

Analysis of Bimodal Aerosol Size Distributions at SGP Using RSS 105 and AERONET CIMEL Data

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Need for Improved Aerosol Size Distribution Monitoring

- *Liu et al., 2006*: Aerosol size distribution climatology in GISS GCM does not agree with observations.
- *Dusek et al., 2006*: Variations in CCN concentration depend on variations in aerosol size distribution far more than chemistry.

The Data

- Two devices
 - RSS 105 and CIMEL
 - at C1 of SGP
 - 2003 to 2005

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- Two retrieval algorithms
 - *Gianelli et al., 2005*
 - *Dubovik and King, 2000*

Information Limits (*Box et al., 1996*)

- At most, three items of independent aerosol information obtainable from optical thickness data in wavelength range of RSS and CIMEL, assuming 10% relative error.
- Information is added/subtracted by broadening/narrowing the wavelength range.

Size distribution retrieved from dependence of AOT on wavelength

- Mie scattering: assumes spherical particles
- For a smaller particle:
 - Greater extinction at short wavelengths
 - Less extinction at long wavelengths

Gianelli et al., 2005

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- Fine mode R_{EFF} is retrievable, but with uncertainties -- NO_2 , fine mode V_{EFF}
- Algorithm applicable to other devices

Dubovik and King, 2000

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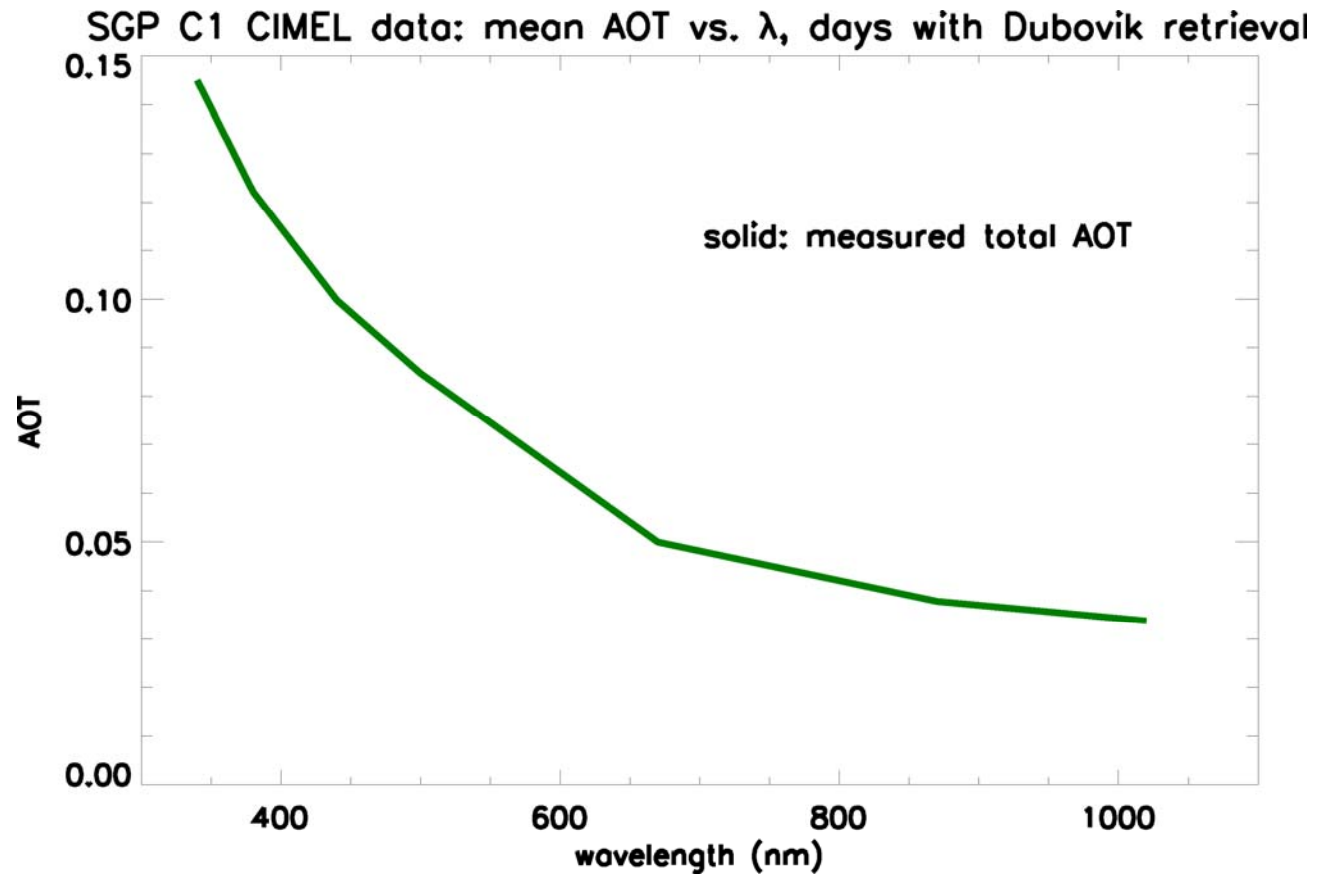
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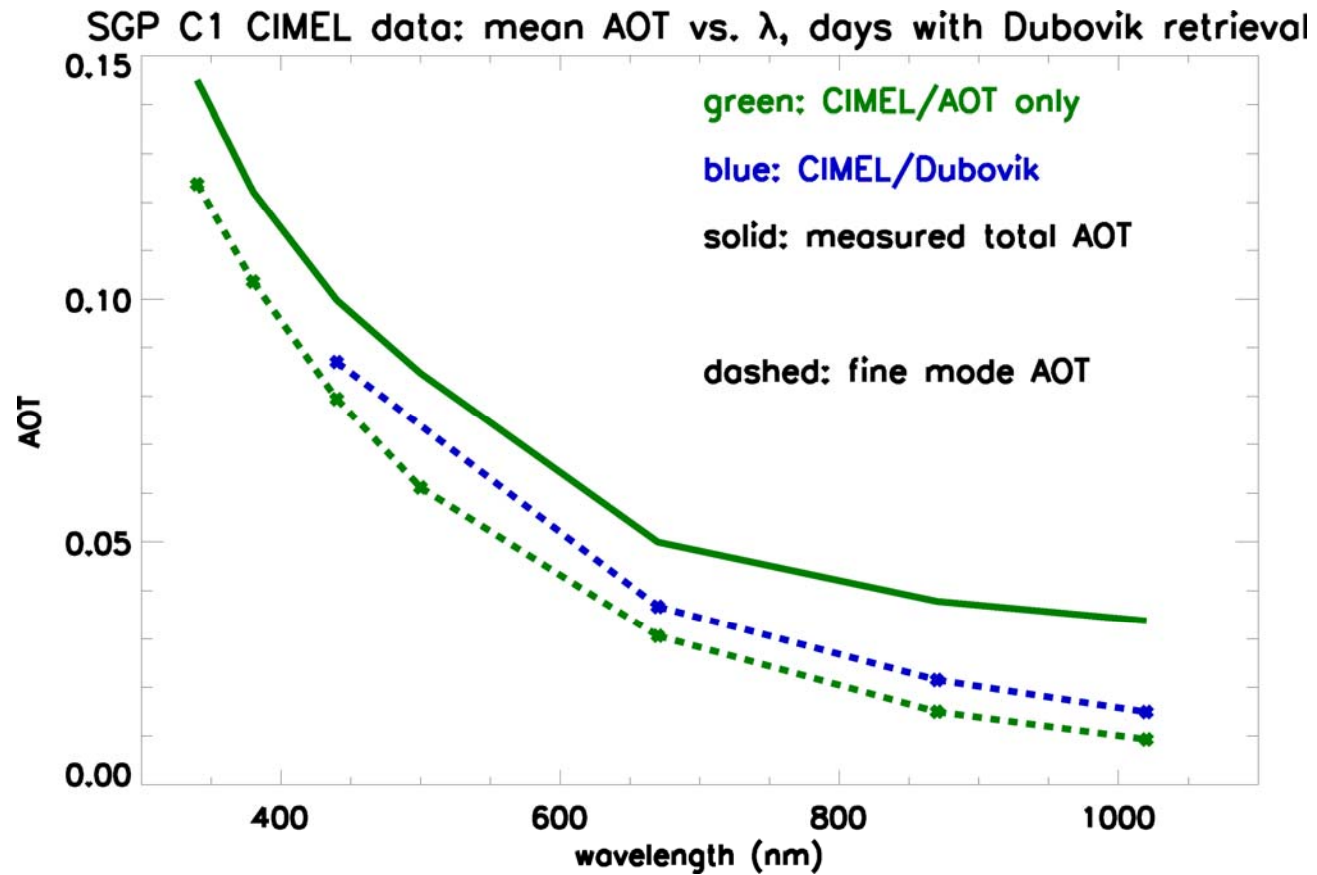
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- Retrieves full size distribution, plus real and complex index of refraction
- R_{EFF} and V_{EFF} for both modes can be calculated from size distribution

