MLTS-4

Analysis of Local Thermospheric Wind Patterns and Their Characteristics over the Korean Peninsula

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1 Key Points

- Extended local wind profiles are produced by combining a meteor radar and ICON/MIGHTI wind data.
- The mid-to-upper thermospheric circulation and the lower-thermospheric circulation are distinguished in observational wind data.
- Wind patterns derived from HWM14 display different wind patterns in the observational meridional winds.

2 Introduction

The summer-to-winter pattern of neutral winds in the thermosphere is widely recognized as a global circulation mode. There is abundant literature on improving the simulation model for describing the thermospheric global circulation (Roble et al., 1982; . Jiang et al., 2018; Yamazaki et al., 2023). However, in contrast, there has been limited research on local thermospheric wind circulation. Therefore, in this study, we analyzed the local thermospheric wind circulation using wind data observed from a meteor radar and ICON/MIGHTI and HWM 14 simulation results.

3 Data and Methodology

- **KASI-Meteor Radar**

Parameter	Value
Location	36.2°N, 127.1°E
Frequency	40.8 MHz
Transmit Power	24 kW

Table 1. KASI-MR spec

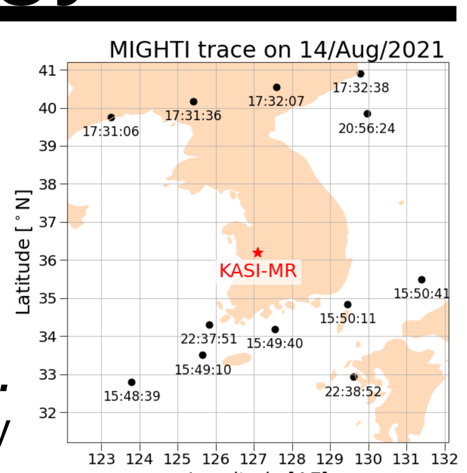

Figure 1. Data boundary

- **ICON/MIGHTI**

Observes oxygen atomic emissions (557.7 nm green line and 630.0 nm red line) by limb-scanning.

- **HWM14 model**

Empirical Model based on wind data obtained from the AE-E and DE 2 satellites.

- **Extended wind profiles**

The extended wind profile is the result of combining KASI-MR wind data after assigning weights to MIGHTI wind data (Lee et al., 2024).

- **Extracted diurnal winds**

The extracted diurnal wind is the result of subtracting MIGHTI zonal mean winds from local winds at specific local time.

