Regional Variability of the ITCZ and of the Hadley Cell

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We examine the seasonal behavior of the ITCZ and of the Hadley cell, zonally averaged, and averaged over seven longitudinal sectors: Africa, India, West Pacific, Central Pacific, East Pacific, South America, and Atlantic.

**ZONAL HADLEY CELL**

The meridional circulation in each hemisphere is composed of three cells: the Hadley, the Ferrel and the polar cell. The Hadley cell in the winter hemisphere always prevails over the cell in the summer hemisphere. In the average, the flow is stronger in the austral hemisphere.

(a) The ITCZ migrates following the Sun in a sinusoidal seasonal pattern with a 3° bias to the north, because the continents favor the monsoonal regime to the north of the equator.

(b) A permanent feature of the tropics is the inhibition of deep convection across the equator due to the Svendrup vorticity balance.

(c) The yearly mean zonal tropical meridional circulation mainly results from the average of the cells during solstices.

**METHOD**

Dataset: NCEP/NCAR Reanalysis

**VERTICAL VELOCITY**

**SUMMARY AND CONCLUSIONS**

**OCEANS**

- Atlantic: the ITCZ mainly resides north of the equator.
- Pacific: the SPCZ is a permanent south easterly tilted convergence line. The ITCZ resides mainly in the austral hemisphere in the central Pacific because of the SSTA distribution in this region.
- The position of the ITCZ is mainly determined by the SSTA distribution.

**CONTINENTS**

- The East Africa-Asia-Australia monsoon is a major climatic planetary system, where the convective activity has multiple cells, spatially and temporally separated.
- The continents introduce a strong variability which gives a general strengthening of the Hadley cell, and this effect is stronger in summer because of the monsoons.
- Africa and South America are the only two continents crossed by the equator where the convective monsoonal activity shows up mainly in correspondence to a latitudinal broadening and strengthening of the ITCZ.
- In South America the monsoon displaces the ITCZ southward.
- South Africa and South America have a one week center during the austral summer.
- North Africa has three main centers of monsoonal activity during the boreal summer. The presence of the Saharan desert enforces the summer boreal Hadley cell.