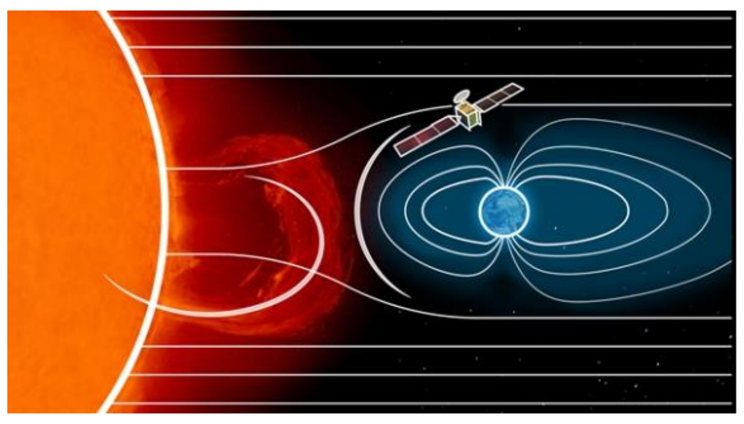

Cross comparison of TIDI winds with meteor winds and assessment of the accuracies depending on local time and geographical latitude

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Introduction

Wind measurements with global coverage at the mesosphere/lower thermosphere (MLT) are still sparse. These winds are characterized by atmospheric waves and provide a substantial source of variability at the lower boundary of the upper atmosphere. They play a crucial role in the vertical coupling between the middle and upper atmosphere affecting the space weather. The **TIMED Doppler Interferometer (TIDI)** onboard the Thermosphere-Ionosphere-Mesosphere-Energetics and Dynamics (TIMED) satellite observes neutral winds at the MLT using airglow emissions. TIDI vector winds are suitable to investigate migrating. **This study compares TIDI winds to ground-based meteor radar observations covering northern and southern polar and mid-latitudes:** focus is on the **dependence to local time and geographical latitude.**

Data/Methods

TIDI Observations

- TIDI achieves **day and night coverage of neutral wind and temperature** measurements throughout the MLT by performing limb scans in 4 orthogonal directions through the terrestrial airglow layers along the satellite orbit.
- These 4 views provide the measurements necessary to **construct the horizontally resolved vector winds as a function of altitude.** Accuracy approaches ~3 m/sec and ~3 K. The vertical altitude resolution of the instrument is 2.5 km. TIDI sampling track covers 24 hours in local time every 60 days.

Meteor radar winds

- The Meteor radars are at different latitudes

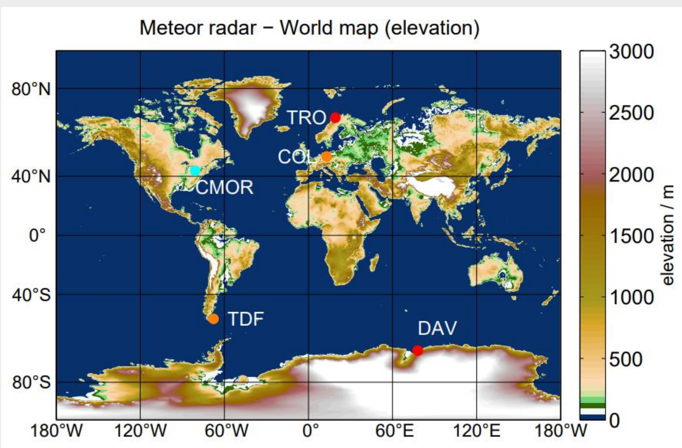

Fig1. Meteor radar stations

Methods

- **TIDI winds analysis and MR wind comparison:** removing of all zonal and meridional wind measurements that exceed 120 m/s and binning of the data in longitude, latitude, and time. Preparation of a spatial grid with 30° longitude bins and 10° latitude.
- A seasonal comparison of the zonal mean zonal and meridional wind is performed. The longitudinal difference is converted in a time offset concerning the Greenwich meridian. **These composite days are decomposed applying a classical tidal fit.**

