Influence of geomagnetic disturbances on midlatitude mesosphere/lower thermosphere mean winds and tides

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Outline

- MLT wind observations over Collm and Kazan
- Geomagnetic influence on mean winds
- Geomagnetic influence on tides
- Conclusions

	Kazan (56°N, 49°E)	Collm (51°N, 13°E)
1. Operating dates	Since 2015	Since 2004
2. Carrier frequency	29.75MHz	36.2MHz
3. Pulse peak power	15kW	15kW
4. Pulse repetition rate	2015/2016 – 925Hz, since 2017 – 1594Hz.	625Hz
5. Receiving antennas	Five crossed dipole 2-element Yagis.	Five crossed dipole 2-element Yagis.

Collm/Kazan mean winds

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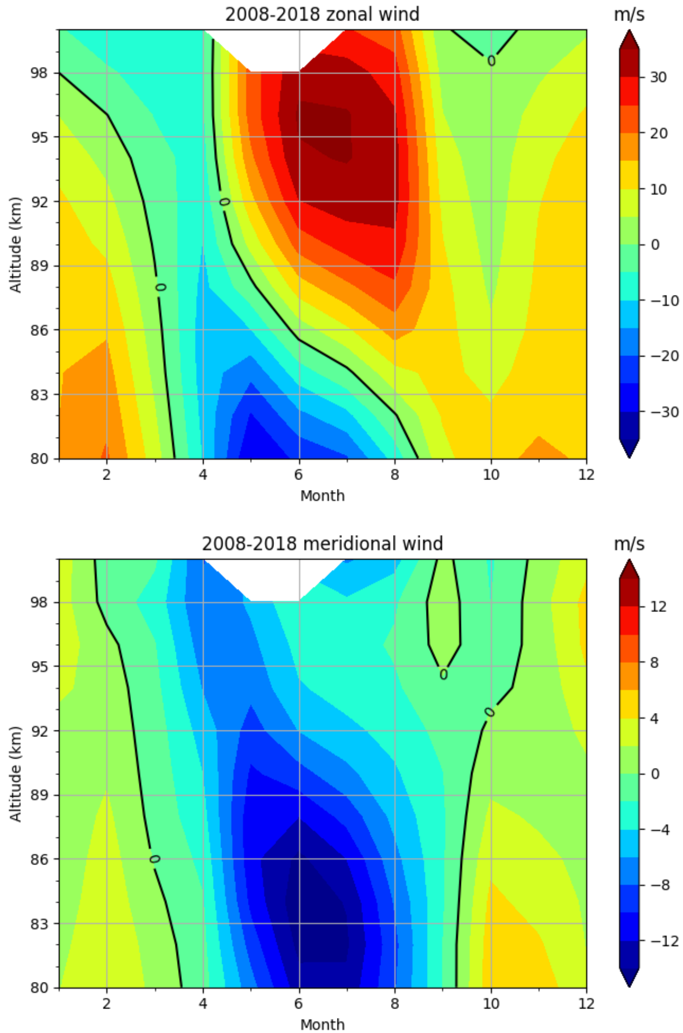
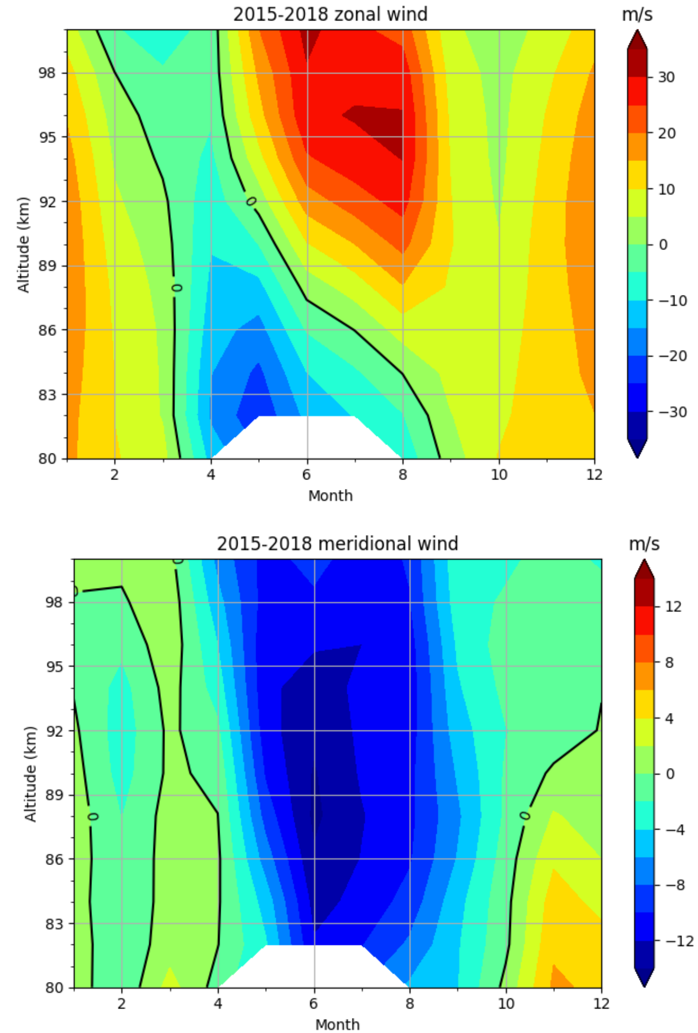
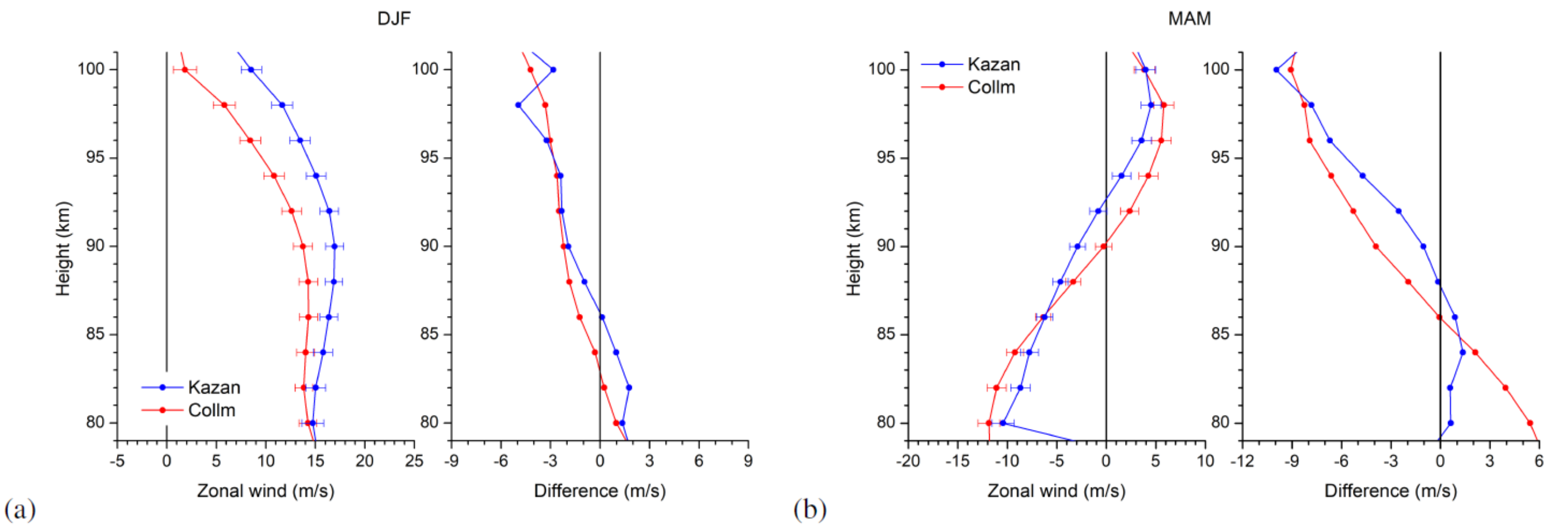
Collm 51°N, 13°E



