Contribution ID: **158** Type: **Oral Presentation**

Monte Carlo based estimation of the effect of different aerosol classes on solar irradiance in African atmospheric conditions

Wednesday, 1 July 2015 14:20 (20 minutes)

Abstract content
   (Max 300 words)
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Aerosols influence ground level solar irradiance through their scattering and absorption of the solar light. The degree of direct solar beam attenuation, as well as the angular and wavelength dependence of the diffuse (scattered sunlight) sky brightness strongly depends on the concentration, size distribution and nature of the aerosol class. Aerosols common in the atmosphere in African conditions, such as biomass burning-generated smoke, wind-generated dust and salt crystal-based marine haze all influence incoming sunlight in different ways. In this paper, a Monte Carlo approach is employed to track the movement of photons from the top of the atmosphere to the Earth's surface for a variety of atmospheric compositions characteristic of typical African localities. The results show that the variations in aerosol types not only change the amount of direct solar radiation reaching a ground based detector or solar panel, but also the angular distribution and color of the detected diffuse light. We compare the ground-level solar energy yield for the cases investigated and briefly discuss the consequences for solar energy generation in typical African conditions.

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Session Classification: Applied

Track Classification: Track F - Applied Physics