



TIMED Doppler Interferometer Neutral Wind Measurements using the O₂ P-Branch Broadband Filter

T. L. Killeen¹, Q. Wu¹, R. D. Gablehouse¹,
R. M. Johnson¹, S. C. Solomon¹, D. A. Ortland³,
W. R. Skinner², R. J. Niciejewski², and D. A. Gell²

¹National Center for Atmospheric Research

²The University of Michigan

³Northwest Research Associates



The TIDI Instrument

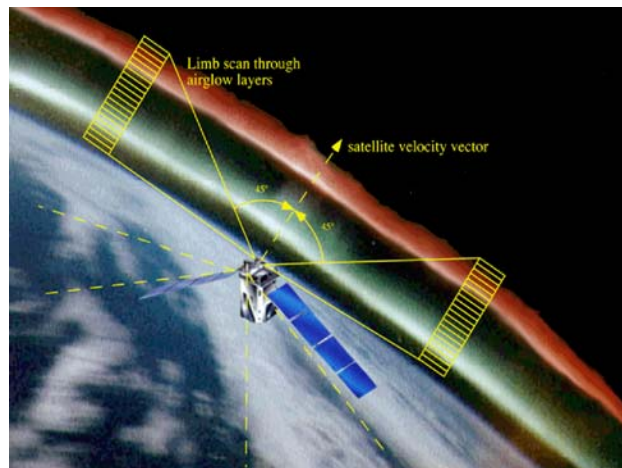
The TIMED Doppler Interferometer (TIDI) is a 4-telescope Fabry-Perot interferometer for measuring global winds and temperatures in the Earth's upper atmosphere

Primary measurement goal:
Global wind field, 60–180 km

Additional measurements:
Temperature, O₃ (day), O
(night)

Primary emissions observed:
O₂ ¹Σ (0-0) P9 line pair

Other emissions observed:
O₂ ¹Σ (0-0) P15 line pair,
O(¹S) “green line”