Kazan 56°N, 49°E



Zonal wind geomagnetic effects 2015-2020



Daily mean zonal winds

Undisturbed: Ap ≤ 5 ~ 200 days

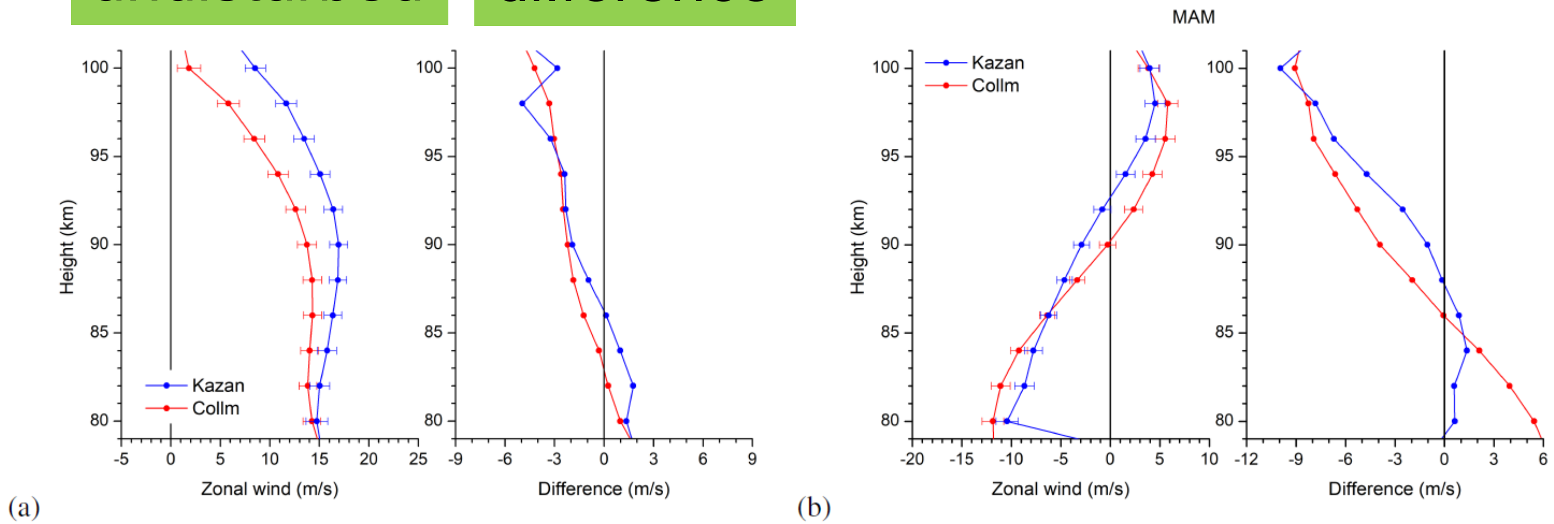
Unsettled/disturbed: Ap ≥ 20 ~ 20 days

Mean difference „Disturbed – Undisturbed" ~ 5 m/s

Zonal wind geomagnetic effects 2015-2020

undisturbed

difference



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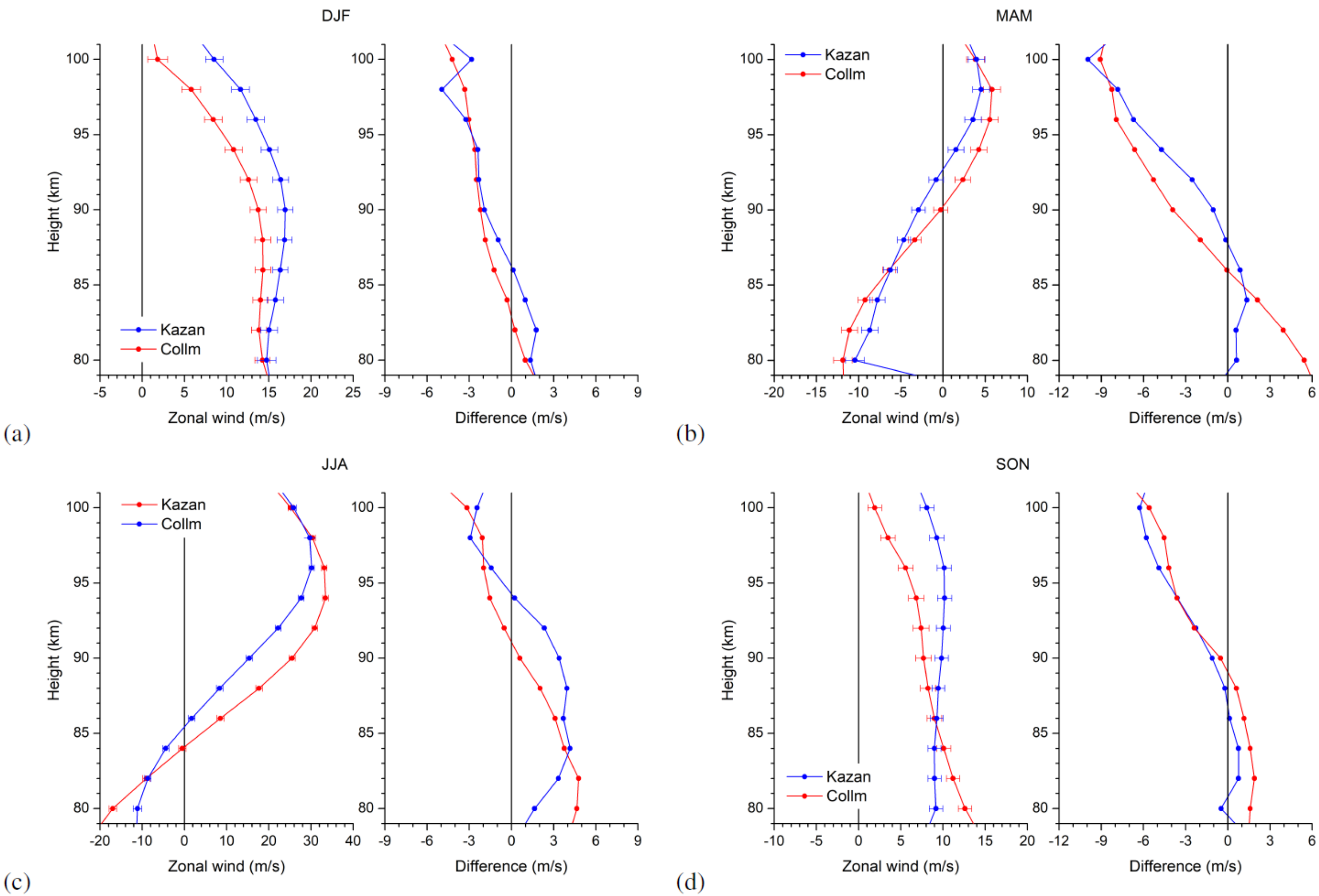
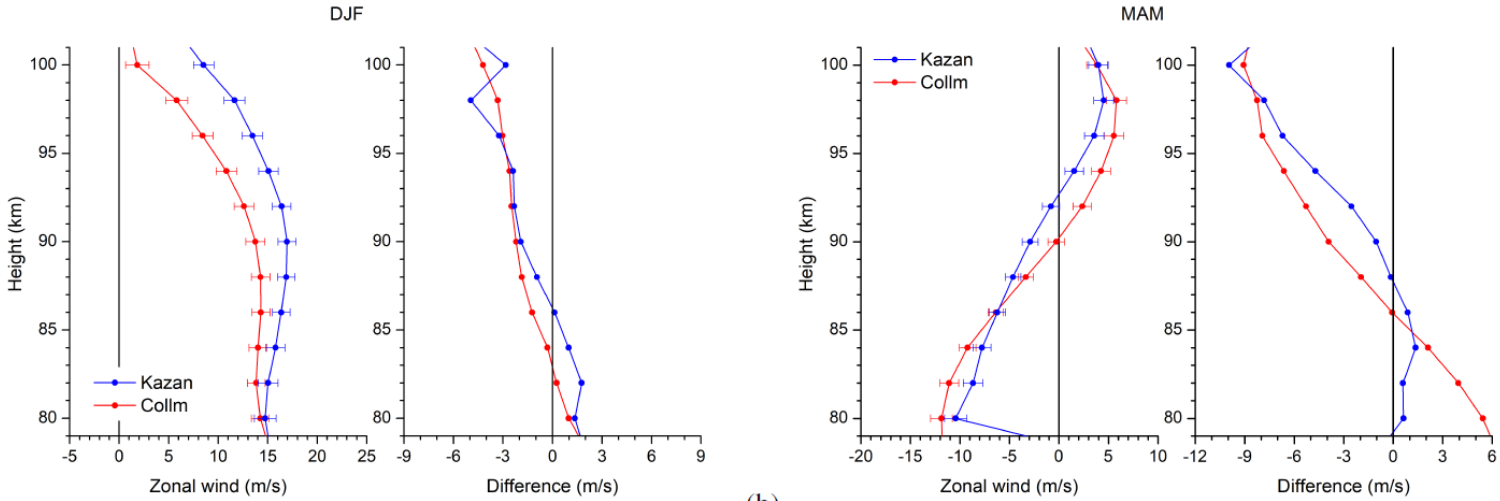


