Atmospheric Chemistry and Physics Discussions

Interactive Comment

Interactive comment on "Oxidation of SO$_2$ by H$_2$O$_2$ on ice surfaces at 228 K: a sink for SO$_2$ in ice clouds" *by* "S. M. Clegg and J. P. D. Abbatt"

Anonymous Referee #1

General comments

This paper presents an important topic in tropospheric chemistry and is well written. The referee recommends publishing this paper with some minor modifications.

Specific comments

1. Page 84. H$_2$O$_2$ was in isotherm equilibrium with the ice surface (approximately) (page 80) before SO$_2$ was introduced to the system. Should [H$_2$O$_2$(ad)] be nearly a constant? Also, [H$_2$O$_2$]>[SO$_2$], the competition between H$_2$O$_2$ and SO$_2$ should not be a significant factor.

2. The semi-quantitative or qualitative mechanism/explanation has some problems. SO$_2$ is efficiently taken by H$_2$O$_2$ covered ice surfaces, but not on H$_2$O surfaces. Reaction 4 was assumed to be the rate determining step. As it was written, Reactions 2-3,

Print Version

Interactive Discussion

Original Paper

the loss of SO_2 on H_2O surfaces, should be slower steps. Reaction 4 is a reversible reaction and a rate expression in Equation 6 should have both forward and backward terms. Equation 7 was from isotherms of SO_2 on H_2O surfaces. The expression for $[HSO_3^-(ad)]$ may not be that simply as it was given in Equation 7 if one applies the steady-state approximation to Reactions 1-5.

3. Equation 11 was obtained by a semi-quantitative approach. The discussion in the last paragraph on page 83 perhaps stretched the conclusion of Equation 11 beyond its limit. The difference between -0.5 and -0.7 can also be an uncertainty of the semi-quantitative approach.

Technical corrections

Use thicker lines in figures.

Interactive comment on Atmos. Chem. Phys. Discuss., 1, 77, 2001.

Print Version

Interactive Discussion

Original Paper

© EGS 2001