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Atmos. Chem. Phys., 3, 225-231, 2003

www.atmos-chem-phys.net/3/225/2003/

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The H Lyman- α actinic flux in the middle atmosphere

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Abstract. The penetration of solar H Lyman- α radiation into the terrestrial middle atmosphere is studied in detail. The Lyman- α actinic flux is calculated with a Monte Carlo approach including multiple resonance scattering of Lyman- α photons within the terrestrial atmosphere and a temperature dependent absorption cross section of molecular oxygen. The dependence of the actinic flux on the temperature profile is significant for O₂ column densities greater than about 10²⁴ m⁻². For column densities greater than about 5 · 10²⁴ m⁻² resonance scattering becomes important at solar zenith angles > 60°. The O(¹D) quantum yield of the O₂ dissociation by Lyman- α photons is found to decrease from 0.58 in the lower thermosphere to 0.48 in the lower mesosphere. Parameterisations for Lyman- α actinic flux, mean O₂ absorption cross section and O(¹D) quantum yield including temperature dependence and resonance scattering are given valid up to a O₂ column density of about 10²⁵ m⁻².

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Citation: Reddmann, T. and Uhl, R.: The H Lyman- α actinic flux in the middle atmosphere, Atmos. Chem. Phys., 3, 225-231, 2003. [Bibtex](#) [EndNote](#) [Reference Manager](#)

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