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# Comparative analysis of photolysis rates calculated using Cloud-J and LibRadran tools

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Photolysis, the dissociation of molecules by solar irradiance, drives atmospheric chemistry and controls the chemical composition of the air. Photolysis rates are governed by the intensity and spectral distribution of solar irradiance, which is altered by scattering and absorption processes within the atmosphere. Clouds, aerosols, and gases control these processes, but ambiguity in the representation of clouds in atmospheric models is currently the largest source of uncertainty in photolysis rates. A new approach for modeling photolysis rates (J values) in atmospheres with fractional cloud cover has been developed and is implemented as Cloud-J – a multi-scattering eight-stream radiative transfer model for solar radiation. Using observations of the vertical correlation of cloud layers, Cloud-J provides a practical and accurate method for modeling photodissociation processes [1]. In this work, the latest photolysis rate calculation code (Cloud-J v8.0) is evaluated by comparison with the widely used high-resolution “uvspec” model from LibRadtran, which has demonstrated good accuracy in several validation campaigns [2]. Using these two tools we calculated photolysis rates of several important species using spectral solar irradiance (SSI) provided by the Naval Research Laboratory (NRL) [3]. The NRL data set is chosen because it is the most frequently used data set in chemistry-climate models. We performed calculations using a tropical standard atmosphere with 42 vertical levels from 0 to 80 km [4], for cloud and aerosol-free conditions, for three solar zenith angles (10°, 40°, and 70°), and surface albedo equal to 0.1. The results confirmed the high quality and applicability of the Cloud -J for the atmospheric chemistry studies.

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