ex) Extracted diurnal winds at 13:00

= local winds at 13:00 – MIGHTI zonal mean winds at 13:00

4 Results and Discussion

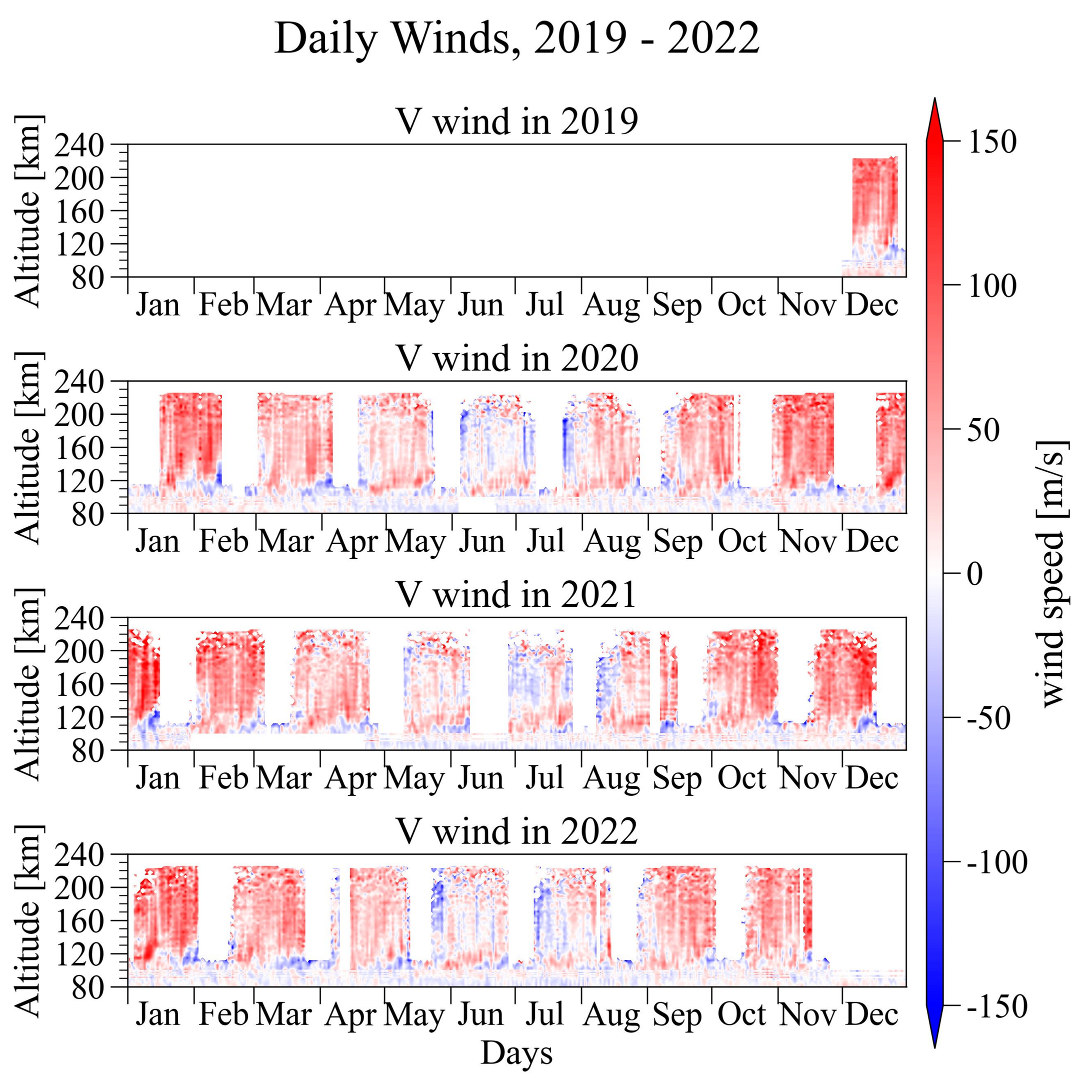

Figure 2.
Extended daily meridional winds.

