EVALUATION OF A SIMPLE THEORETICAL EXPRESSION FOR HADLEY CELL WIDTH

Karlie N. Rees (Timothy J. Garrett)
Department of Atmospheric Sciences

The latitudinal width of Earth's Hadley cell has a simple expression that is a function of the planetary radius, and the atmosphere's angular velocity, stability, and depth. We contrast previously known approaches to this expression and test for application to other planetary bodies within the Solar System. In general, we find the expression accounts for the wide range of cell widths, ranging from very narrow (Jupiter) to very wide (Titan). However, for terrestrial planets, the choice of atmospheric depth that we find agrees with observed data is the density scale height rather than the depth of the troposphere itself, as has commonly been assumed. For gas and ice giants, however, tropospheric depth returns values that more closely represent observed data. We investigate possible explanations for these differences and other discrepancies.