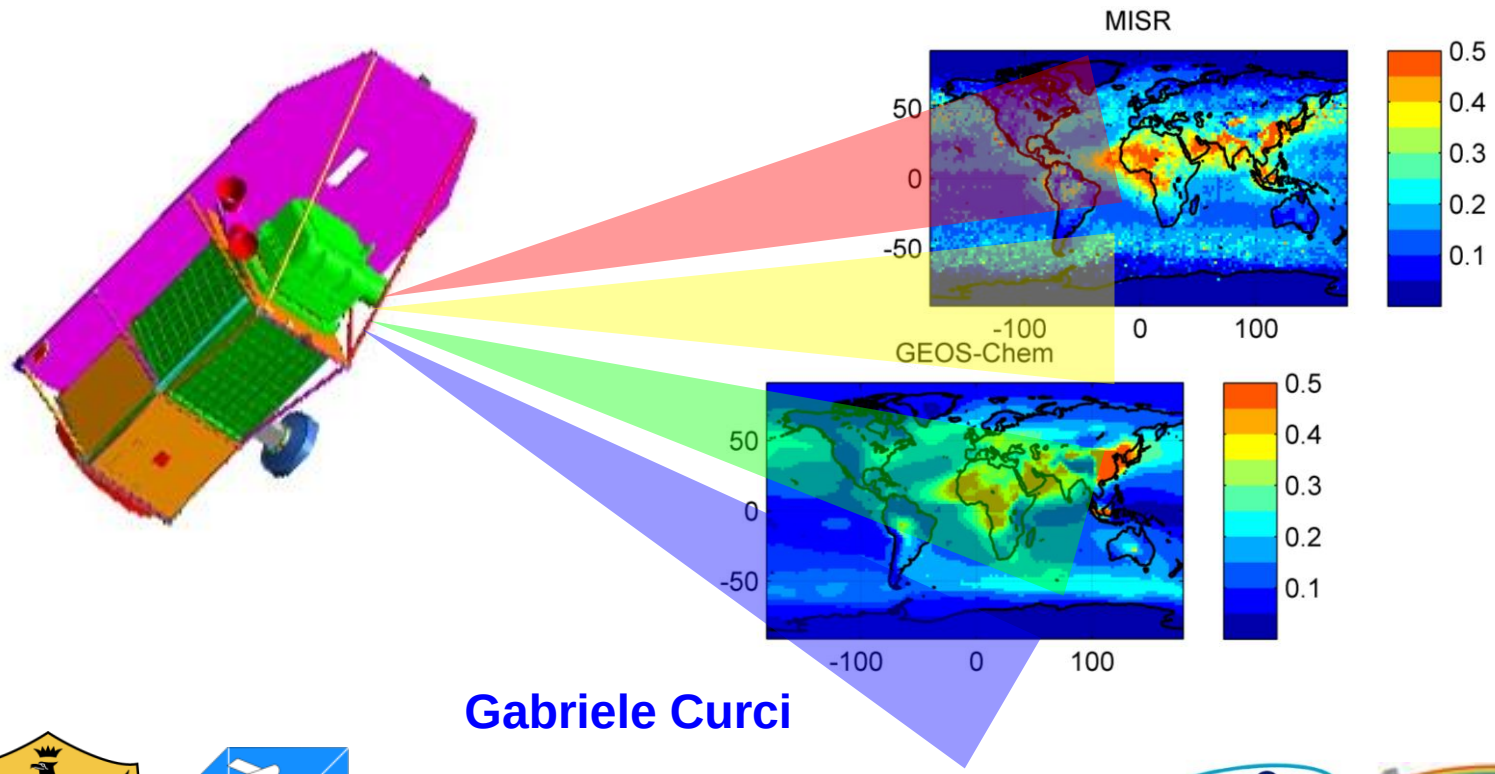
-- FlexAOD --

A NEW GEOS-Chem POST-PROCESSING TOOL FOR AEROSOL OPTICAL PROPERTIES CALCULATIONS



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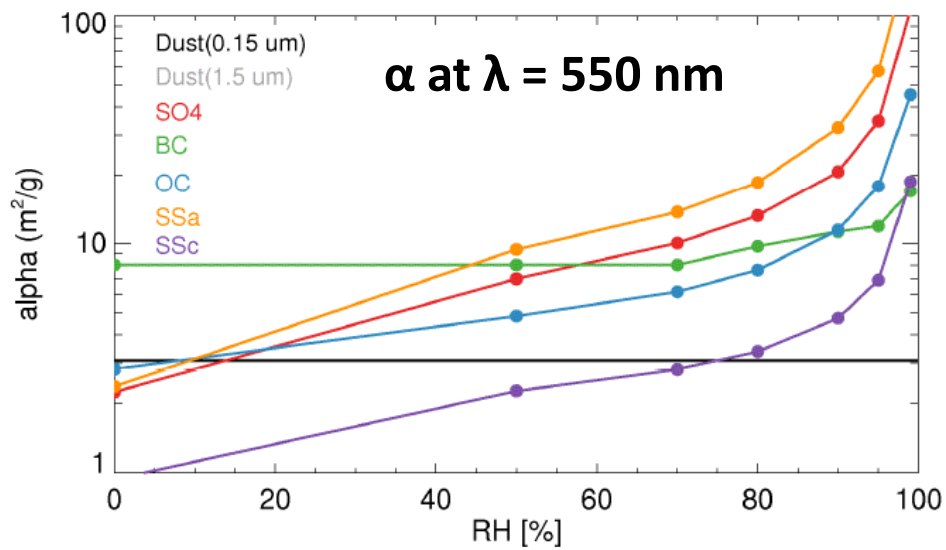
GEOS-Chem AEROSOL OPTICS

