

Characteristics of MODIS Satellite Data during Fog near the Incheon International Airport

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Simultaneous observations of Moderate Resolution Imaging Spectroradiometer (MODIS) radiometer onboard the Aqua and Terra satellites and weather station at ground near the Incheon International Airport (37.2-37.7 N, 125.7-127.2 E) during the period from December 2002 to August 2004 have been utilized in order to analyze the characteristics of satellite-observed infrared (IR) and visible data under fog and clear-sky conditions, respectively. The differences ($T_{3.7-11}$) in brightness temperature between 3.75 μm and 11.0 μm were used as threshold values for remote-sensing fog (or low clouds) from satellite during day and night. The $T_{3.7-11}$ value during daytime was greater by about 21 K when it was foggy than that when it was clear, but during nighttime fog it was less by 1.5 K than during nighttime clear-sky. The value was changed due to different values of emission of fog particles at the wavelength. This may result from the fact that emission of fog particle is 1.0 at 11 μm , and 0.8-0.9 at 3.7 μm . Based on these features of the satellite data, the threshold values of $T_{3.7-11}$ during day and night were derived. However, the values included errors when clouds existed above a layer of fog. Since the near-IR channel at 3.7 μm was affected by solar and IR radiations in the daytime, both IR and visible channels (or reflectance) have been used to detect fog. Since fog particles resulted in high reflectance of solar radiation, the reflectance during fog was higher by 0.05-0.6 than that during clear-sky (Fig. 1). As optical thickness of fog became greater, reflectance got higher. The value of reflectance was sensitive to the change of solar zenith angle.

In summary, the threshold values of $T_{3.7-11}$ have been derived in this study for detecting fog during day and night near the Incheon International Airport. However, the daytime value needs to be compensated by solar radiation and reflectance, together with radiative transfer simulation.

Key words: fog, Incheon Airport, MODIS, IR, visible, reflectance, remote-sensing

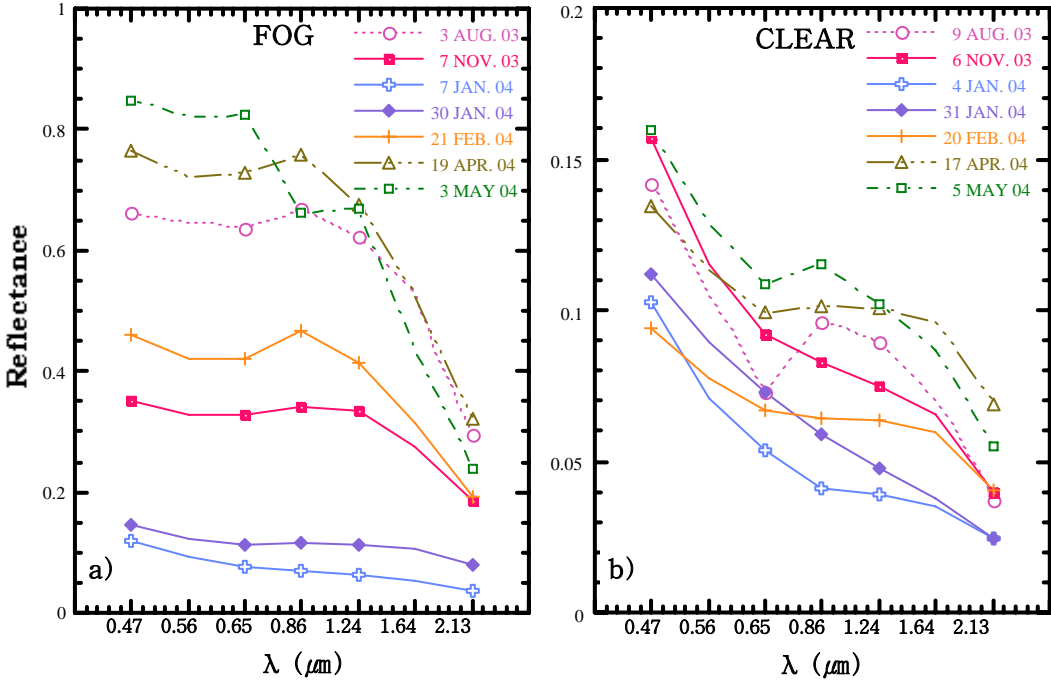


Fig. 1. Daytime MODIS reflectance in seven visible channels near the Incheon International Airport for a) seven foggy days and b) seven clear-sky days.