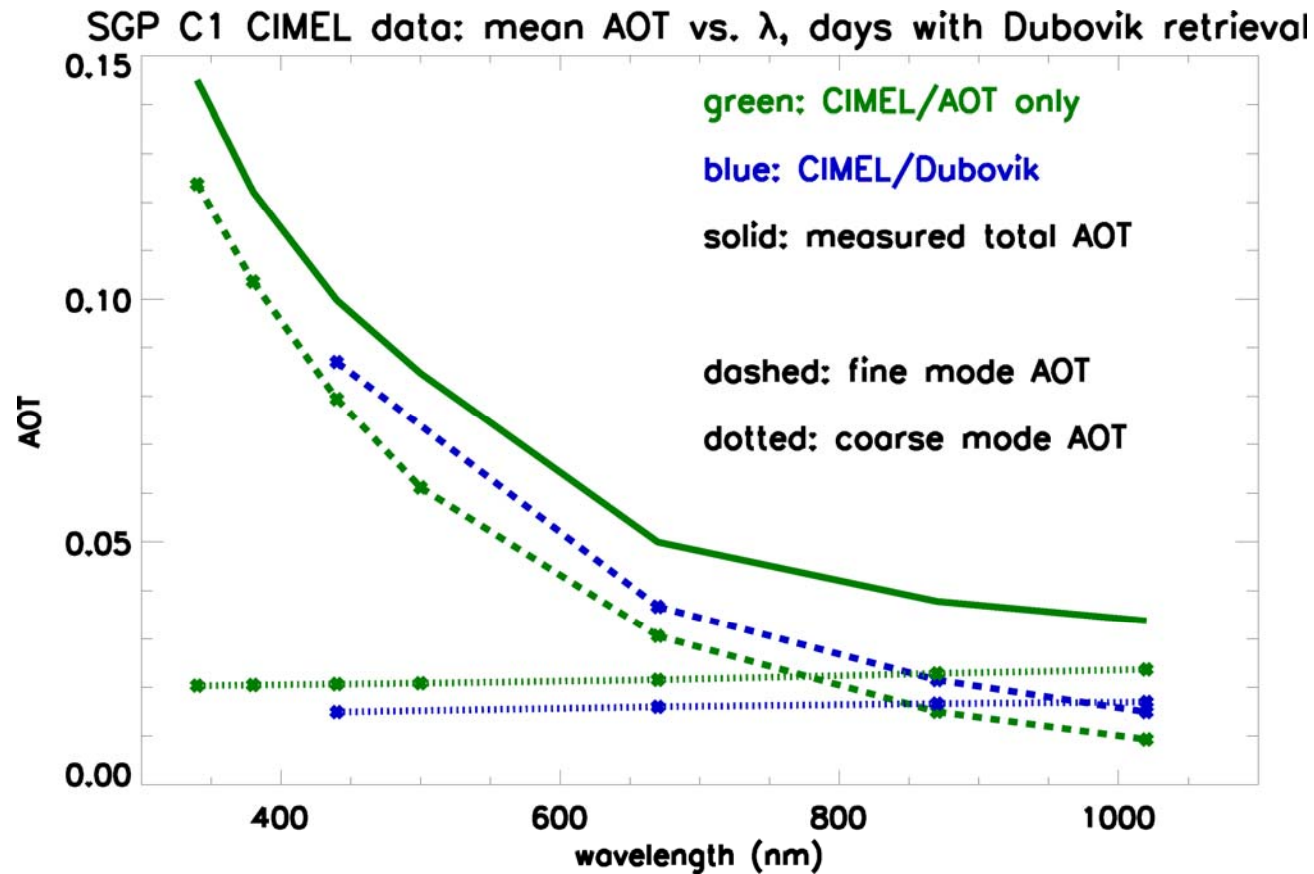
Different retrievals, same data



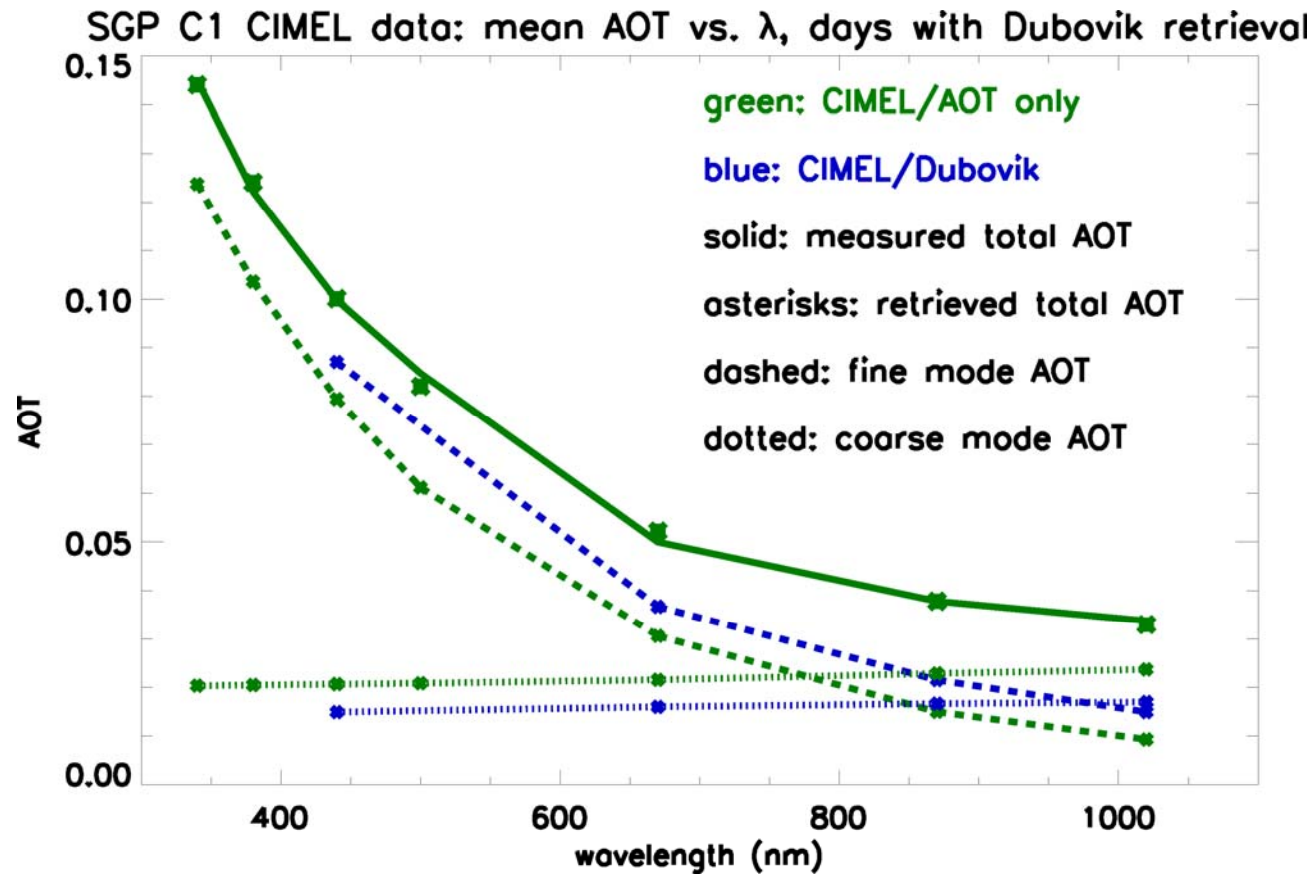
