The Stratospheric Diurnal Cycle in Radio Occultation Data and Implications for Climate Monitoring

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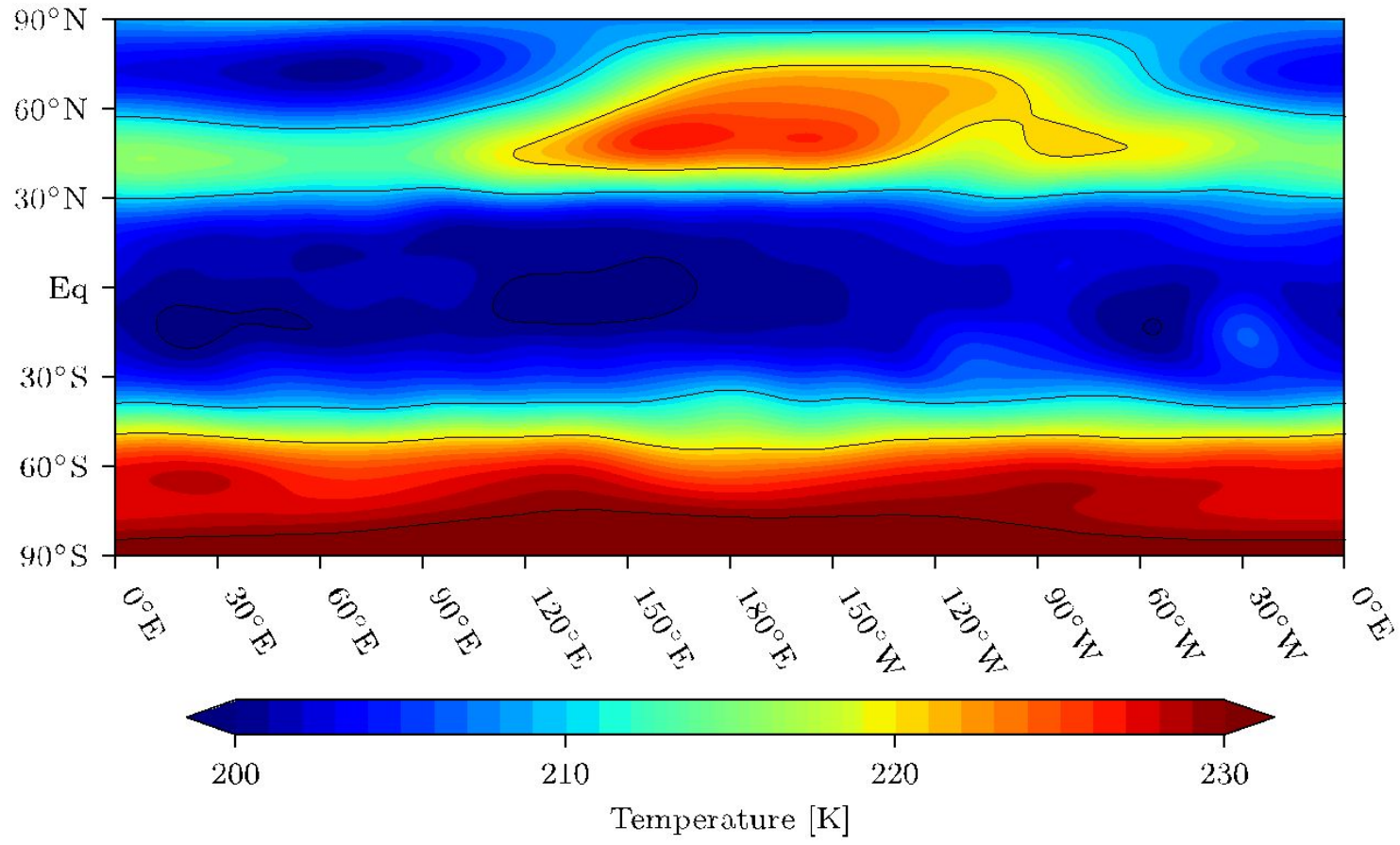
Background and Method