6 "optical" species with assumed size distributions, hygroscopic factors, densities, and refractive indices
→ jv_spec.dat



Mie extinction efficiency (m^2/m^2)
Ratio of effective to geometrical cross-section

Hygroscopic scaling factor

Column mass (g/m^2)

$$AOD = \frac{3}{4}\frac{Q_{ext}\, f_{RH}}{r_{eff}\,\rho} M = \alpha M$$

Mass extinction coefficient (m^2/g)

Effective radius (µm)
"Optically" weighted mean radius

Species density (g/cm^3)

[C. Heald and R. Martin, GC wiki]

NEED FOR A POST-PROCESSING TOOL?

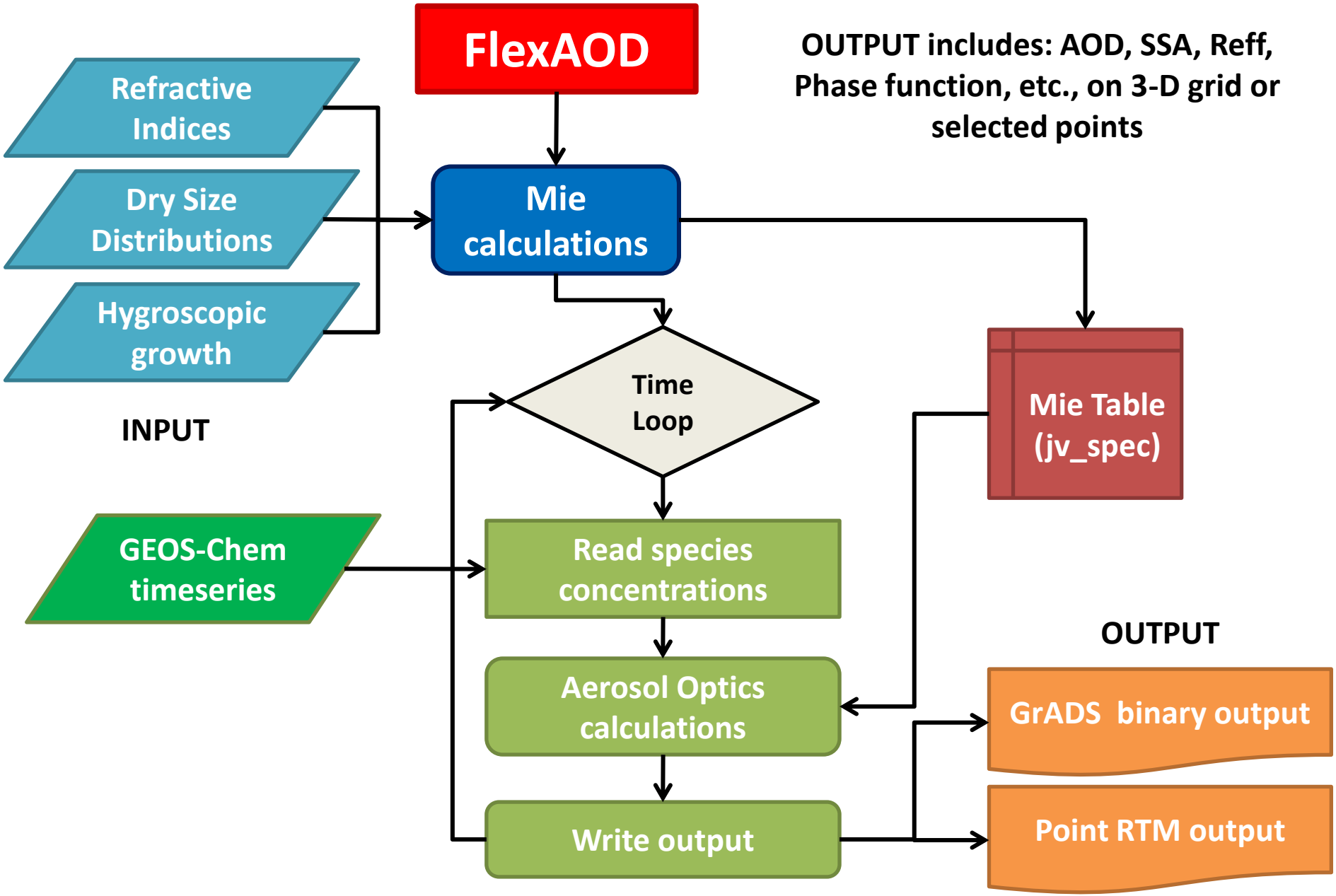
You may want:

- Test sensitivity on assumptions
- Output at several wavelengths
- Other aerosol optical variables: single scattering albedo, phase functions, etc.

