Multi-instrumental study of the ionospheric response to the 2015 St. Patrick's Day storm

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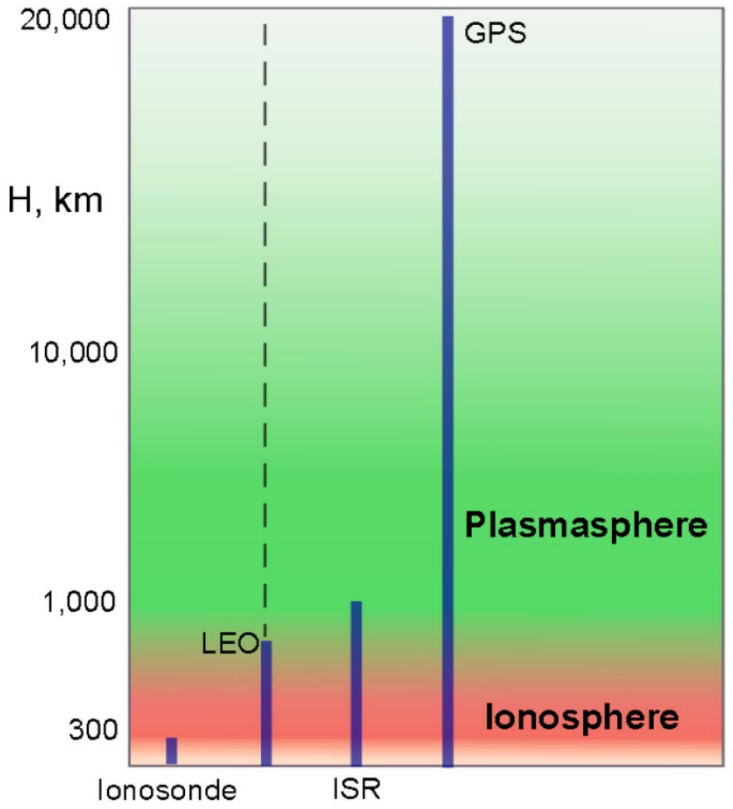
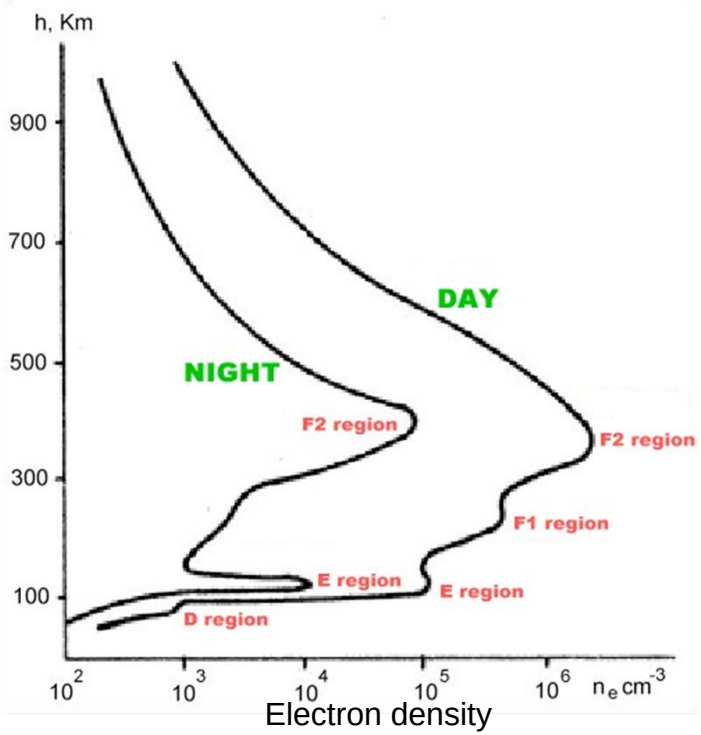
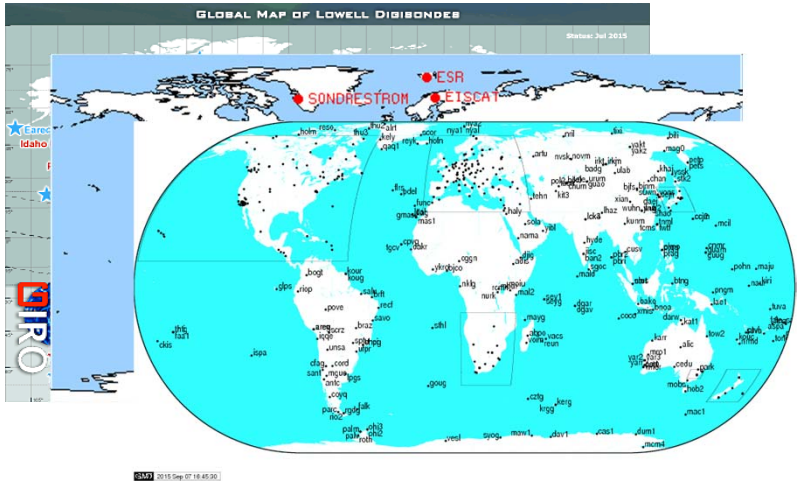
Ionospheric plasma density