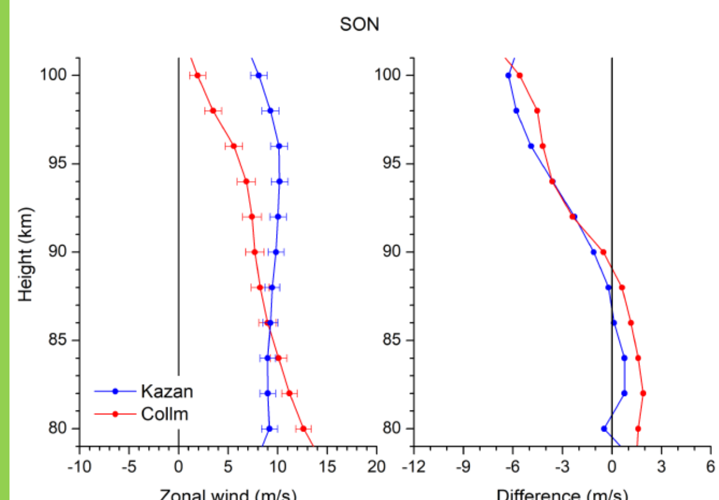
Zonal wind geomagnetic effects 2015-2020



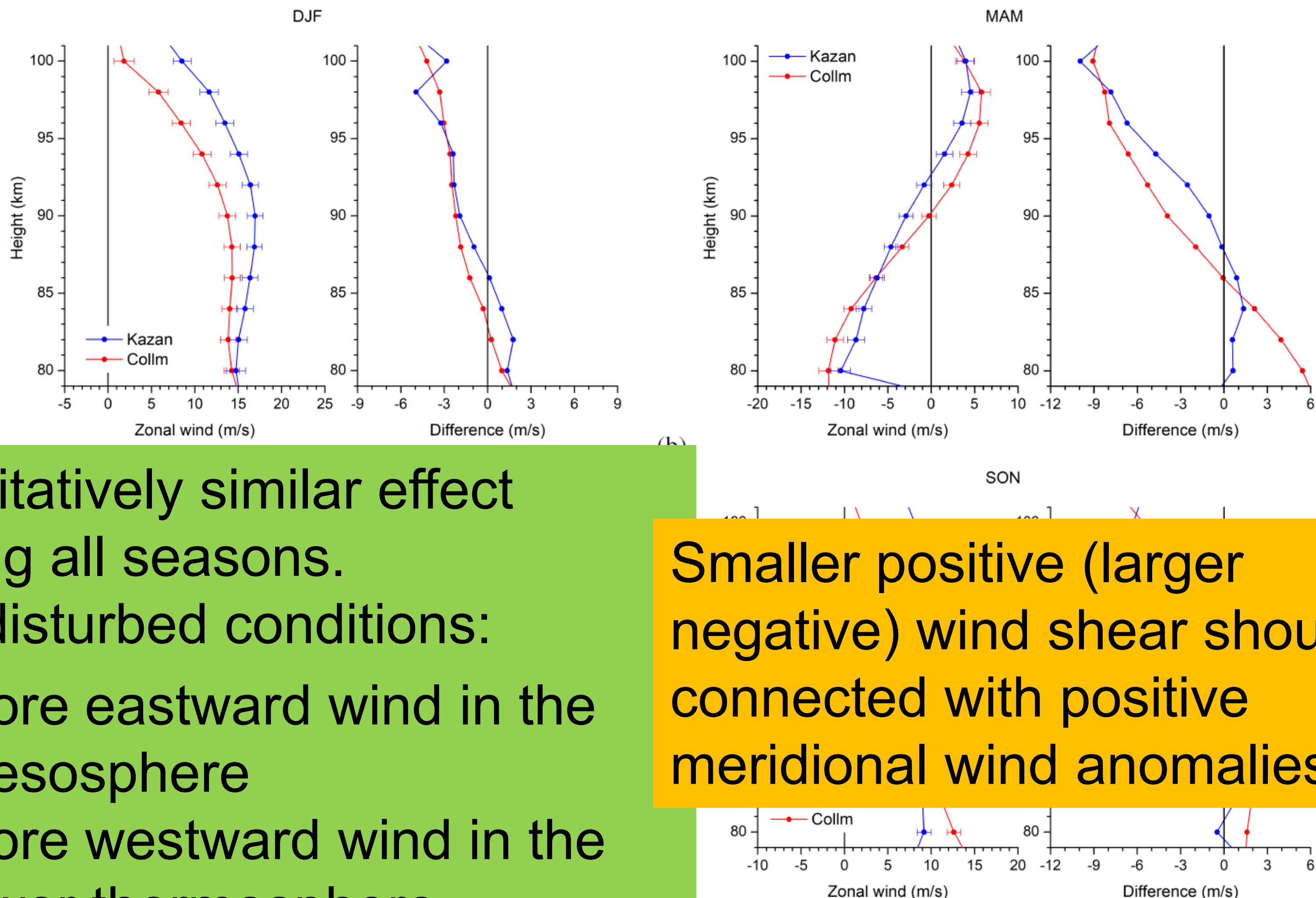
Qualitatively similar effect during all seasons.

For disturbed conditions:

- more eastward wind in the mesosphere
- more westward wind in the lower thermosphere