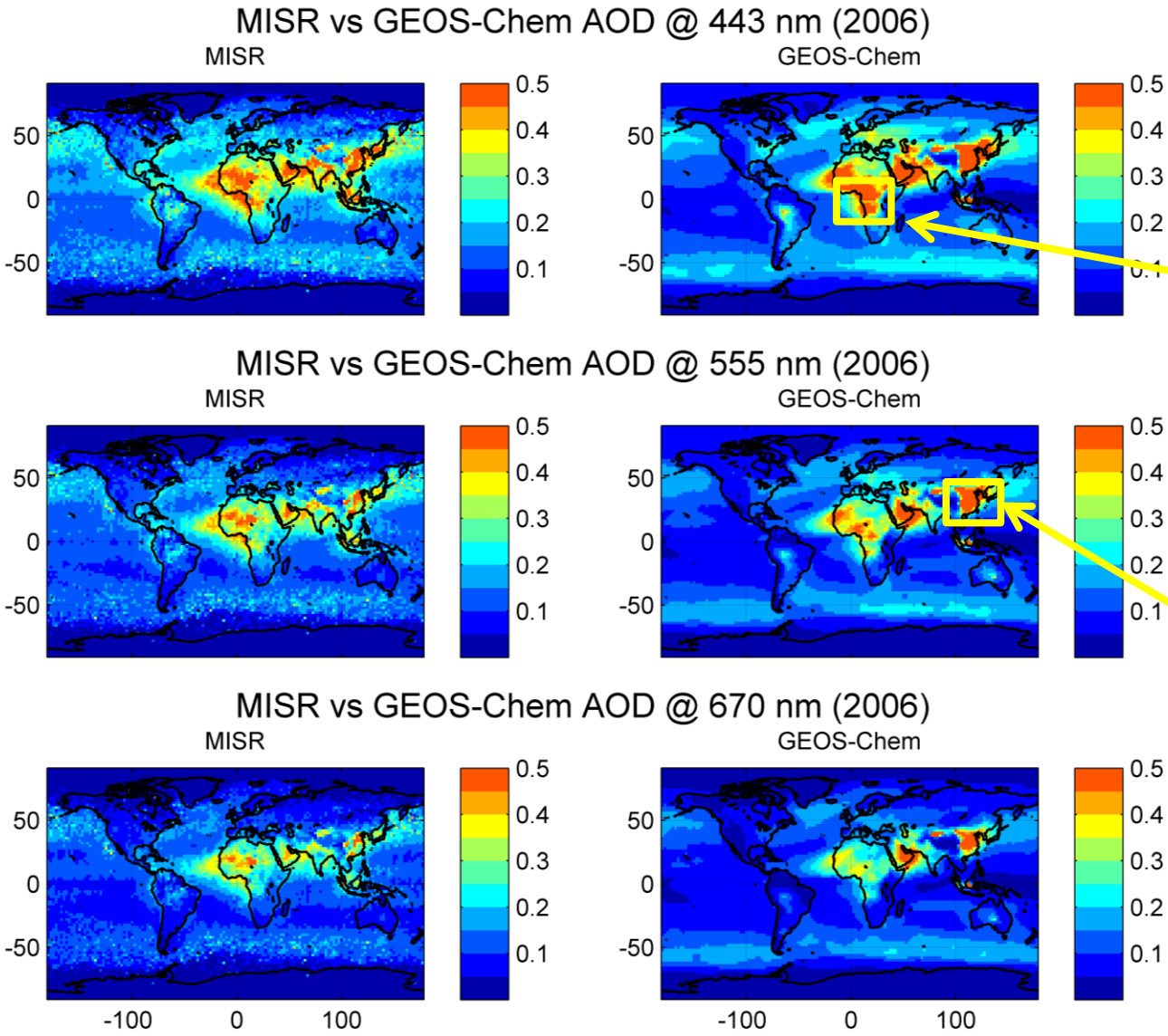
E.g. for:

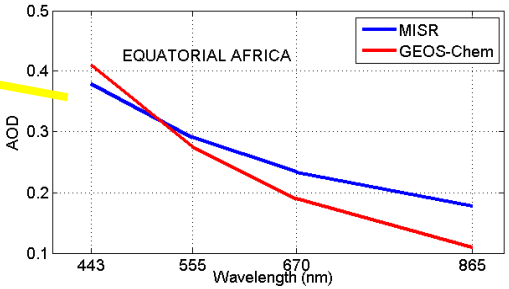
- Comparison with measurements
- Input to RTMs for aerosol retrieval a-priori