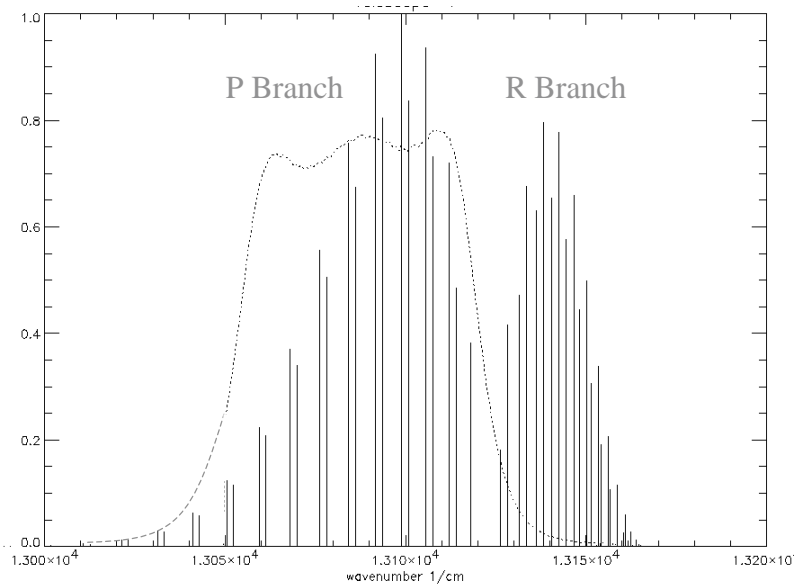
TIDI Viewing Geometry

Motivation for “Broadband” Measurements

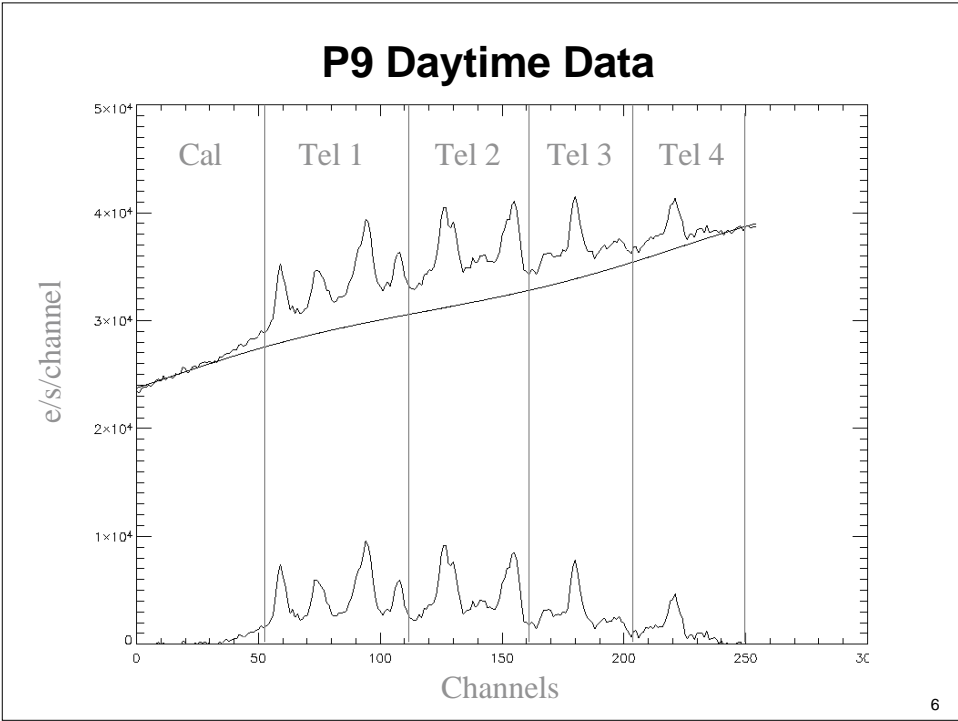
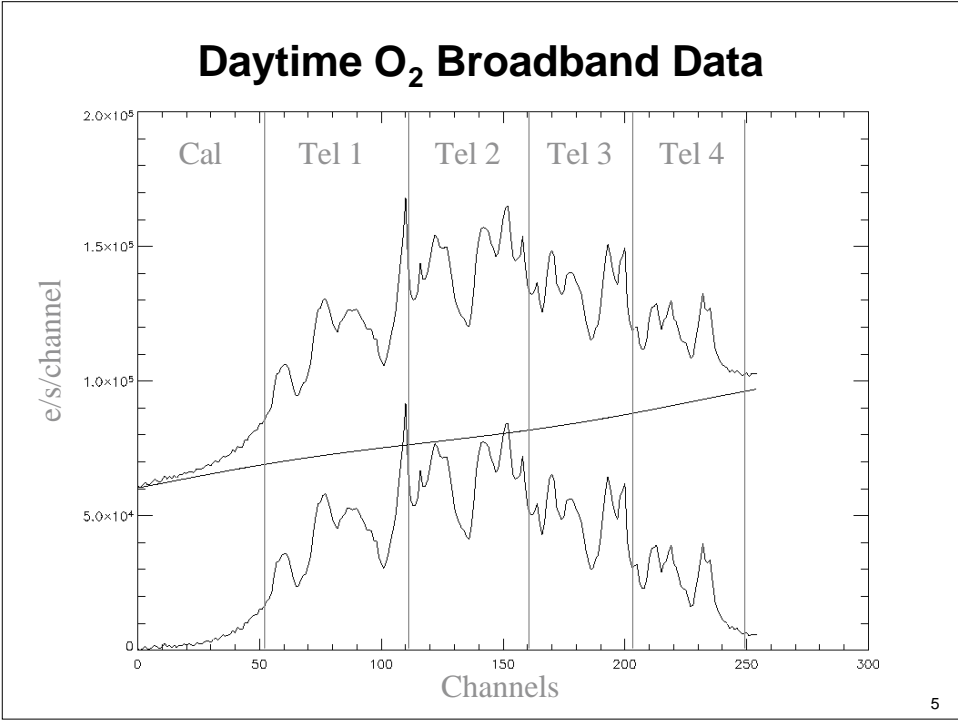
- The TIDI instrument is a single-etalon FPI that normally uses narrow-band filters to select a few lines of a rotational band.
- Due to elevated background levels, we have been looking for ways to increase instrument throughput and hence the signal-to-noise ratio.
- The instrument includes a 4-nm “broadband” filter that passes the entire O₂ Atmospheric (0,0) band P-branch, originally for calibration and photometric measurements.
- This study investigates the utility of this filter for measuring neutral winds in the mesosphere and lower thermosphere.

