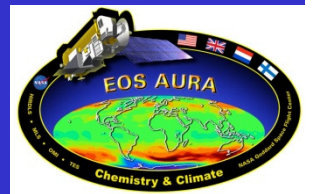


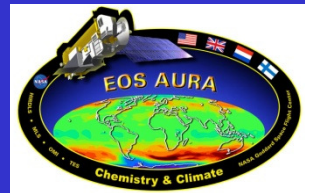
The Effect of Rotational Raman Scattering on Ozone Profile Retrieval

Joke Meijer
AK/CK – 2 september 2009

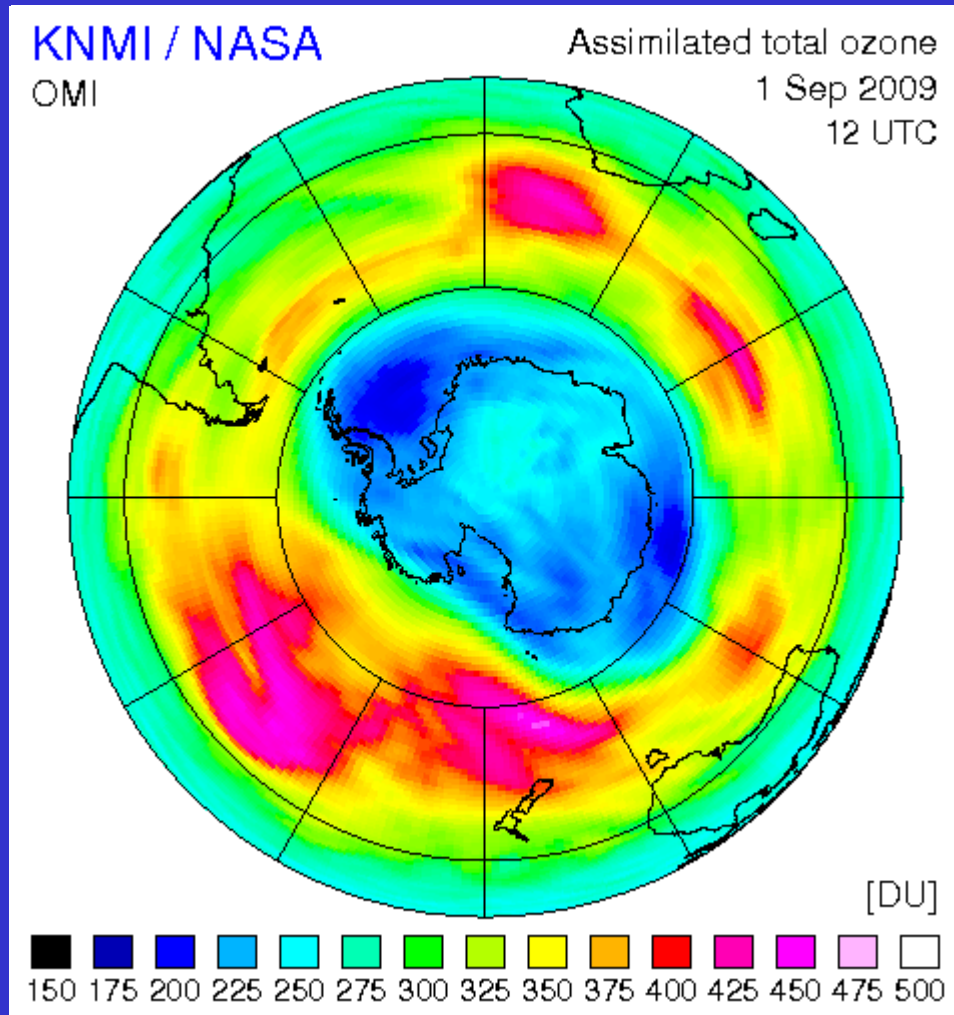


Contents

- Introduction
- Rotational Raman Scattering
- RRS Approximation Algorithm
- Results
- Conclusions



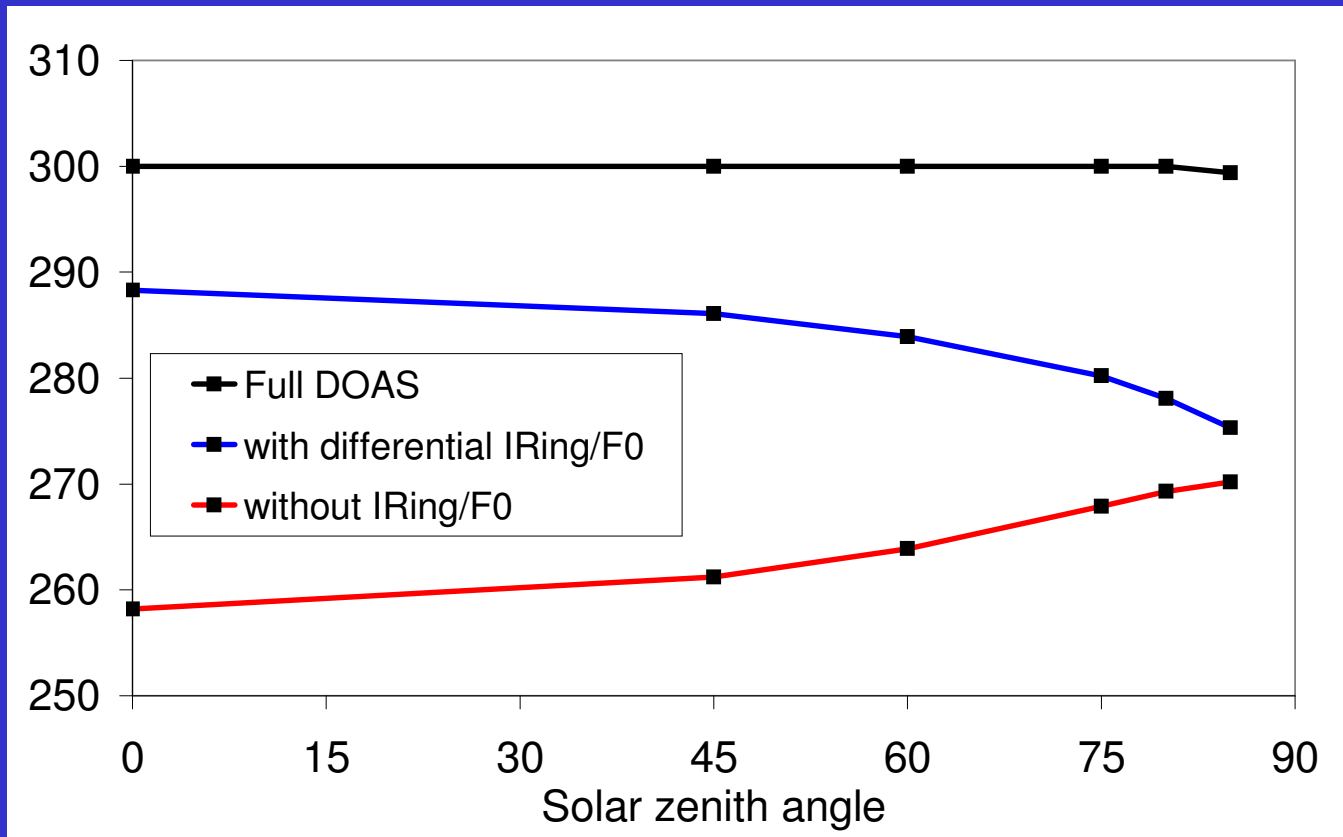
Introduction



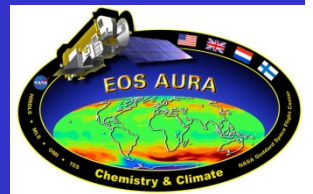
error in total DOAS
ozone column if
rotational Raman
scattering is not
'properly' taken into
account

