

Some new methods for approaching Meridional Circulation with Time-Distance Helioseismology

Tom Duvall

MPS Göttingen

What we did on summer vacation ...



From Duvall, T., 1979 Solar Physics, 63, 3-15.

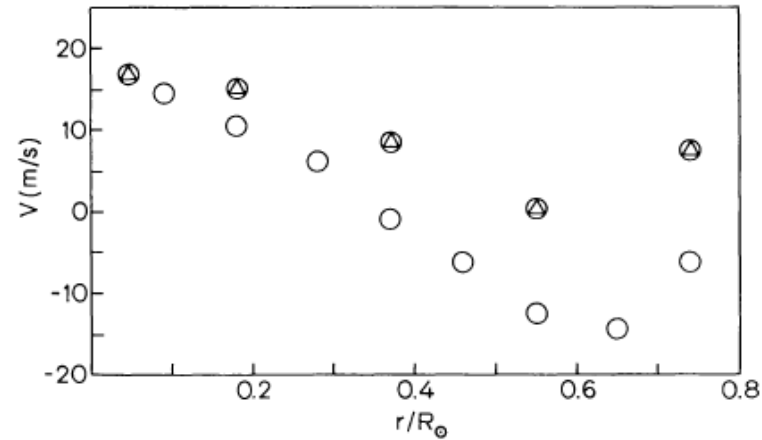


Fig. 9. Average folded velocity residuals (\circ) for the central swath compared with the average folded central meridian scan (\triangle). All folding is done across the center of the disk. Disk center is at the left in the plot. The two groups of points have been shifted vertically so they match at disk center. 171 central swath residuals and 184 central meridian scans during the time period July 20, 1976–June 22, 1977 went into the averages. The computed errors are $< 1 \text{ m s}^{-1}$ for all points.

History!

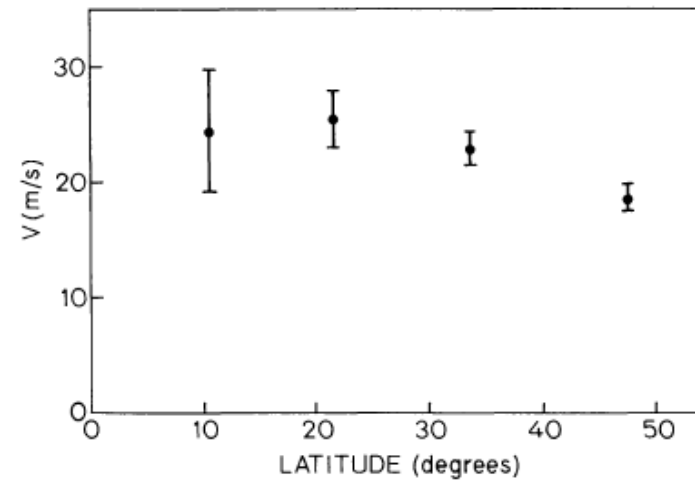
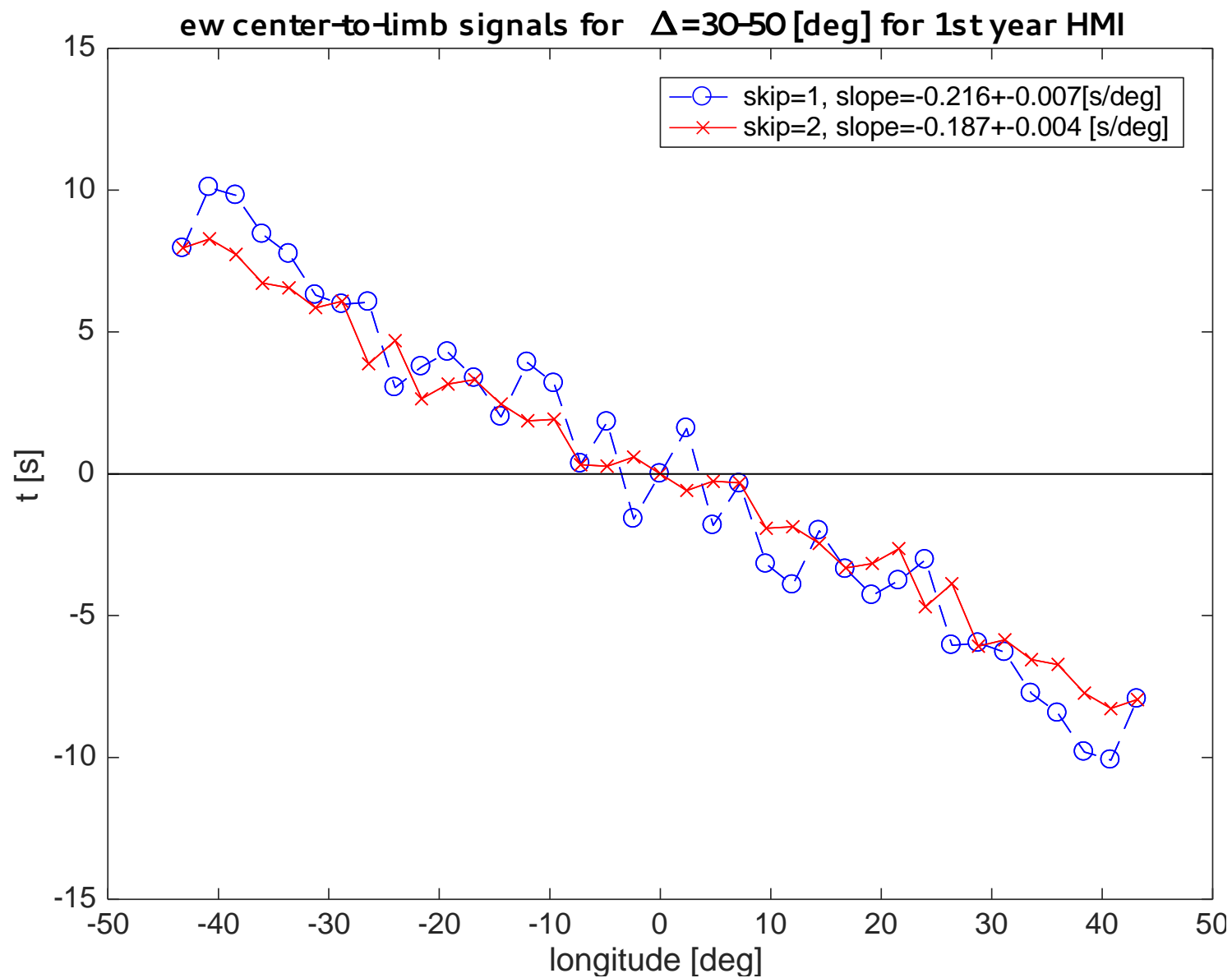


