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Thermal Infrared Emission Spectra of Terrestrial Exoplanets Influenced by Multi-layer Clouds

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Clouds play an important role in the radiative transfer of planetary atmospheres: they are key elements of the climate system and influence the planet's spectral appearance.
Given the thousands of exoplanets discovered so far, including some dozens of Earth-sized exoplanets, the feasibility of remote sensing of exoplanet atmospheres is attracting increasing attention.

Here we present a study of the thermal emission of cloud-covered Earth-like exoplanets orbiting in the habitable zone of F, G, K, and M-type stars.
A line-by-line model for molecular absorption has been coupled to a discrete ordinate multiple scattering radiative transfer solver.
Pressure, temperature, and molecular concentration profiles were taken from a consistent radiative-convective climate model including a parameterized cloud description (Kitzmann et al., A&A, 2010).

The main focus of the current work is the impact of multi-layer clouds on emission spectra in the thermal infrared.
The effects of low-level water clouds and high level ice clouds simultaneously on signatures of H_2O, CO_2, O_3, etc will be studied for various resolutions.
Furthermore, comparisons with spectra resulting from a low-resolution code will be shown.