



Climate and Water Contents on Rocky Planets Near the Inner Boundary of Habitable Zones (IHZ) Around Low Mass Star

Jiayu Bin and Feng Tian

Department of Earth System Science, Tsinghua University, Beijing, China 100084

Exoplanets around low mass stars are the focus of the search for habitable exoplanets. Previous general circulation models (GCM) studied the locations of the IHZ around stars with effective temperature from 3300 to 4500K (Yang et al. 2014, Kopparapu et al. 2016). However, water vapor mixing ratios at 3 hPa pressure level do not satisfy what is required for scenarios of rapid water loss in the “last converged solution” for stars cooler than 4000 K.

In this work we use the Community Earth System Model (CESM) to investigate the IHZ problem for low mass stars. The model includes atmospheres with 1 bar of N₂, 1 ppm of CO₂, and slab oceans with thermodynamic sea ice. Rotation period is determined by the mass and luminosity of the star and planet orbital distance. Black body spectra of low mass stars are used to obtain top-of-atmosphere incident short wavelength radiation.

Our model results are qualitatively consistent but quantitatively different from those in earlier works. Specifically, water vapor mixing ratios required by rapid water loss are found at 3 hPa for hosts star warmer than 3650 K.