

Advances in Understanding 3D Interactions between Sunlight and the Atmosphere during the *SORCE* Mission

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Some of the largest uncertainties in understanding recent climate changes arise from difficulties in quantifying the interactions of solar radiation with atmospheric aerosols and clouds. Part of the difficulties come from the inherently three-dimensional (3D) nature of solar radiative processes, which is not represented in most current applications. For example, both the calculation of solar heating in climate models and the measurement of aerosol or cloud properties using satellite-observed solar reflectances tend to rely on the one-dimensional (1D) approximation, which treats each atmospheric column separately, without considering radiative interactions between columns. While this approximation often works well, it reduces accuracy in case of strong horizontal gradients in atmospheric properties, for example around cloud edges.

We will discuss some of the advances made since the *SORCE* launch in two closely related areas: Quantifying the uncertainties and biases caused by the 1D approximation, and representing the 3D nature of sunlight-atmosphere interactions both in the solar heating calculations of climate models and in the satellite remote sensing of aerosols and clouds. Such advances help pave the way toward better understanding sun-climate interactions in the post-*SORCE* era.