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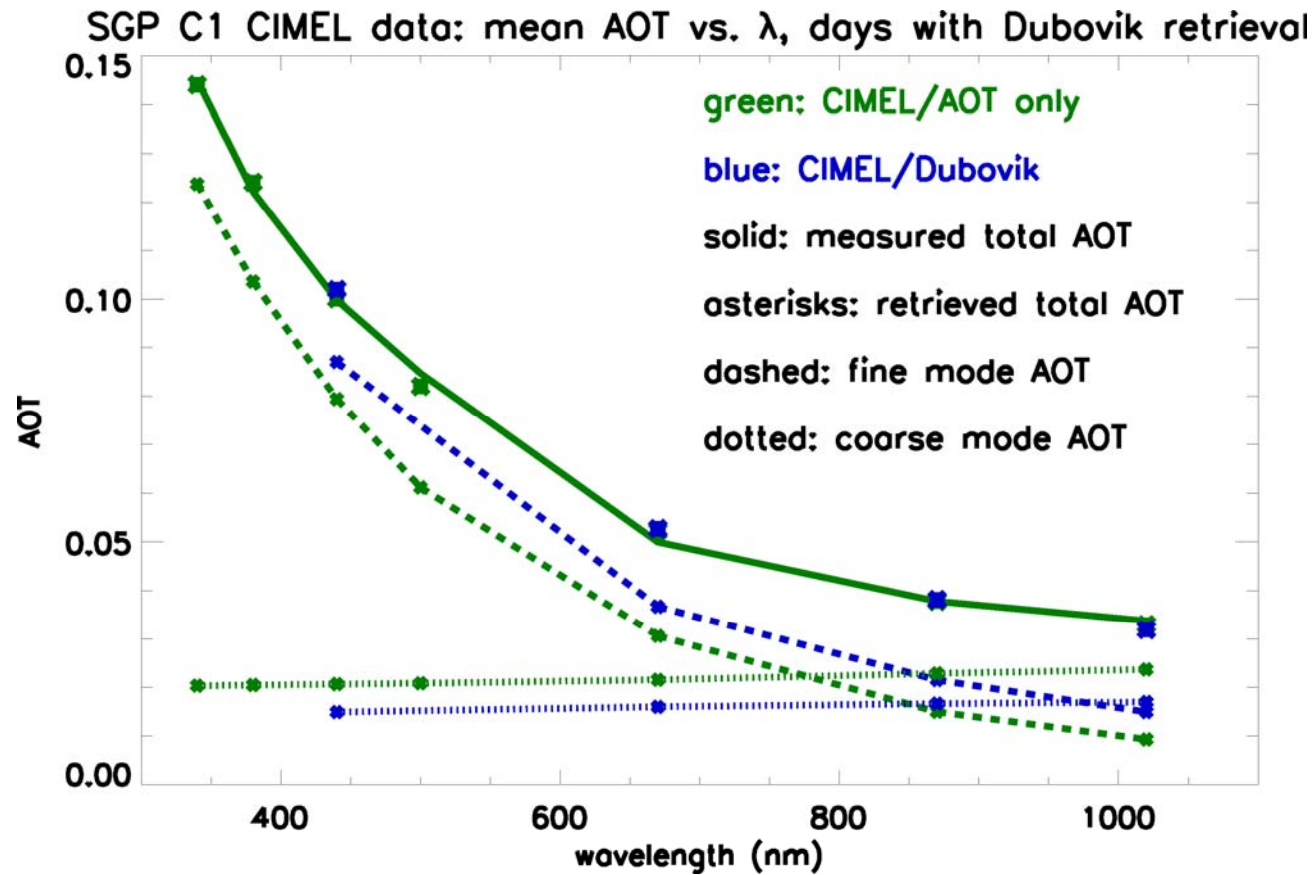
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