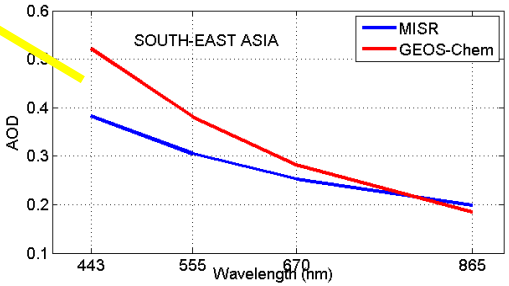
FlexAOD (Flexible AOD) FLOWCHART



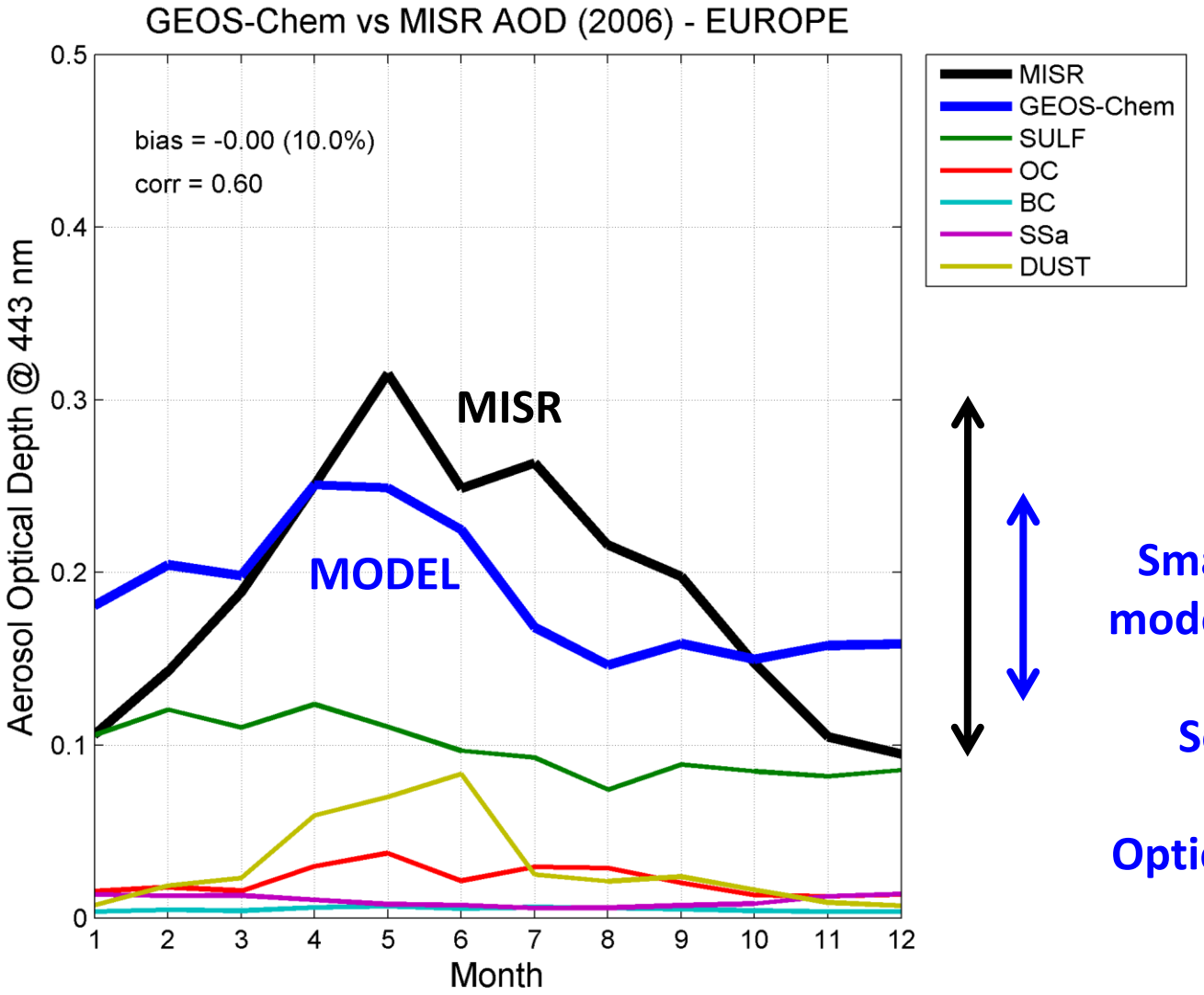
MISR vs GEOS-Chem: MULTI-SPECTRAL COMPARISON