up to 10 %

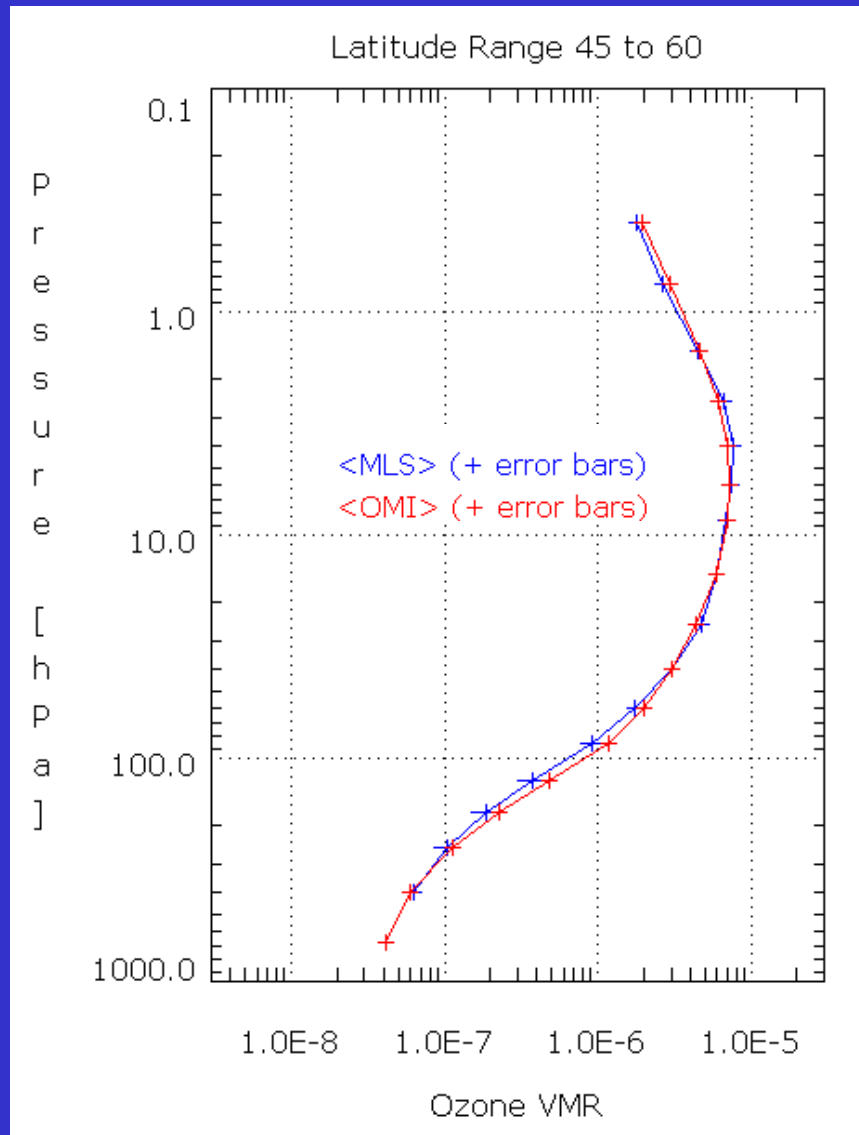
Introduction



J.F. de Haan, 2003

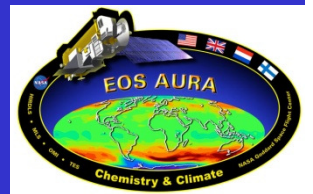


Introduction

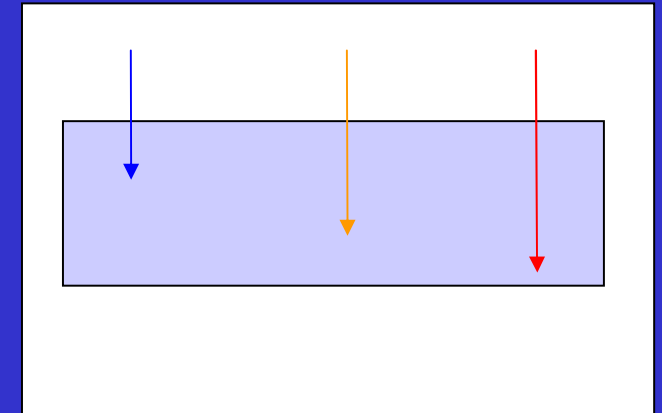
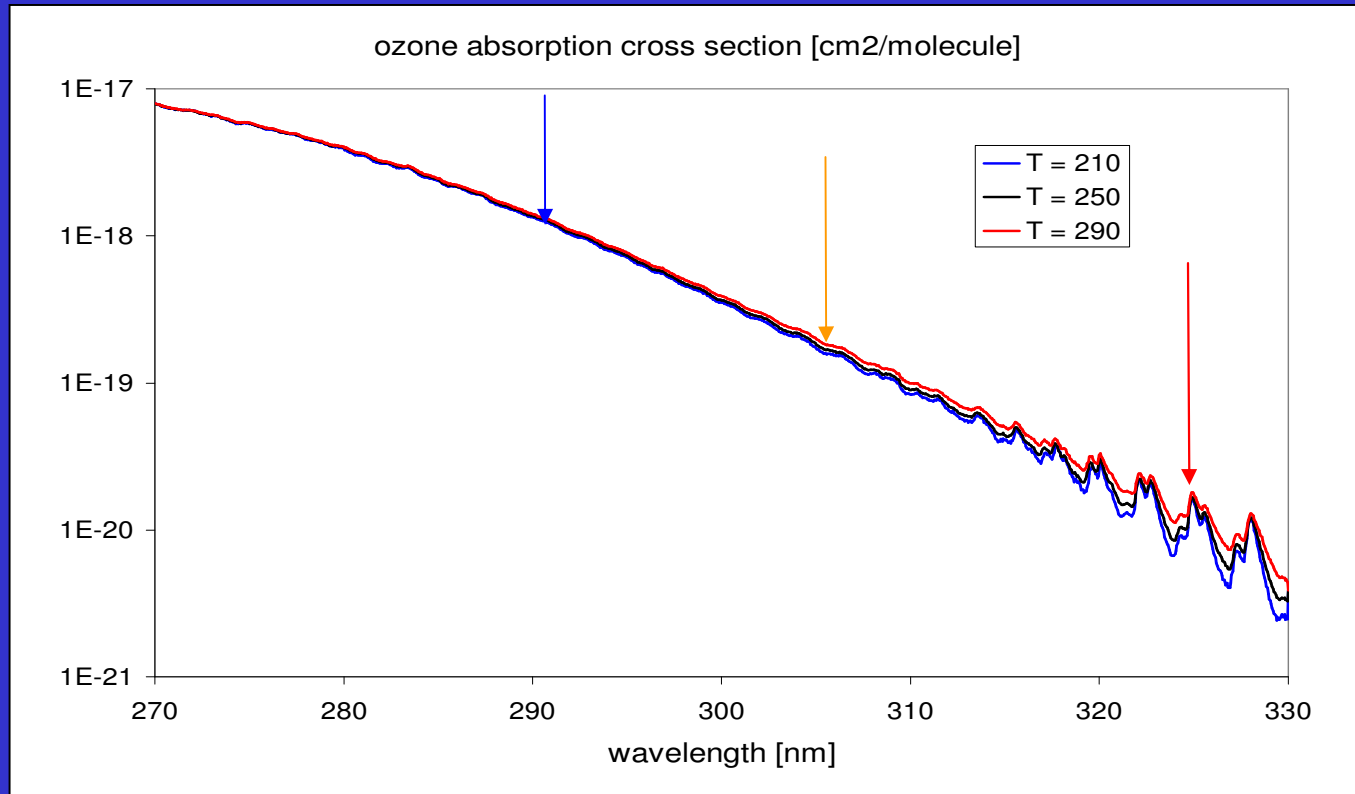