Backgroun

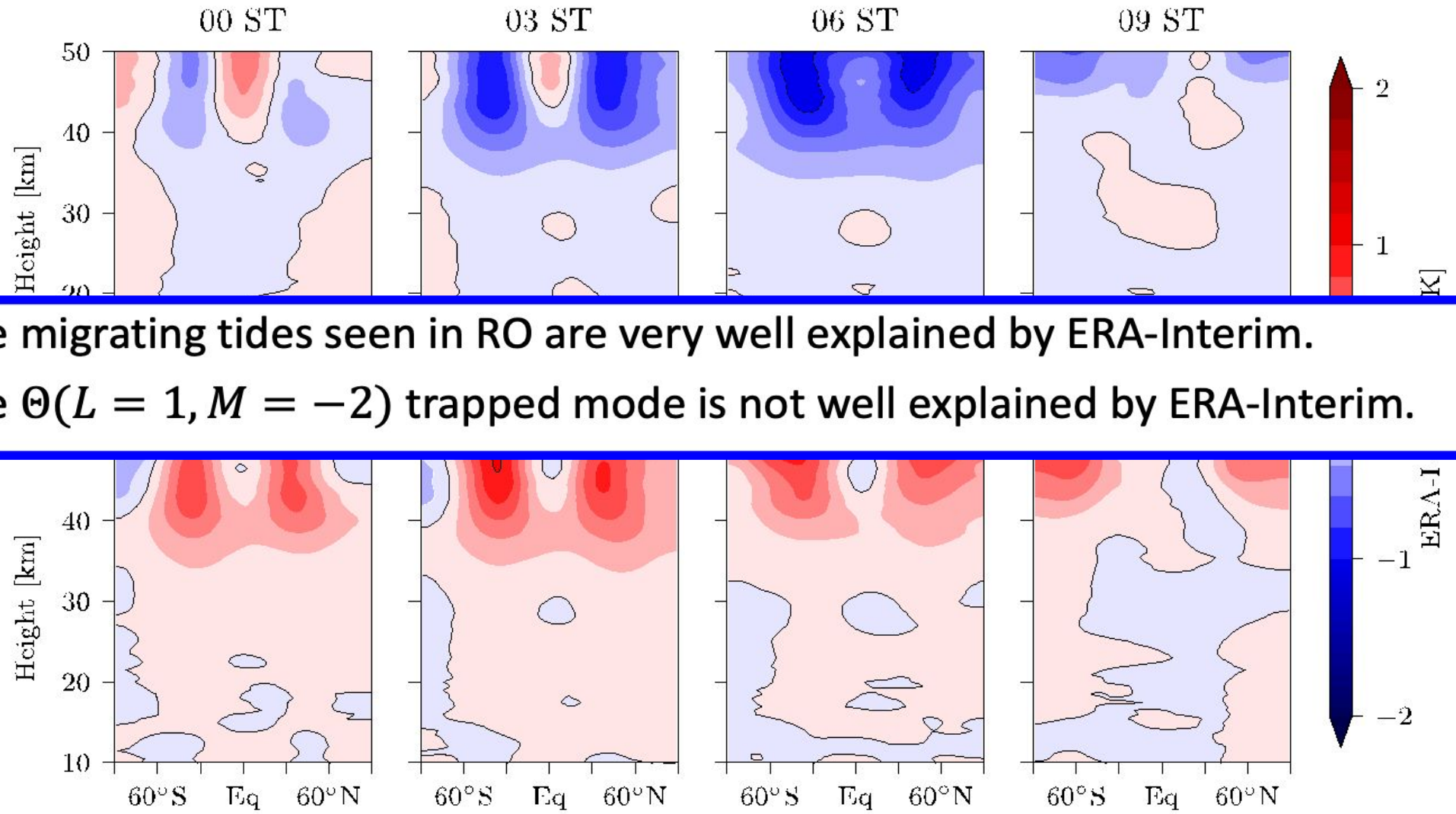
- Atmosphe
- Sampling
- Ionosphe

Method: Ba

- For refrac
- To COSMI
- To differe
- Througho
- Degree 14



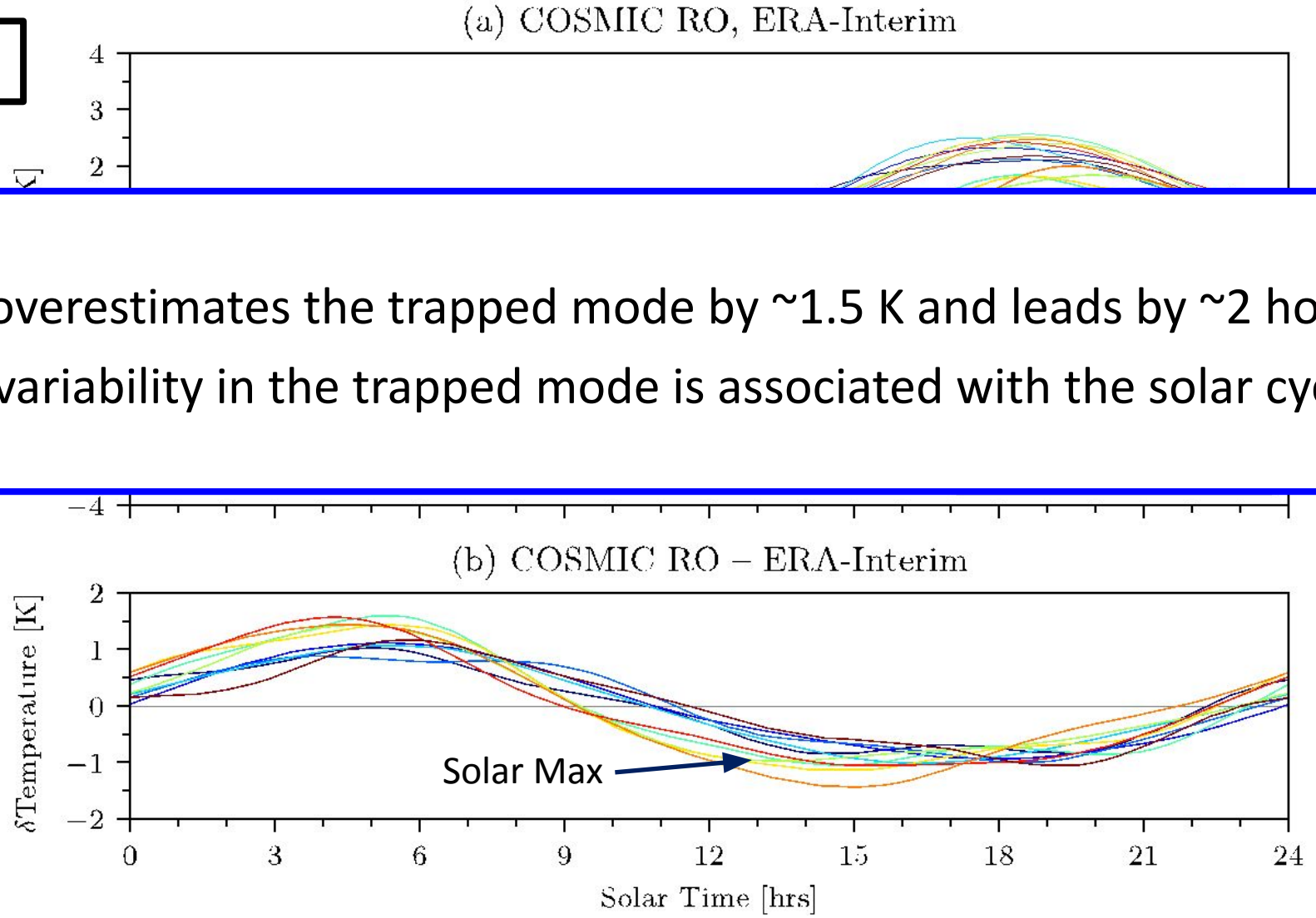
Migrating tides



- The migrating tides seen in RO are very well explained by ERA-Interim.
- The $\Theta(L = 1, M = -2)$ trapped mode is not well explained by ERA-Interim.