Ground-based observations:

- Ionosonde
- ISR
- GPS



Satellite-borne observations:

- C/NOFS *(I=13, end)*
- DMSP *(H=850, no data)*
- Swarm *(3 sat, H=450-550)*

What do these satellites have in common?

GRACE-A
GRACE-B

JASON-1
JASON-2

CHAMP

MetOp-A
MetOp-B

GOCE

SAC-C

CASSIOPE

TerraSAR-X

Swarm A,B,C

Onboard GPS receiver

LEO GPS technique:

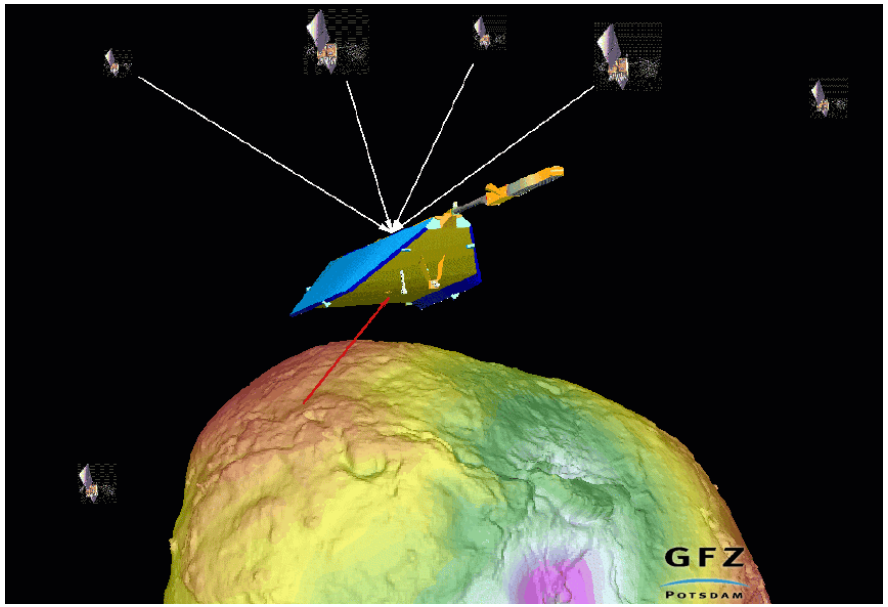
A dual frequency GPS receiver (8-12 channels)

POD – precise orbit determination

Output:

RINEX 2.1-3.0

Time sampling 1s - 10 s

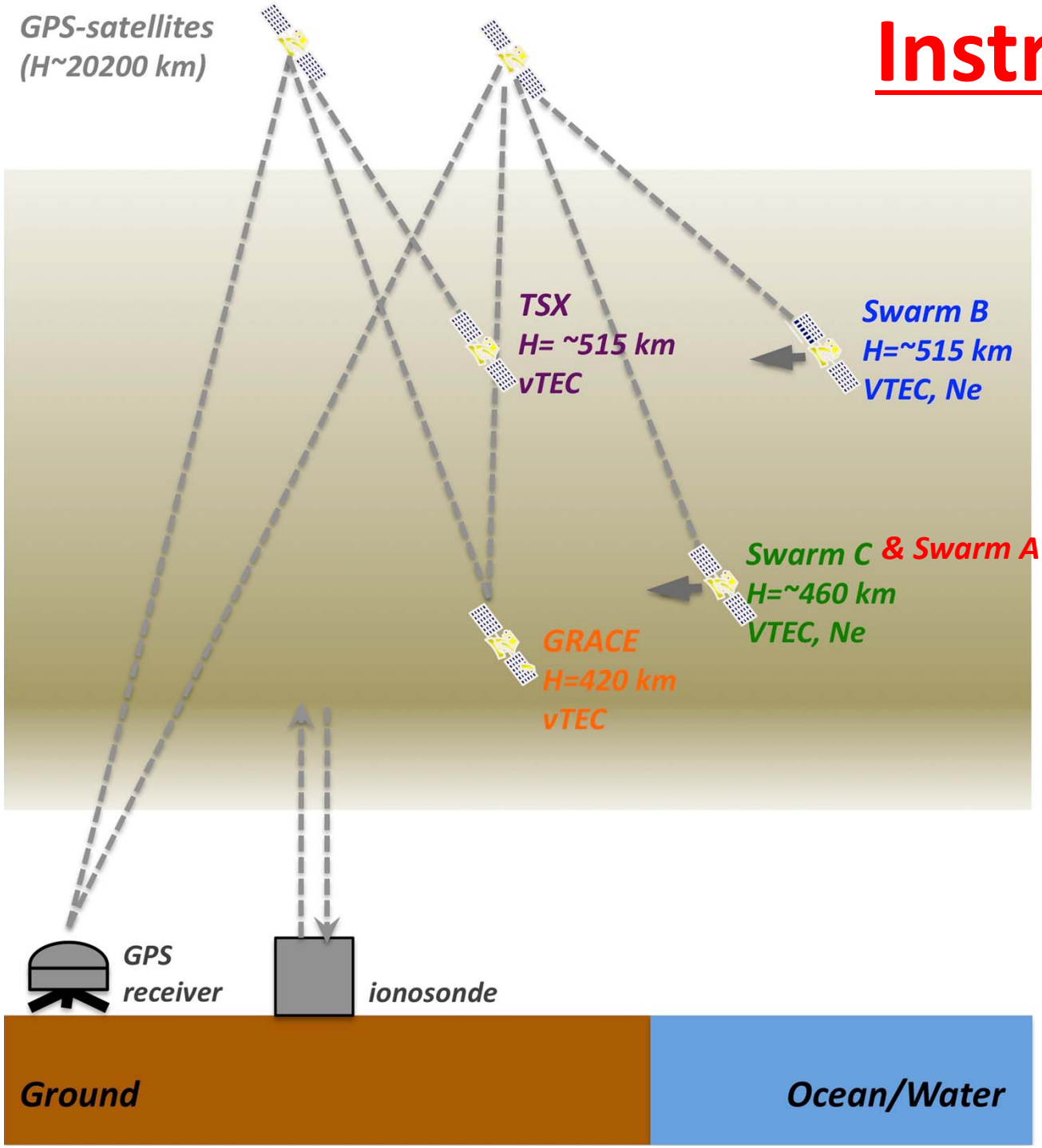


Images credit: GFZ

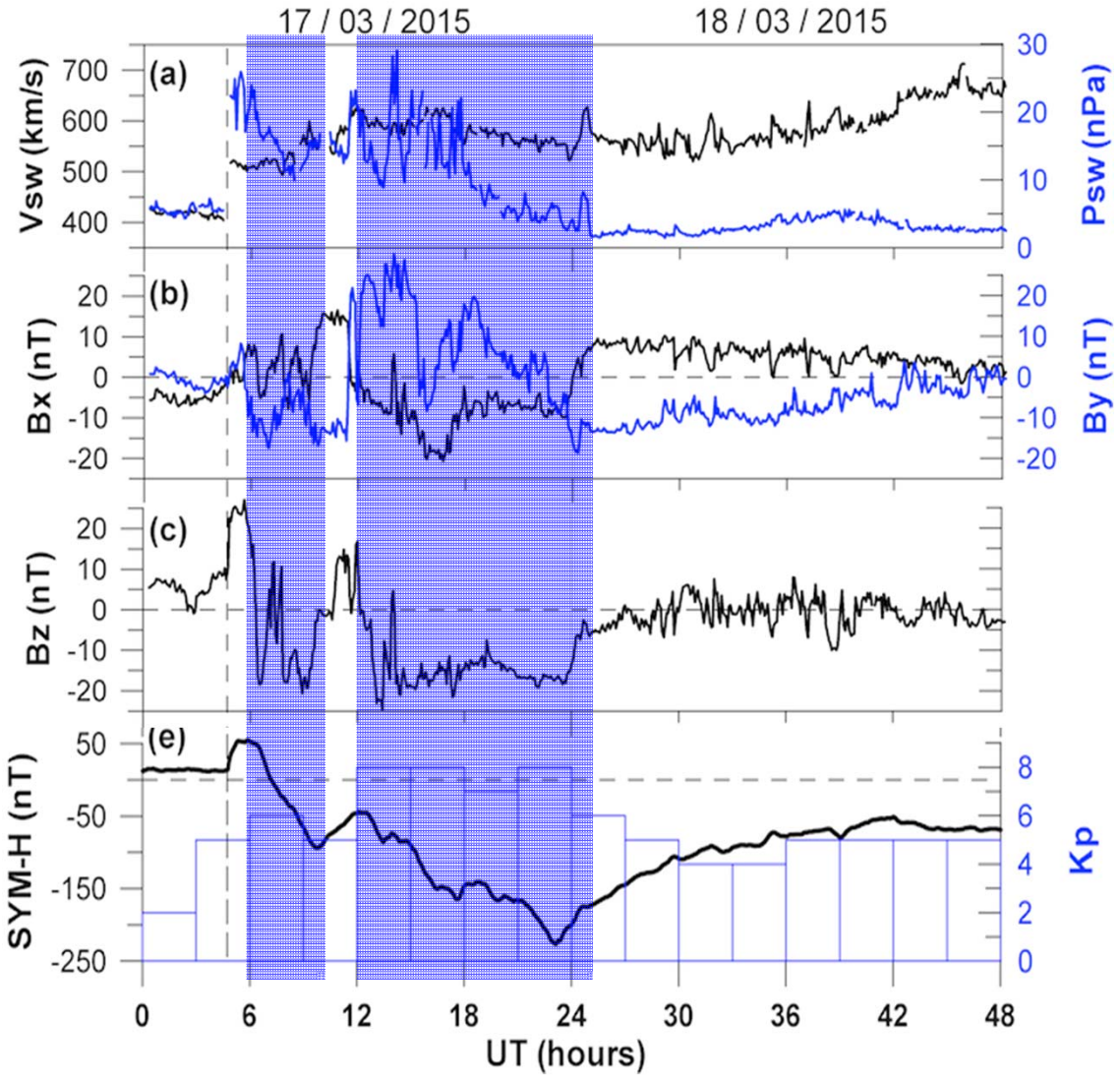
Main objectives:

- Orbit solution
- Timing
- Calibration of accelerometer data
- Absolute TEC for topside ionosphere / plasmasphere research

Instruments:



St. Patrick's Day storm: 17-18 March 2015



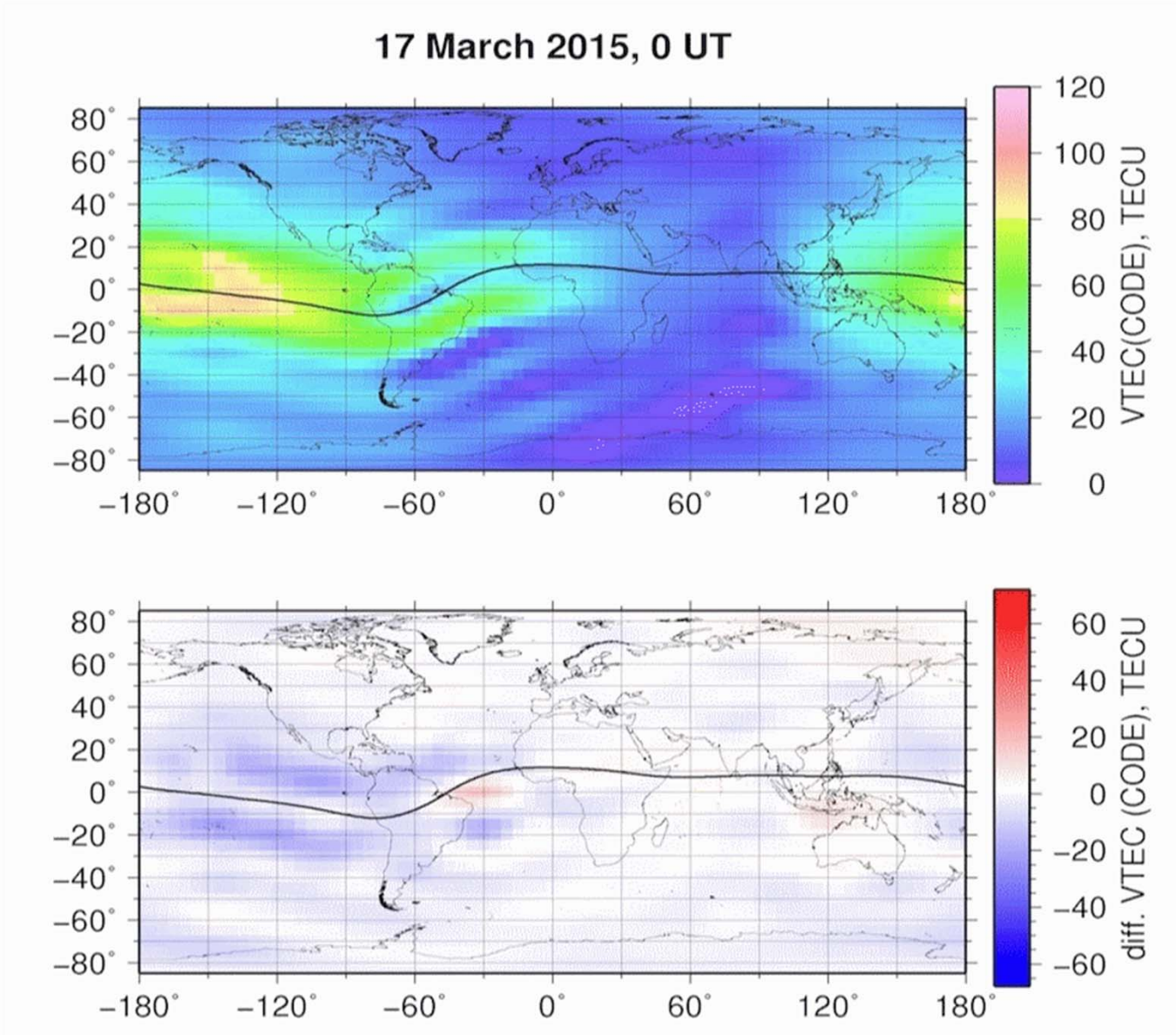