error in ozone profile if
rotational Raman
scattering is not taken
into account

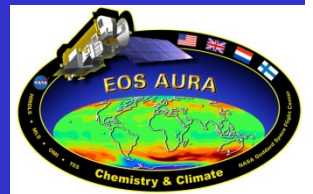
up to 60 %



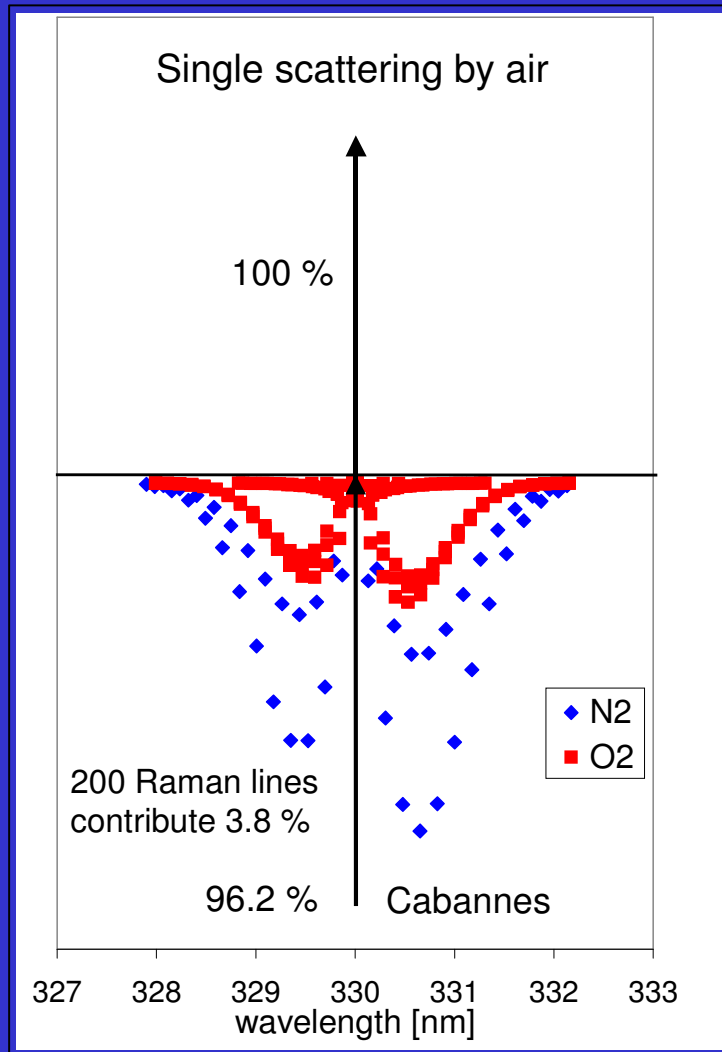
Introduction - Profile Retrieval



Different wavelengths give information
on different heights



Rotational Raman Scattering

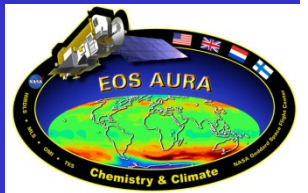
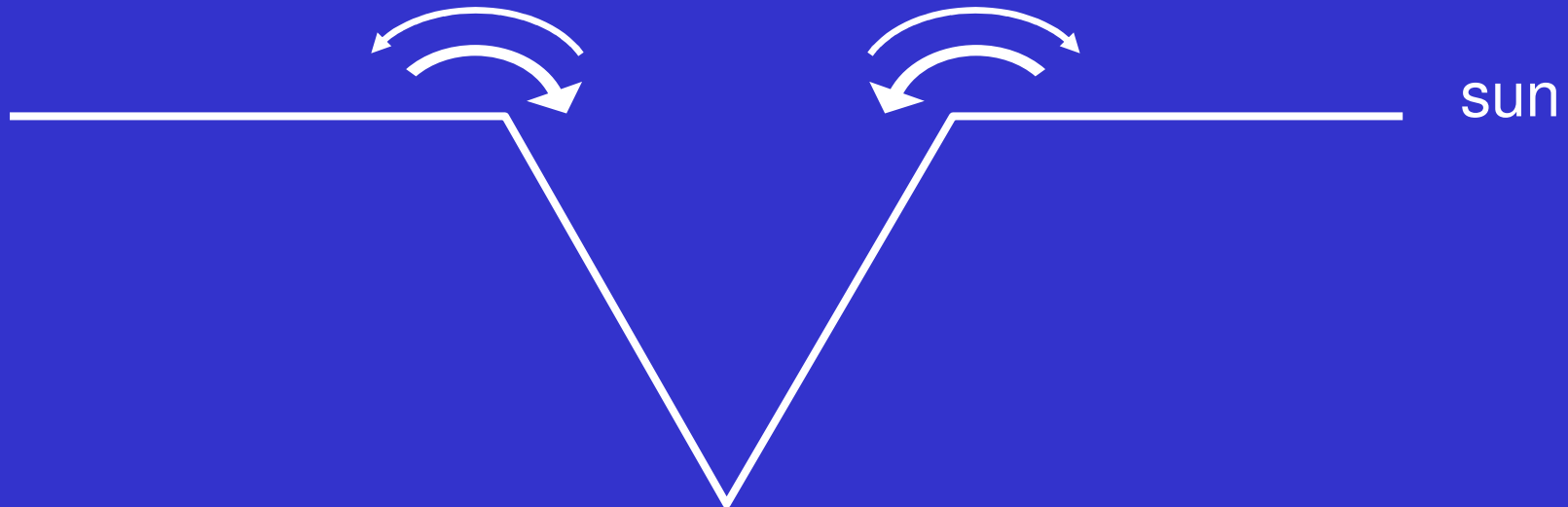