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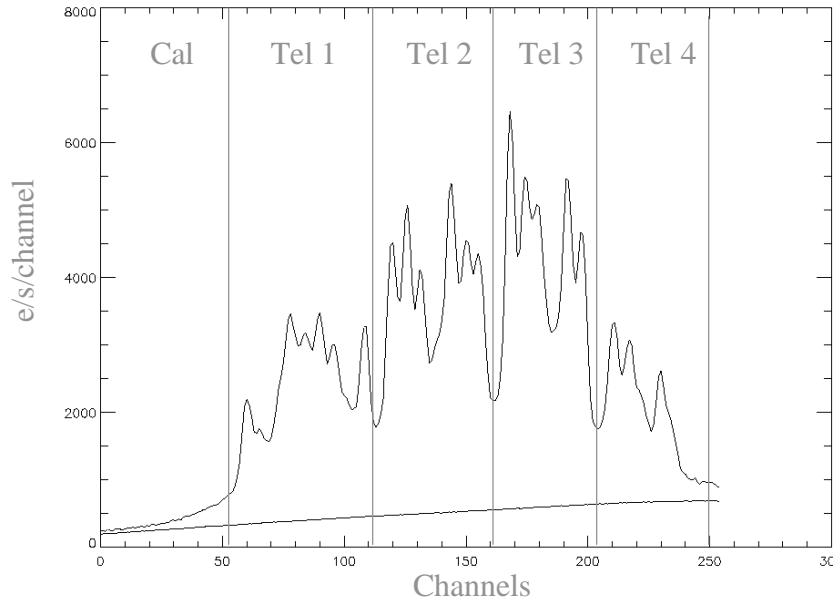
Filter Transmission Curve and O₂ (0-0) Band Emission Lines



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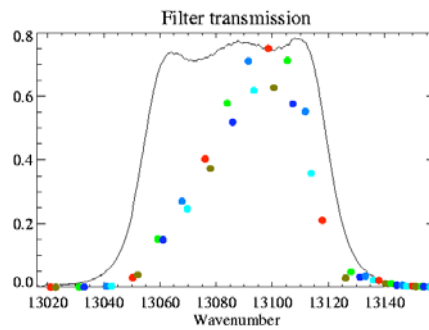
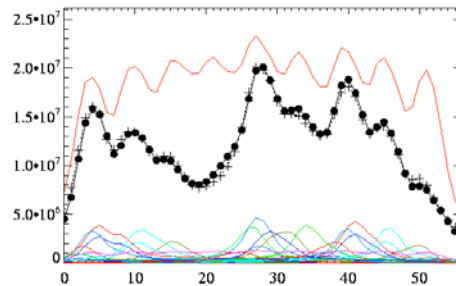


Nighttime O₂ Broadband Data



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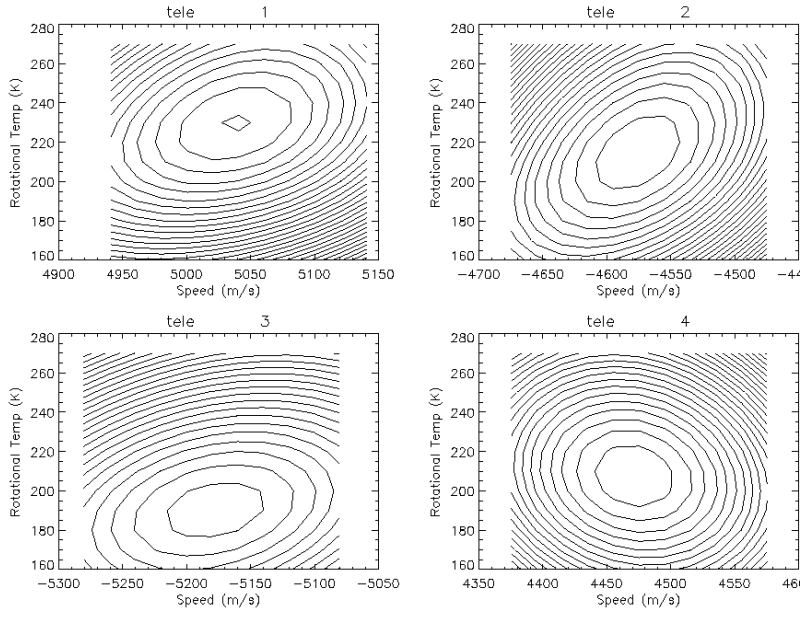
Forward Model and TIDI Spectrum



