Geophysical Research Abstracts
Vol. 20, EGU2018-9649, 2018
EGU General Assembly 2018

A simplified model for the transverse circulations of a differentially heated axisymmetric vortex

Eric Hendricks
(eahendri1@nps.edu)

A two-layer version of the Held-Hou model of the planetary Hadley cell is derived for a differentially heated surface-based vortex on an f-plane. With tropical cyclone applications in mind, the heat source is centered away from the axis of rotation, and thus two transverse circulations are calculated: (i) an inner circulation between the center of circulation and the heated region, and (ii) an outer circulation between the heated region and the environment. Application of an asymmetric two-layer Held-Hou model to a differentially heated vortex using the forced, balanced, axisymmetric equations yields a system of four implicit nonlinear equations for four unknowns. Direct numerical solution of these equations yields the radial extents of the inner and outer transverse circulations, which then are used to calculate the magnitude of the vertical and radial velocities in the circulation branches. While the model is simplified, it produced reasonable estimates for the radial extents of these circulations, and demonstrates how these circulations change with variation in vortex intensity, radial structure, and the Coriolis parameter.