inelastic scattering of photons on air molecules

3.8% of photons are scattered both to longer and shorter wavelengths

width of feature about 4 nm in UV

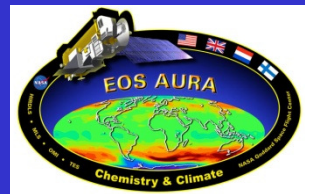
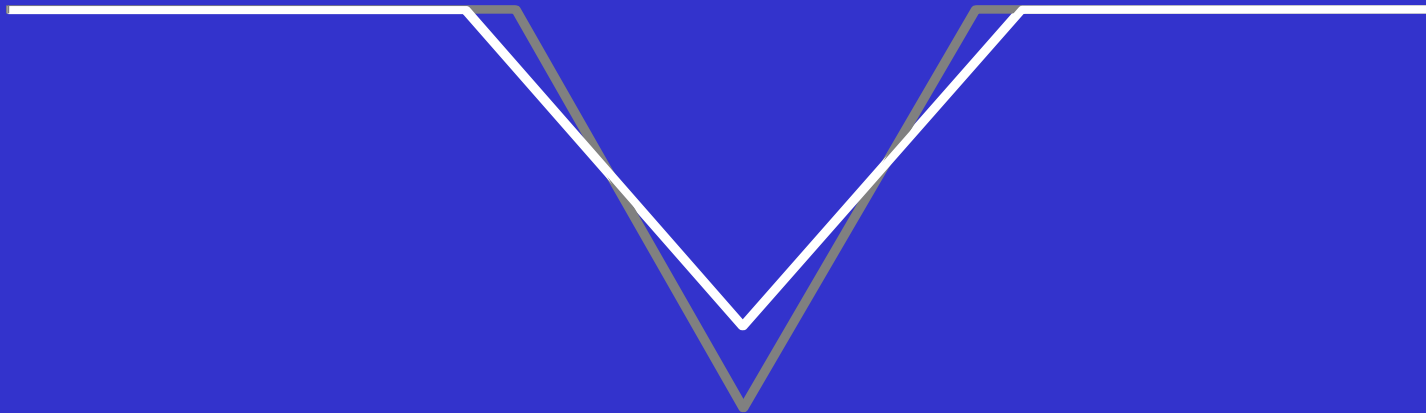
Rotational Raman Scattering



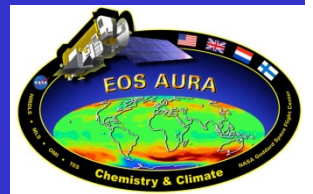
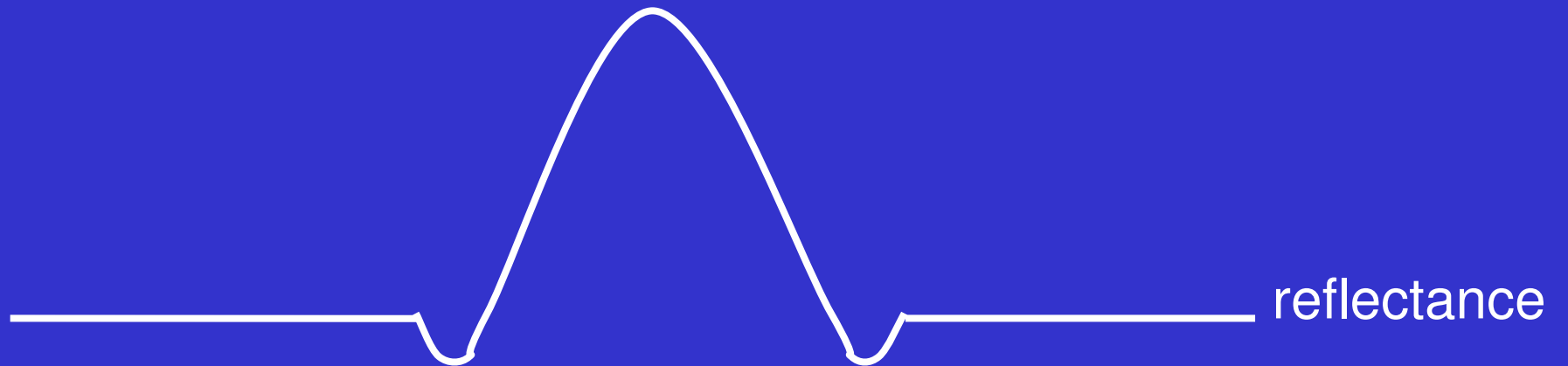
Rotational Raman Scattering

sun

earth



Rotational Raman Scattering



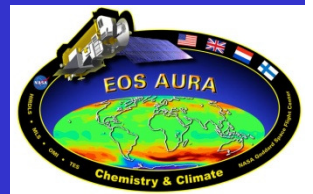
Rotational Raman Scattering

connection between wavelengths →
radiative transfer code very complicated

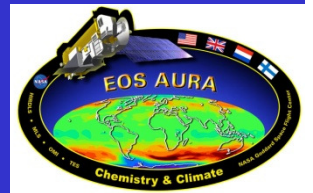
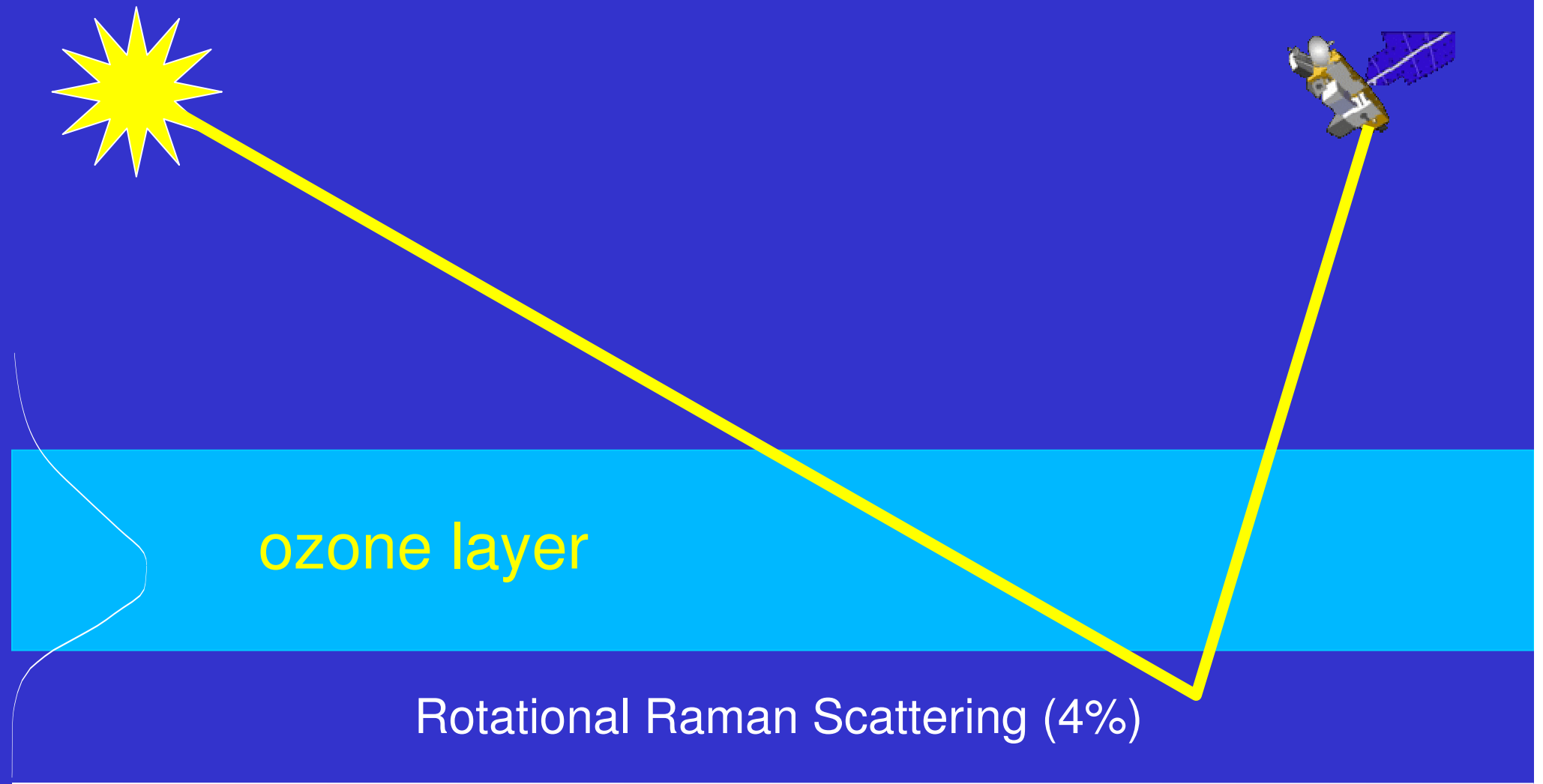
not feasible for operational ozone profile algorithm

