Chemical Kinetic Model for the Lower Atmosphere of Venus

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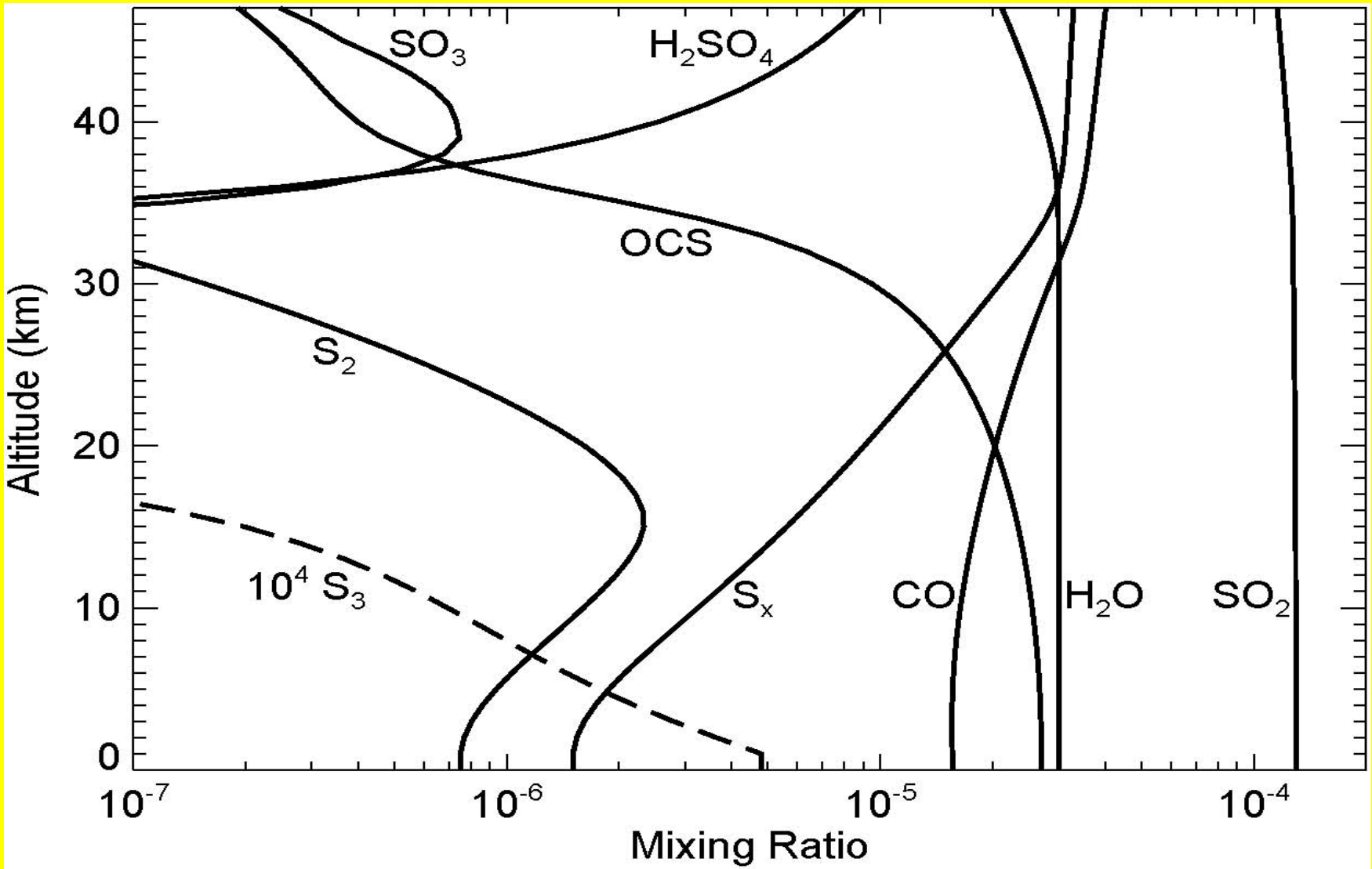
First self-consistent model for the Venus atmosphere below clouds (0-47 km)