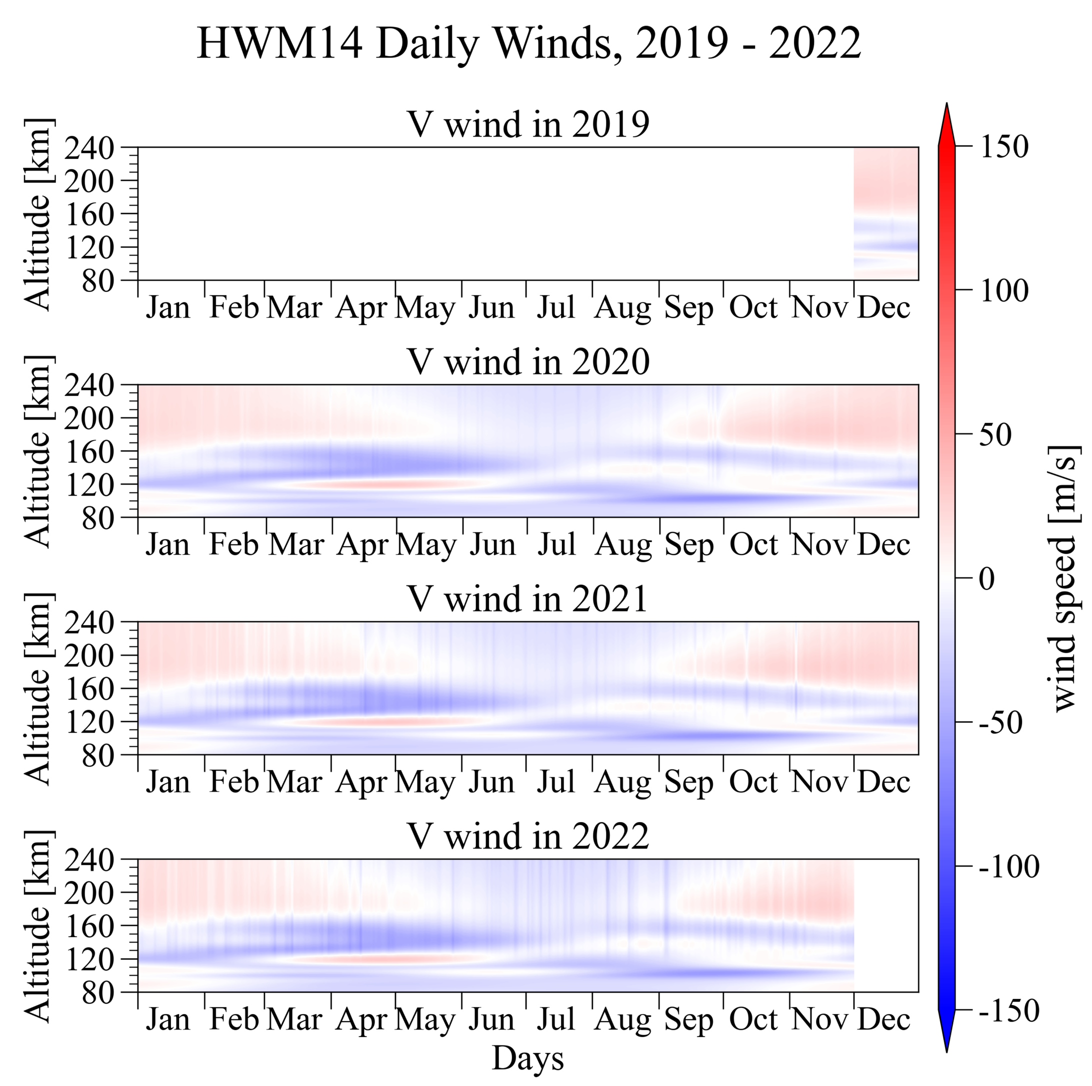

Figure 3.
HWM14 daily meridional winds.

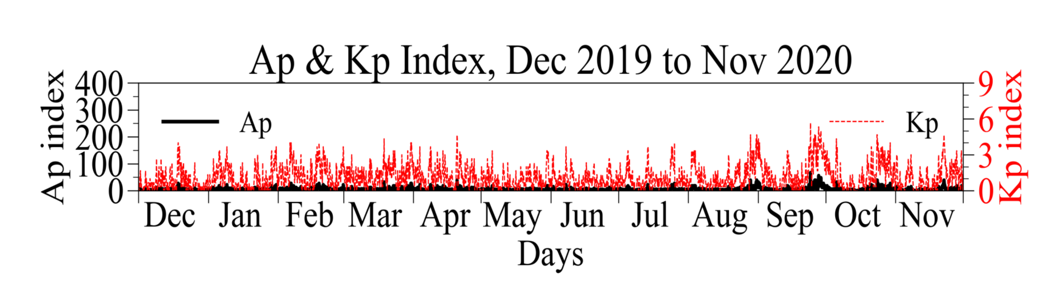

Figure 4.
Ap (black line) and Kp (red dotted line) index.