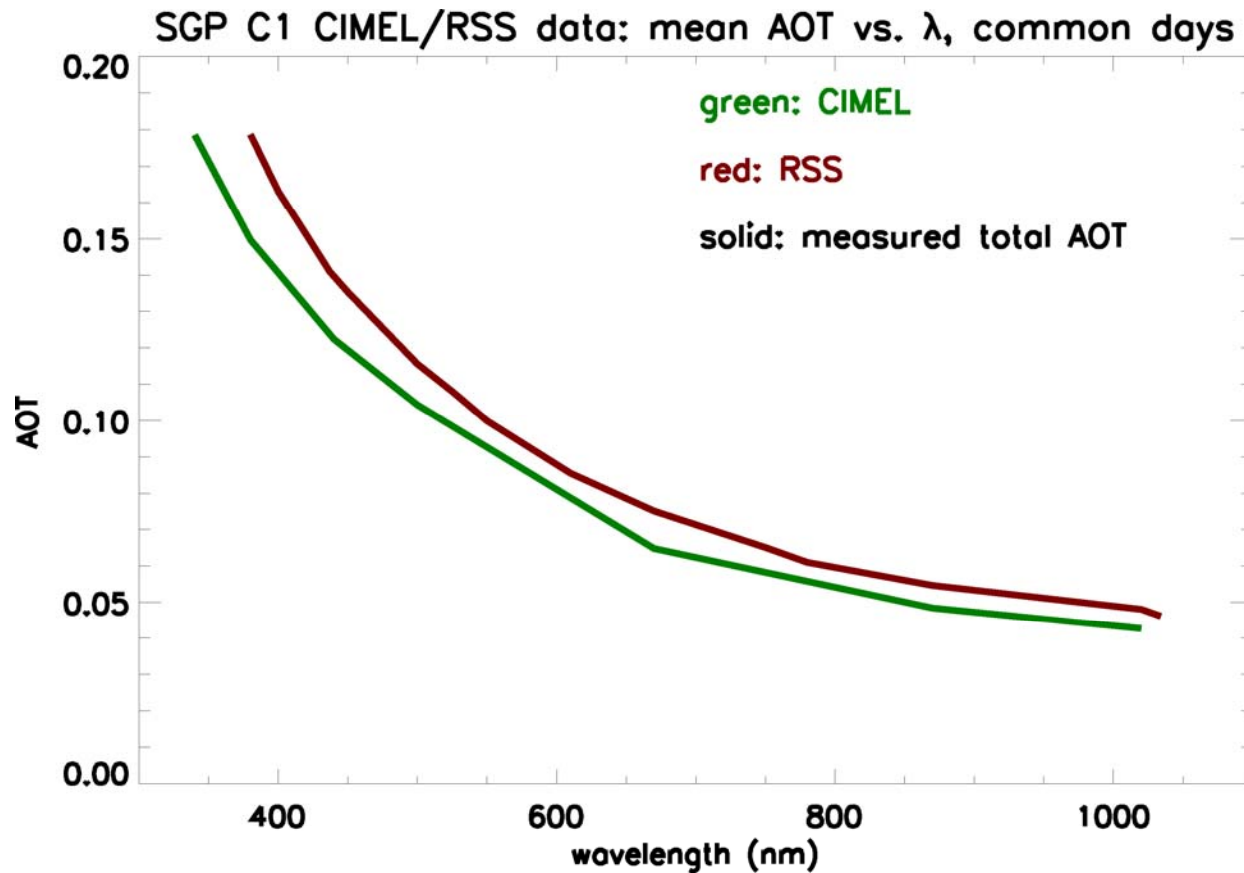
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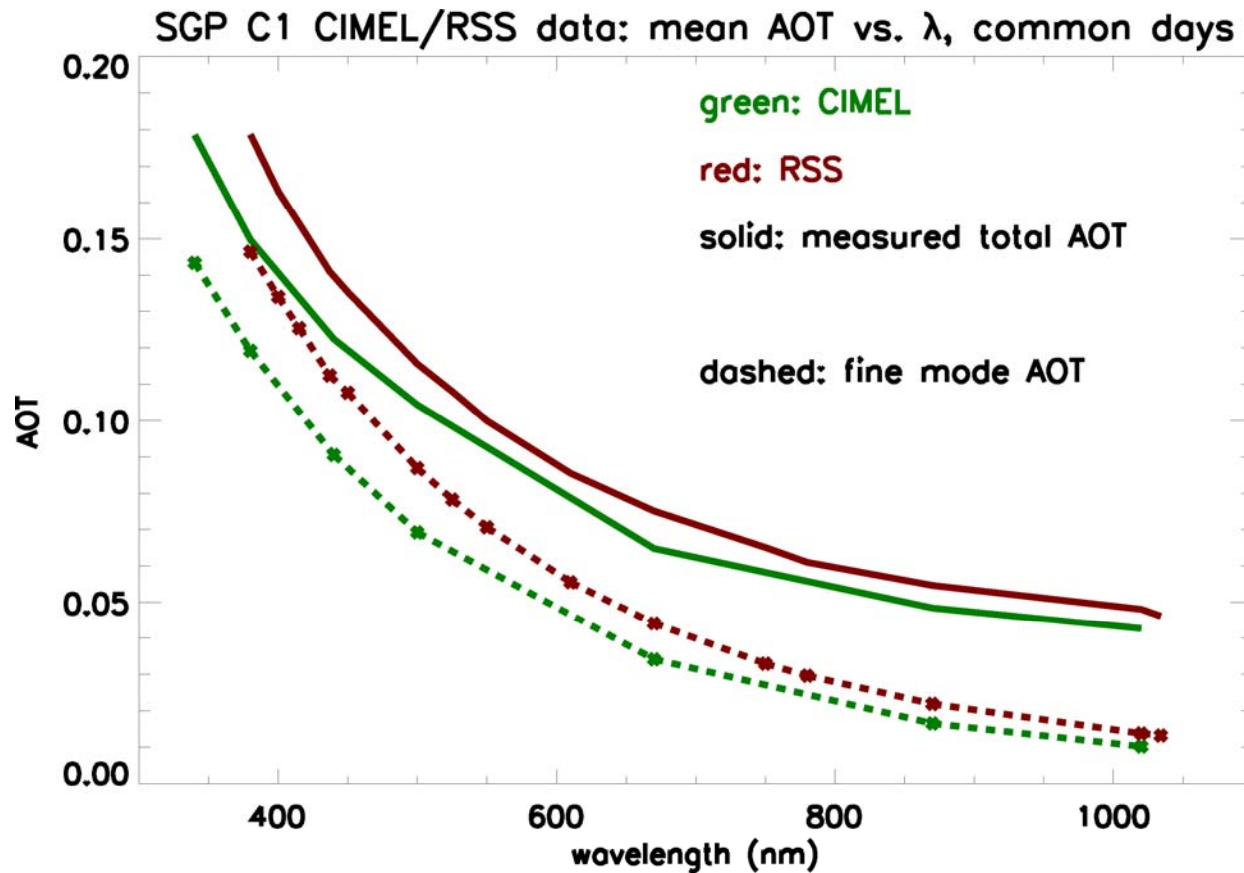
