Are Sulfur Aerosols a Solution The Faint Young Sun Paradox?

Megan Smith
Penn State/U of Washington

Question: **Can atmospheric sulfur aerosols warm the surface of the early Earth, and thus solve the faint young Sun paradox?**

BACKGROUND:

Previous research by Kasting et al. (1989) proves that S_8, a strong absorber in the near ultraviolet, could have formed an ultraviolet shield in the anoxic atmosphere of the early Earth.

It is likely that amorphous sulfur (S_3,S_4) would have been in the atmosphere , too.

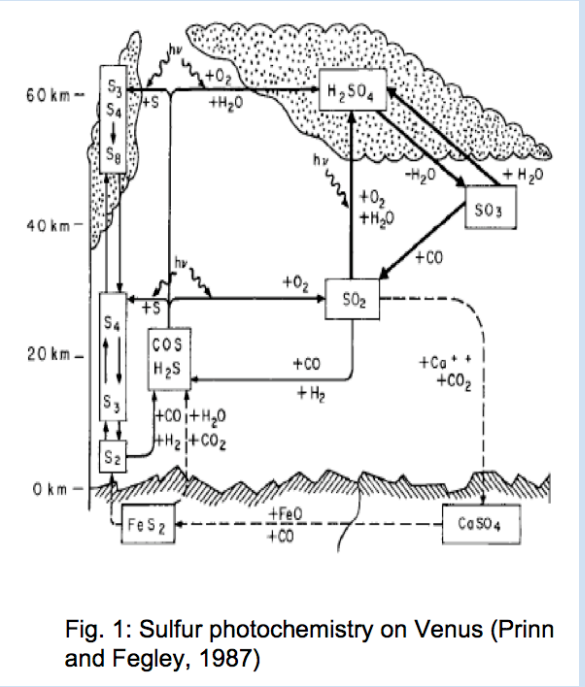

Fig. 1: Sulfur photochemistry on Venus (Prinn and Fegley, 1987)

METHODS

Calculate the particle properties for both S_8 and amorphous sulfur (S_3,S_4) and then insert them into 1-D photochemical and climate models.

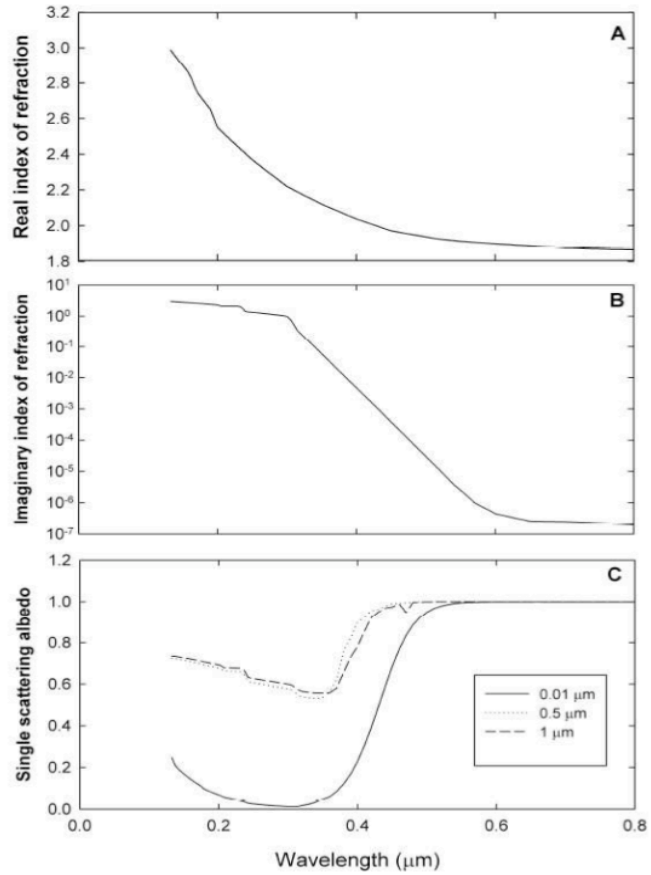

Fig. 2: (A) The real index of refraction and (B) the imaginary index of refraction of elemental sulfur input into the Mie scattering code of Mätzler, 2002. (C) The single scattering albedo for three different particle sizes, as calculated by the Mie scattering code of Mätzler, 2002.

RESULTS

Three different simulations were run with the climate model:

- No particles included
- S_8 particles only
- Amorphous sulfur particles only

The surface temperatures produced are reported in Table 1.

Table 1: Surface temperatures from the climate model output.

Simulation	Surface Temperature
Control	283.7 K
Only S_8 Particles	281.0 K
Only amorphous sulfur particles	281.1 K

CONCLUSION

Sulfur aerosols do not warm the surface! More research should be done.

*greenhouse gases

*particle size distribution