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Scattering Properties of Jovian Tropospheric Cloud Particles Inferred from Cassini/ISS

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It is essential to know scattering properties (e.g., scattering phase function) of clouds for determination of vertical cloud structure and its optical properties. However, we cannot derive the scattering phase function from ground-based and Earth-orbit observations because of the limitation of solar phase angle as viewed from the Earth. Then, most previous studies have used the scattering phase function deduced from the Pioneer 10/Imaging Photopolarimeter (IPP) data (blue: 440 nm, red: 640nm) [Tomasko et al., 1978].

There are two shortcomings in the above scattering phase function. One is that we have to use this scattering phase function at red light as a substitute for analyses of imaging photometry using CH_4 bands (center: 727 and 890 nm), although clouds should have wavelength dependency. The other is that the red pass band of IPP was so broad (595-720 nm) that this scattering phase function in red just show wavelength-averaged scattering properties of clouds.

In order to provide a new reference scattering phase function with wavelength dependency, we have analyzed the Cassini/ISS data in BL1 (center wavelength: 451 nm), CB1 (619 nm), CB2 (750 nm), and CB3 (938 nm) over wide solar phase angles (3-141 degrees) during its Jovian flyby in 2000-2001.

A simple cloud model which consists of a thin stratospheric haze, a semi-infinite cloud, and an intervening Rayleigh gas layers is adopted. Applying Mie theory to scattering by clouds, we deduce the scattering phase function of cloud and effective particle size in the South Tropical Zone. As a result, when we use the nominal value of reflective index for NH_3 ice [Martonchik et al., 1984], we cannot obtain reasonable fit to the observed limb-darkening profiles. This would imply that we should consider possible effects on the impurity and/or the nonsphericiy of clouds.

In this presentation, we will show detail model description and these results. Finally, we discuss scattering properties of clouds through comparison with previous works.

Keywords: Jupiter, atmosphere, Cassini/ISS, radiative transfer