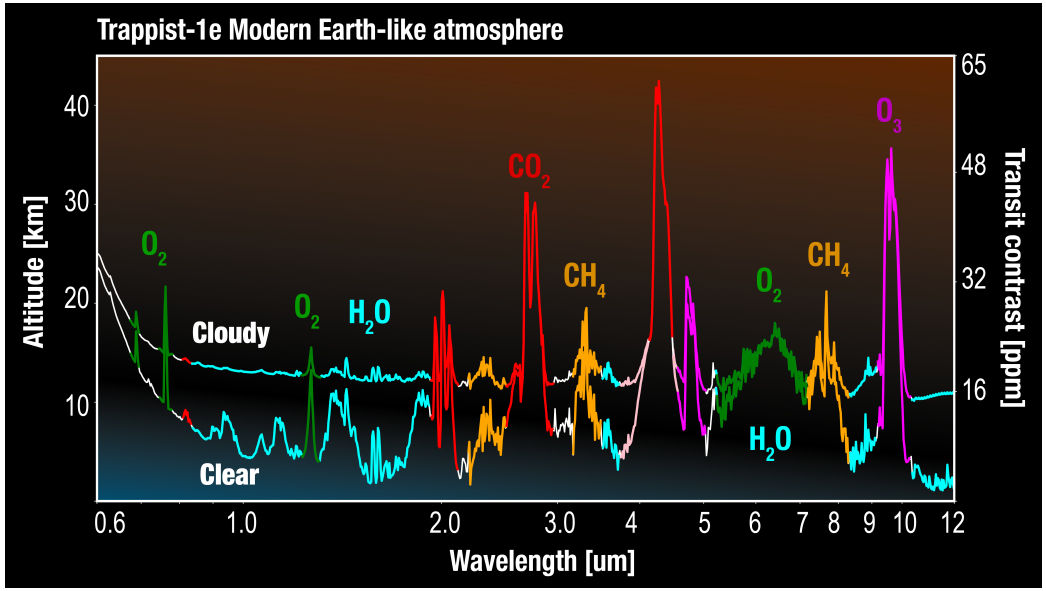
Impact of Clouds and Hazes on the Characterization of Exoplanet Atmospheres

What is the science question? How would the presence of clouds or hazes impact our ability to characterize the atmospheres of habitable exoplanets using infrared light transmission spectroscopy techniques?

What were your findings? If liquid water is on the surface of a habitable planet, we know that clouds will form in its atmosphere. Our simulations of the behavior of exoplanet atmospheres in the TRAPPIST-1 system show that clouds and hazes strongly absorb and scatter near infrared light. These effects make infrared light transmission spectroscopy less useful for detecting the presence of various kinds of molecules.

What was the impact? Habitability hides itself behind clouds! Infrared light transmission spectroscopy is one of the most important tools we have for determining the composition of an exoplanet's atmosphere. The reduced sensitivity of this technique due to the presence of clouds and haze means that habitable worlds orbiting M class dwarf stars may be very difficult to characterize with future observatories such as the James Webb Space Telescope.



Simulated infrared transmission spectra of the TRAPPIST-1e exoplanet atmosphere as seen by the James Webb Space Telescope. Note that the spectral peaks are much smaller for the cloudy atmosphere.

Why does it matter to non-scientists? The study of the composition of an exoplanet's atmosphere will provide crucial clues about whether the exoplanet supports life as we understand it. Determinations of the effectiveness of our measurement techniques thus contributes to the quest of finding life on other planets in our Galaxy.

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