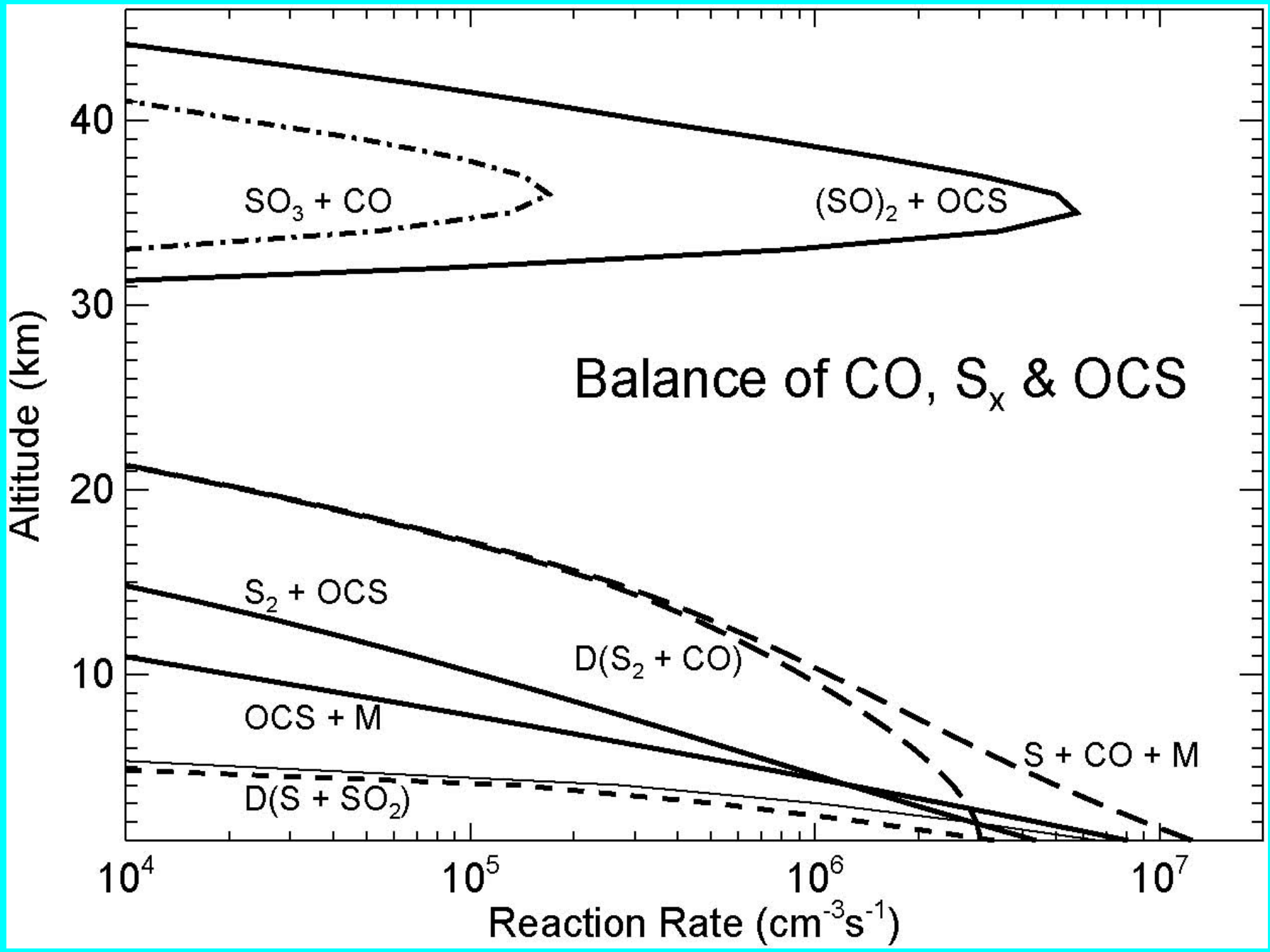
Chemistry is driven by

1) photochemical products from the middle atmosphere (SO_3, CO, S_x)
2) thermochemistry in the lowest 10 km
3) photolysis of S_3

26 species, 64 reactions

Basic Chemical Species




Balance of CO, S_x & OCS
Altitude (km)
40
30
20
10
SO_3 + CO
$(SO)_2$ + OCS
S_2 + OCS
D(S_2 + CO)
OCS + M
S + CO + M
D(S + SO_2)
10^4
10^5
10^6
10^7
Reaction Rate ($cm^{-3}s^{-1}$)

Conclusions

- S-bonds in OCS and S_x are weaker than other chemical bonds, and chemistry below 47 km is sulfur-driven
- The model results agree with the observations of H_2SO_4, CO, OCS, and S_3
- Predicted abundances of $ClSO_2$ and SO_2Cl_2 are very low (~10^{-11})
- The current concept of sulfur cycles is incompatible with the observations and has been significantly revised