**Objectives**

- Radiative transfer models simulate atmospheric radiation under all-sky conditions and can be used for a broad range of applications.
- This study introduces NREL’s recent advancements in developing new radiative transfer models to meet the requirements of solar energy applications.

**Fast All-sky Radiation Model for Solar applications: Narrowband Irradiances on Tilted surfaces (FARMS-NIT)**

- A lookup table of cloud transmittances is computed for 2002 wavelengths, 39 cloud optical thicknesses, 28 cloud effective particle sizes, 50 solar zenith angles, 25 viewing zenith angles and 18 relative azimuth angles.
- The cloud transmittances are combined with a clear-sky radiative transfer model, SMARTS, to efficiently solve the radiative transfer equation.

**Clear-sky Comparisons**

- GHIs computed by FARMS-NIT and SMARTS (industry standard clear sky spectral model) have excellent agreement.
- FARMS-NIT better represents the strong forward scattering by aerosols.

**Cloudy-sky comparisons**

- GHIs for (left) solar zenith angle=15° and AOD=0.5, (right) solar zenith angle=30°, cloud optical thickness=10, and effective particle size=20 μm.

**Validation data**

- FARMS-NIT: 0.8 second.
- LibRadtran (16 stream): 492 seconds.
- LibRadtran (32 stream) 2493 seconds.

**Acknowledgements**

This work was supported by PV Subprogram in the Solar Energy Technology Office of the U.S Department of Energy under Contract No. DE-AC36-08GO28308 with the National Renewable Energy Laboratory (Funding opportunity: Reducing PV Performance Uncertainty by Accurately Quantifying the “PV Resource”).

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