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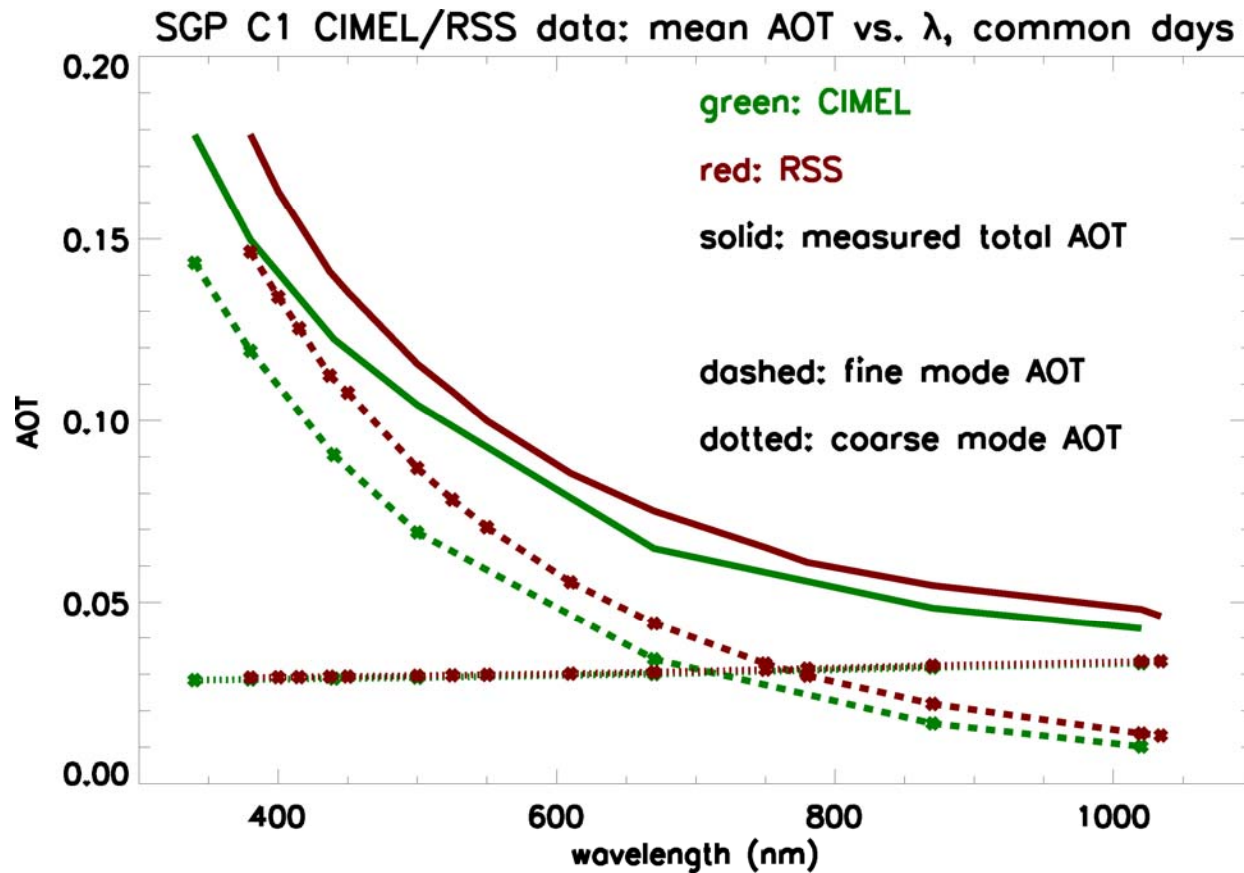
Optical thickness-only retrievals for the RSS 105 and CIMEL



