Effect of Aerosols on LP Radiances

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Aerosol Scattering Index (ASI)

Definition:

$$\mathbf{ASI(\lambda, SSA, TH) = \ln(I_m/I_{no_aer})}$$

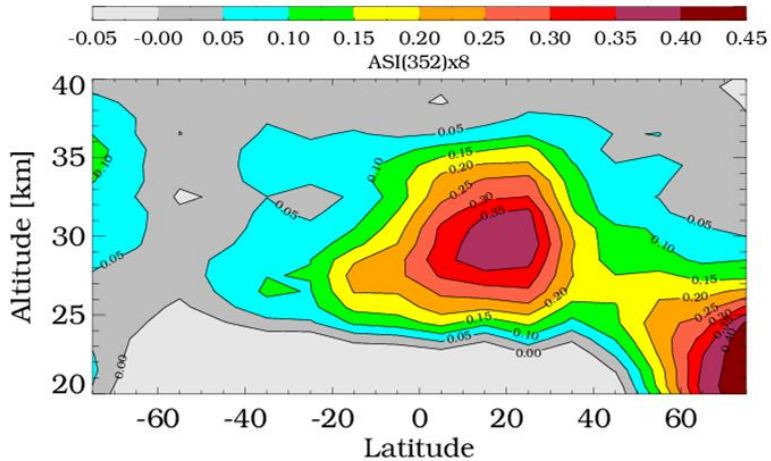
λ is the wavelength
SSA is the single scattering angle
TH is the tangent height
$\mathbf{I_m}$ is the measured limb radiances
$\mathbf{I_{no_aer}}$ is the calculated limb radiances assuming no aerosols
Both I_m and I_{no_aer} are normalized at 45 km

Properties:

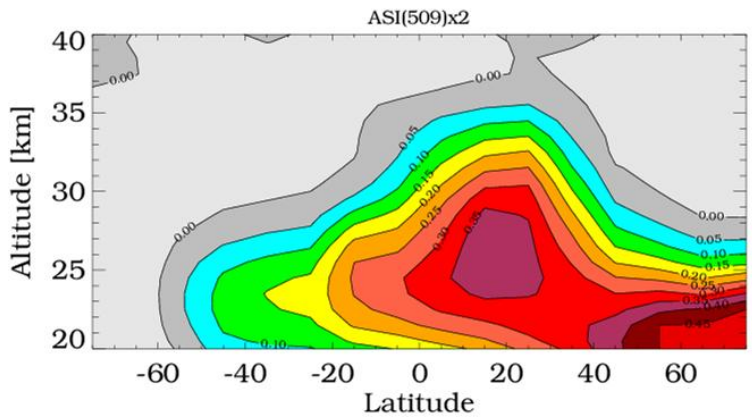
- ASI @ 45 km=0
- ASI≈ I_{aer}/I_{no_aer}≈ aerosol MR
- ASI is reduced by attenuation of Rayleigh by aerosols, which can make ASI even negative at altitudes where Rayleigh scattering is large.
- For a fixed aerosol amount, ASI varies by a factor of 30 with latitude due to variation in aerosol scattering phase function

