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# Sensitivity of thermal infrared sounders to the chemical and micro-physical properties of UTLS secondary sulphate aerosols

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Table 1: Dependence of the extinction at 1170 cm$^{-1}$ on the temperature: N=number of data points (different temperatures), $T_{max}$=maximum available temperature [K], $T_{min}$=minimum available temperature [K], $\Delta$=difference between the extinction coefficient at $T_{min}$ and $T_{max}$ [%].

| H2SO4 | N | $T_{max}$ | $T_{min}$ | Background $\Delta$ | Volcanic $\Delta$ |
|---|---|---|---|---|---|
| 80 | 1 | 293 | 293 | — | — |
| 75 | 2 | 293 | 193 | +11.0% | +10.2% |
| 70 | 4 | 293 | 233 | +8.0% | +7.9% |
| 64 | 6 | 293 | 188 | +8.3% | +7.8% |
| 60 | 5 | 293 | 213 | -4.2% | -3.9% |
| 57 | 8 | 293 | 188 | +20.1% | +20.0% |
| 50 | 5 | 293 | 215 | -4.7%% | -4.8% |
| 45 | 6 | 293 | 203 | +2.6% | +1.7% |
| 40 | 4 | 293 | 213 | -9.5% | -9.2% |
| 30 | 8 | 293 | 193 | -8.6% | -7.0% |
| 20 | 5 | 293 | 233 | -8.7%% | -8.8% |
| 10 | 6 | 293 | 253 | -9.8% | -8.9% |
| 0 | 4 | 293 | 253 | -0.3% | -1.3% |

Table 2: Dependence of the relative extinction 1170-800 cm$^{-1}$ on the temperature: N=number of data points (different temperatures), $T_{max}$=maximum available temperature [K], $T_{min}$=minimum available temperature [K], $\Delta$=difference between the extinction coefficient at $T_{min}$ and $T_{max}$ [%].

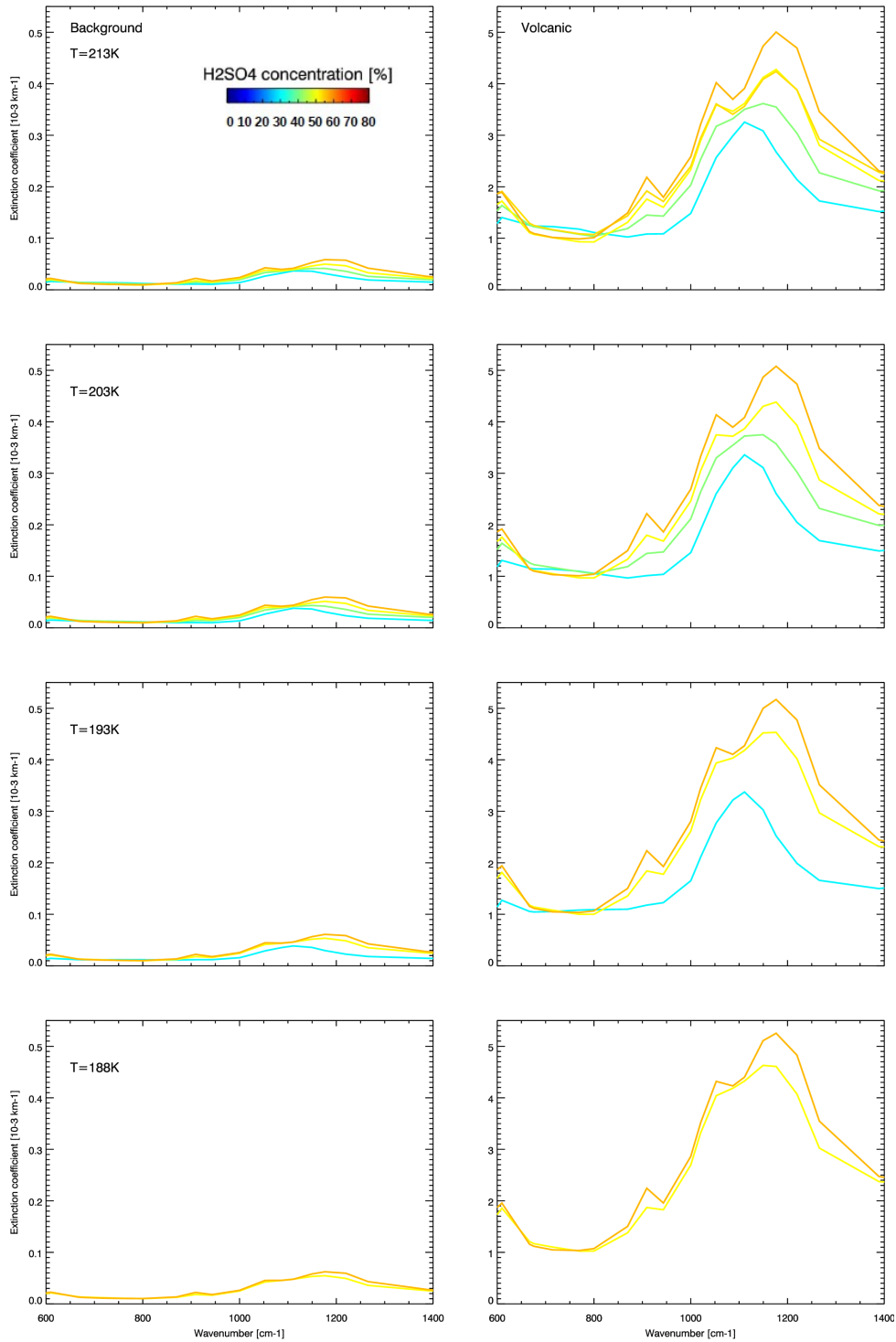| H2SO4 | N | $T_{max}$ | $T_{min}$ | Background $\Delta$ | Volcanic $\Delta$ |
|---|---|---|---|---|---|
| 80 | 1 | 293 | 293 | — | — |
| 75 | 2 | 293 | 193 | -1.2% | -3.2% |
| 70 | 4 | 293 | 233 | -1.3% | -2.8% |
| 64 | 6 | 293 | 188 | +4.1% | +5.1% |
| 60 | 5 | 293 | 213 | -8.2% | -9.7% |
| 57 | 8 | 293 | 188 | +8.0% | +8.3% |
| 50 | 5 | 293 | 215 | +2.9%% | +4.2% |
| 45 | 6 | 293 | 203 | -2.2% | -3.9% |
| 40 | 4 | 293 | 213 | -8.8% | -9.8% |
| 30 | 8 | 293 | 193 | -7.2% | -8.1% |
| 20 | 5 | 293 | 233 | -3.2%% | -4.7% |
| 10 | 6 | 293 | 253 | -2.6% | -3.8% |
| 0 | 4 | 293 | 253 | -0.1% | -0.3% |