OMI takes 15 spectra/second →
time available 0.2 – 1.0 s per computer/node

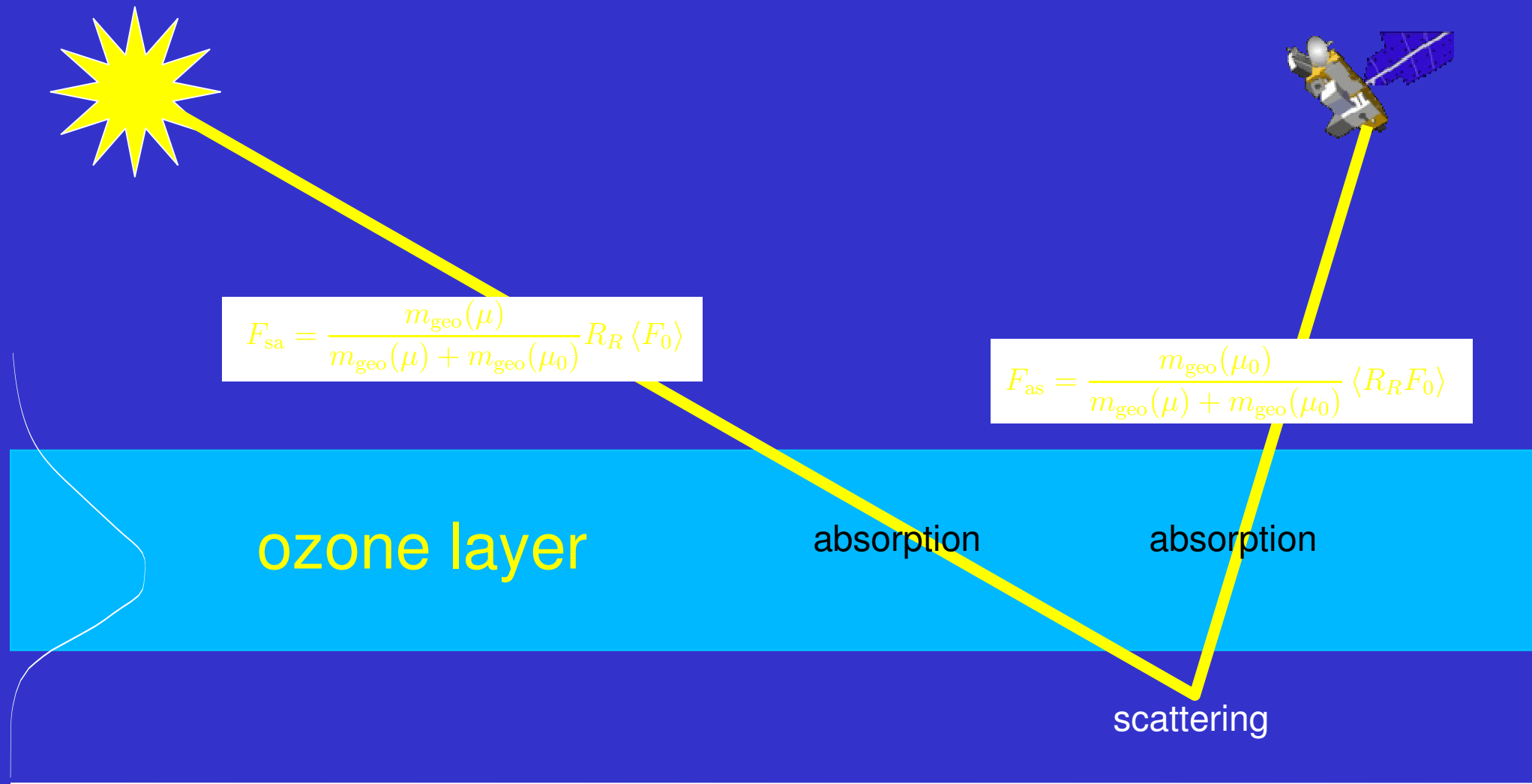
we have to use an approximation



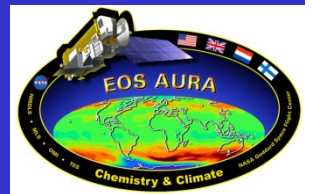
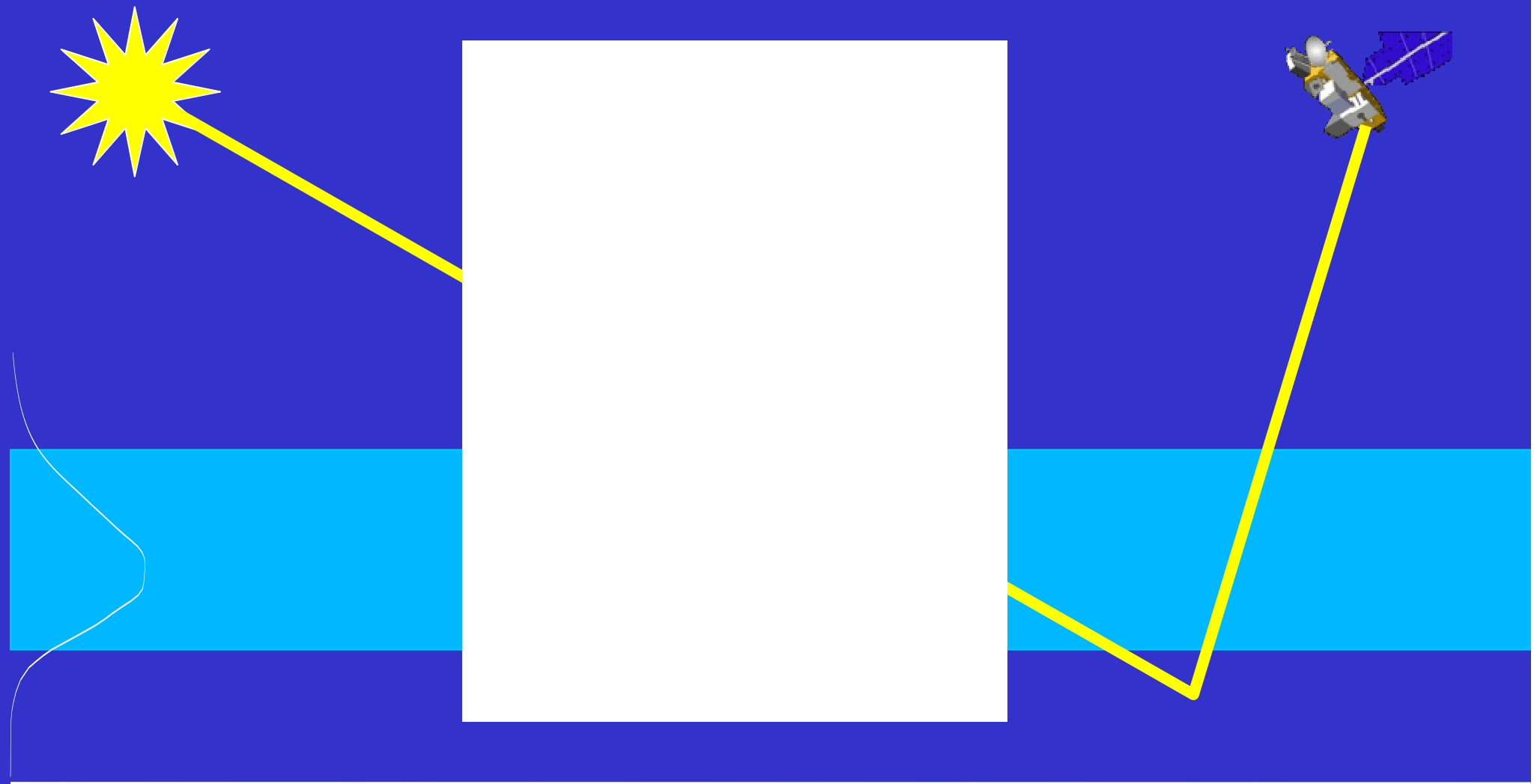
OMI Raman Approximation