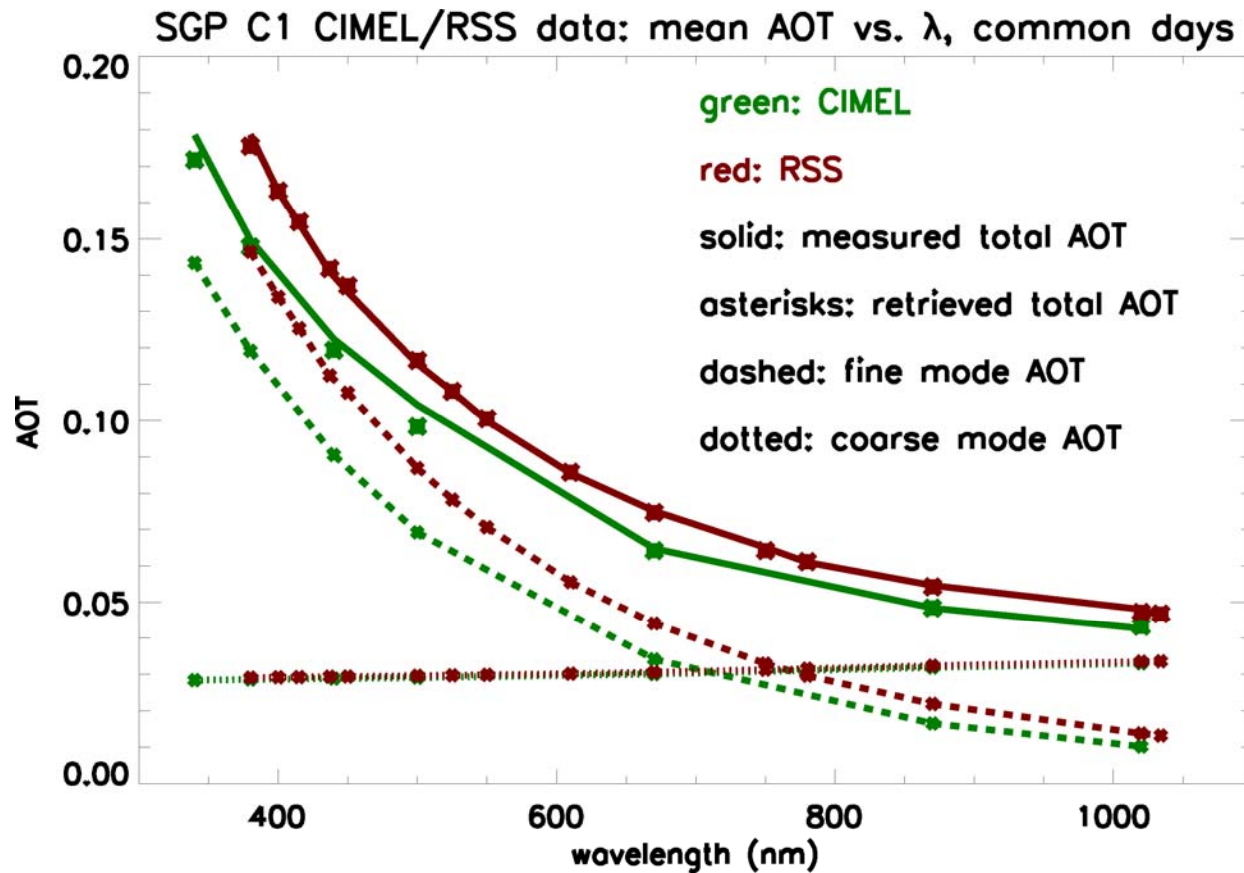
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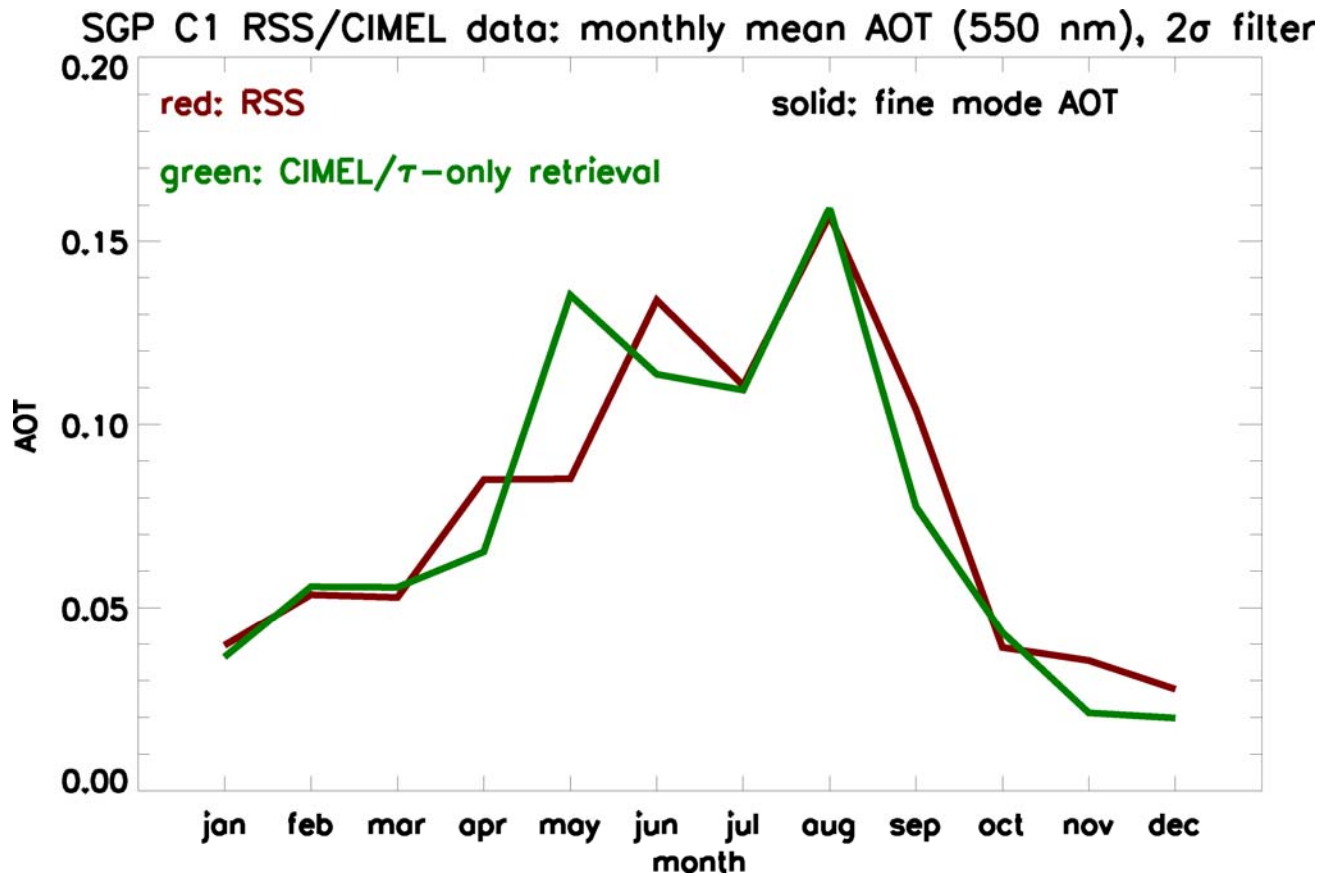
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