**A total of 27
emission lines
are used**

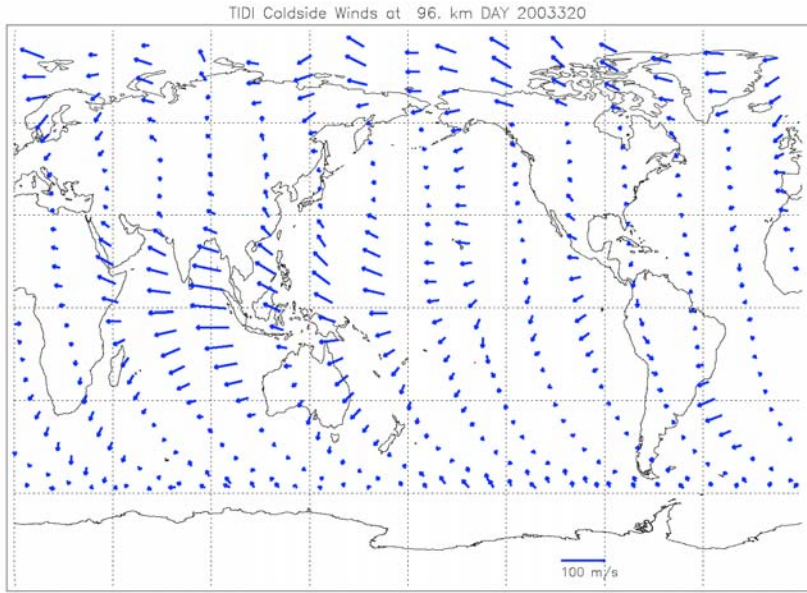
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Wind Speed and Rotational Temperature



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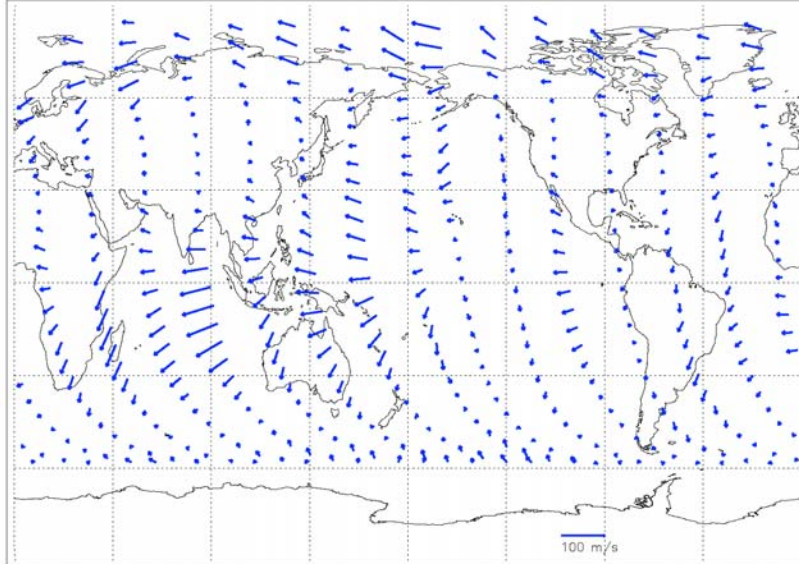
Wind Vector Maps