ASI Zonal Mean Sept, 14, 2012

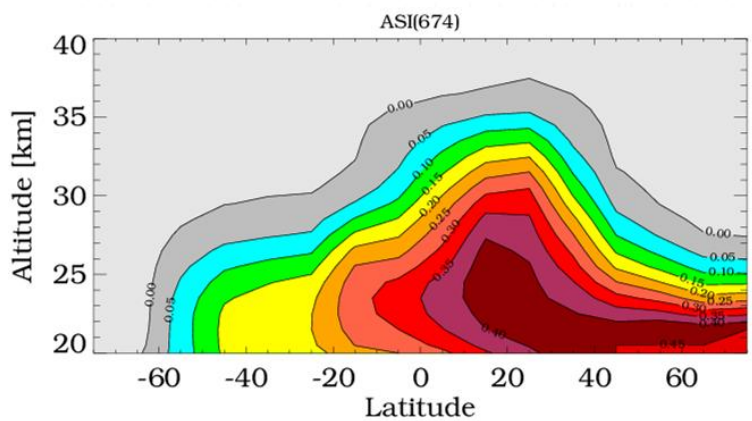
($(674/352)^3$=6.2



ASIx5 @ 352 nm

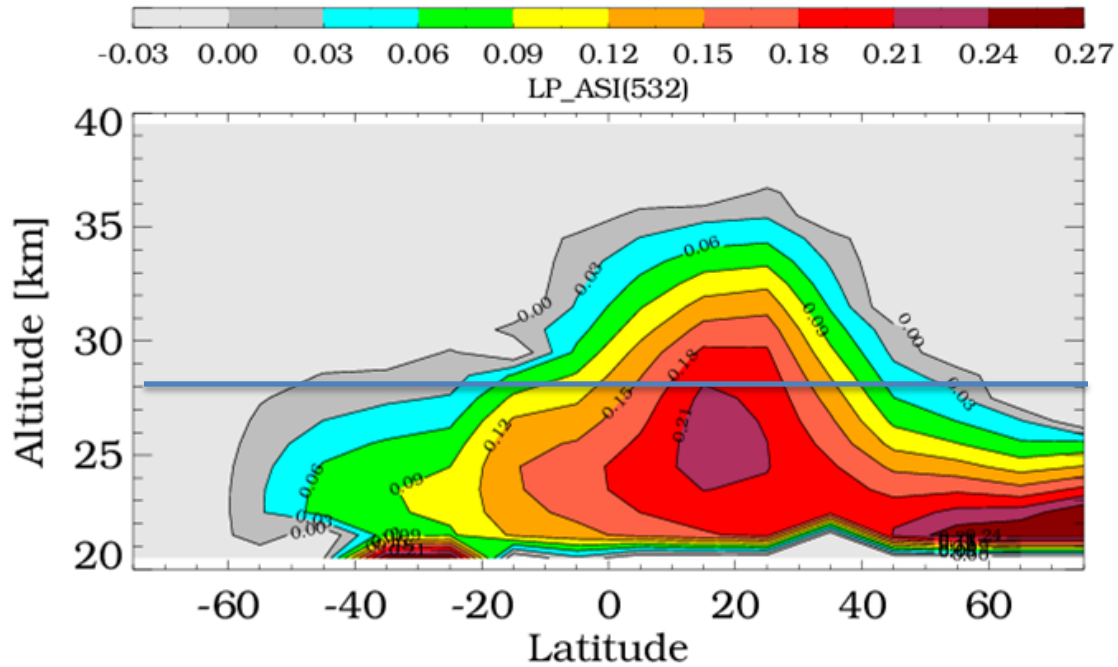


ASIx2 @509 nm

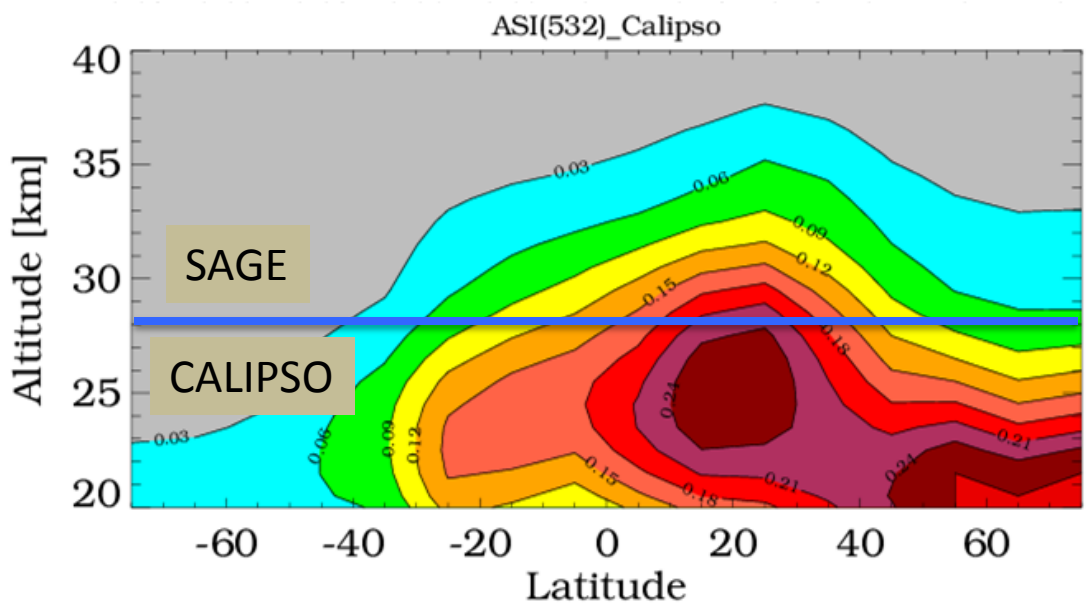


ASI @674 nm

Comparison with CALIPSO/SAGE climatology

