

Composition, Chemistry, Aerosols and Radiation (Session II) Plenary Discussion

This very broad discussion centered on the roles of composition, clouds and hazes on atmospheric structure and dynamics. The presentations discussed formation conditions and evolution of an atmosphere and how they affect haze production. For example, a reducing atmosphere is much more likely to have organic hazes while an oxidizing atmosphere can have sulfate hazes, while the hottest exoplanets may have Fe, Al, Mg, and Si clouds and hazes. This composition affects atmospheric transparency, though cloud and haze formation.

In addition, it was discussed how thermo-chemical equilibrium models may be oversimplistic in predicting cloud formation, as disequilibrium chemistry is seen on Earth and most of the solar system planets, and hazes affect the ability for direct spectral identification of clouds. Both of these are less of a problem in brown dwarf atmospheres, which appear to follow standard condensation curves, and therefore this may not be an issue for the hottest exoplanets. In addition, thermo-chemical equilibrium approaches do not anticipate the role of dynamics in determining the altitudes at which clouds occur and the existence of subsaturation and thus fractional cloud cover above the equilibrium condensation level. Difficulties in exoplanet observations that constrain clouds were also discussed. Polarization measurements are exceedingly difficult given the large zodiacal dust background, but they contain unique signatures of particle shape, size and refractive index that might be detectable. Effective temperatures that assume an albedo (usually 0.3) may mischaracterize the atmosphere, so real Bond albedos are needed, but difficult to measure, even within our own solar system.