



Reply to comment by Edgar L Andreas on “Vertical coarse aerosol fluxes in the atmospheric surface layer over the North Polar Waters of the Atlantic”

Tomasz Petelski¹ and Jacek Piskozub¹

Received 16 June 2007; revised 13 August 2007; accepted 19 August 2007; published 14 November 2007.

Citation: Petelski, T., and J. Piskozub (2007), Reply to comment by Edgar L Andreas on “Vertical coarse aerosol fluxes in the atmospheric surface layer over the North Polar Waters of the Atlantic,” *J. Geophys. Res.*, *112*, C11011, doi:10.1029/2007JC004399.

[1] We are grateful for the interest Edgar L Andreas took in our work. His comments [Andreas, 2007] on our paper [Petelski and Piskozub, 2006] are insightful and confirm the methodology we chose, the aerosol concentration gradient, as a step forward toward achieving a reliable estimation of the aerosol production function. The difference between our approach and the recalculation of our results by Andreas [2007] is the value of the von Kármán constant analogue for the aerosol flux.

[2] It is not obvious that the dimensionless parameter of the logarithmic profile of aerosol concentration needs to be identical to the von Kármán constant. The physics of momentum flux and aerosol flux are identical because we assume Monin-Obukhov similarity, but that implies only the existence of such a constant, not its value. Andreas gives theoretical reasons for its value to be identical to the Kármán constant (approximately 0.40). We implicitly assumed it to be 1.0. Hence the approximate 2.5-fold difference of calculated fluxes in our original paper and in the comment by Andreas (approximate because we presented best fit flux functions for each wind speed bin data separately, which makes each of them differ from values of the “universal” function, namely, equation (5) of Petelski and Piskozub [2006], derived from the complete data set). However, we believe that the only way this problem can be solved is by experimental determination of the constant value. Until better data are available (one possibility is eddy correlation measurements in the open sea), our aerosol concentration data processed using the dry deposition method [Smith *et al.*, 1993] may be the best calibration of the coefficient. Results presented in Figures 9 and 10 of Petelski and Piskozub [2006] (the “Eq(10)” lines) seem to suggest that the coefficient may be higher than the von Kármán constant, possibly even closer to the value we

implicitly chose (1.0). Also, the only eddy correlation measurements of aerosol concentration [Nilsson and Rannik, 2001] in the open sea, measured in the same areas as our data, seem to suggest that the flux functions favored by Andreas [2002] may be underestimated, further strengthening our estimation of the coefficient value.

[3] Even with the above disagreements with Andreas [2007], we believe that his analysis of the influence of the flux coefficient choice on the results moves us forward toward a consensus on the marine aerosol source function. Even a 2.5-fold difference in the function value is minor compared to the several orders of magnitude range of functions reviewed by Andreas [2002]. However, further studies using more than one method of aerosol flux estimation are needed to narrow the von Kármán constant–related uncertainty.

References

- Andreas, E. L. (2002), A review of the sea spray generation function for the open ocean, in *Atmosphere-Ocean Interactions*, vol. 1, edited by W. Perrie, pp. 1–46, WIT, Southampton, U. K.
- Andreas, E. L. (2007), Comment on “Vertical coarse aerosol fluxes in the atmospheric surface layer over the North Polar Waters of the Atlantic” by Tomasz Petelski and Jacek Piskozub, *J. Geophys. Res.*, *112*, C11010, doi:10.1029/2007JC004184.
- Nilsson, E. D., and Ü. Rannik (2001), Turbulent aerosol fluxes over the Arctic Ocean: 1. Dry deposition over sea and pack ice, *J. Geophys. Res.*, *106*(D23), 32,125–32,137.
- Petelski, T., and J. Piskozub (2006), Vertical coarse aerosol fluxes in the atmospheric surface layer over the North Polar Waters of the Atlantic, *J. Geophys. Res.*, *111*, C06039, doi:10.1029/2005JC003295.
- Smith, M. H., P. M. Park, and I. E. Consterdine (1993), Marine aerosol concentrations and estimated fluxes over the sea, *Q. J. R. Meteorol. Soc.*, *119*, 809–824.

T. Petelski and J. Piskozub, Institute of Oceanology, Polish Academy of Sciences, ul. Powstańców Warszawy 55, 81-712 Sopot, Poland. (petelski@iopan.gda.pl; piskozub@iopan.gda.pl)

¹Institute of Oceanology, Polish Academy of Sciences, Sopot, Poland.