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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Vertical advection and nocturnal deposition of ozone over a boreal pine forest" *by* Ü. Rannik et al.

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I'm afraid the editor's brief comment regarding units does not represent the intended clarification.

The variable defined as mass per unit volume is density. "Concentration" is an ambiguous term, sometimes used as a synonym for density (as the editor intends) but often enough used in a dimensionless sense. See for example, the 2007 IPCC report (Chapter 2 by Forster et al.), but really one need look no further than the most recent issue of ACP to find ozone "concentrations" expressed in ppb (e.g., Atmos. Chem. Phys., 8, 1-13, 2008). For gas phase applications, the term "concentration" has equivocal definitions and its use in the atmospheric sciences is best avoided for this reason. In order to refer to expressions measured in ppb, a far more exact term is the molar fraction (or

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equivalently, volumetric fraction).

Given that mixing is a mass-dependent process (i.e., a mass-weighted combination of initial temperatures determines the final temperature of dry air two parcels mixed isobarically), meteorologists have defined the mixing ratio as a mass fraction whose appropriate units for ozone should therefore be micrograms per kilogram. It is inappropriate to quantify a mixing ratio in units of ppb. The most traditional use of ppb is to represent a volumetric or molar fraction, where "parts" (per billion) refer to moles.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 18437, 2008.

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Interactive Comment