Zonal wind geomagnetic effects 2015-2020

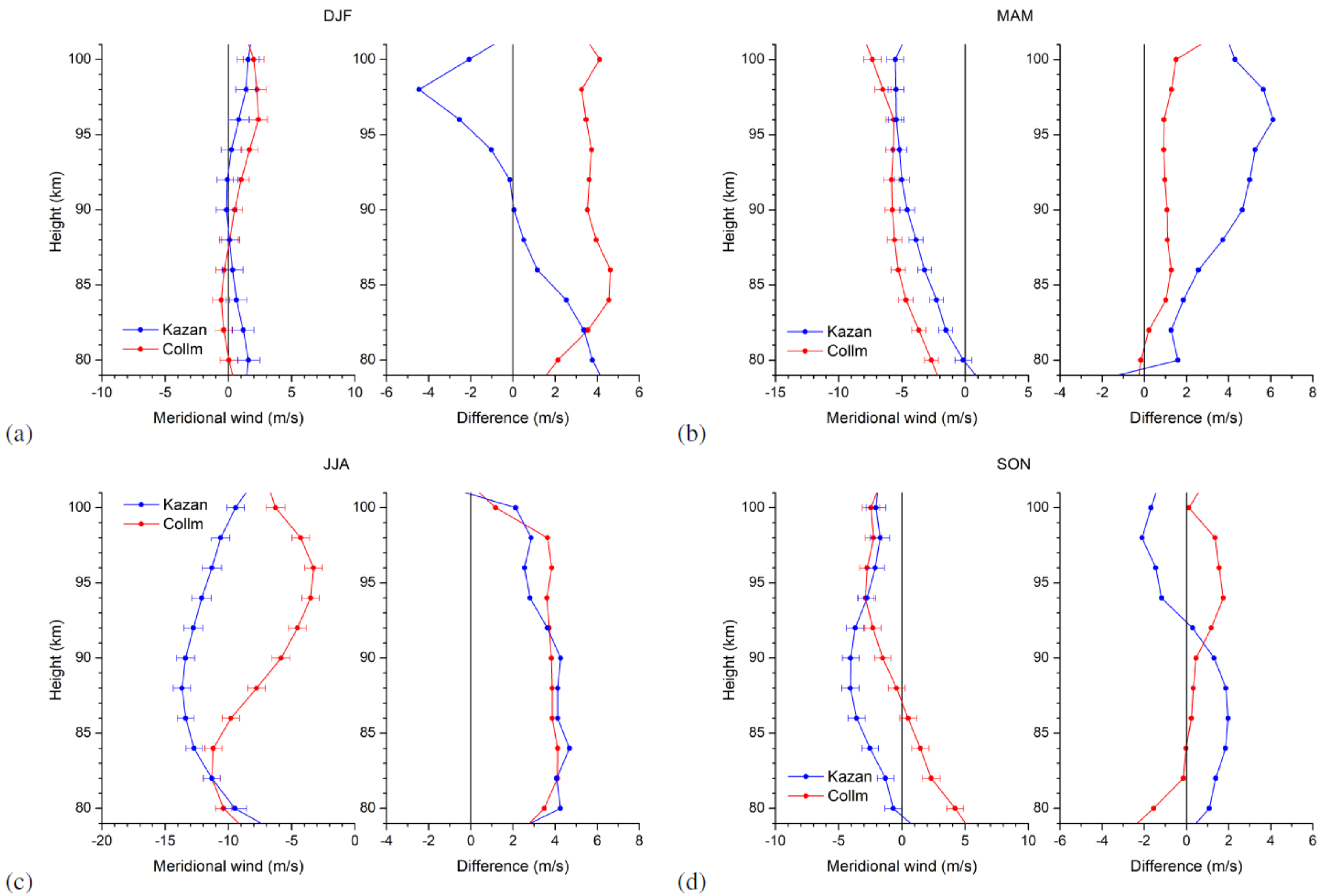


Qualitatively similar effect during all seasons.
For disturbed conditions:

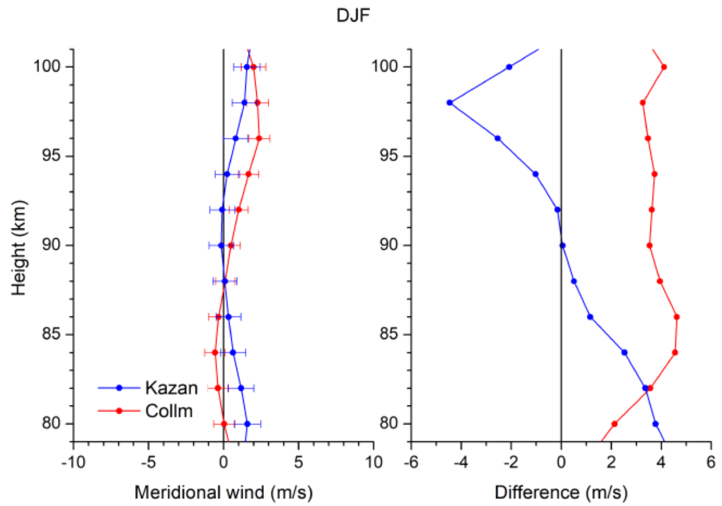
- more eastward wind in the mesosphere
- more westward wind in the lower thermosphere

Smaller positive (larger negative) wind shear should be connected with positive meridional wind anomalies

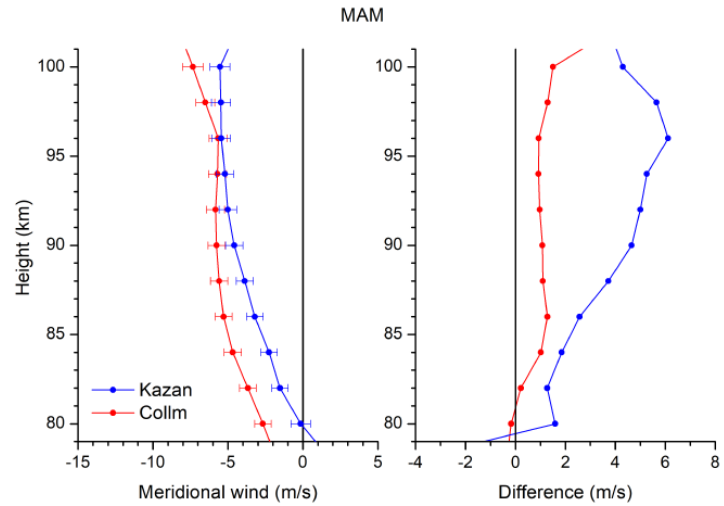
Meridional wind geomagnetic effects 2015-2020