SSC at 04:45UT on 17 March

2 successive storms

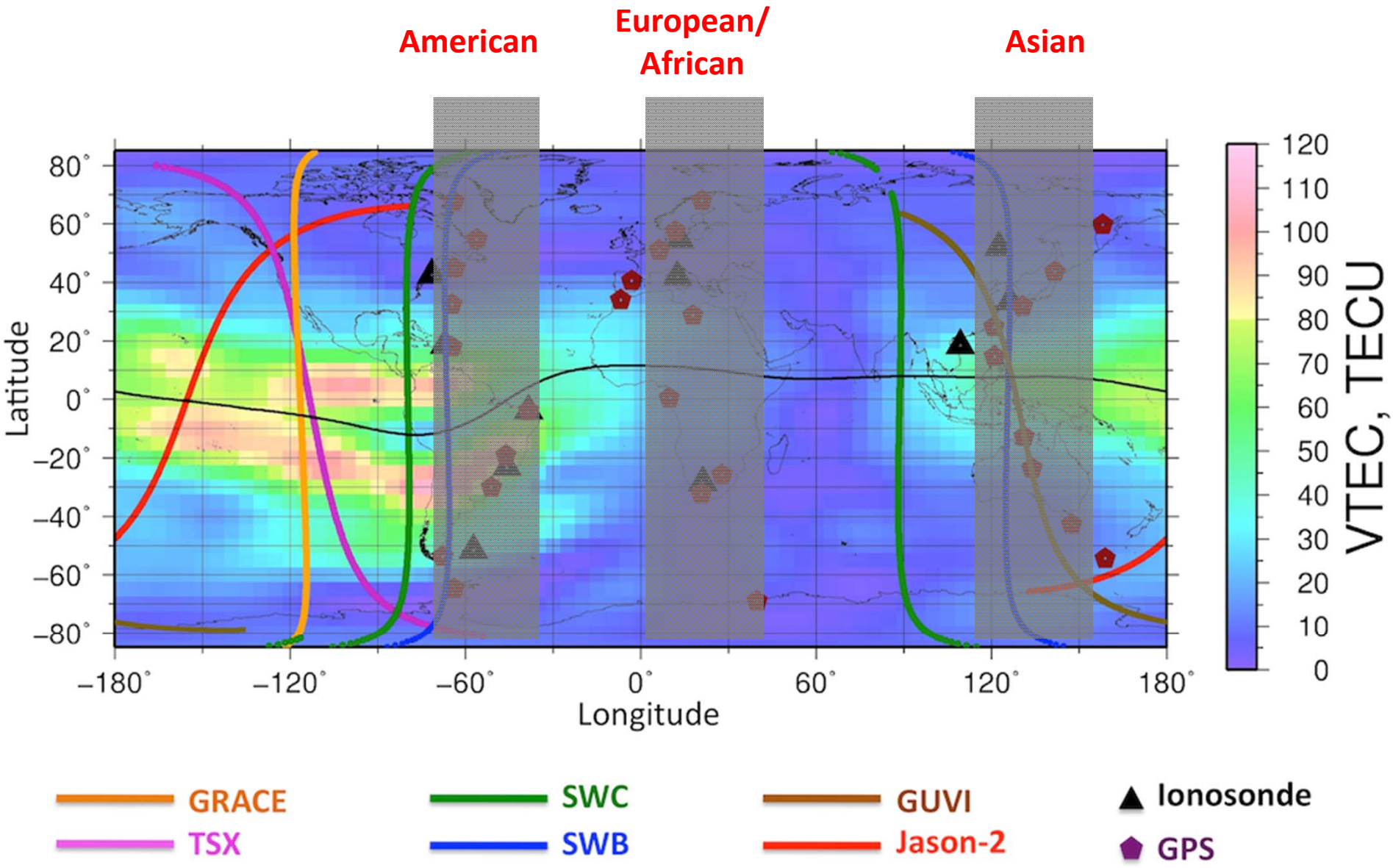
SYM-H min = -233nT