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Wind Vector Maps

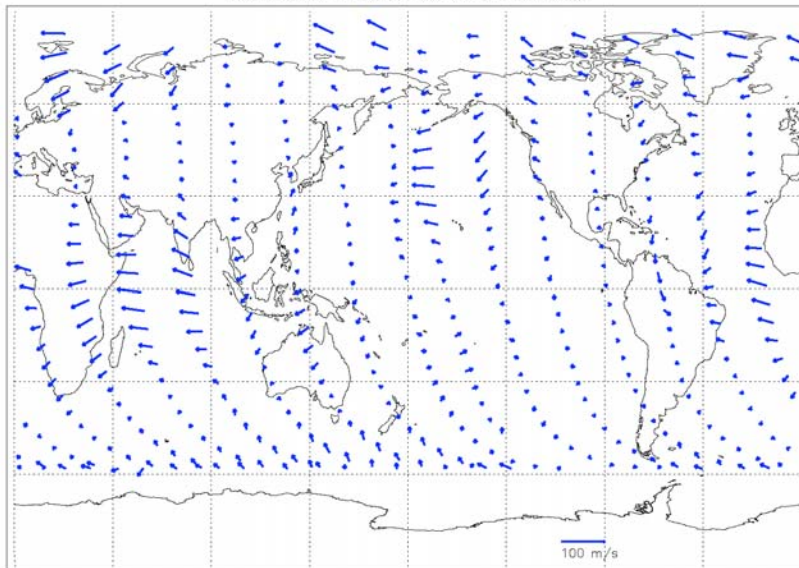
TIDI Coldside Winds at 96. km DAY 2003321



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Wind Vector Maps

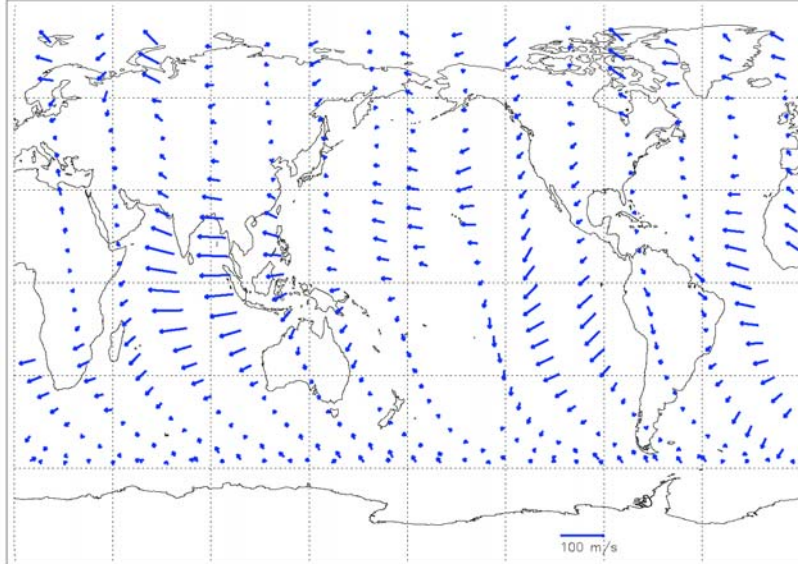
TIDI Coldside Winds at 96. km DAY 2003322



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Wind Vector Maps

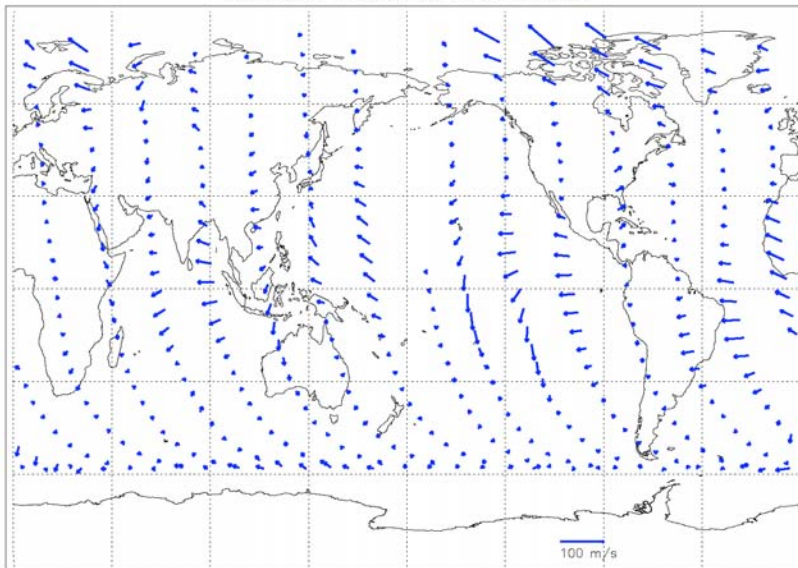
TIDI Coldside Winds at 96. km DAY 2003323



