The Effect of Land Coverage and Host Star Spectral Energy Distribution on the Planetary Albedo of Terrestrial Worlds

ANDREW RUSHBY[1], AOMAWA SHIELDS[1], AND MANOJ JOSHI[2]

[1]Department of Physics and Astronomy, University of California, Irvine. (corresponding: arushby@uci.edu)
[2]School of Environmental Sciences, University of East Anglia

Intro: We present results from a study investigating the effect of host spectral energy distribution (SED) on the albedo of planetary surfaces using a one-dimensional (1-D) energy balance model, focussing on how varying fractional coverage of land and ocean surfaces affects the overall planetary albedo, climate, and ice-albedo feedback response.

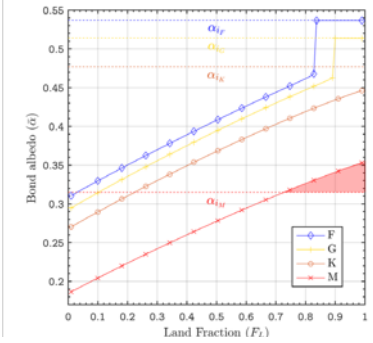

Figure 1: Planetary albedo as a function of land fraction (FL)

Methods: We employed a seasonally-varying 1-D EBM for this work. Orbital properties and incident flux were held at the normalized present day value for Earth. Land fraction (F_L) varied between 0.01 and 0.99, distributed uniformly within each model latitude. A linearized approximation of OLR was included. The albedos of land, ocean, and ice were computed using a multiple-scattering radiative transfer model assuming Earth-like atmospheric conditions.

Results: Planets dominated by land are relatively cooler and more reflective regardless of star type. However, the peak output of M-dwarf stars in the NIR, where water ice is more absorptive, resulted in a lower climate sensitivity to the ice-albedo feedback, especially at high land fractions. Conversely, planets covered largely by ocean, and especially those orbiting brighter stars, are on average warmer and exhibit a stronger potential ice-albedo feedback.