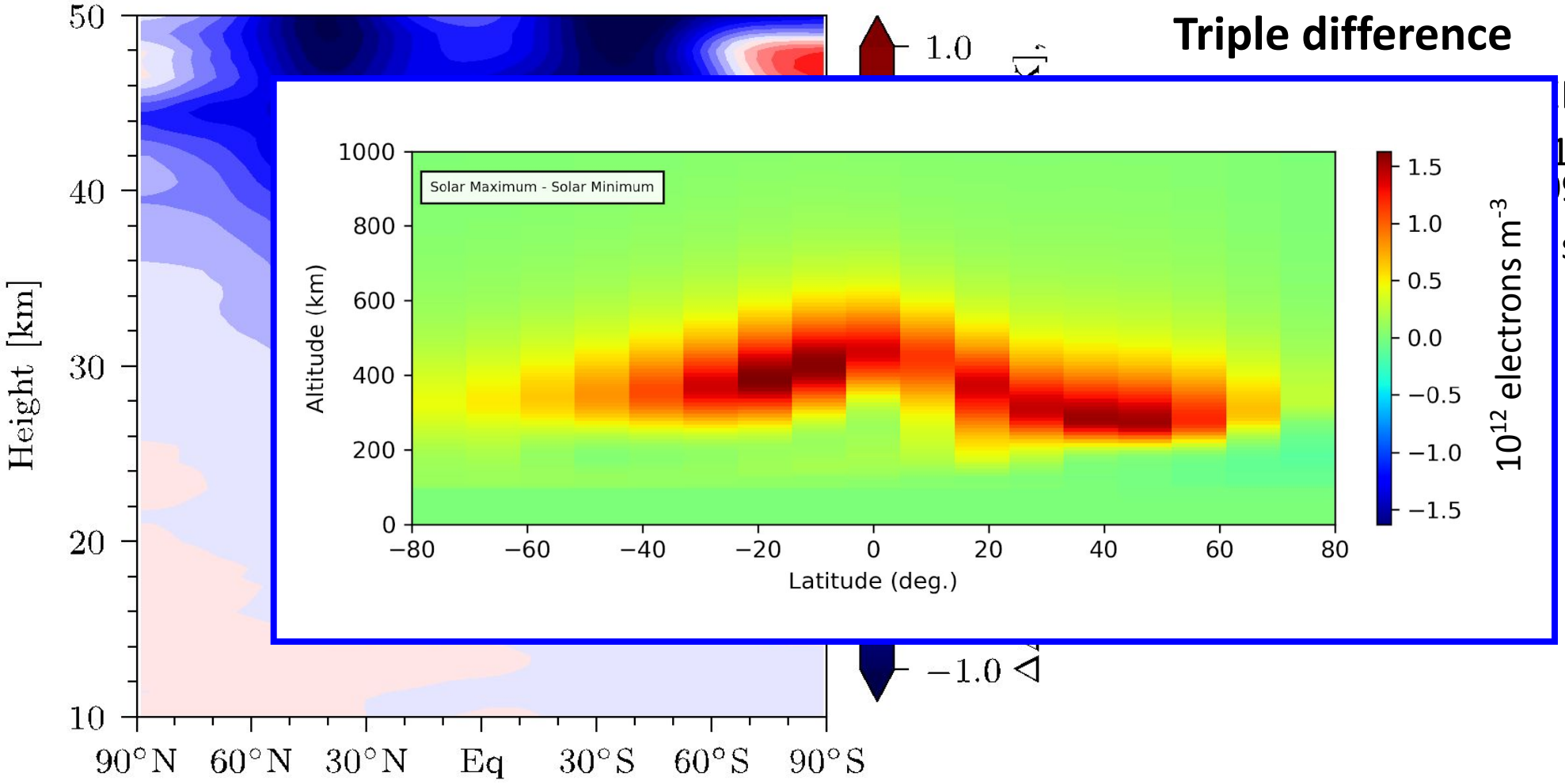
The trapped mode

45°N, 48 km



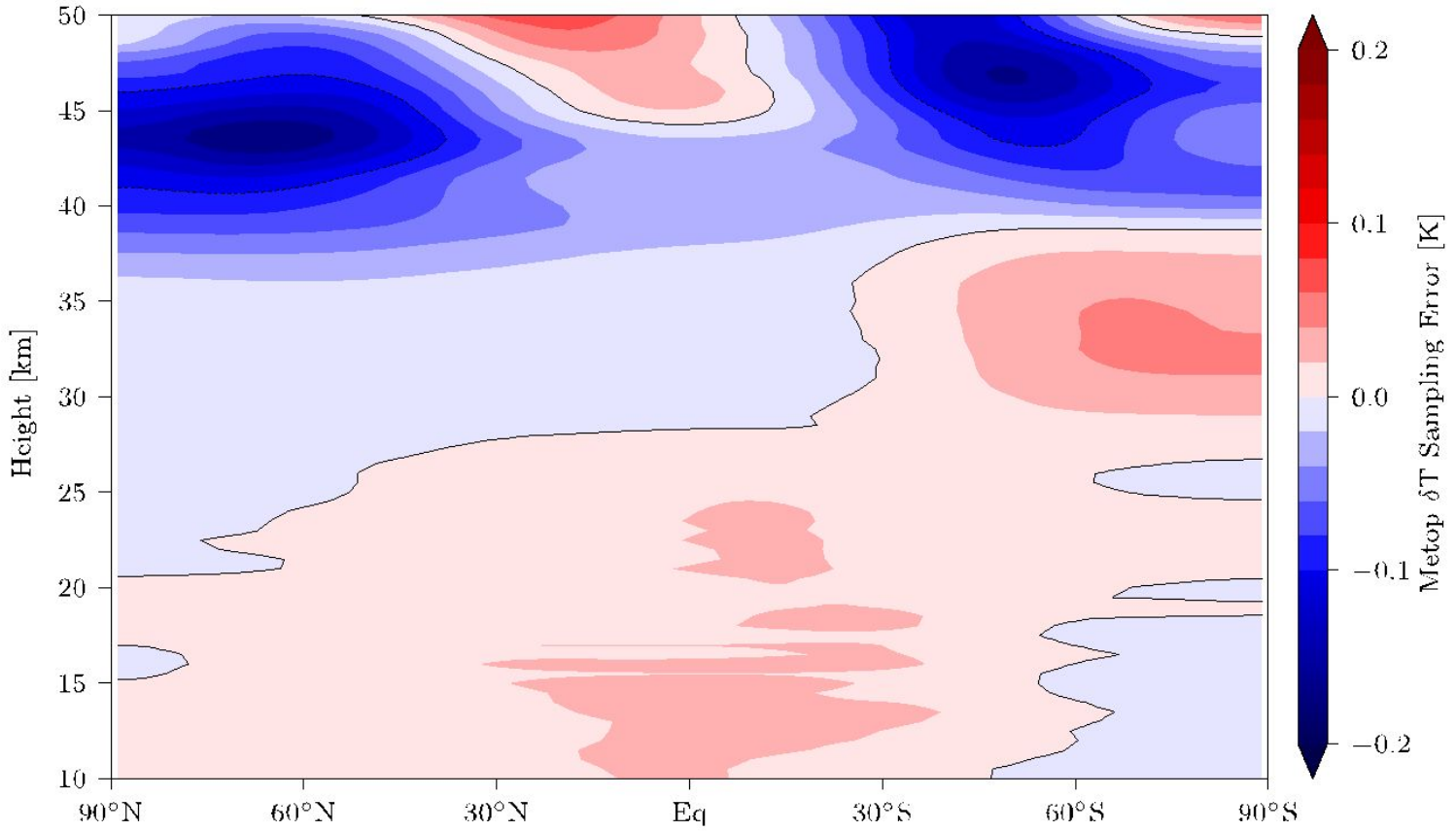
- ERA-Interim overestimates the trapped mode by ~1.5 K and leads by ~2 hours in phase.
- Inter-annual variability in the trapped mode is associated with the solar cycle.