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Wind Vector Maps

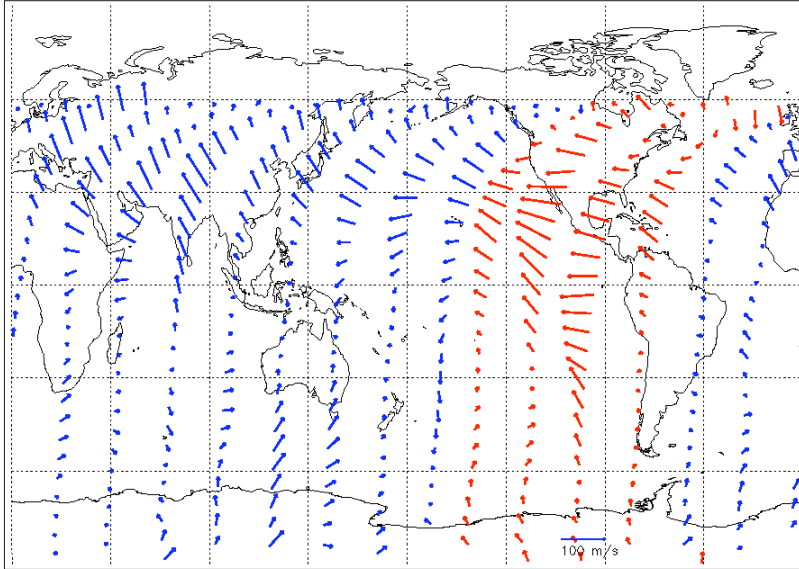
TIDI Coldside Winds at 96. km DAY 2003324



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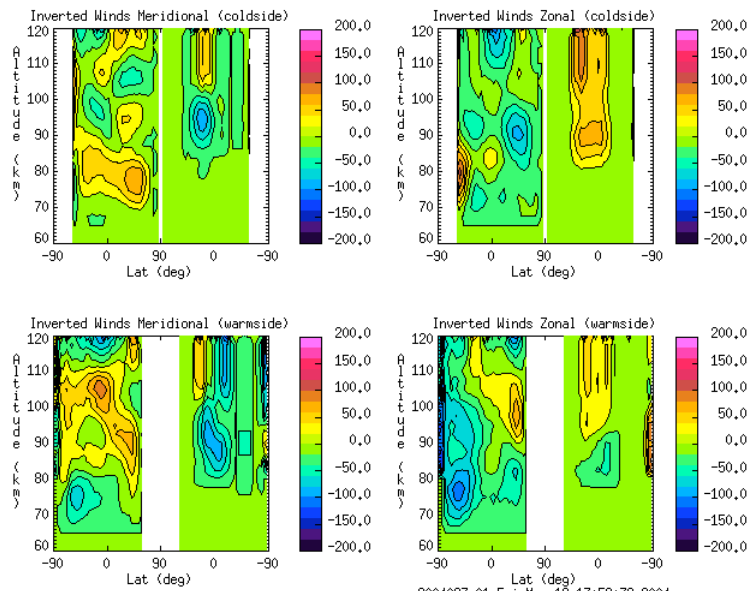
Wind Vectors During Yaw Maneuver

TIDI Coldside Winds at 96. km DAY 2004015



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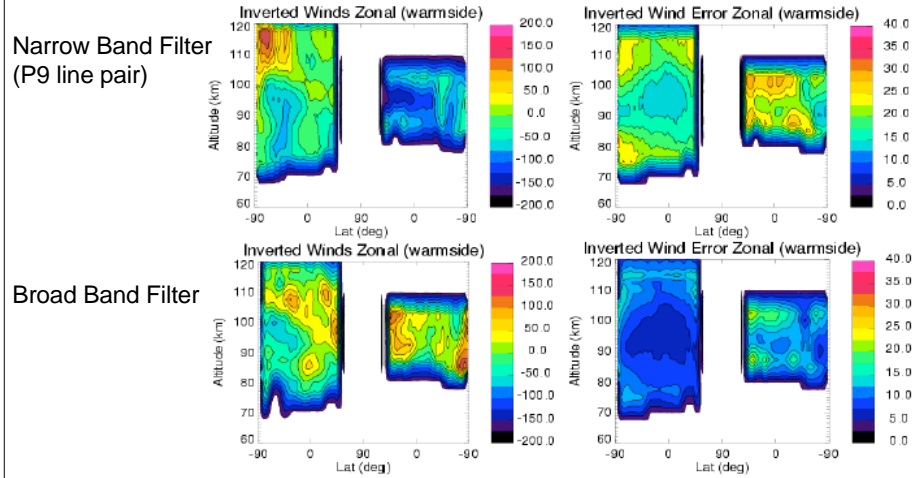
Broadband Filter Winds



