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Interactive Comment

Interactive comment on "Attenuation of concentration fluctuations of water vapor and other trace gases in turbulent tube flow" *by* W. J. Massman and A. Ibrom

W. J. Massman and A. Ibrom

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We thank T. Griffis for his interest.

The questioner asks if the tube flow model could be used to investigate the fractionation effect for water vapor in both laminar and turbulent flow.

Regarding laminar flow, the answer is no because the model is designed specifically for turbulent flow. Laminar tube flow is described be different profiles for $U(r)$ and $D(r)$. Most importantly, the appropriate diffusivity for laminar flow is molecular diffusivity which, unlike turbulent diffusivity, does not vary with radial position. But it seems worthwhile to model wall (water vapor) effects for laminar tube flow.

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Interactive Discussion

Discussion Paper

Regarding turbulent flow, the answer is unknown at this time. Clearly the model did not describe $\Lambda_1(Re)$, which is a first order effect, so it is not clear how successful (or appropriate) the model might be at describing a second order effect like $\Lambda_1(Sc)$. Nonetheless, the model does suggest that the Schmidt number dependency is most significant at lower Reynolds number. Consequently (and according to the model), the greatest probability of observing or quantifying the fractionation effect for water vapor isotopes in turbulent tube flow is likely to be at lower values turbulent Re (= 2500-5000). This might make a good test of the model. But a true description of the fractionation effects for any polar molecule is likely to require a description of the mean concentration as well as the fluctuations. This implies a more detailed model and a model that would still have to deal why the present model does not appear to work.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 9819, 2008.