Figure 1: Spectral extinction coefficients for sulphate aerosol layers with different $H_2SO_4$ mixing ratios, from 0 to 80 % as indicated by the colorbar, and different temperatures, from 188 to 213 K as reported in the individual sub-figures. Different mixing ratio/temperature combinations are shown, depending on the availability in the refractive indices dataset of Biermann et al. (2000). The extinction coefficients are shown for a typical background size distribution (left column) and for a moderate volcanically perturbed size distribution (right column). See the manuscript for further details.
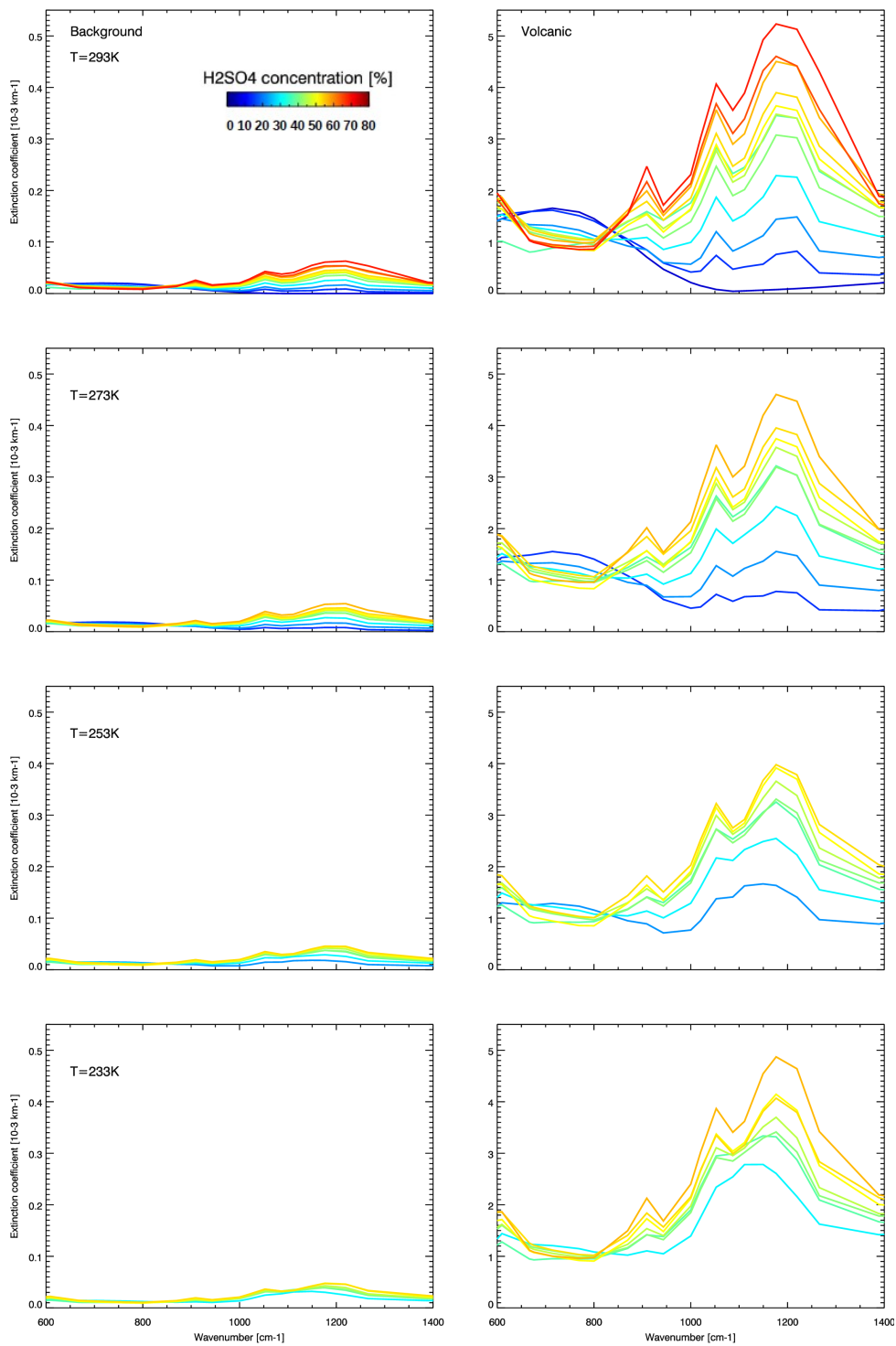
Figure 2: Same as Figure 1 but for temperatures from 233 to 293 K.