対流圏オゾンおよび微量成分観測における短波長域地表面アルベドの影響評価

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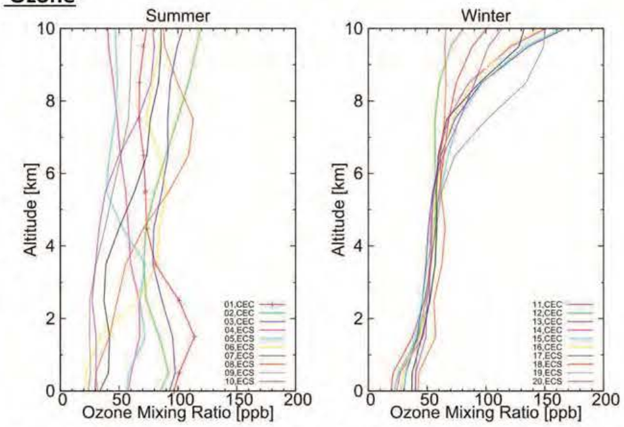
Abstract: We discuss the effect of the uncertainties of UV surface albedo on spaceborne tropospheric ozone measurements over China by comparing the radiance changes (weighting functions) of ozone and surface albedo in the Huggins band. We utilized a radiative transfer model, SCIATRAN, to simulate the atmospheric radiance observed from space, assuming realistic scenarios including ozone, which is simulated by a chemical transport model, and the surface albedo, which is taken from OMI measurements at the wavelength of 328 nm, in two regions of China, the Central East China (CEC, 110-123E, 30-40N) and the East China Sea (ECS, 125-129.5E, 29-33N). Results show that the uncertainty of the UV surface albedo expected from the OMI measurements is about 20-40% for the CEC and about 10% for the ECS, respectively. Based on the uncertainties of the surface albedo, we estimated the effect of the UV surface albedo on the tropospheric ozone measurements by using weighting functions (Jacobians) of ozone and surface albedo.

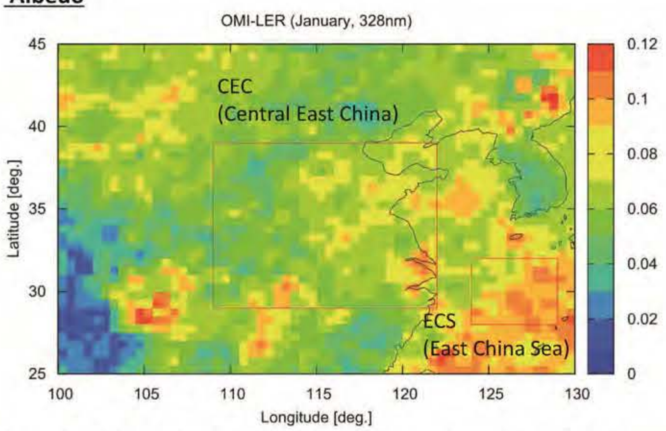
1. Ozone and albedo scenario input to RTM, SCIATRAN

Ozone



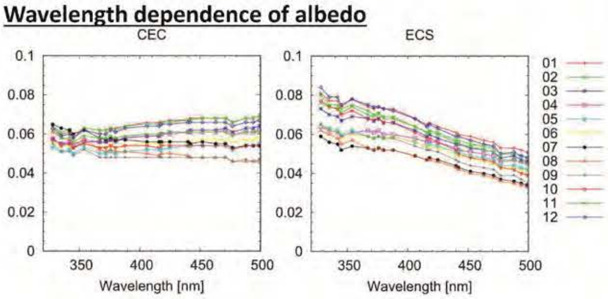
The 20 typical profiles for summer (June) and winter (December) taken from the calculation of a 3D CTM [Takigawa et al. 2009].

Albedo



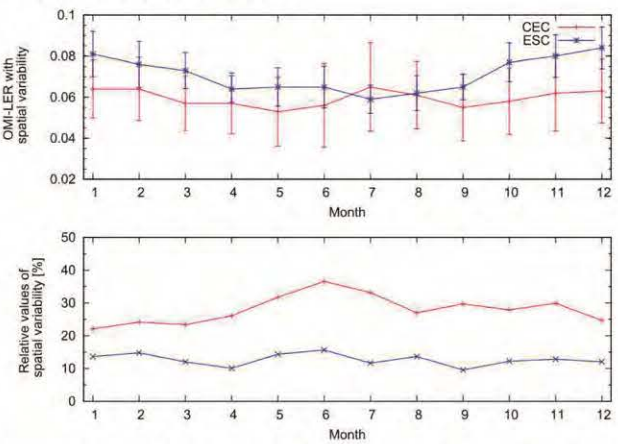
Example of the horizontal distribution of the surface albedo derived from the OMI measurements for January over CEC and ECS .

Wavelength dependence of albedo



Monthly wavelength dependence of the surface albedo derived from the OMI measurements over CEC and ECS.

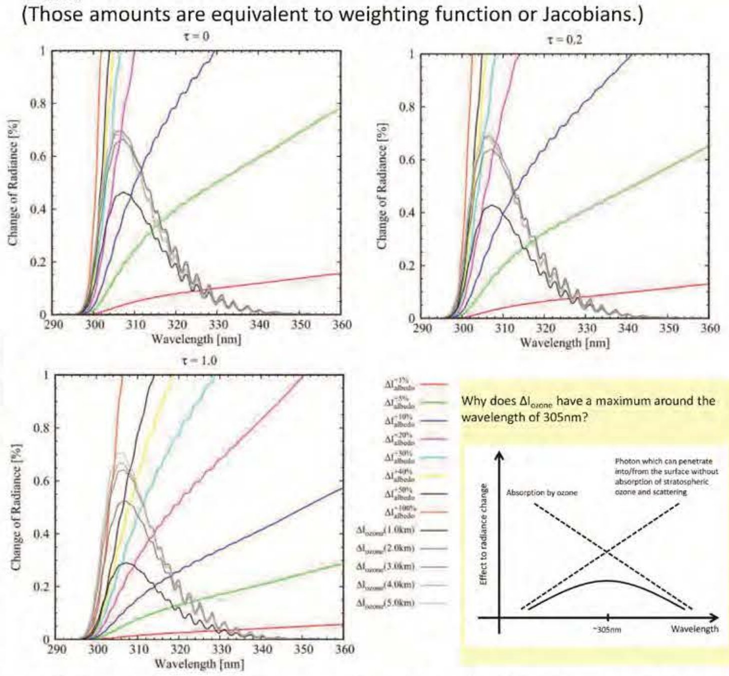
Spatial variability of albedo



Monthly averages and spatial variability (shown by error bars) of the surface albedo derived from the OMI measurements over CEC and ECS (top) and the relative values of the spatial variability (bottom). We assume that the albedo uncertainties have the same magnitude as the spatial variability shown above.

2. Comparison between albedo and ozone variability

- ΔI_{ozone} : change of atmospheric radiance against ozone change
- ΔI_{albedo} : change of atmospheric radiance against albedo change
  (Those amounts are equivalent to weighting function or Jacobians.)



- In the short wavelength range, ΔI_{albedo} is smaller than ΔI_{ozone} , and at a longer wavelength ΔI_{albedo} exceeds ΔI_{ozone} .
- For larger AOD of aerosols, ΔI of both ozone and albedo decreases and the wavelengths where ΔI_{albedo} and ΔI_{ozone} cross become longer, which means less effect of ΔI_{albedo} on ΔI_{ozone} .

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