Meridional wind geomagnetic effects 2015-2020



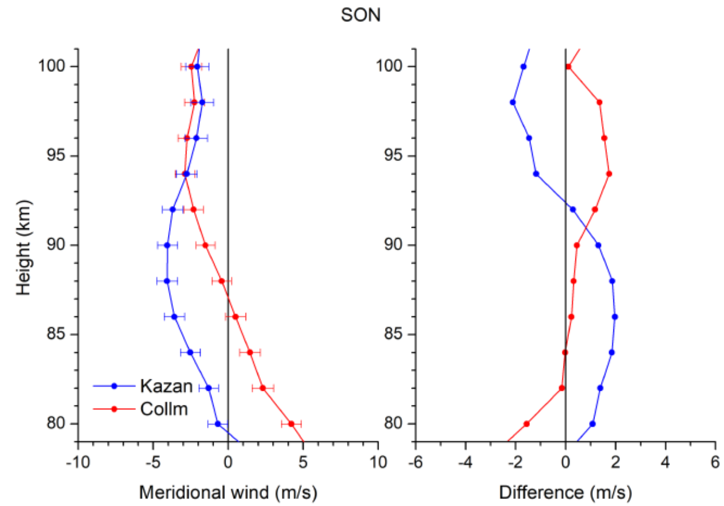
(a)



(b)

Less clear tendencies than for zonal wind.
For disturbed conditions:

- stronger northward/weaker southward wind
- corresponding to zonal wind differences



