**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Deposition of dinitrogen pentoxide, N_2O_5, to the snowpack at high latitudes" *by* D. M. Huff et al.

Anonymous Referee #3

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General Comments

This paper attempts to estimate vertical fluxes of a trace gas (N2O5) using vertical gradients of both tracer and temperature plus turbulence measurements.

As it stands, the paper appears to have significant flaws in the procedure, with the bulk of the Supplemental Material being inappropriate. The authors state that they have measurements of the tracer gradient (that is, $\partial N2O5 / \partial z$ estimated from measuring $\Delta N2O5/(z2-z1)$) . They also have measurements of potential temperature gradient, $\partial \theta / \partial z$, which are available from thermometers. Finally they estimate the heat flux, w'θ', using sonic anemometers. The flux of N2O5 is therefore the tracer gradient multiplied by the effective tracer diffusivity:

$[\partial N2O5 / \partial z].[w'\theta']/[\partial \theta / \partial z]$

The convoluted (and inherently inaccurate) method given is not required.

In addition the two sonic anemometers, sampling at 10 Hz, may be too near the surface to capture the full range of the turbulence diffusion eddies. As a check on this, u* and w'T' from both instruments should be compared: if both of the sonic anemometers are within the constant flux layer (likely) and sampling at a sufficiently high sample rate to capture the turbulence scales (which is doubtful) they will agree. If they do not agree, then any estimate of N2O5 will be inaccurate.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 25329, 2010.