Annales Geophysicae

ISSN: 0992-7689 (printed version)
ISSN: 1432-0576 (electronic version)

Abstract Volume 12 Issue 7 (1994) pp 664-673

Theoretical validation of ground-based microwave ozone observations

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Received: 21 October 1993/Revised: 9 February 1994/Accepted: 21 February 1994

Abstract. Ground-based microwave measurements of the diurnal and seasonal variations of ozoneat 42±4.5 and 55±8 km are validated by comparing with results from a zero-dimensional photochemical model and a two-dimensional (2D) chemical/radiative/dynamical model, respectively. O_3 diurnal amplitudes measured in Bordeaux are shown to be in agreement with theory to within 5%. For the seasonal analysis of O_3 variation, at 42±4.5 km, the 2D model underestimates the yearly averaged ozone concentration compared with the measurements. A double maximum oscillation (\sim3.5%) is measured in Bordeaux with an extended maximum in September and a maximum in February, whilst the 2D model predicts only a single large maximum (17%) in August and a pronounced minimum in January. Evidence suggests that dynamical transport causes the winter O_3 maximum by propagation of planetary waves, phenomena which are not explicitly reproduced by the 2D model. At 55±8 km, the modeled yearly averaged O_3 concentration is in very good agreement with the measured yearly average. A strong annual oscillation is both measured and modeled with differences in the amplitude shown to be exclusively linked to temperature fields.

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