Correction to and updated reaction in "Chemical markers of possible hot spots on Mars"

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[1] This correction and update is the most up to date, and it supersedes the previous correction (paper 2003JE002210) to our original paper (2002JE002003).

[2] In our original paper "Chemical markers of possible hot spots on Mars" (*Journal of Geophysical Research*, *108*(E4), 5026, doi:10.1029/2002JE002003, 2003) (hereinafter WAE), there is an error in reaction (R34) in Table 2. The corrected (R34) is

$$SO_2 + O_3 \rightarrow SO_3 + O_2. \qquad \text{(R34)}$$

The rate coefficient is $k = 3 \times 10^{-12}\ e^{-7000/T}\ cm^3\ s^{-1}$.

[3] We also include an additional reaction omitted in WAE:

$$SO + O_3 \rightarrow SO_2 + O_2. \qquad \text{(R52)}$$

The rate coefficient is $k = 3.6 \times 10^{-12}\ e^{-1100/T}\ cm^3\ s^{-1}$.

[4] The reaction (R34) is very slow under Martian atmospheric conditions, not affecting the overall chemical scheme. The inclusion of R52 also has little effect, altering the sulfur species abundance less than 15% relative to those in WAE.

[5] Once in the atmosphere, SO_2 is photodissociated to produce SO, which is further photodissociated to form sulfur atoms. The reaction of SO, particularly with O_2, O, OH, and O_3, recycles sulfur atoms back to SO_2 ((R33), (R32), (R35) in Table 2 of WAE and (R52) above). On the other hand, SO_2 reacts with OH and then O_2 to form sulfur trioxide (SO_3, (R38) and (R41)), which quickly combines with water vapor to form sulfuric acid (H_2SO_4, (R39)). H_2SO_4 undergoes condensation in the atmosphere. The revised reaction pathway is shown in Figure 1.

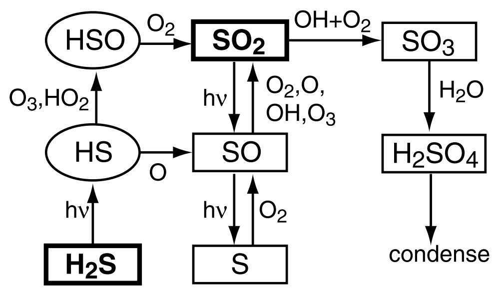

Figure 1. Reaction pathway for sulfur species in the Martian atmosphere. Stable species are in rectangles, radicals are in ovals, and outgassing species are in bold.

[6] After applying the above changes, for Model B in WAE, where the assumed mixing ratio of the outgassed SO_2 is 10^{-5} at the surface, the column abundance of SO_2 above 10 km is found to be 8.5×10^{17} molecules cm^{-2}, compared

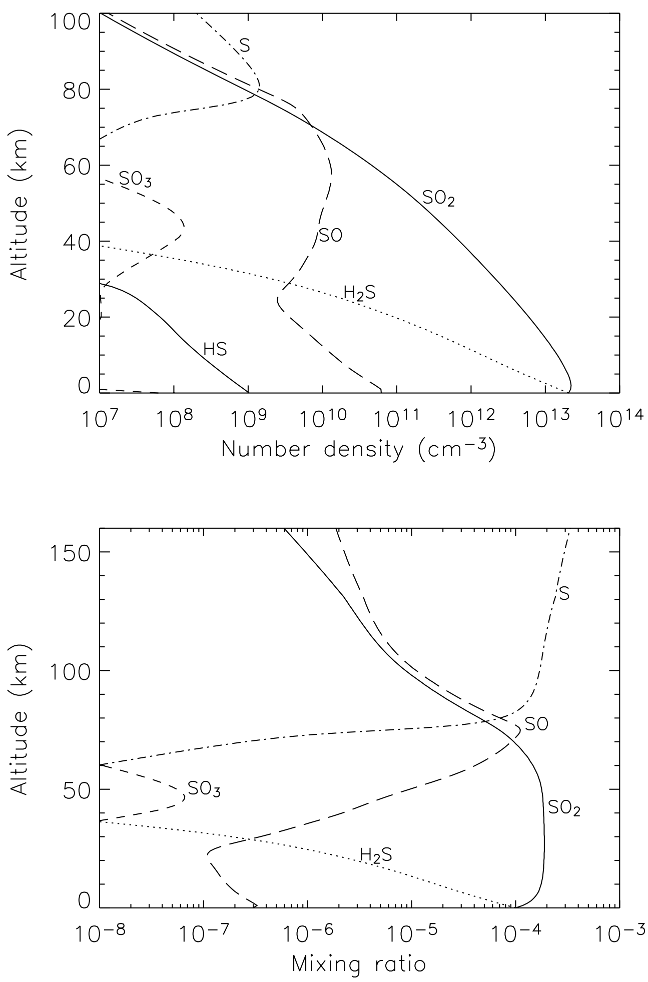

Figure 2. Number densities and mixing ratios versus altitude for important species calculated with 100 ppm each of H_2S and SO_2 at the surface of Mars (Model G).

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to 7.2×10^{17} molecules cm^{-2} in WAE. Other species and their abundances, as well as the overall conclusions, are not affected.

[7] For Model G of WAE, where both SO_2 and H_2S are outgassed, each with an assumed mixing ratio of 100 ppm at the surface, the new mixing ratios at 10 km are found to be 1.8×10^{-4}, 1.7×10^{-5}, and 1.7×10^{-7} for SO_2, H_2S, and SO, respectively. The corresponding column abundances above 10 km are, in molecules cm$-^{2}$, 1.6×10^{19}, 6.1×10^{17}, and 5.4×10^{16}. These values are within 15% of those in WAE for Model G. The number densities and mixing ratios of important sulfur species for this revision are shown in Figure 2. For the case with current global upper limit of 0.1 ppm each for SO_2 and H_2S, the change due to (R34) and (R34) is imperceptible. The corresponding lifetime of SO_2 is found to be approximately 600 days.

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