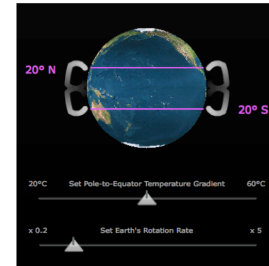


- 4) The Hadley circulation of today has rising motion near the equator and sinking motion near 30° latitude (section 9.3 of H&P). If the earth did not rotate, a single-cell model with an equator-to-pole Hadley cell would exist (section 9.2 of H&P). In view of the earth's slowing rotation rate being 10% faster 620 Mya and 28% faster 1.4 Gya, how is the north-south extent of the Hadley cell changing with increasing time?

We can explore this sensitivity with a simple model of the Hadley cell (Held and Hou, 1980). The sensitivity of north-south extent of the Hadley cell to changes in the rotation rate can be examined using a simple model⁵. The default settings for the model are for today's rotation rate and an observed equator-to-pole temperature difference of 40 K (Comment: a 70 K difference is more appropriate for this model that ignores heat transfer from the tropics to the poles by extratropical cyclones.)



Held & Hou model applet.

- a) Use the model to determine at what rotation rate the Hadley cell would first extend poleward of the Arctic Circle and Antarctic Circle (~67 degrees latitude).
- b) Use the model to determine at what latitude the Hadley would extend if earth's rotation rate was 10% faster than today, which corresponds to a length of day of about 21.9 hours.
- c) Use the model to determine at what latitude the Hadley would extend if earth's rotation rate was 28% faster than today, which corresponds to a length of day of about 18.7 hours

⁵ <http://physicalscience.jbpub.com/ackerman/meteorology4e/appletFiles/chap7/hadley/hadley.html>