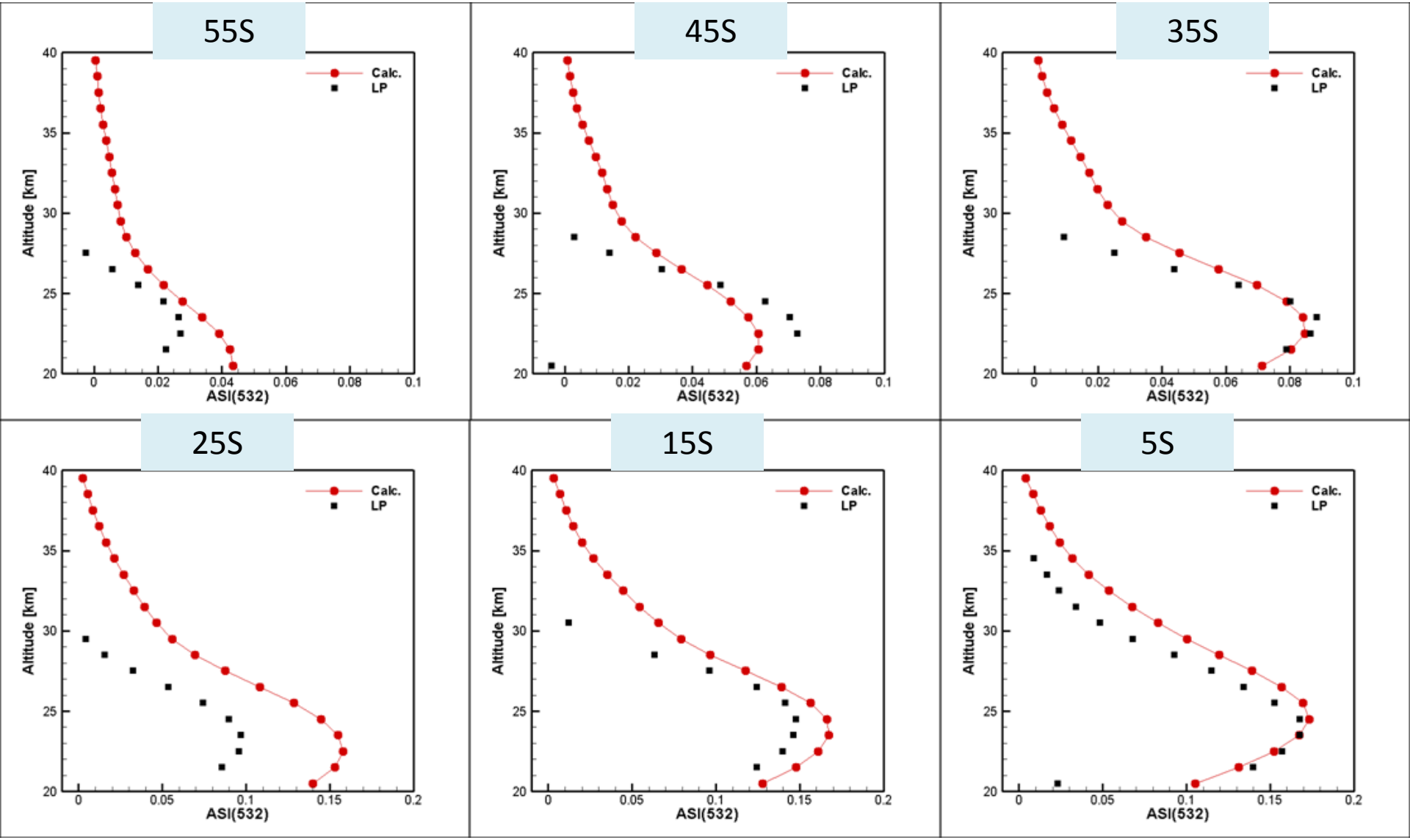


LP ASI @532 nm

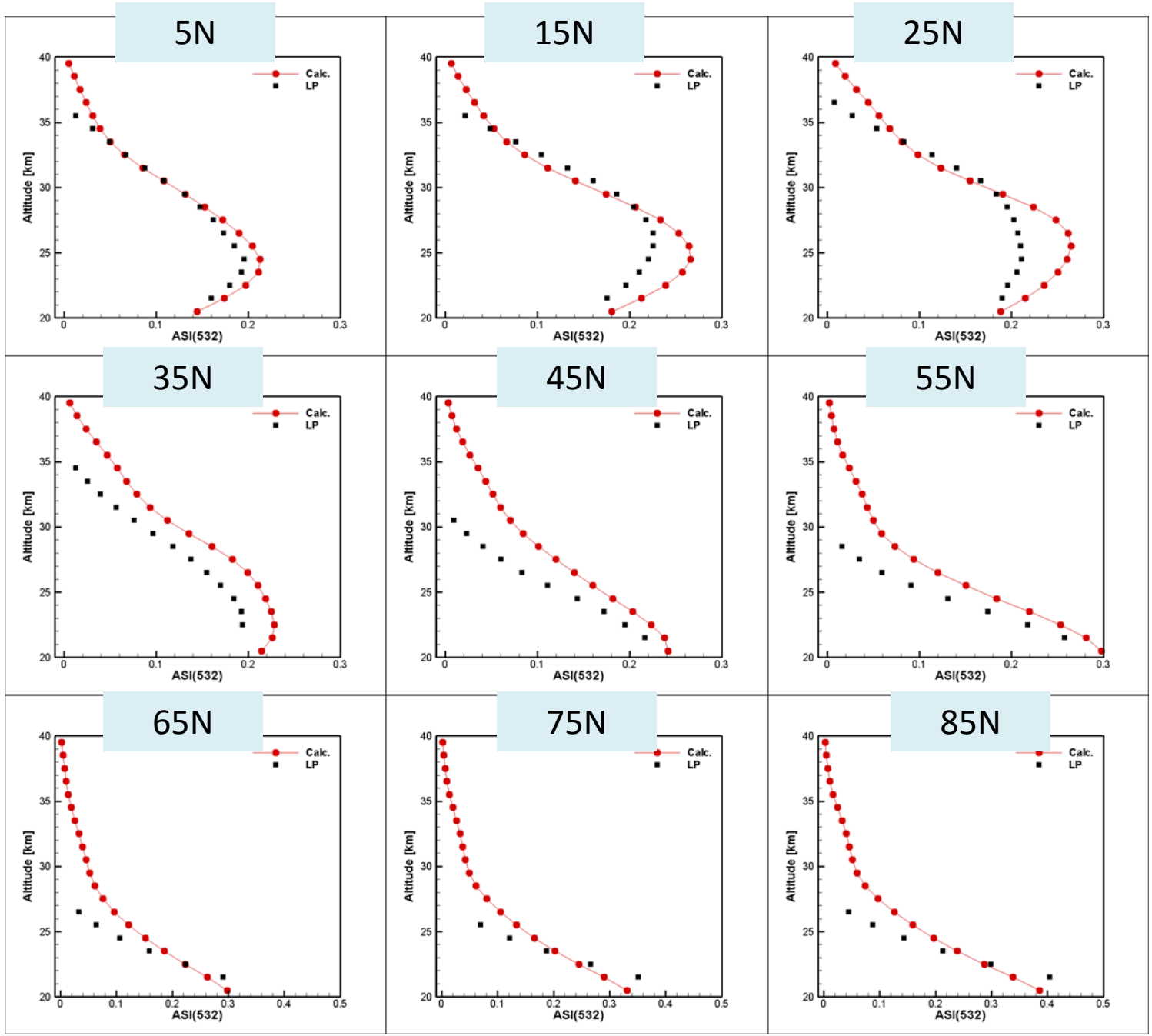


Calculated using SAGE/CALIPSO climatology

The measured and calculated ASIs @ 532 nm, South



The measured and calculated ASIs, North



Future Work

- Evaluate LP derived ZM aerosol profiles against ASI.
- If the agreement is reasonable use LP ZM to correct O_3 profiles, otherwise use ASI-adjusted CALIPSO/SAGE climatology.
- Little or no change in O_3 expected above ~20 km in tropics, above ~15 km at other lats. <10% change at lower altitudes.