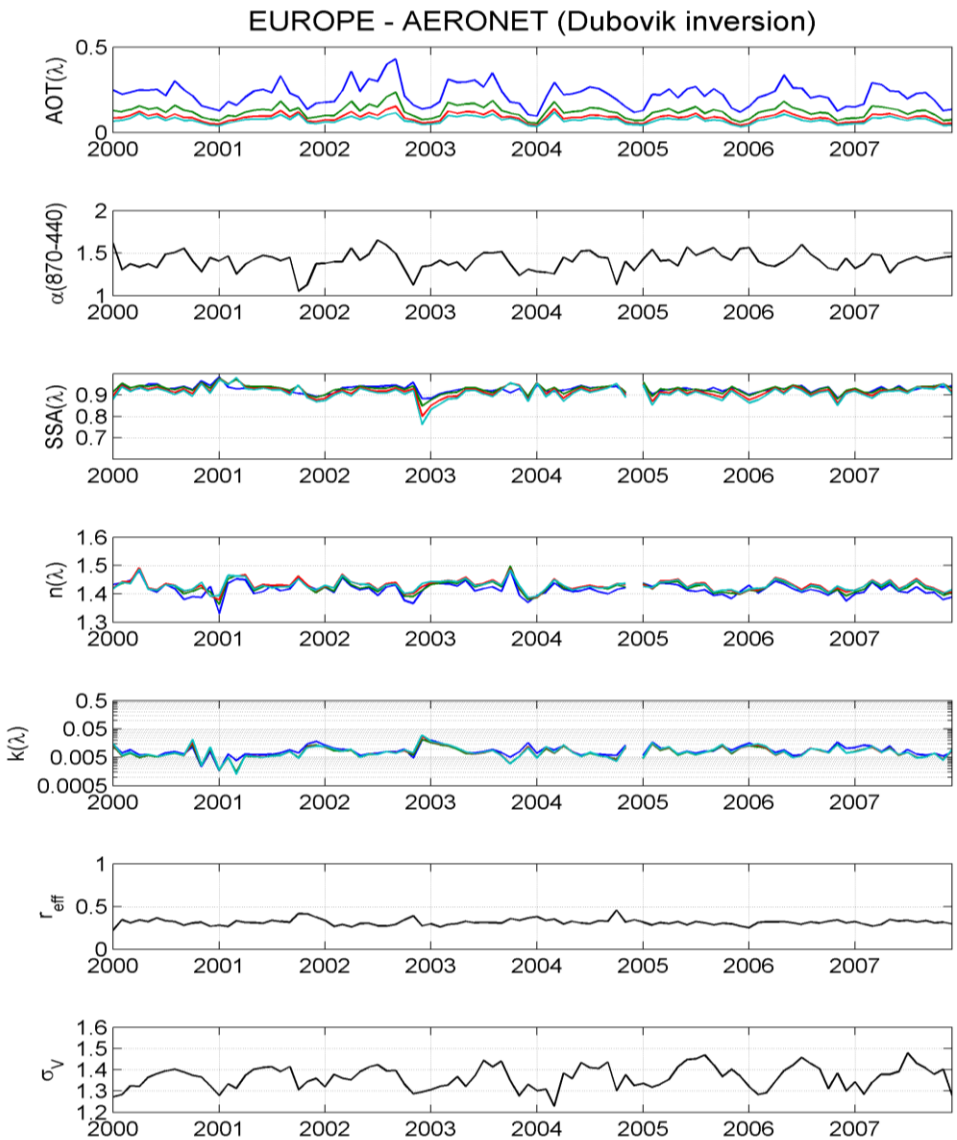
MISR vs GEOS-Chem: EUROPE AVERAGE 2006



Small amplitude of model seasonal cycle:

Sources/sinks?
Transport?
Optical assumptions?

AERONET INVERSION OF REFRACTIVE INDEX AND SIZE DISTRIBUTION



AOT Europe (monthly)

Angstrom exponent (related to size)

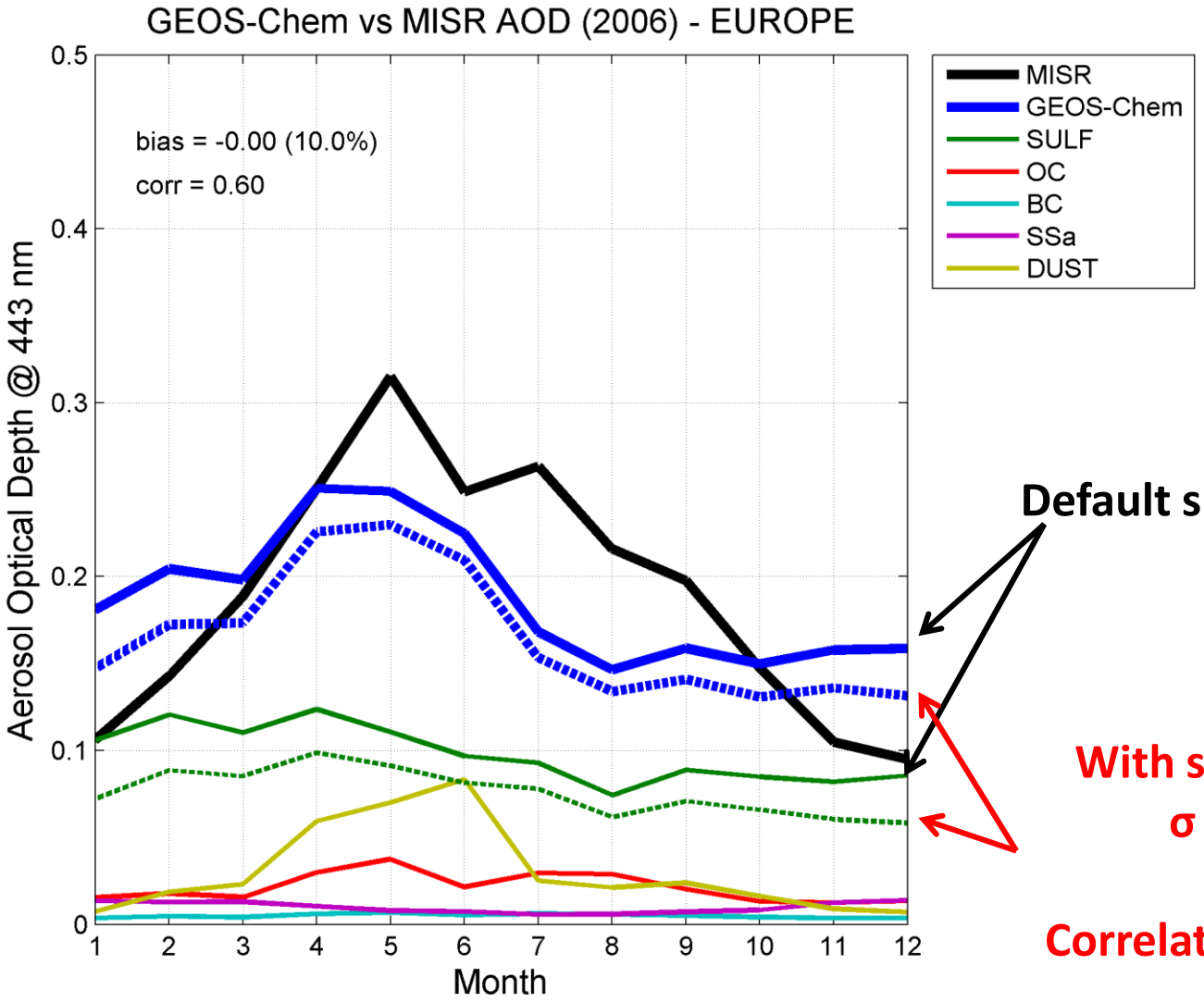
Single Scattering Albedo (related to composition)

