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Interactive Comment

Interactive comment on "Kinetic model framework for aerosol and cloud surface chemistry and gas-particle interactions: Part 1 – general equations, parameters, and terminology" *by* U. Pöschl et al.

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General comments:

Pöschl et al. provide a very thorough analysis of gas-particle interactions. I would like to add a few remarks from a modeler's point of view. To describe the phase transfer in a model, the mass transfer coefficient k_{mt} is defined as a first order rate coefficient. Considering both gas-phase diffusion and interfacial mass transport, the following equation is obtained (see Schwartz (1986) and Sander (1999) for details, full references can be found in Pöschl et al.):

$$k_{\mathrm{mt}} = \left(\frac{r^2}{3D_{\mathrm{g}}} + \frac{4r}{3\bar{v}\alpha} \right)^{-1} \tag{1}$$

Here, α is the accommodation coefficient, and all other symbols are the same as defined in Pöschl et al. To describe only the net flux, the uptake coefficient γ could be used here instead of α.

If only the interfacial mass transport is considered, the first order rate coefficient k_{i} is obtained:

$$k_{\mathrm{i}} = \frac{3\bar{v}\alpha}{4r} \tag{2}$$

The ratio $k_{\mathrm{mt}}/k_{\mathrm{i}}$ is another way to describe the gas phase diffusion correction factor introduced by Pöschl et al.:

$$\frac{k_{\mathrm{mt}}}{k_{\mathrm{i}}} = \frac{\frac{4r}{3\bar{v}\alpha}}{\frac{r^2}{3D_{\mathrm{g}}} + \frac{4r}{3\bar{v}\alpha}} = \frac{1}{1 + \frac{r\bar{v}\alpha}{4D_{\mathrm{g}}}} \tag{3}$$

Using the approximation $3D_{\mathrm{g}} = \lambda\bar{v}$, this can be transformed to

$$\frac{k_{\mathrm{mt}}}{k_{\mathrm{i}}} = \frac{1}{1 + \alpha\frac{3r}{4\lambda}} \tag{4}$$

which is identical to equation (20) obtained by Pöschl et al. I think it is useful to see that equivalent results are obtained for the new kinetic model framework by Pöschl et al. and previous descriptions of the process.

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Specific comments:

- I think the readability of the text and especially of the equations could be improved substantially by simplifying the symbols throughout the manuscript. For example, instead of X_i and Y_j, simply X and Y would be sufficient.
- Equation (4): I find the symbol C_g for the newly introduced gas phase diffusion correction factor confusing. In the literature, C_g is often used for the gas-phase concentration. What about using f_g for the factor, instead?
- Page 2118, line 13: The unit should be "molecules per unit volume per time" and not "molecules per unit volume".
- Page 2120, line 9: The Knudsen number should be defined when it is introduced: Kn = λ/r.
- Page 2123, line 16: Change "occurr" to "occur".
- Appendix A: The unit of the fluxes J should be $m^{-2}s^{-1}$ and not m^2s^{-1}.
- Appendix A: The unit of $[Y_j]_b$ should be m^{-3} and not m^{-2}.
- Page 2183, line 21: Change "cloiud" to "cloud".
- Figure 1: In the caption, it is said that both the symbols and the dotted lines are calculated according to equation (20). However, they are different. Please clarify.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 2111, 2005.