**Global Circulation and the Hadley Cell**

The sun heats the air over the equator more than at the poles. This differential heating causes the warmer air near the equator to rise, and cells of convection to develop (Hadley cells). The Hadley cell is an overturning circulation with four branches:

1. Rising motion near the equator.
2. Poleward motion near the tropopause.
4. Equatorward return flow near the surface.

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**Diurnal Winds**

While current models can replicate the (mosty sub-diurnal) variability in the zonal (u) wind component (not shown), there is more discrepancy amongst the (mosty diurnal) weaker meridional (v) wind component, especially in the Intertropical Convergence Zone (ITCZ).

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**Convergence: QuikSCAT and ASCAT Data**

**Zonal Component - 10 year mean**

**Divergence: Zonal Averages - means for 10 years**

The 20-yr set of coincident scatterometer and TRMM/GPM data since 1999 provides a unique dataset to examine the role of the surface convergence and its impact upon the convective precipitation vertical structure, and how changes to the ascending branch of the Hadley cells (convective activity manifesting in any noted diurnal (and/or semi-diurnal) variability.

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**Diurnal Variability in Tropical Surface Winds, Convergence and the Associated Precipitation**

Everyone is encouraged to share their knowledge and contribute to the global understanding of the Earth's systems. Let's work together to make a difference.

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**References**


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**Figure courtesy of EarthInfo: https://www.earthinfo.edu/studies/hurricane.html**

**Sub-diurnal fit to TAO/ITCZ data (wherever available)**

**Era-Interim data (wherever available)**

**Same as above, but for corresponding ERA-Interim data**

**Convergence: QuikSCAT and ASCAT Data**

**Zonal Component - 10 year mean**

**Divergence: Zonal Averages - means for 10 years**

**Hadley Convergence (Integral)**

The diurnal signal is in collocated ECMWF analysis is different than that in the RapidScat observations. Note that there is a stronger ITCZ convergence in the ASCAT observations (i.e., the integral over the area of convergence is more negative).

**Summary**

Scatterometer surface winds were used to determine the extent of the Hadley cell. While not shown here, breaks in the Hadley width (as determined from the zonal wind) were found when using different models and assimilation. The cause might be an uncorrected for diurnal variability. To investigate this diurnal signal we looked at tandem scatterometer missions and RapidScat observations. Tandem mission analyses support the significance of the diurnal signal. RapidScat analyses revealed that there is a significant variability in the Hadley cell with, a clear diurnal signal, providing observational evidence that the Hadley cell is wider during the ASCAT observing times than it is during the RapidScat observing times. This supports a theory that diurnal variability might be (one) cause for previously found discrepancies between the QuikSCAT and ASCAT observations. The diurnal signal in the ECMWF collocated analysis is different than that in RapidScat.