

Modeling Titan Using ROCKE-3D Global Circulation Model. M. Q. Collins, The University of Hong Kong, maxqc@connect.hku.hk

Abstract:

The Resolving Orbital and Climate Keys of Earth and Extraterrestrial Environments with Dynamics (ROCKE-3D) is a General Circulation Model adapted from the Goddard Institute for Space Studies ModelE2, which simulates modern and paleo-Earth climate. ROCKE-3D expands upon the base model to include the possibility of modelling extraterrestrial bodies such as Saturn's moon Titan. Previous models of Titan have largely been focused on 1D or 2D radiative-convection models and have neglected large scale spatial distributions. This model includes spectral input files within Titan's range of received radiation and can be further improved upon, including updated topographical maps and orbital parameters adapted to synchronously rotating bodies. Titan's nitrogen rich atmosphere contains complex organic chemistry key to understanding the origins of life. This, combined with stable surface liquid methane/ethane bodies, creates an environment conducive to crucial prebiotic chemistry. ROCKE-3D contains extensive coupled atmospheric-surface interactions which provide insight into regions of habitability; atmospheric dynamics over long timescales in conjunction with updated topographical input describe essential features in surface deposition of heavy organic material, i.e., polycyclic aromatic hydrocarbons and tholins, given their production region and lifetime. The ROCKE-3D Titan GCM may be used to advise future missions in locations of interest and as an analogue to early Earth and origins of life studies as is identified by similar chemical constituents such as hydrogen cyanide (HCN).

References: Way MJ, Aleinov I, Amundsen DS, Chandler MA, Clune TL, et al. 2017. Resolving Orbital and Climate Keys of Earth and Extraterrestrial Environments with Dynamics (ROCKE-3D) 1.0: A General Circulation Model for Simulating the Climates of Rocky Planets. *The Astrophysical Journal Supplement Series* 231: 12