Small variability of refractive index (related to composition) and effective radius

Cycle of volume standard deviation

440 nm 675 nm 870 nm 1020 nm

MISR vs GEOS-Chem: INTRODUCING A SEASONAL CYCLE TO SIGMA

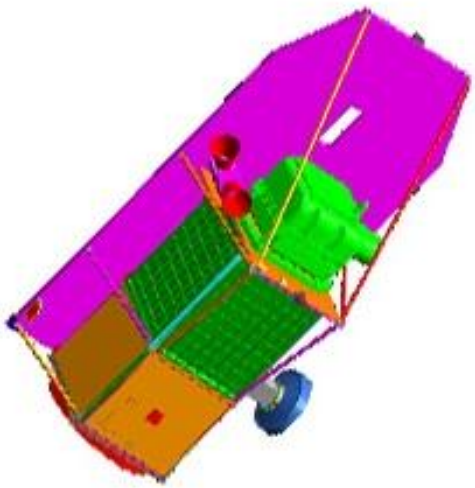


Default sulfate σ = 1.6

With sinusoidal cycle σ = 1.3-1.45

Correlation 0.60 → 0.71

PRISMA HYPERSPECTRAL MISSION



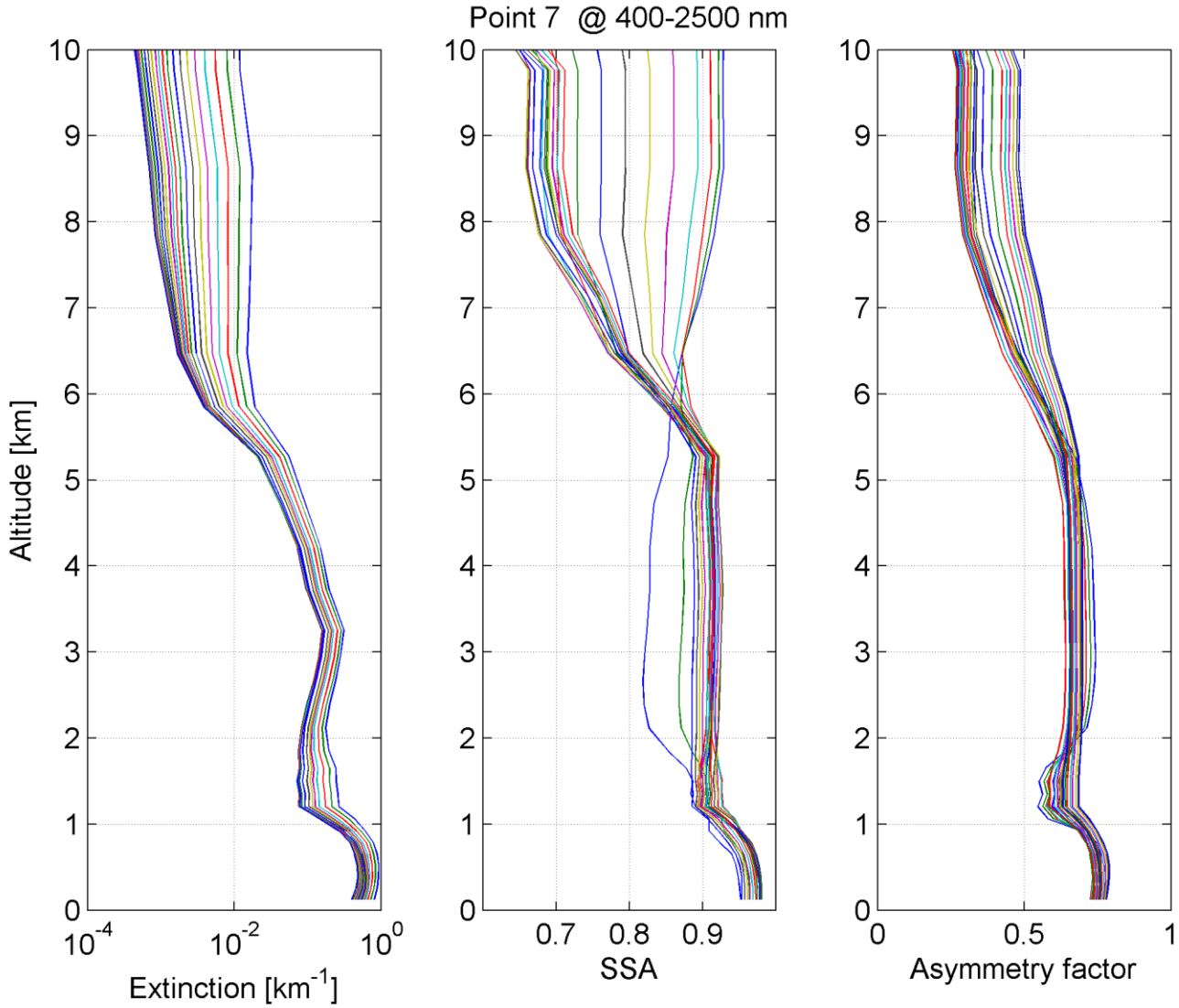
Main features:

