3D Climate Simulations of Terrestrial Atmospheres Near the Inner Edge of the Habitable Zone Around F, G, and K Stars

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At the inner edge of the habitable zone, terrestrial planets become too warm to harbor life. Habitability is terminated as planetary climate transitions into moist and runaway greenhouse states. However, at present the specific evolutionary sequence of warming terrestrial climates remains an unresolved problem. In addition, the solar insolation at which these transitions occur are not well defined. Here we use a modified version of the Community Earth System Model from the National Center of Atmospheric Research to conduct three-dimensional climate simulations of hot atmospheres for Earth-analog planets located near the inner edge of habitable zone around F, G, and K type stars. We use stellar spectra from HD128167 (F), our Sun (G) and HD22049 (K) available from the Virtual Planetary Laboratory. Around our Sun the inner edge of the habitable zone is defined by catastrophic water-loss from a moist greenhouse atmosphere and a thermal runaway never occurs. Spectra from F and K stars are blue and red shifted respectively compared with that of our Sun. This affects scattering interactions with air and absorbing interactions with water vapor at near-infrared wavelengths. Here, we present results describing how spectral differences between F, G and K stars influence the evolutionary sequence of warming terrestrial atmospheres.