# Modeling Snow Thermal Infrared Spectral Emissivity with Modern Radiative Transfer Theory

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Snow cover has a strong impact on the surface energy balance. Snow spectral emissivity is a key parameter for snow surface temperature retrieval, they both determine the surface longwave radiation of snow surface. Besides, trace gases and atmospheric composition sounding using a nadir-looking thermal infrared sensor also need a priori emissivity spectrum of snow for accurate retrieval. However, snow spectral emissivity is treated coarsely in current studies and often assigned as a constant, its spectral and view angle dependence are omitted.

The spectral emissivity of snow in the TIR has been investigated based on the radiative transfer theory and/or the measurements of the directional-hemispherical reflectance conducted in laboratory. Some good results have been reported. Snow surface physical state and measurement environment in laboratory are different from that in the field. Actually, we care more about snow spectral emissivity in natural state, which has direct relationship with space-borne/airborne remote sensing. The ability of the radiative transfer theory in modeling snow spectral emissivity measured in the field need investigate.

In this study, the modeling ability of several analytical radiative transfer models (e.g. Conel model, Dozier & Warren model, Hapke model) are tested by comparing with in-situ measured snow thermal infrared directional spectral emissivity. Independent scattering approximation in these analytical radiative transfer models is investigated using numerical radiative transfer model DISORT combined two modified methods (diffraction subtract and static structure factor correction). A promising method for modeling snow spectral emissivity is presented in the end.

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