- **LEO Solar Synchronous Orbit**
- **Hyper-spectral and Panchromatic payload**
- **Spatial resolution: 30 m (Hyp) / 5 m (PAN)**
- **Swath: 30 km**
- **Return time: 7 days**
- **Spectral range: 0.4-2.5 µm (Hyp) / 0.4-0.7 µm (PAN)**
- **Spectral resolution: 10 nm contiguous bands**
- **Launch: 2013**
- **Lifetime: 5 years**

Main atmospheric level 2 products:

- **Aerosol Optical Thickness and Angstrom Exponent**
- **Water vapor**
- **Cloud optical thickness**

SAMPLE FlexAOD POINT OUTPUT FOR RADIATIVE TRANSPORT MODEL



CONCLUDING REMARKS

IN DEVELOPMENT!

IF INTERESTED IN FlexAOD …

JUST LET ME KNOW!

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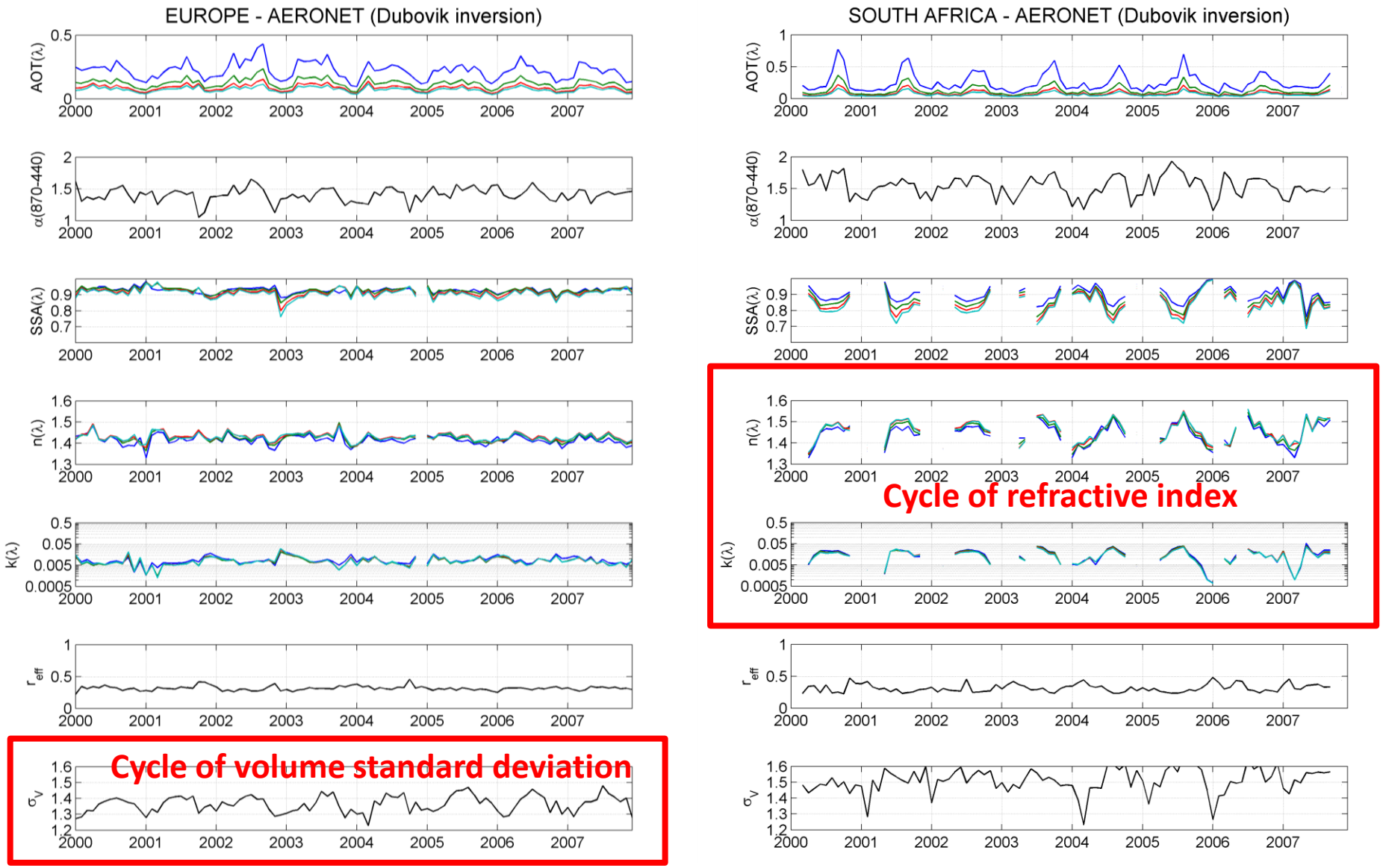
EXTRA SLIDES