Diurnal tide geomagnetic effects 2015-2020

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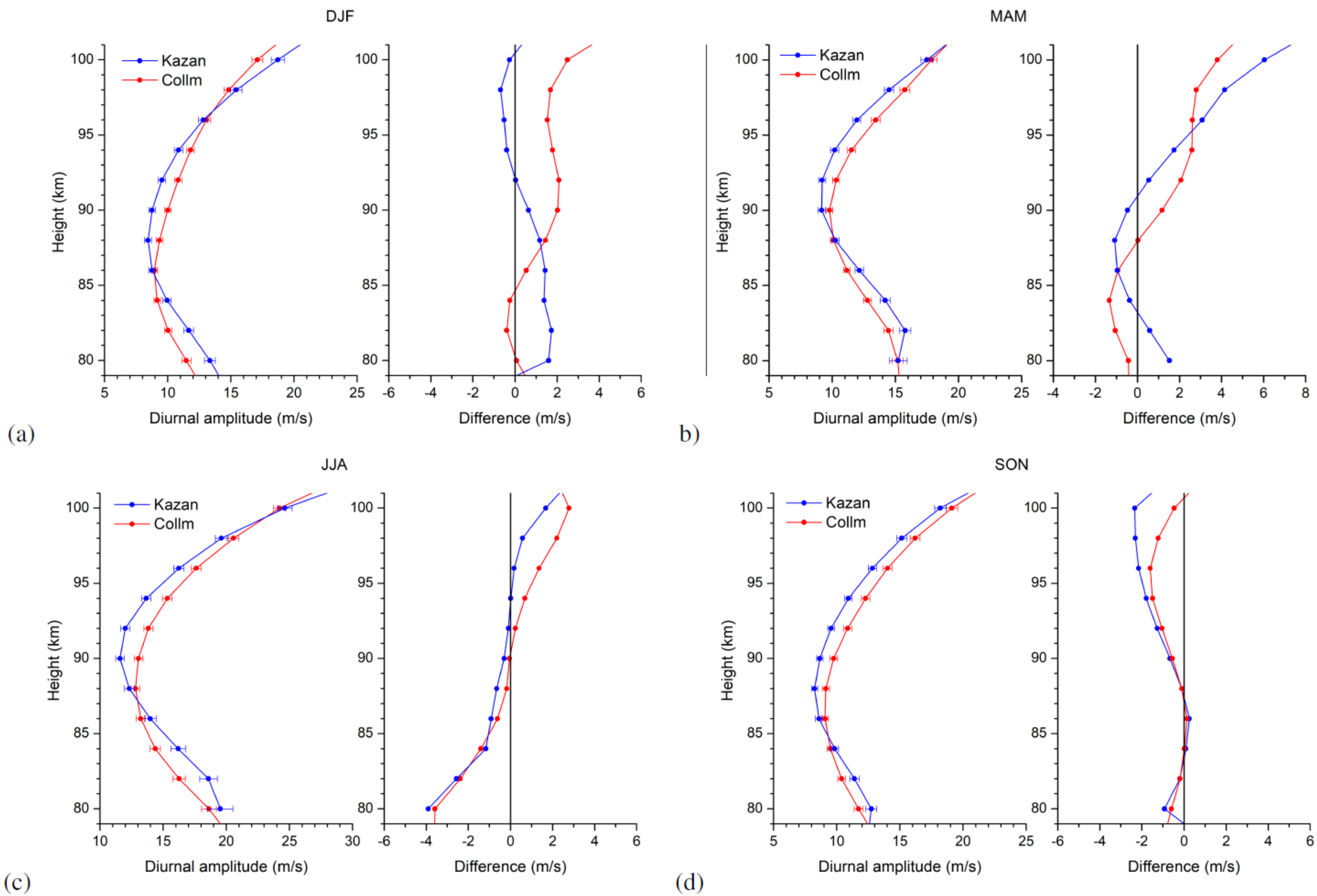
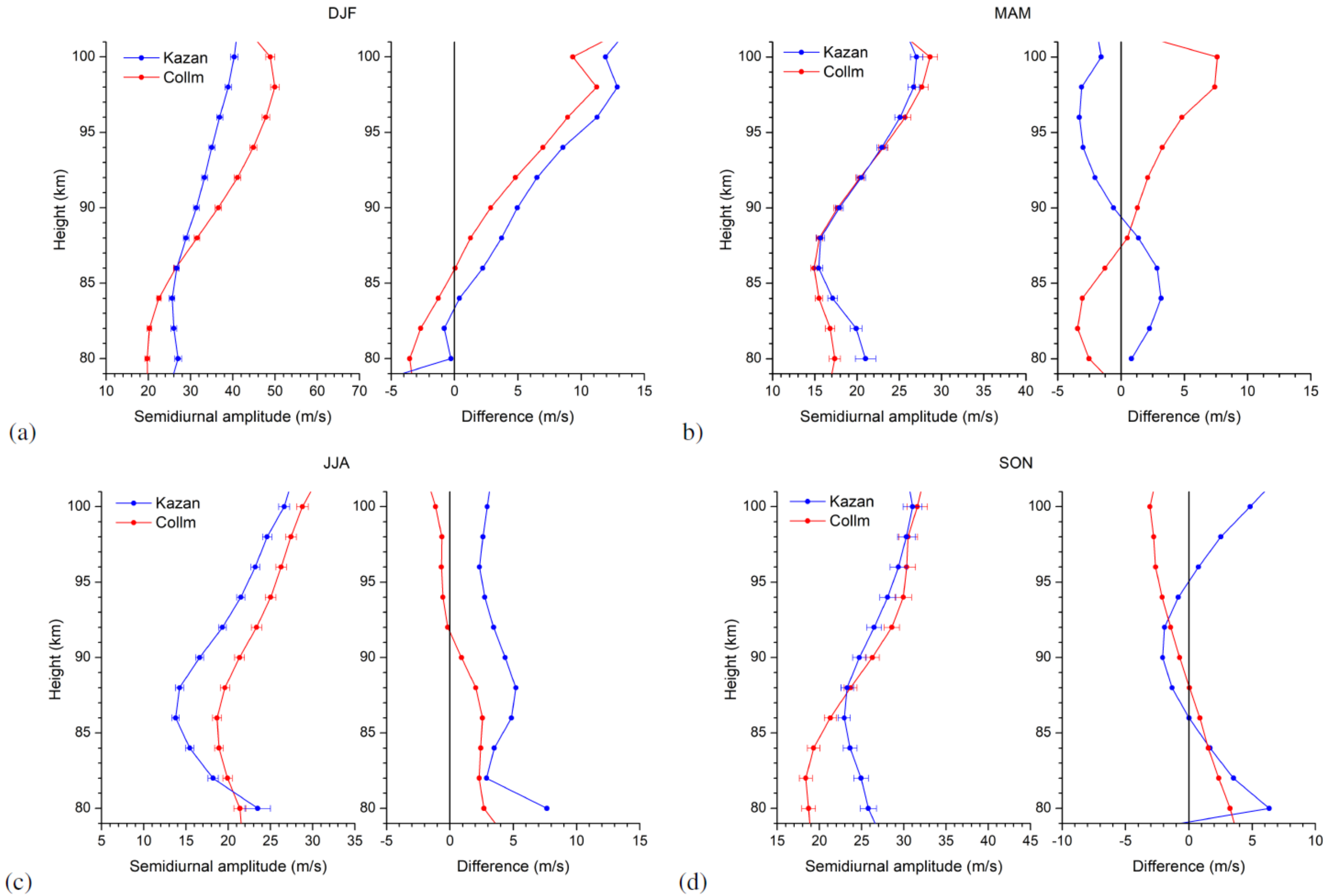
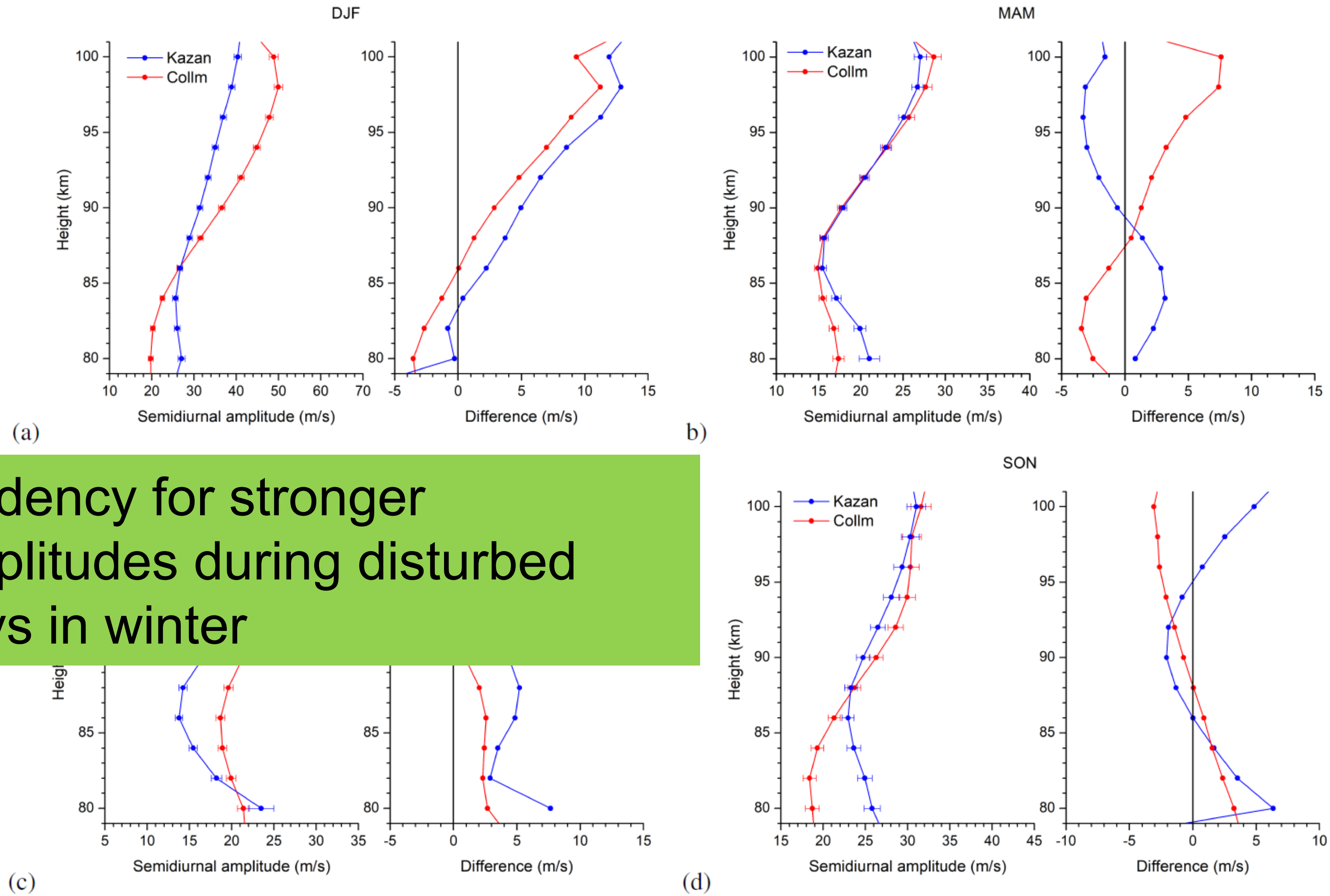