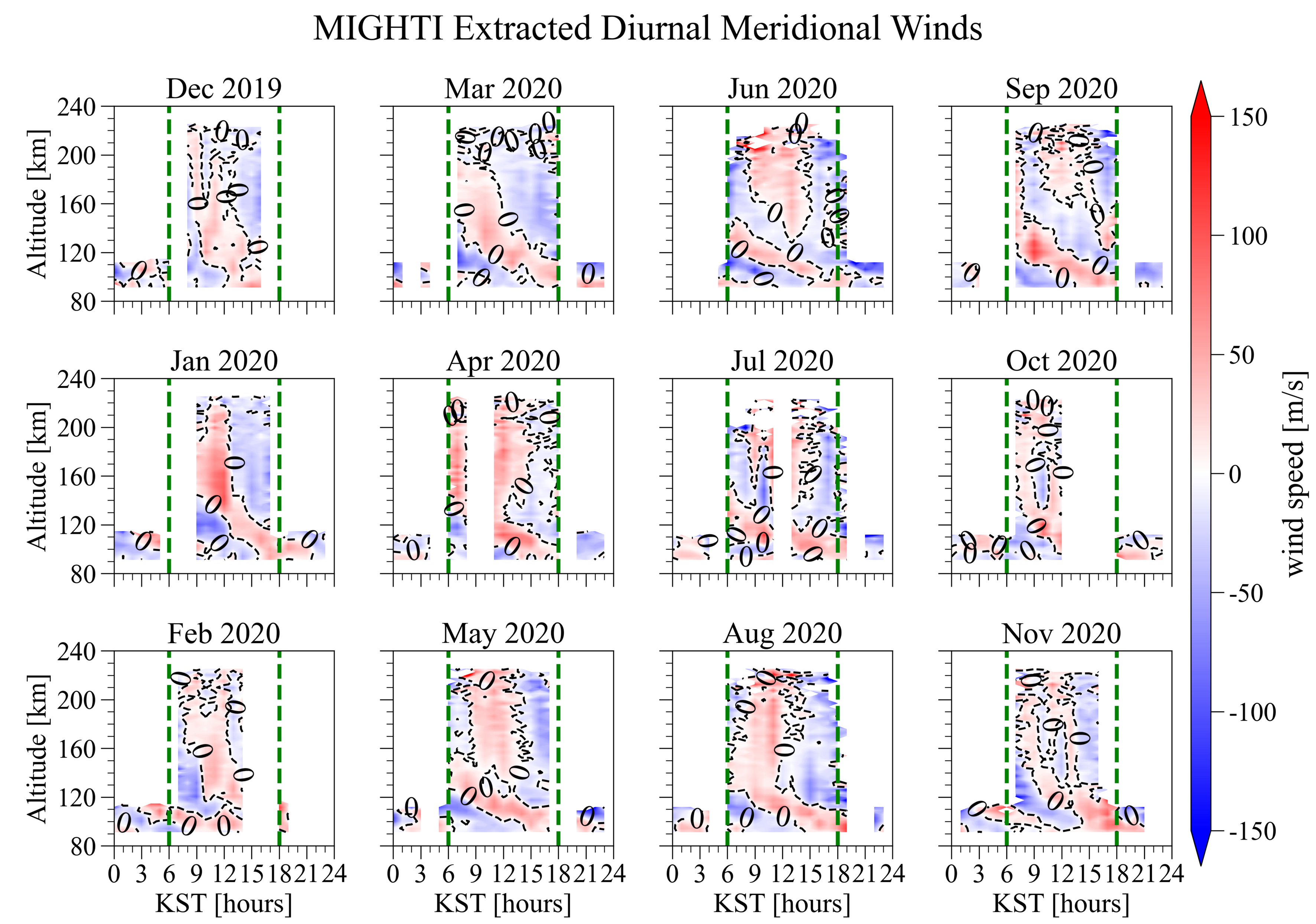

Figure 5.
Extracted MIGHTI diurnal meridional winds. Left and right vertical green dashed lines represent 6:00 and 18:00, respectively.