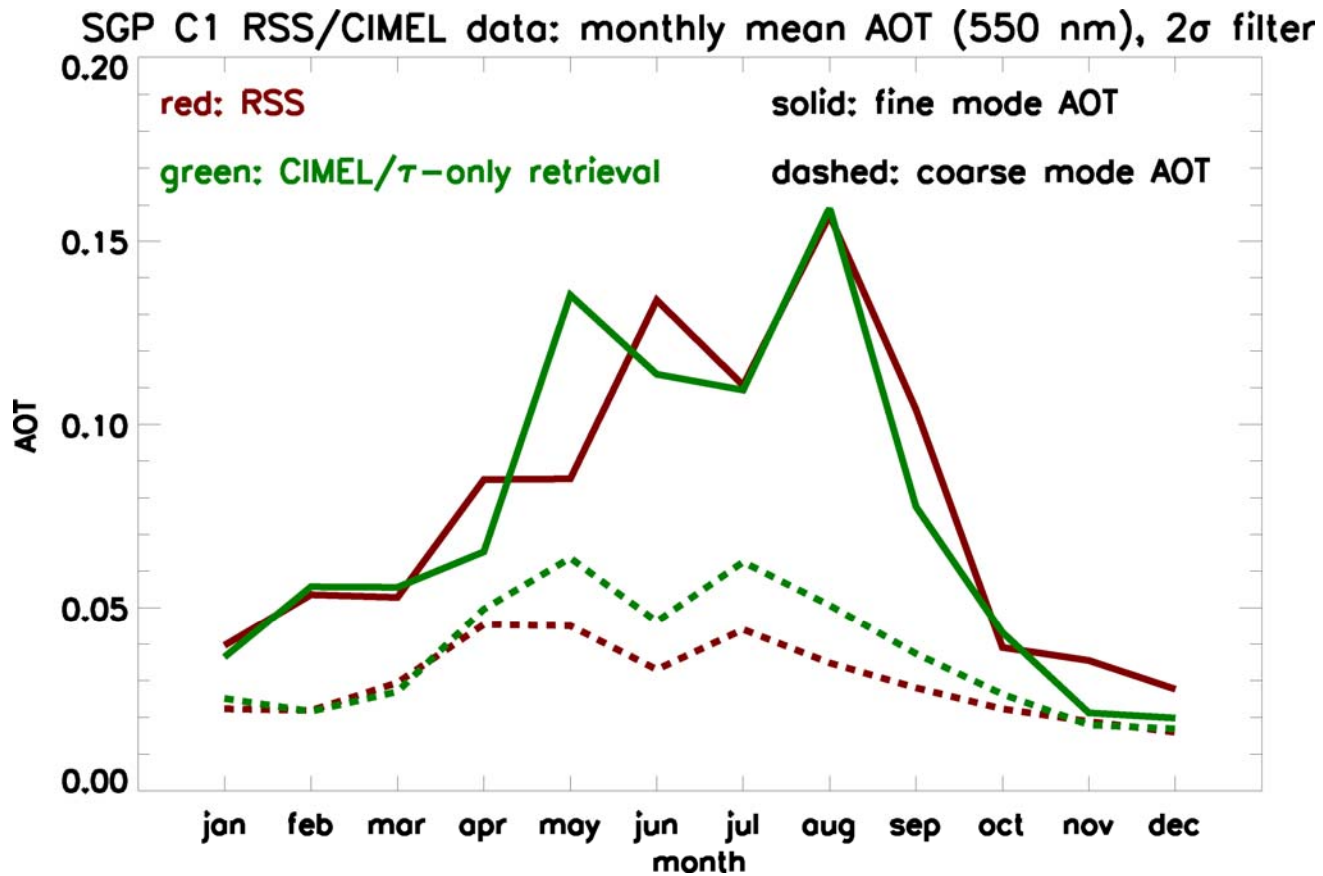
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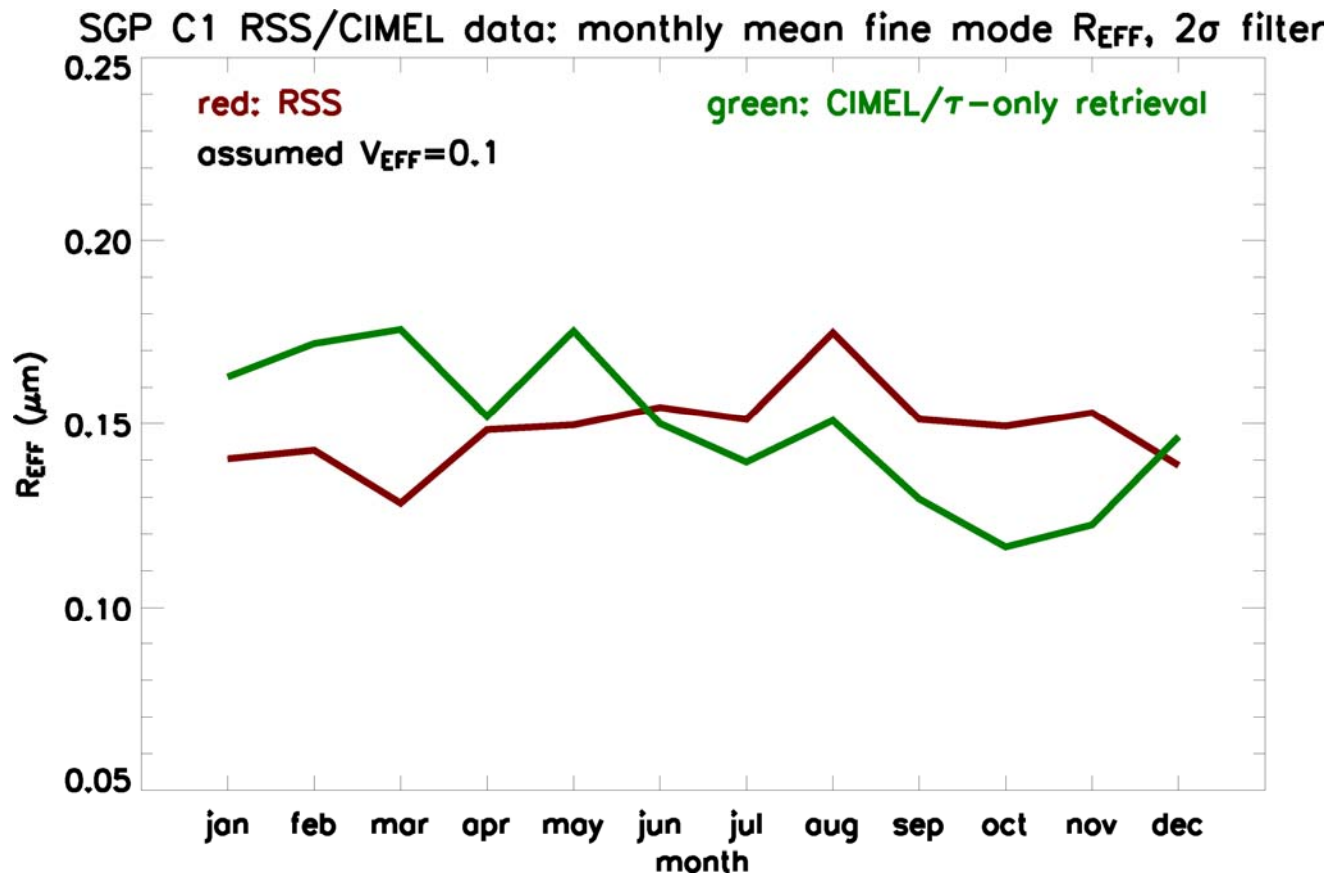
Climatologies: AOT