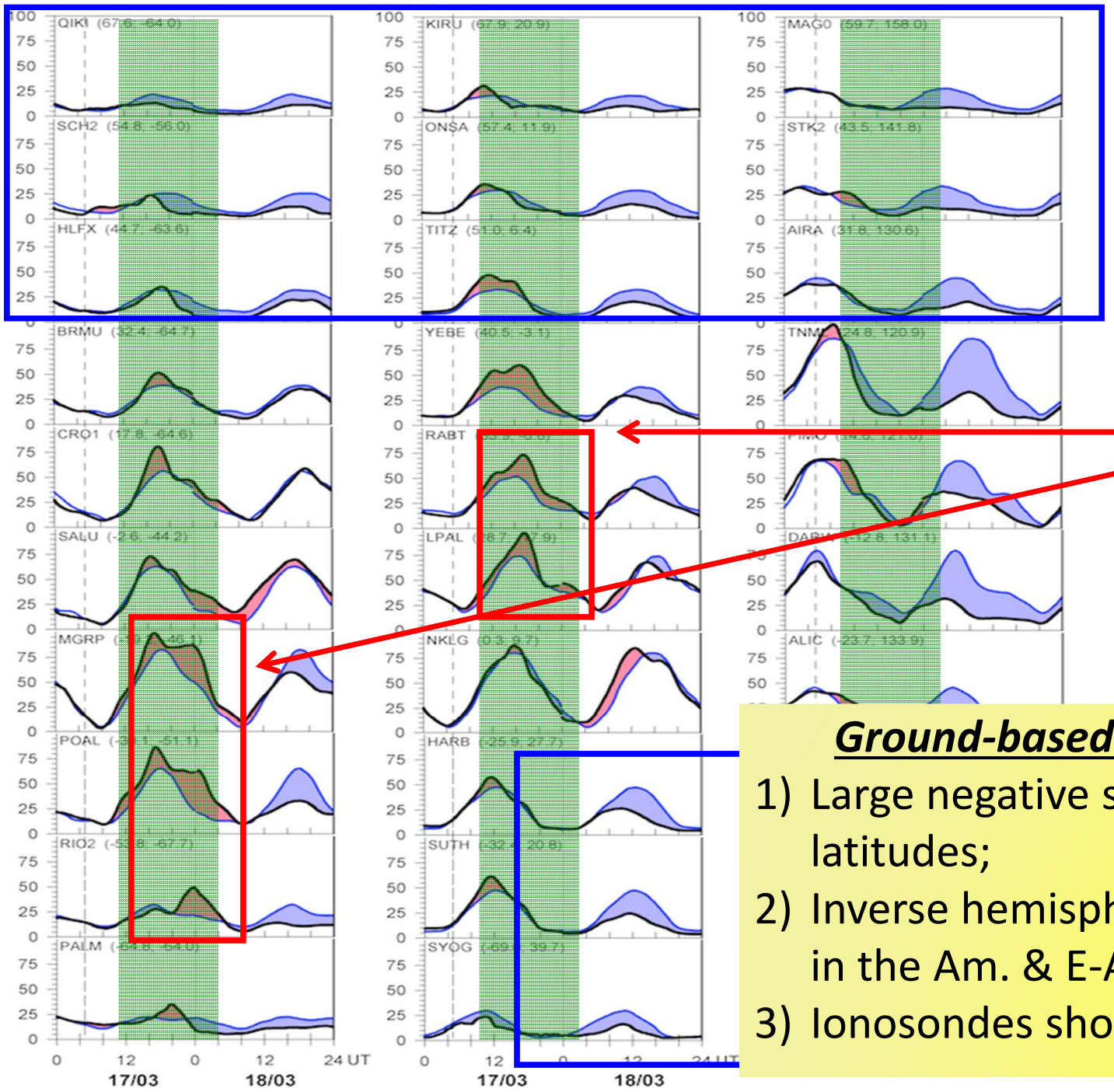
The largest storm in the 24th solar cycle !!!