AERONET INVERSION OF REFRACTIVE INDEX AND SIZE DISTRIBUTION



IMPACT OF INPUT PARAMETERS ON MIE MASS EXTINCTION

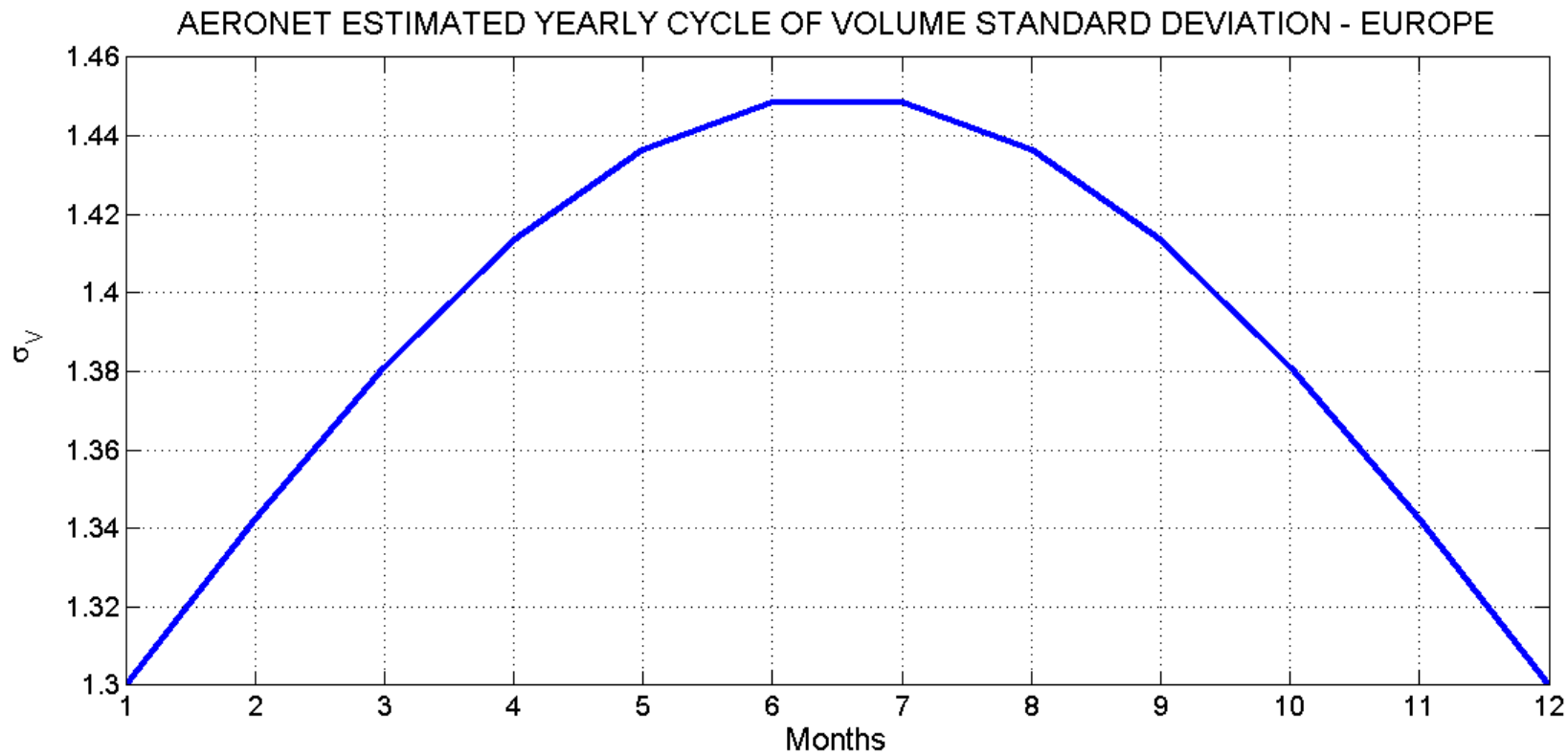
λ = 440 nm r_{mod} = 0.07 µm ρ = 1.7 g/cm^3 RH = 0%

n = 1.4 k = 0.01	Q_{ext}	r_{eff} (µm)	SSA	α (m^2/g)
σ_V = 1.3	0.32	0.083	0.88	**2.26**
σ_V = 1.6	0.90	0.122	0.93	**4.36**

σ_V = 1.4 k = 0.01	Q_{ext}	r_{eff} (µm)	SSA	α (m^2/g)
n = 1.4	0.46	0.093	0.91	**2.90**
n = 1.6	0.98	0.093	0.95	**6.21**

σ_V = 1.4 n = 1.4	Q_{ext}	r_{eff} (µm)	SSA	α (m^2/g)
k = 0.005	0.44	0.093	0.95	**2.80**
k = 0.02	0.49	0.093	0.83	**3.11**

SIGMA YEARLY CYCLE ESTIMATED FROM AERONET



Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.3	1.34	1.38	1.41	1.44	1.45	1.45	1.44	1.41	1.38	1.34	1.3