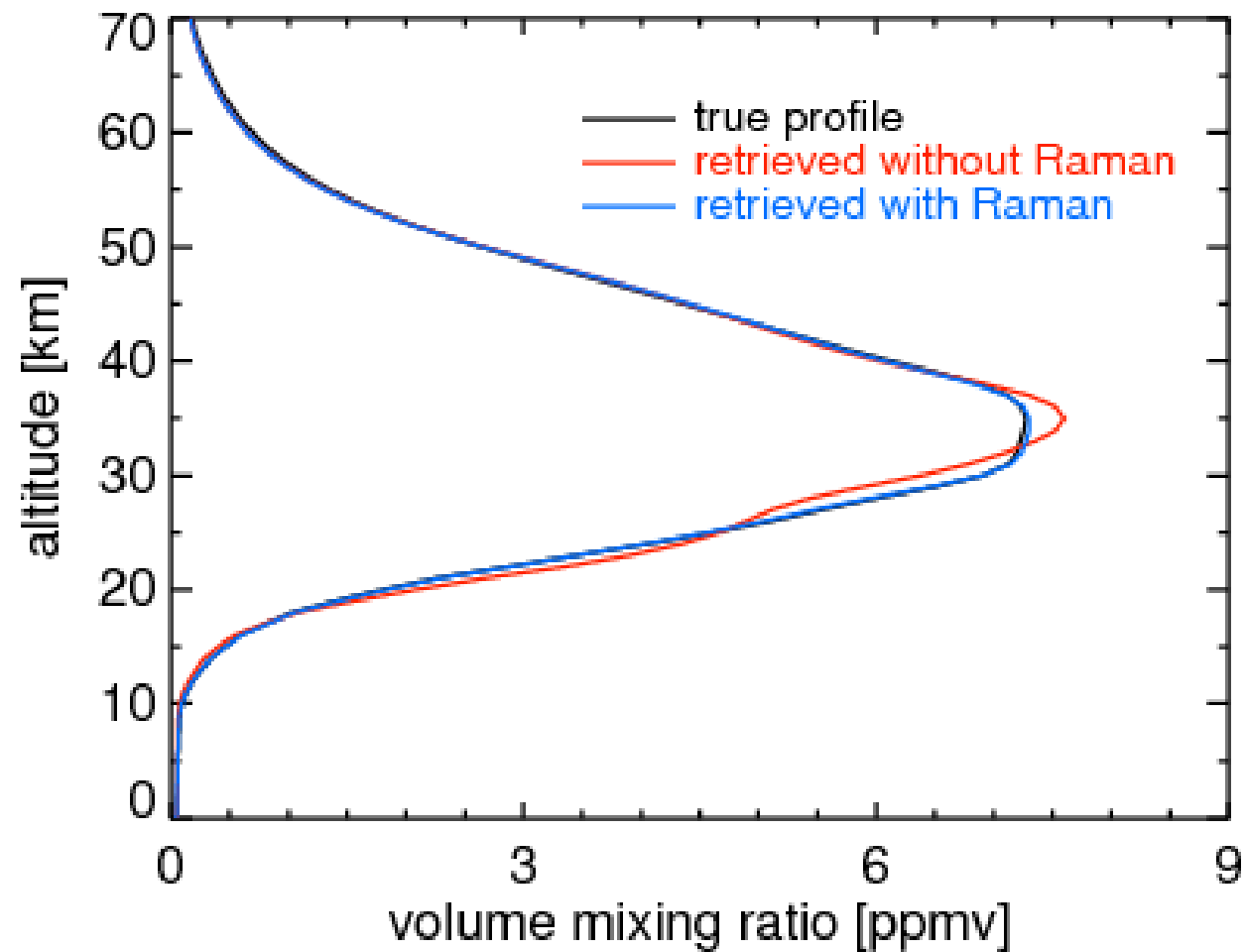
OMI Raman Approximation



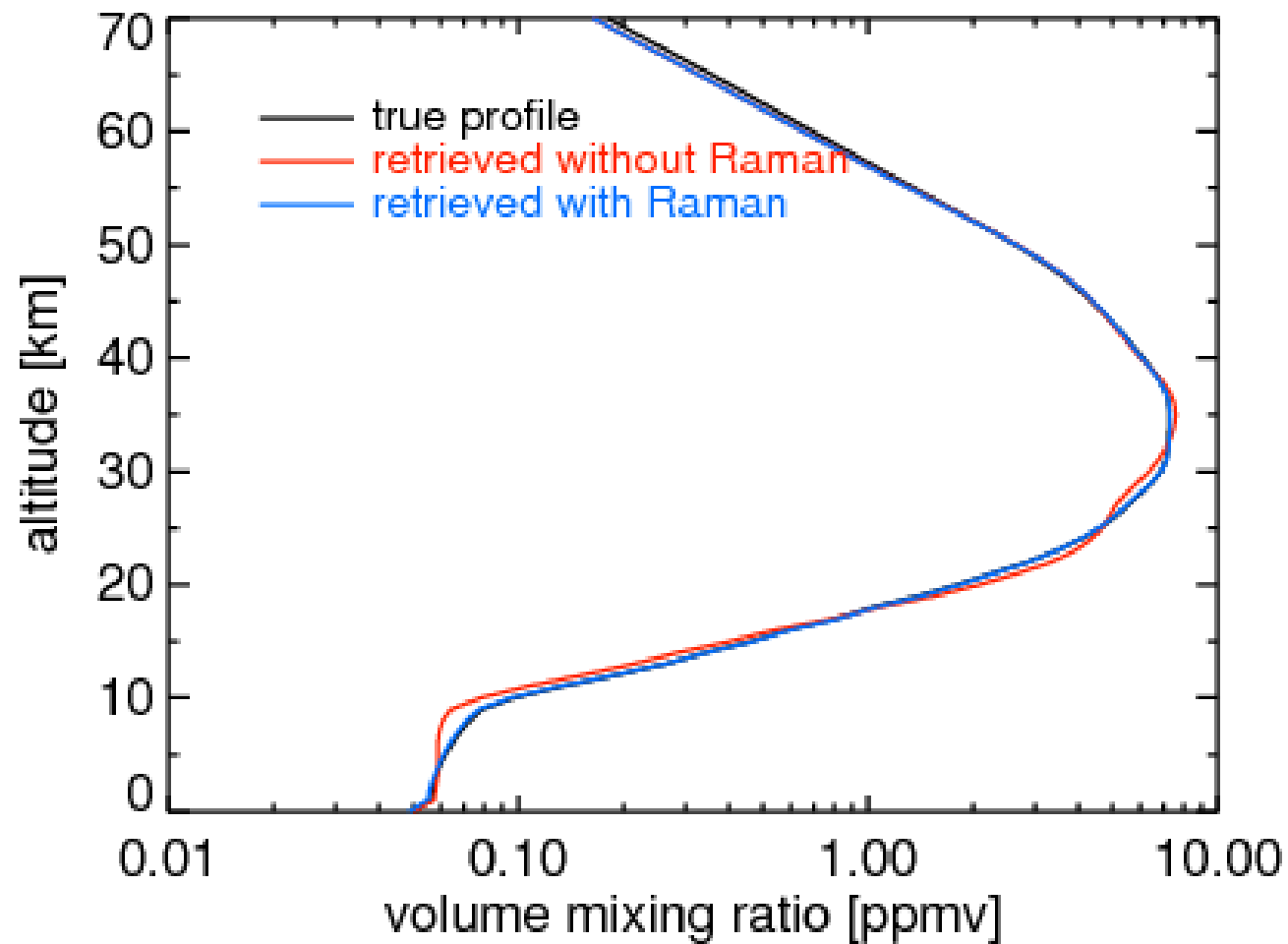
OMI Raman Approximation



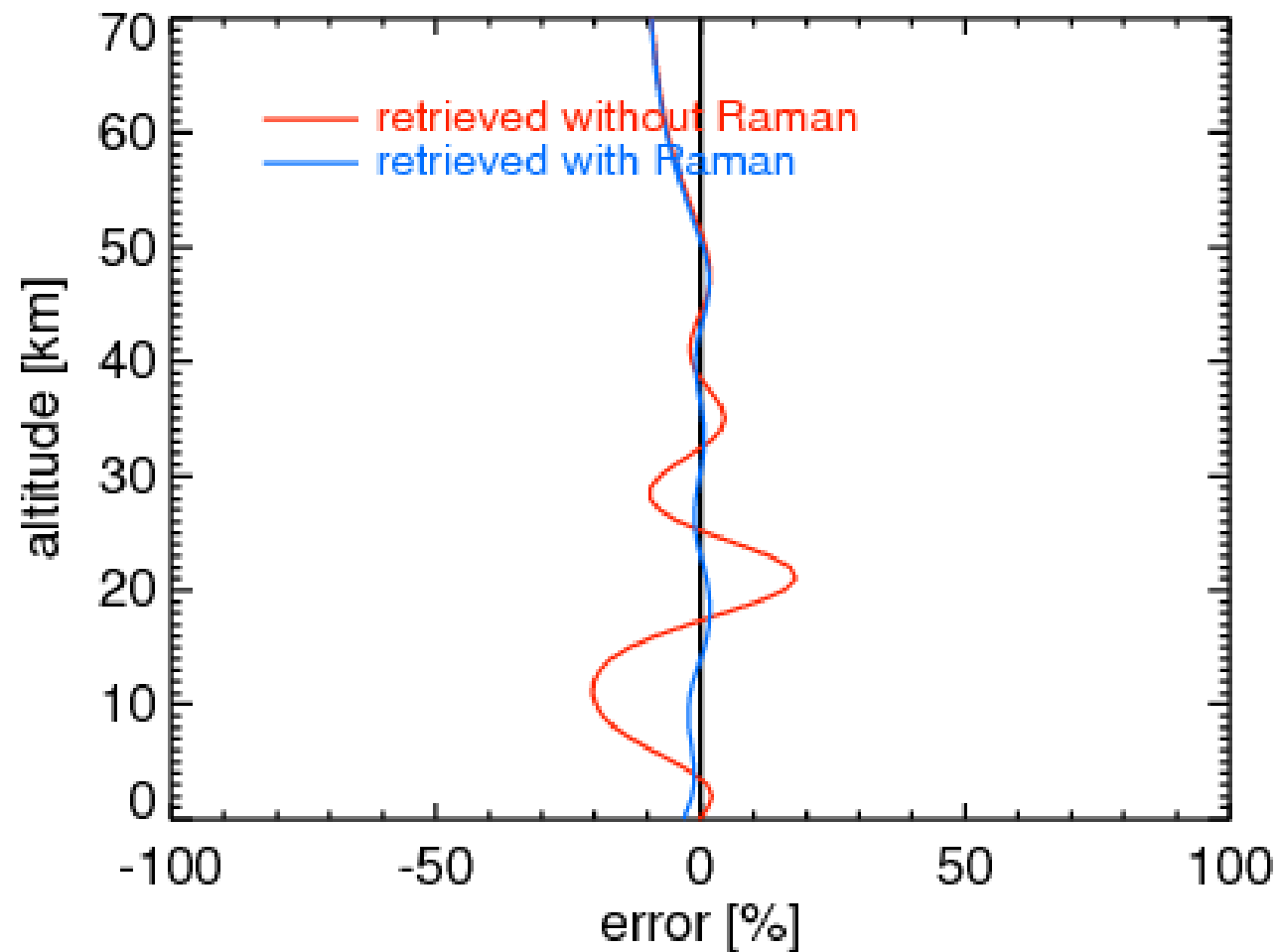
Results



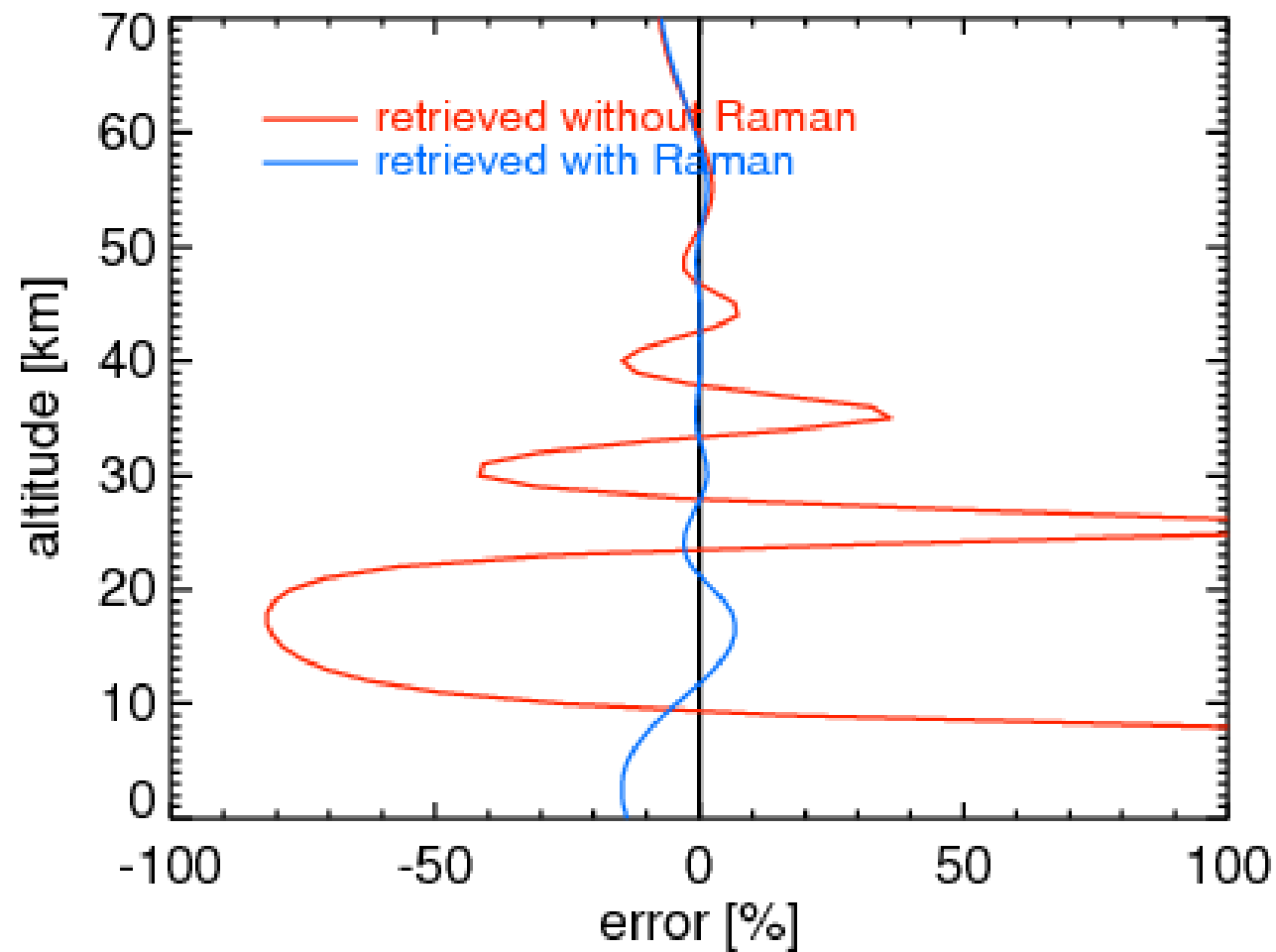
Results



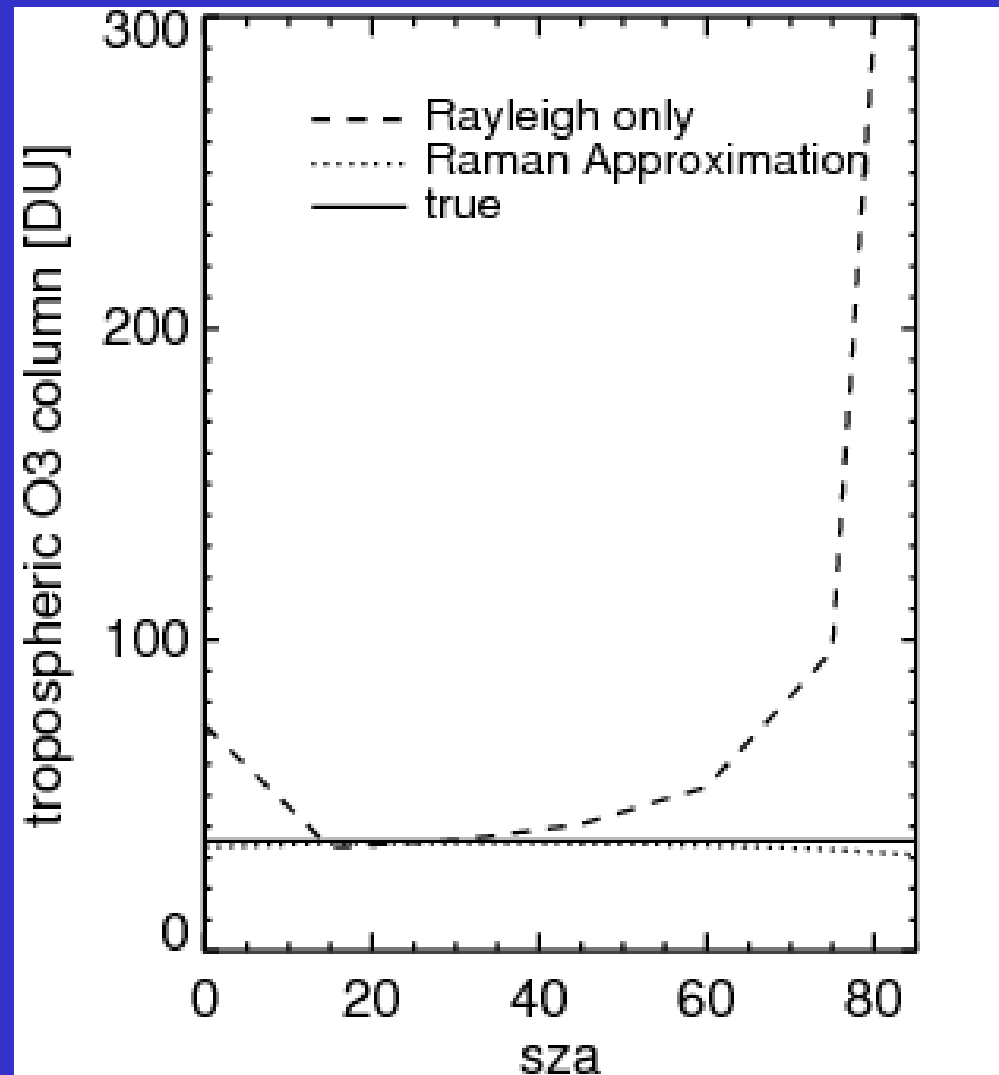
Results



Results

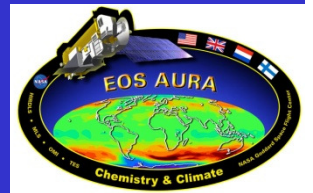


Results



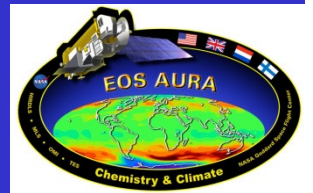
Conclusions

- Dramatic improvement in ozone profile retrieval by including rotational Raman scattering, especially for the troposphere and lower stratosphere
- Approximation is efficient and has been implemented in the operational OMI KNMI ozone profile retrieval algorithm



Future work

- Compare Raman approximation to differential Ring spectrum
- Calculate accuracy of approximation by comparing to full radiative transfer retrieval



Thank you

