Correction to "Sulfuric acid deposition from stratospheric geoengineering with sulfate aerosols"

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[1] In the paper "Sulfuric acid deposition from stratospheric geoengineering with sulfate aerosols" (*Journal of Geophysical Research, 114*, D14109, doi:10.1029/2009JD011918, 2009), there are two errors that we would like to correct. The first is an arithmetic error. In contrast to our calculation of the average global surface sulfur emissions of 5.41×10^{-5} kg S m^{-2} a^{-1}, the correct value is 2.67×10^{-4} kg S m^{-2} a^{-1}. This value was calculated as a reference value, so this correction actually strengthens our conclusions that the additional amount of sulfur from geoengineering would be much smaller than current sources.

[2] The second error involves our incorrect application of a formula. In section 4, we convert model output of sulfate deposition, given in kg SO_4 m^{-2} a^{-1}, to a form used in critical loading studies, mEq m^{-2} a^{-1}. Our formula as printed reads

$$\frac{1\ \mathrm{kg}}{\mathrm{m}^2 \cdot \mathrm{a}} \cdot \frac{1000\ \mathrm{g}}{1\ \mathrm{kg}} \cdot \frac{1\ \mathrm{mEq} \times 0.048}{1\ \mathrm{g}} = 48 \frac{\mathrm{mEq}}{\mathrm{m}^2 \cdot \mathrm{a}}.$$

However, the formula should read

$$\frac{1\mathrm{kg\ SO_4}}{\mathrm{m}^2 \cdot \mathrm{a}} \cdot \frac{1000\ \mathrm{g\ SO_4}}{1\ \mathrm{kg\ SO_4}} \cdot \frac{2\ \mathrm{Eq/mol}}{96\ \mathrm{g\ SO_4/mol}} \cdot \frac{1000\ \mathrm{mEq}}{1\ \mathrm{Eq}} = 20,833 \frac{\mathrm{mEq}}{\mathrm{m}^2 \cdot \mathrm{a}}.$$

Figure 3 was a conversion of model output into these new units, using the old conversion factor. We attach a corrected Figure 3, using the correct conversion factor. This changes the magnitude of our values significantly. The maximum point value in Figure 3 (top) is approximately 650 mEq m^{-2} a^{-1}, which represents total amount of acid deposition from anthropogenic sources plus geoengineering with 5 Tg SO_2 per year in the tropics. Figure 3 (bottom) has a maximum point value of approximately 35 mEq m^{-2} a^{-1}, representing the additional acid deposition that would result just from geoengineering. These values assume that all sulfate deposition occurs as sulfuric acid, which is a realistic assumption in moist environments, where acid deposition could be a problem (R. Skeffington, personal communication, 2010). This does not change our conclusion that acid deposition due to geoengineering would be much smaller than the amount already being received in industrialized regions. Moreover, this does not change our conclusion that all but the most sensitive, pristine areas of the world have significant buffering capacity against additional sulfuric acid that would result from geoengineering.

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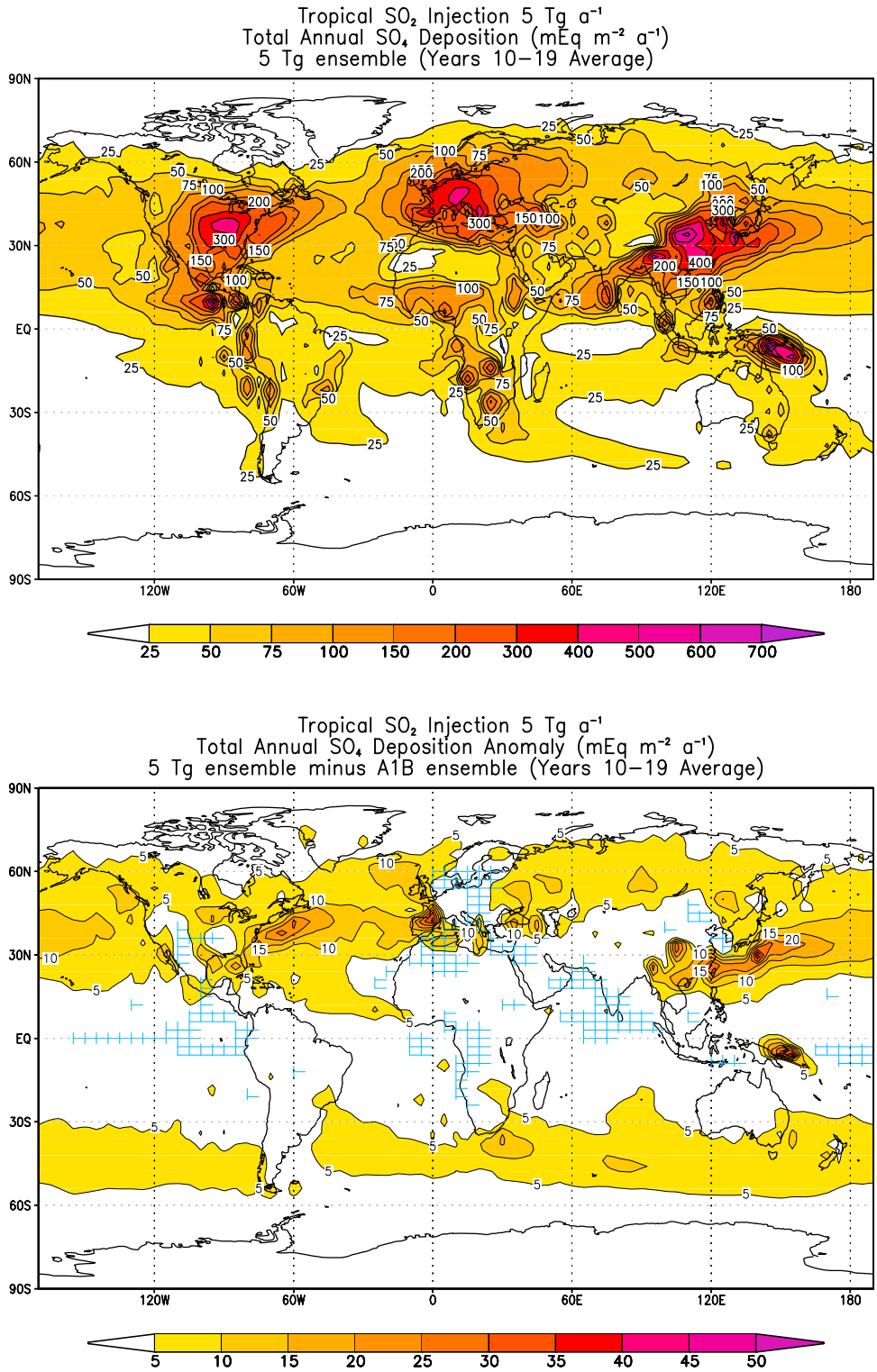

Figure 3. Results for a tropical 5 Tg a^{-1} injection. (top) Total sulfate deposition (geoengineering plus baseline). (bottom) Sulfate deposition anomaly (injection minus baseline, revealing only the additional deposition from geoengineering). The largest total sulfate deposition point value is approximately 650 mEq m^{-2} a^{-1}, and the largest anomaly point value is approximately 35 mEq m^{-2} a^{-1}. These plots are made from the model output of the climate simulations performed by *Robock et al.* [2008], averaged over three ensemble members and years 10–19 for each experiment. Values not statistically significant at a 95% confidence level are denoted by blue hatching.