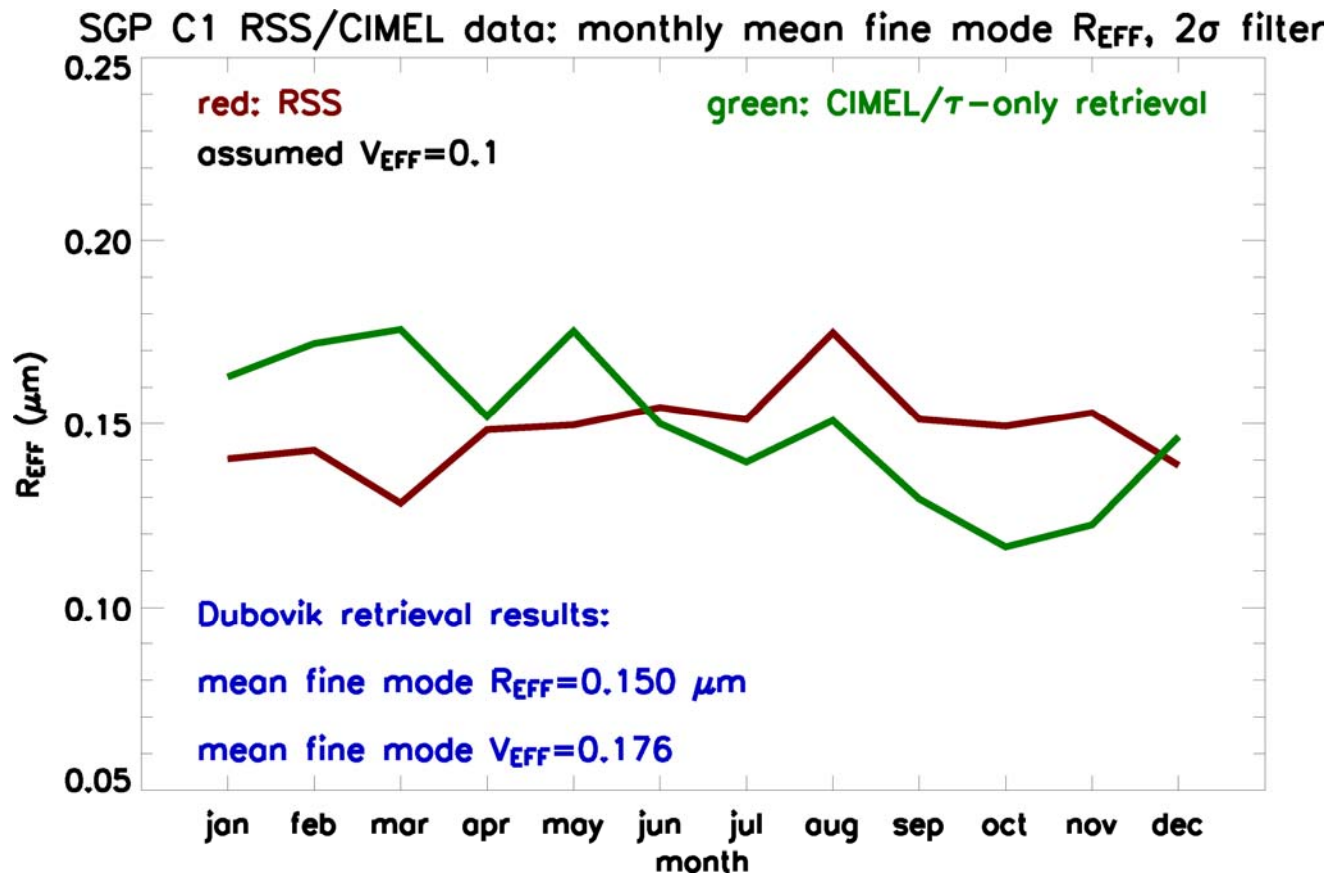
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- Incorporate diffuse radiation into RSS retrievals, to assess ω_0 in addition to size distribution.

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- Does the fine mode effective radius have an annual cycle or not?