Fig. 11. Assuming the meridional flow is horizontal at the photosphere, the average symmetric component of the meridional circulation has been corrected for the projection of the velocity vector.

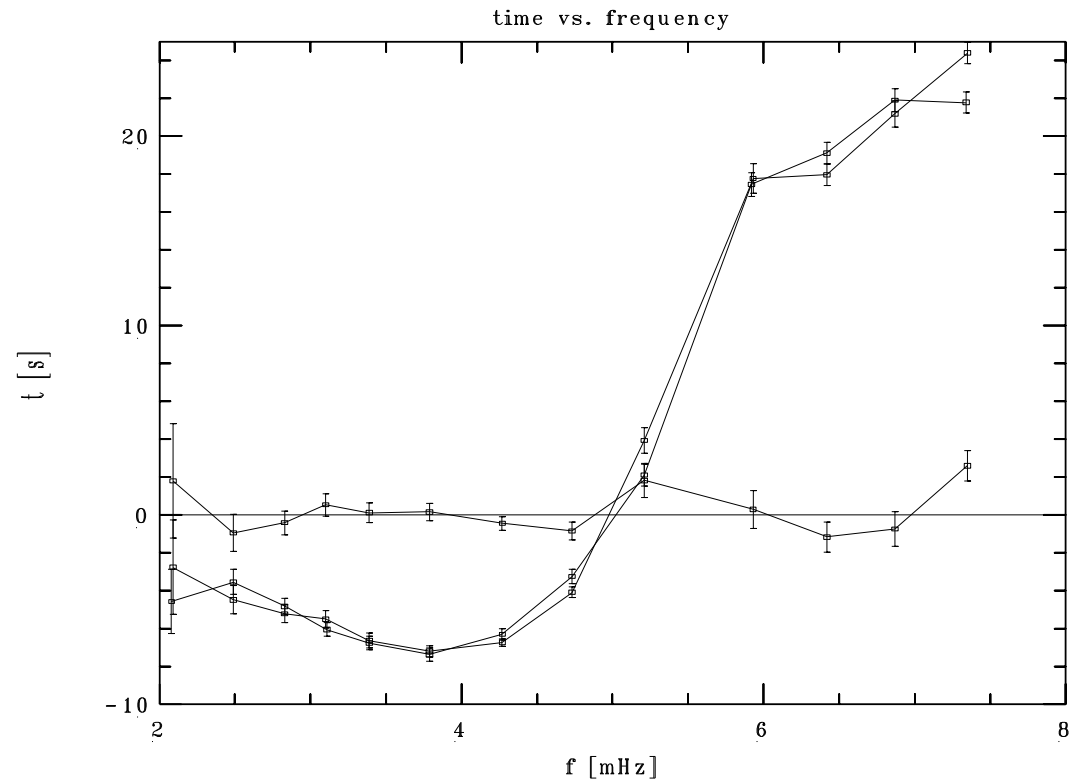
Plan

- 1) By measuring the travel times for multiple skips, it should be possible to remove center-to-limb effects in place rather than referencing north-south times to east-west times.
- 2) Instead of using quadrants (4 sectors), it may be advantageous to use more, like 12 or 16.
- 3) To learn more about center-to-limb effects, it is useful to measure the temporal frequency dependence.
- Tests of 1)-3) have been done using 1-year of HMI data and Thomas Hartlep's simulations including a center-to-limb effect.
- Intensity at higher level outside of the granulation layer?

Center-to-limb signals for 1st and 2nd skip (for same endpoints)



Center-to-limb effect for HMI Doppler signal, large separations (30-50 deg)
for the first year of HMI data.



Modified line core intensity?

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ZHAO ET AL.

