Atmospheric Chemistry and Physics
An Interactive Open Access Journal of the European Geosciences Union









Atmos. Chem. Phys., 8, 6699-6706, 2008
www.atmos-chem-phys.net/8/6699/2008/


# Determination of the evaporation coefficient of $D_2O$

W. S. Drisdell[1,2], C. D. Cappa[3], J. D. Smith[2], R. J. Saykally[1,2], and R. C. Cohen[1,4]

[1]Department of Chemistry, UC Berkeley, Berkeley, CA, USA
[2]Chemical Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA, 94720, USA
[3]Department of Civil and Environmental Engineering, UC Davis, Davis, CA, USA
[4]Department of Earth and Planetary Science, UC Berkeley, Berkeley, CA, USA

Abstract. The evaporation rate of $D_2O$ has been determined by Raman thermometry of a droplet train (12–15 μm diameter) injected into vacuum ($\sim 10^{-5}$ torr). The cooling rate measured as a function of time in vacuum was fit to a model that accounts for temperature gradients between the surface and the core of the droplets, yielding an evaporation coefficient ($\gamma_e$) of 0.57±0.06. This is nearly identical to that found for $H_2O$ (0.62±0.09) using the same experimental method and model, and indicates the existence of a kinetic barrier to evaporation. The application of a recently developed transition-state theory (TST) model suggests that the kinetic barrier is due to librational and hindered translational motions at the liquid surface, and that the lack of an isotope effect is due to competing energetic and entropic factors. The implications of these results for cloud and aerosol particles in the atmosphere are discussed.

Final Revised Paper (PDF, 614 KB) Discussion Paper (ACPD)

Citation: Drisdell, W. S., Cappa, C. D., Smith, J. D., Saykally, R. J., and Cohen, R. C.: Determination of the evaporation coefficient of $D_2O$, Atmos. Chem. Phys., 8, 6699-6706, 2008. Bibtex EndNote Reference Manager