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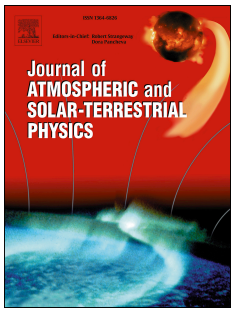

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On the Importance of an Atmospheric Reference Model: A Case Study on Gravity Wave-Airglow Interactions

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Abstract

The atmospheric reference model utilized in an airglow numerical study is important since airglow emissions depend on the number density of the light-emitting species. In this study, we employ 2-dimensional, nonlinear, time-dependent numerical models, Multiple Airglow Chemistry Dynamics (MACD) and OH Chemistry Dynamics (OHCD), that use the MSISE-90, NRLMSISE-00, and Garcia and Solomon (GS) model data as atmospheric reference models, to investigate gravity wave-induced airglow variations for the OH(8,3) airglow, O_2(0,1) atmospheric band, and O(^{1}S) greenline emissions in the Mesosphere and Lower Thermosphere (MLT) region. Our results show that the OHCD-00 produces the largest wave-induced OH(8,3) airglow intensity variation (~34%), followed by the OHCD-90 (~30%), then by the OHCD (~22%). For O(^{1}S) greenline, the MACD produces the largest wave-induced variation (~33%), followed by the MACD-90 (~28%), then by MACD-00 (~26%). As for O_2(0,1) atmospheric band, the MACD produces the largest wave-induced variation (~31%), followed by the MACD-90 and MACD-00 (~29%). Our study illustrates the importance and the need for a good atmospheric reference model that can accurately represent the atmosphere.

Keywords: gravity waves, OH nightglow, O_2(0,1) atmospheric band, O(^{1}S) greenline, atmospheric empirical model, atmospheric reference model