Results

A. Tidi winds analysis and MR wind comparison:

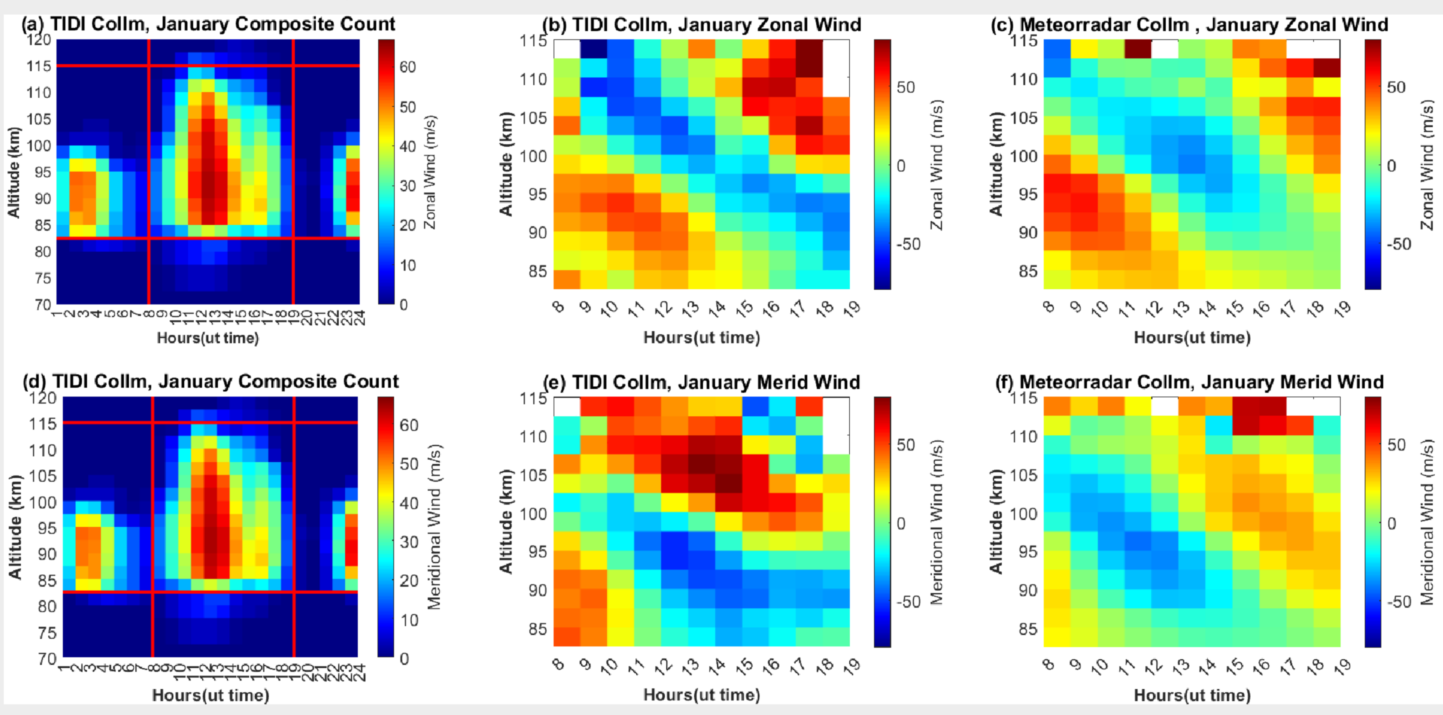

Fig2. Central panels: TIDI zonal and meridional daily composite winds, respectively. Right panels: zonal and meridional daily composite MR winds for Collm

B. Correlation between TIDI and MR stations for summer and winter months:

	Zonal (summer)	Merid (summer)	Zonal (winter)	Merid (winter)
DAV (Davis)	0.62	0.78	0.69	0.49
CMO (CMOR)	0.44	0.82	0.52	
TRO (Nordic)	0.71	0.61	0.52	0.69
COL (Collm)	0.67	0.56	0.87	0.67
TDF (Tierra del Fuego)	0.70		0.67	0.37

Tab1. Summary of all comparisons for the summer and winter months

TIDI zonal and meridional winds with a measurement statistics of 30 and more TIDI observations for each time, altitude, and latitude-longitude bin.

