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Title: The Effect of Wavelength Binning on Solar Irradiance Extinction Altitude by Atmospheric Ozone Absorption

Abstract:
Current atmospheric models such as the CCM2 and CAM3 employ the δ-Eddington approximation which includes a binning of the solar spectrum to 8 bins (for these purposes the first 6 bins, 200-305 nm, will be studied). This analysis compares the solar irradiance penetration at 1nm wavelength resolution to the 6-bin averaged irradiance spectrum. The analysis began by constructing a 1-dimensional model atmosphere consisting of only ozone molecules. Next, ozone absorption cross section data was used in conjunction with the model atmosphere to calculate optical depth for all wavelengths at all altitudes. Finally, solar spectral irradiance data was taken from the SORCE mission and, using Beer's Law, the transmitted irradiance was calculated for all altitudes and integrated over wavelength. This resulted in an extinction altitude of around 29 km. A similar analysis was performed using irradiance data averaged over each of the 6 wavelength bins which gave an extinction altitude of around 38 km. This results in a difference in irradiance of almost 0.6 W/m^2 at 47 km and almost 100% difference in the 6-bin model at 40 km. This implies that, when employing the wavelength binning, solar irradiance energy is deposited higher in the atmosphere than should be expected.