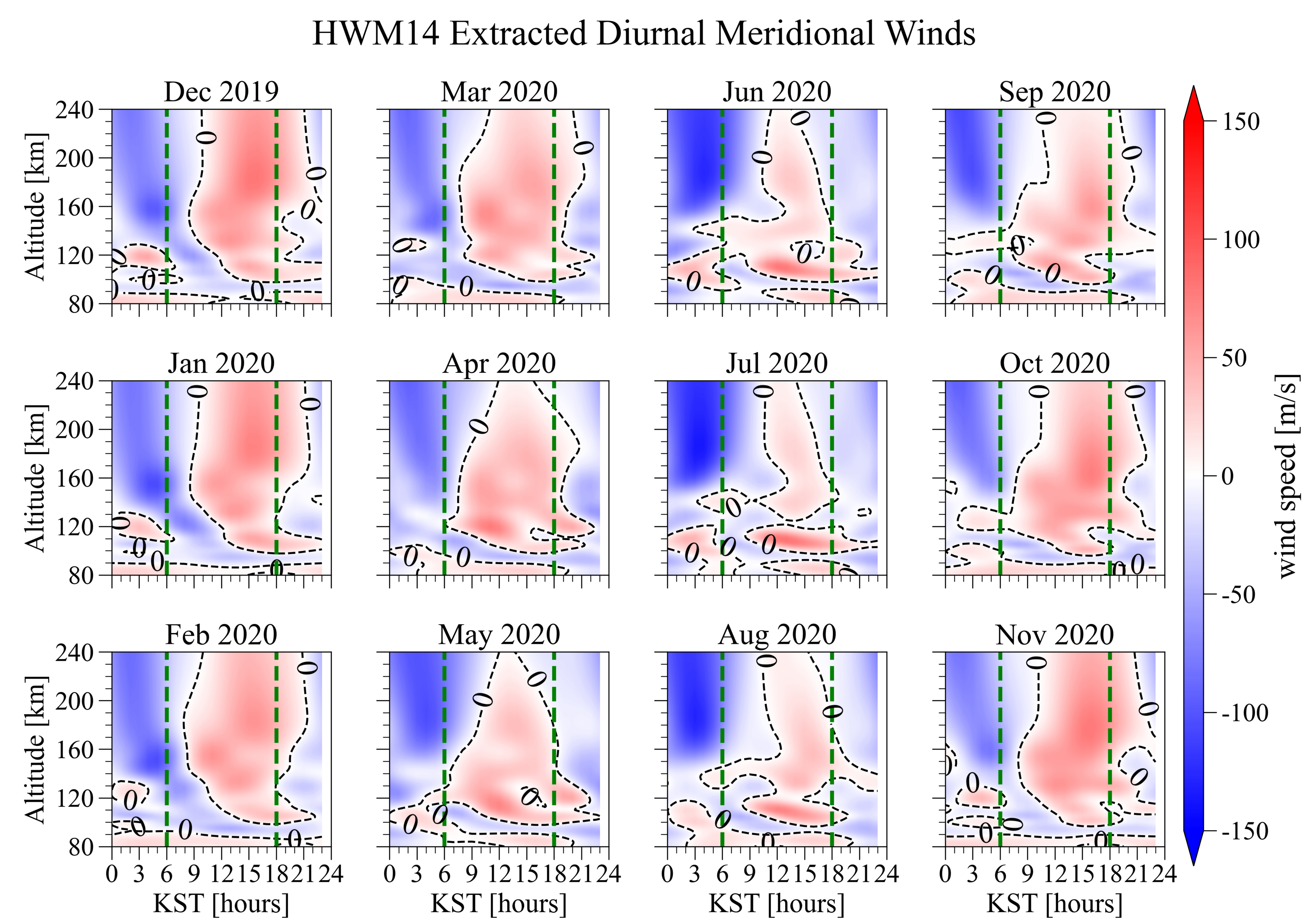

Figure 6.
Extracted HWM14 diurnal meridional winds. Left and right vertical green dashed lines represent 6:00 and 18:00, respectively.

5 Conclusions

- We checked the local global circulation over the Korean Peninsula using MIHGIT winds.
- The Geomagnetic storm was not strong enough to change the daytime global circulation.
- Measurements and model results showed strong northward winds during daytime.
- During the daytime, the extracted diurnal meridional winds measured by MIGHTI did not correspond with those calculated by HWM14.
- It appears that HWM14 model may not accurately represent the components of tidal waves.

6 References

- **Jiang, G., Xu, J., Wang, W., Yuan, W., Zhang, S., Yu, T., ... & Li, Q. (2018).** A comparison of quiet time thermospheric winds between FPI observations and model calculations. Journal of Geophysical Research: Space Physics, 123(9), 7789-7805.
- **Lee, J., Kwak, Y. S., Kam, H., Kil, H., Park, J., Kim, J., ... & Lee, C. (2024).** Vertical wind profiles in the mesosphere and lower thermosphere driven by meteor radar and Ionospheric Connection Explorer observations over the Korean Peninsula. Geophysical Research Letters, 51(4), e2023GL106450.
- **Roble, R. G., Dickinson, R. E., & Ridley, E. C. (1982).** Global circulation and temperature structure of thermosphere with high-latitude plasma convection. Journal of Geophysical Research: Space Physics, 87(A3), 1599-1614.
- **Yamazaki, Y., Harding, B. J., Qiu, L., Stolle, C., Siddiqui, T. A., Miyoshi, Y., ... & England, S. L. (2023).** Monthly climatologies of zonal-mean and tidal winds in the thermosphere as observed by ICON/MIGHTI during April 2020–March 2022. Earth and Space Science, 10(6), e2023EA002962.