Semidiurnal tide geomagnetic effects 2015-2020

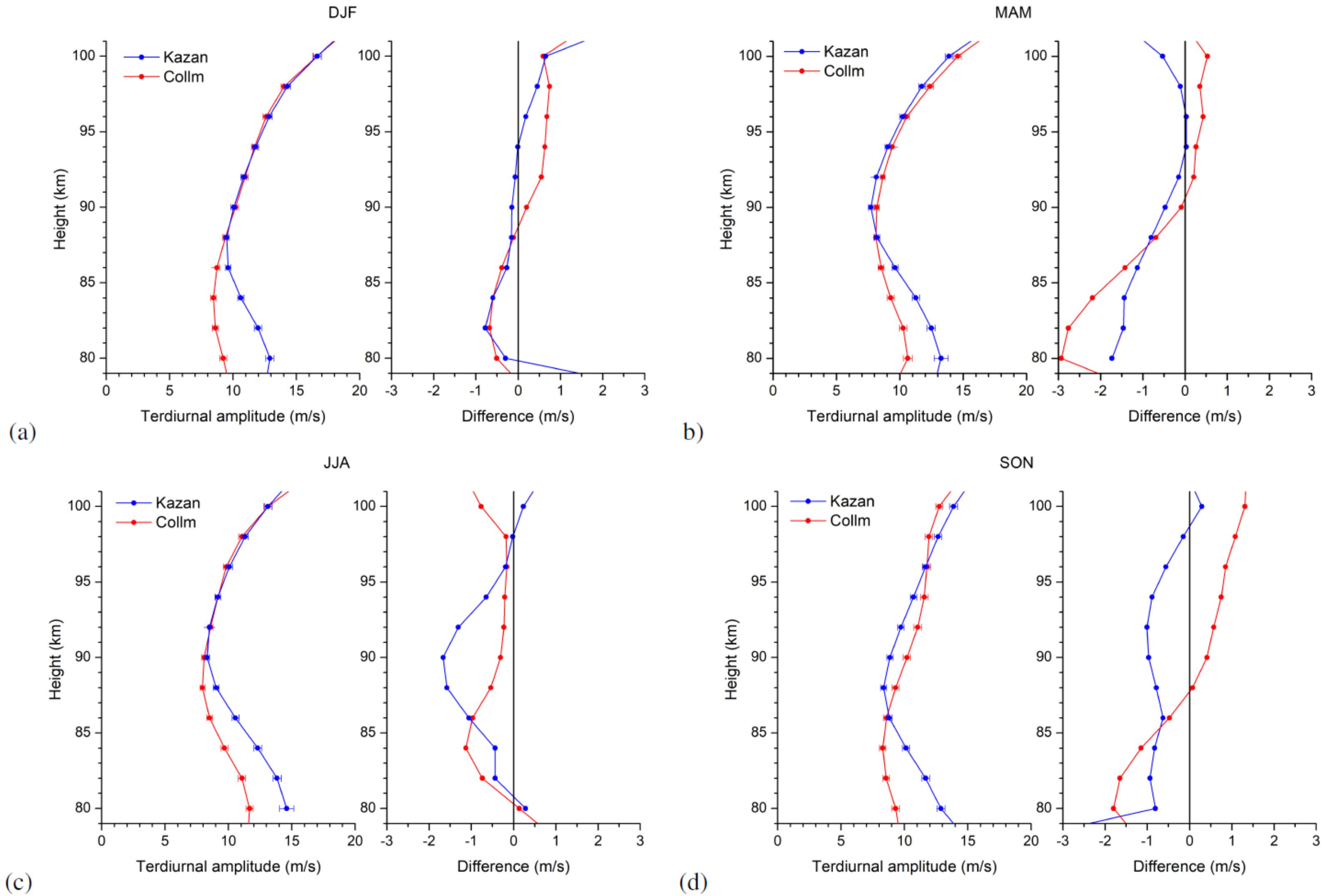


Semidiurnal tide geomagnetic effects 2015-2020



tendency for stronger amplitudes during disturbed days in winter

Terdiurnal tide geomagnetic effects 2015-2020



Summary and conclusions

- Horizontal MLT winds and tides observed at Collm (51°N, 13°E) and Kazan (56°N, 49°E).
- For disturbed conditions, we observe more eastward wind in the mesosphere and more westward wind in the lower thermosphere.
- This is in qualitative agreement with a cooler polar stratosphere during disturbed conditions.
- Smaller zonal wind shear in the MLT is connected with more northward meridional wind during disturbed conditions.
- Geomagnetic effects on tides are weak or inconclusive, except for larger SDT amplitudes for disturbed conditions in winter.