Ionospheric residual



Sampling bias in Metop RO climatology

Simulate residual after sampling error correction: Produce 09:30/21:30 ST expansion without diurnal mean for COSMIC RO less ERA-Interim



Mis-modeling of the trapped mode leads to upper stratospheric sampling error, even with sampling error removal.

Conclusions

- Atmospheric reanalysis does well at explaining the vertically propagating migrating thermal tides.
- Atmospheric reanalysis does poorly at explaining the vertically trapped mode.
- Ionospheric residual is mapped for the first time. Its amplitude is consistent with predictions and previous work. Its structure is inconsistent with hypotheses.
- Metop RO climatology experiences residual sampling error, even after sampling error removal, associated with mid-modeling of the vertically trapped mode.

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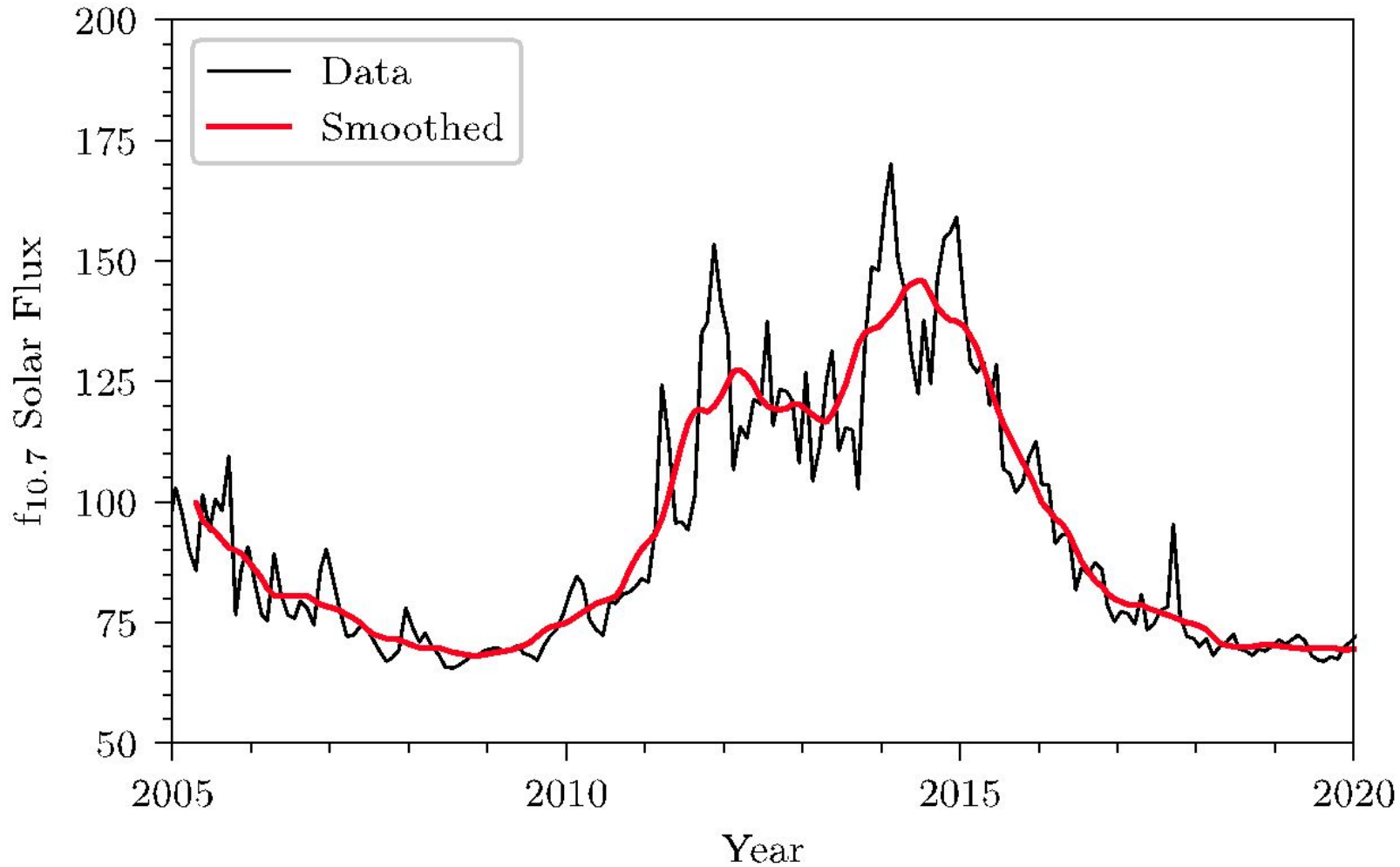
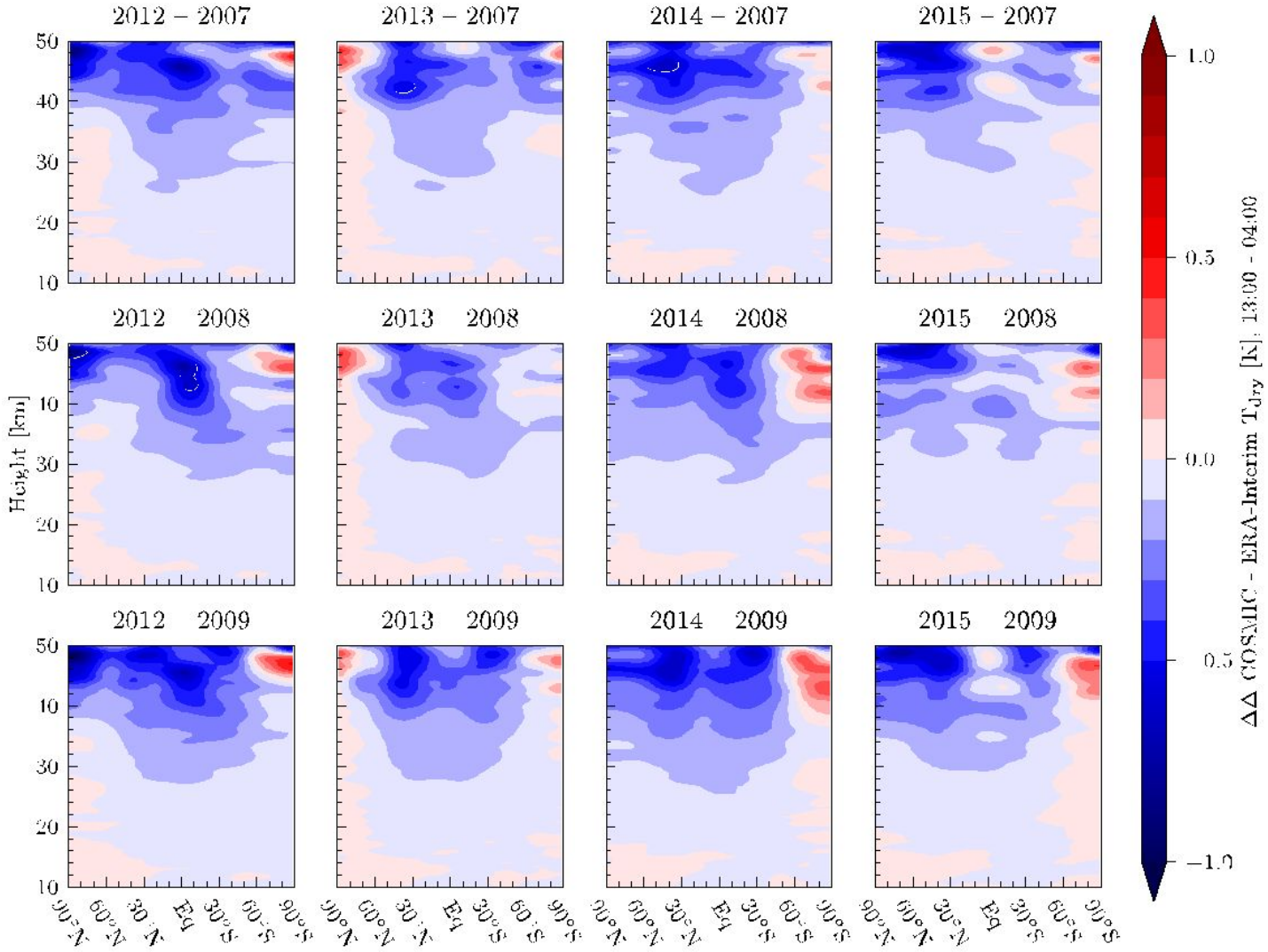
Backup Slides

