Takamura, T. and P. Khatri, 2021: Uncertainties in radiation measurement using a rotating shadow-band spectroradiometer. *J. Meteor. Soc. Japan*, **99**, 1547-1561.
https://doi.org/10.2151/jmsj.2021-075.

Plain Language Summary: A spectral radiometer with a shadow-band system can give two components simultaneously, direct (spDNI) and diffuse (spDHI), of solar radiation by using a combination of different band positions. These components estimated by a current analysis method have some errors due to imperfect correction of radiation shadowed by band. We discuss the errors using typical aerosol models under a realistic operational condition of the instrument. As a fundamental system error, it is clear that the valid range of the band angle is less than 72 deg within 2 % error in correction for a common setting of the instrument. And errors of optical depth (τ) as well as spDNI and spDHI are estimated, depending on their aerosol optical thickness (AOD).

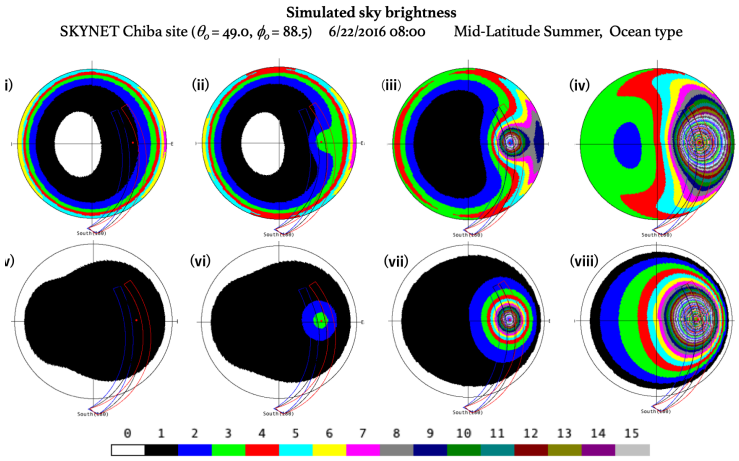

Figure 1. Examples of simulated sky brightness without direct solar radiation. Each brightness pattern corresponds to different AODs: 0, 0.01, 0.1, and 1.0 respectively. The upper panels' series show the radiance pattern (W/m^2/sr/μm) and the lower panels' series are the irradiance pattern (W/m^2/μm) for a unit solid angle. As a reference, band positions are shown in each pattern.

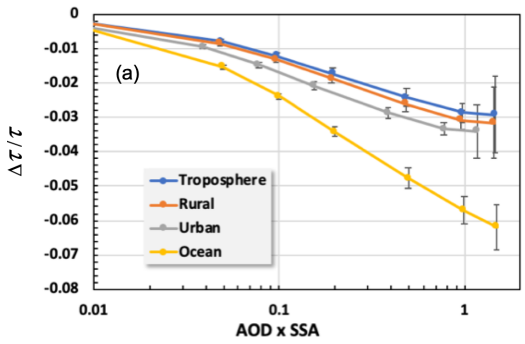

Figure 2. Simulated results of relative error in optical depth as a function of AOD x SSA. Typical four aerosol models are selected with seven AODs, 0.01, 0.05, 0.1, 0.2, 0.5, 1.0 and 1.5.

Highlights:

- A correction coefficient C_{fwd} for forward scattering shadowed by band is introduced and discussed under realistic atmospheric and instrumental conditions.
- Errors on spDNI, spDHI and τ are estimated as a function of AOD using typical four aerosol models, Troposphere, Rural, Urban and Ocean. For example, one of simulated results shows that each error of these has about 5 %, -4 % and -5 %, respectively with AOD of 0.5 for Oceanic aerosol type.