C. Seasonal comparison of zonal and meridional winds: summer zonal wind reversal from westward to eastward winds is well-reproduced concerning the reversal altitude and magnitudes as well as the weak eastward winds during the winter season up to about 90 km altitude. Unfortunately, TIDI meridional winds exhibit a substantially different seasonal behavior compared to the MR winds.

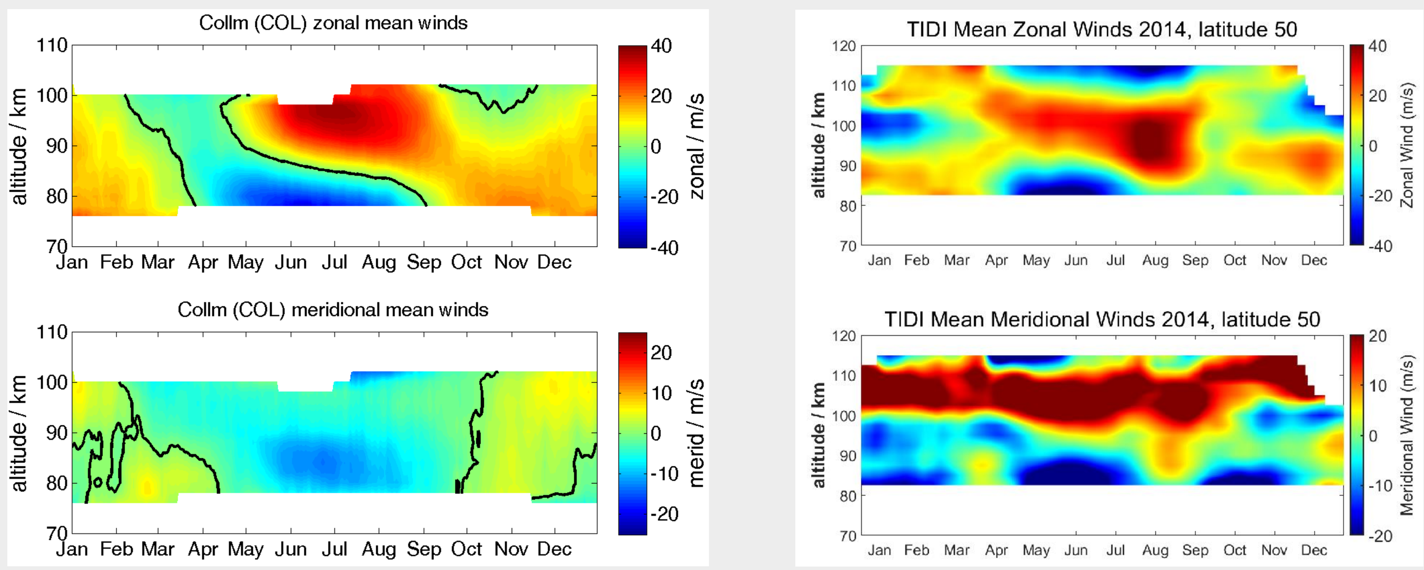

Fig3. Seasonal comparison of zonal and meridional winds for the mid-latitude station Collm and the zonal mean TIDI winds for latitude 50

D. The latitudinal cross-section of zonal mean winds indicates the summer hemispheric wind reversal and the latitudinal dependency of the reversal altitude.