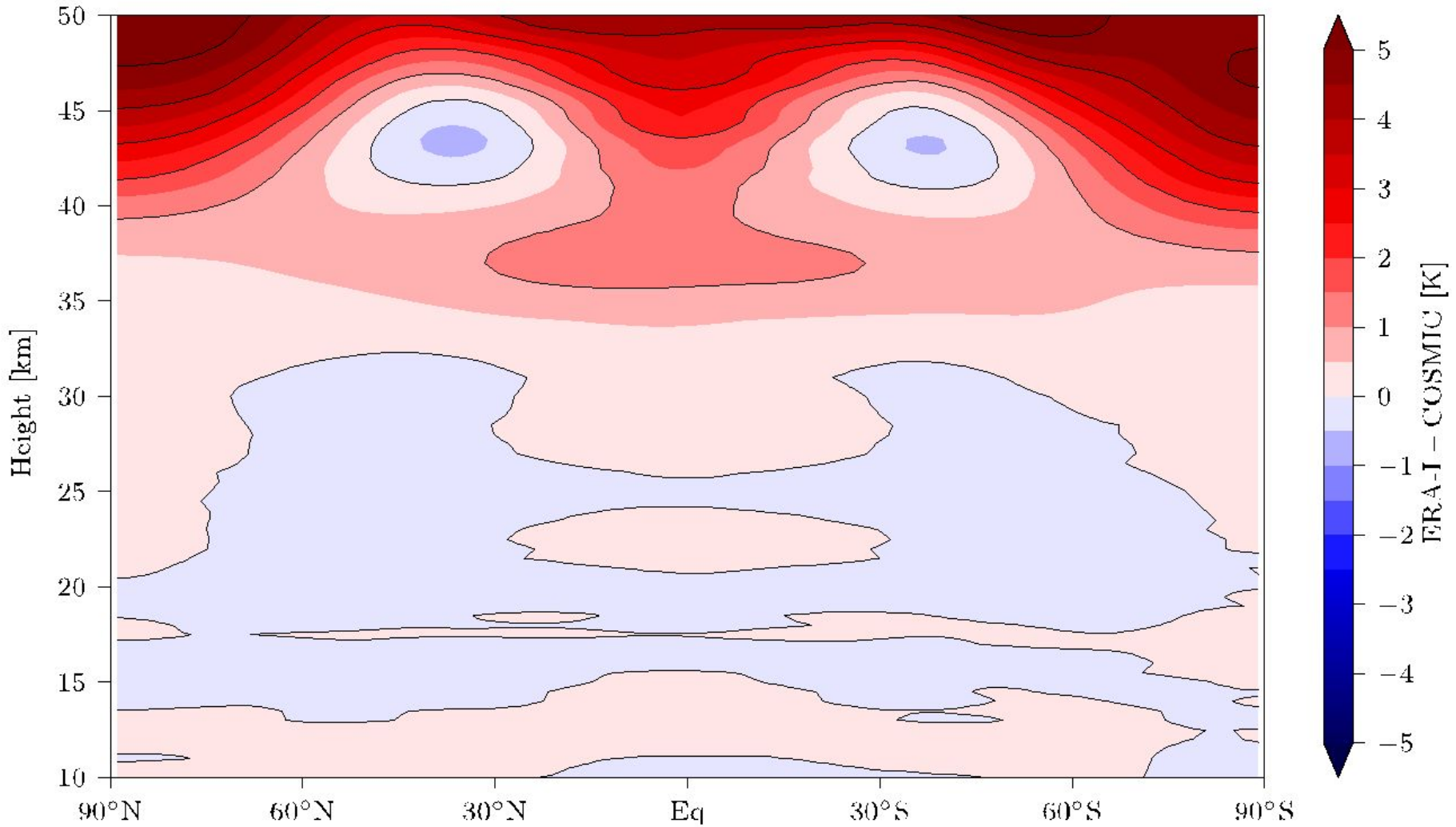
Solar activity



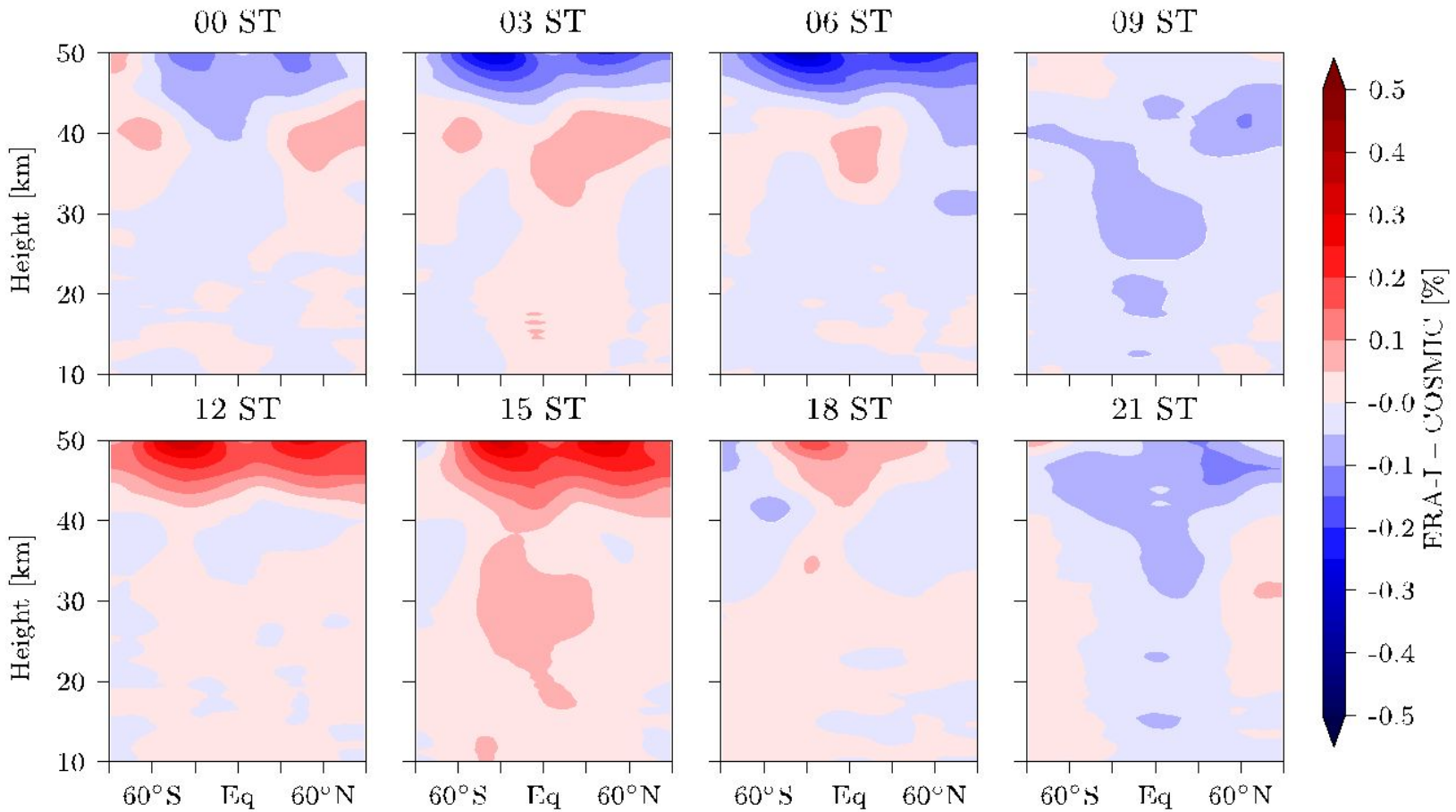
Full suite of ionospheric residual combinations



ERA-Interim v. COSMIC RO bias



Diurnal cycle in refractivity



COSMIC and Metop comparison