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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "The effects of experimental uncertainty in parameterizing air-sea gas exchange using tracer experiment data" *by* W. E. Asher

**R. Wanninkhof (Referee)**

rik.wanninkhof@noaa.gov

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Review: The effects of environmental variability and experimental uncertainty in parameterizing air-sea gas exchange by William Asher

Asher provides a thorough analysis of the effect of experimental error on calculated gas transfer velocities and the resulting effect on gas exchange wind speed relationships. The main conclusion is that much of the observational differences in field and wind-wave tank studies can be explained from these uncertainties rather than the common attribution that other effects are impacting gas transfer. [As a sidebar- this does no mean that other effects are not pertinent but rather Asher suggests that much of the



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Discussion Paper

scatter can be explained by experimental uncertainty]

The paper discusses uncertainty for the Schmidt number exponent based on wind-wave tank results using He, SF6, and CH4; and the uncertainty in the gas transfer velocity in this wind wave study and a compilation dual deliberate tracer field studies. The analyses is performed by a Monte-Carlo simulation spanning a 2 sigma uncertainty based on uncertainty in the measurement of concentration, and in the case of field studies uncertainty in mixed layer depth as well. The results are shown graphically.

The paper is well laid out and overall quite clear. The main issue is that it does not really provide a clear sense if the situation can be improved or if we are stuck with this envelope of uncertainty. In particular, there should be some discussion on the effect of integration time, better estimates of mixed layer, and more precise concentration measurements. Also, while the study assumes steady winds, the effect of variability of wind over the measurement time of the field studies should be, at least, qualitatively assessed.

Specific comments:

Abstract: "could explain a major portion"- be more quantitative

Introduction: First couple of comments should be referenced

Equation 2: I could not readily find how Cs was defined.

Equation 3: provide an estimate of the magnitude of the denominator: (1-(ScHe/ScSF6)ˆ1/2)

Page 5. (Or before): State somewhere what the uncertainty in the Schmidt numbers and diffusion coefficients is.

Page 5, bottom: Explain why despite the larger uncertainty in He concentration measurements the uncertainty in k is the same (or even slightly less) than the measurement of k by SF6



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8, S6671–S6673, 2008



Page 7, bottom: perhaps emphasize that with stated uncertainties n cannot be measured to better than 0.1 (?).

Equation 8: Why should N decrease monotonically with wind speed with wind $>$ 2 m/s

Equation 8: appears to have a "-" missing in the exponential function.

Page 8, middle: the field measurements were not done under steady winds. This uncertainty should be estimated.

Page 9, line 3: states that power law dependence is used. The line Figure 6 does not look like a power law dependence.

Page 9, line 6: Comment on time interval of 1 to 2 days. The time interval is critical for the concentration decrease and therefore the uncertainty

Page 10: While the conclusion that there is less variability in forcing mechanisms is an important one, some words if field and lab studies can be improved to get to these forcing functions and/or more accurate wind speed relationships would be of interest.

Figure 1. I vaguely recall there were 4 data points for IronEx; I only see 3 plotted.

Figure 3. (And 2) Comment why more SF6 points fall outside the error envelope than for He.

Figure 4. It is unclear why the 2-sigma error envelope broadens at low winds.

Figure 5a: Why does error envelope broaden at low winds for Ch4/SF6 but not as much (for figures 5b and 5c.

Figure 6. It might be worth commenting that the % uncertainty decreases with increasing wind speed (as the concentration decreases faster).

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Interactive comment on Atmos. Chem. Phys. Discuss., 8, 16693, 2008.



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8, S6671–S6673, 2008

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