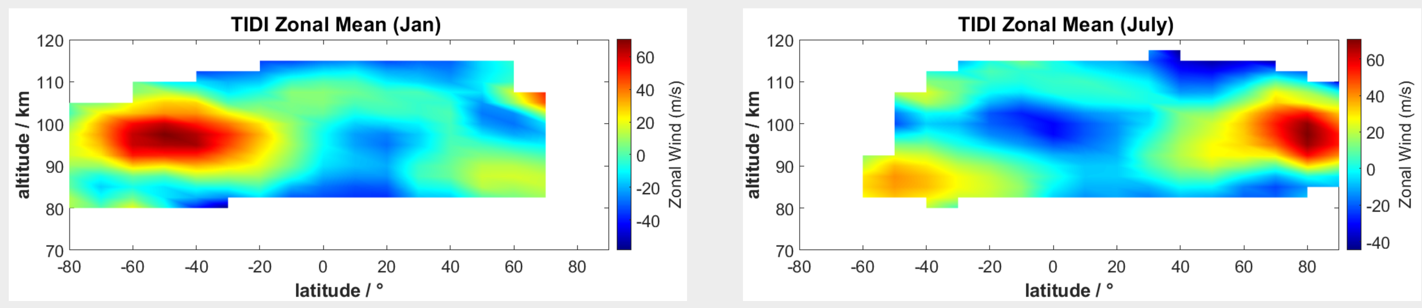

Fig4. Latitudinal cross-section of zonal mean zonal winds from TIDI for January (left panel) and July (right panel)

E. The Global map of zonal winds for the composite month of July shows the diurnal westward propagating tide due to the solar heating of the atmosphere.

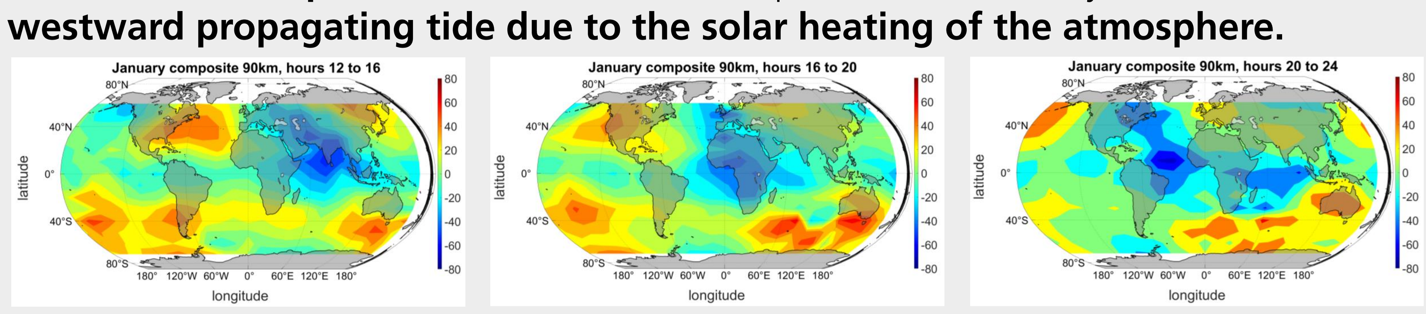

Fig5. 4h steps July composite zonal wind for ut time 0-12

Conclusion

In this study, we performed an analysis of mean winds and a comparison with meteor radar data focused on the dependence to local time and geographical latitude. The calculation of **correlation between TIDI and MR stations for summer and winter months** demonstrates the necessity of using a minimal TIDI measurement statistics since the distribution of measurements is not homogeneous over all local times. Also the **seasonal comparison between TIDI and MR stations** shows good agreement for zonal winds but exhibit differences for meridional winds. Finally the **TIDI latitudinal cross-section of zonal winds** displays the expected hemispheric wind reversal and the latitudinal dependency of the reversal altitude as well as the interhemispheric differences in the strength in the zonal wind systems.

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