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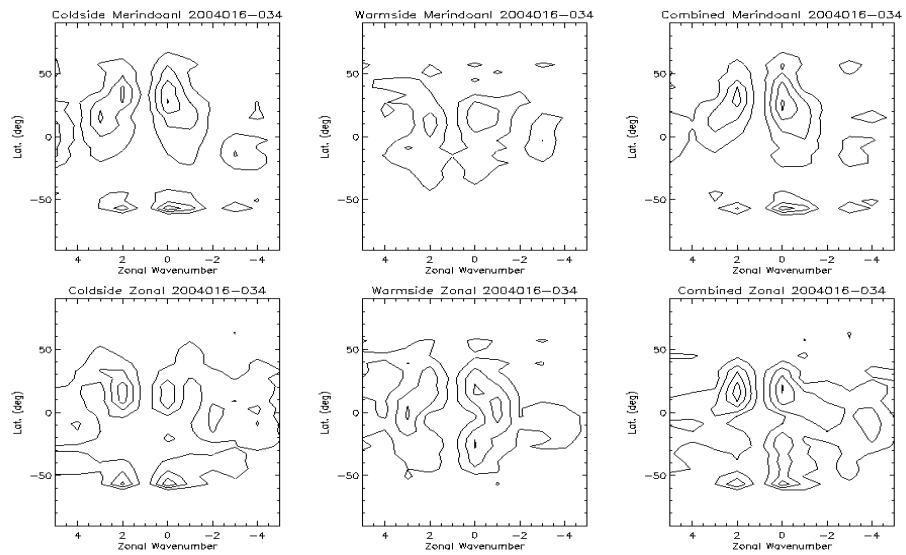
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Comparison of Winds and Error Estimates



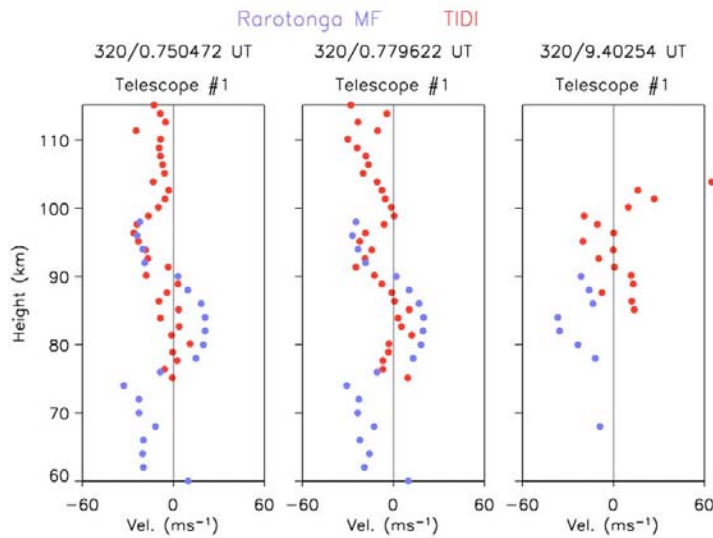
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Non-migrating Diurnal Tides



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Rarotonga MF Radar Comparison



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Summary

- The broadband filter data have better signal-to-noise ratio and apparently better wind accuracy than the narrow-band filters.
- The broadband filter data processing is more complex and rotational temperature effects need to be investigated.
- Comparison with P9 filter data show similar results.
- Non-migrating diurnal tide results are reasonable.
- Early comparisons with ground-based measurements show promising agreement.

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