Ground-Based Observations: GPS-VTEC GIMs



Ground-Based Observations: GPS-VTEC

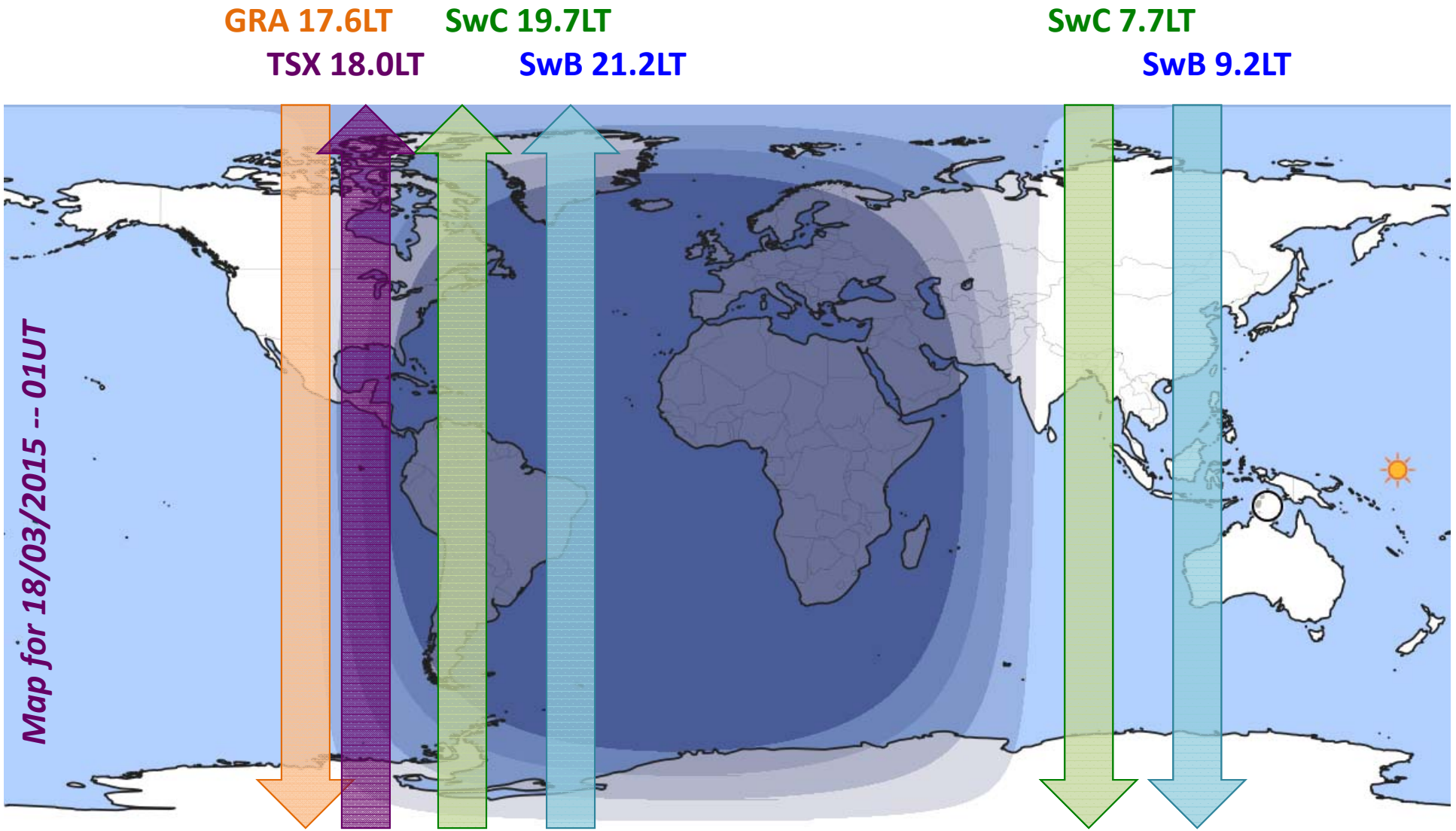




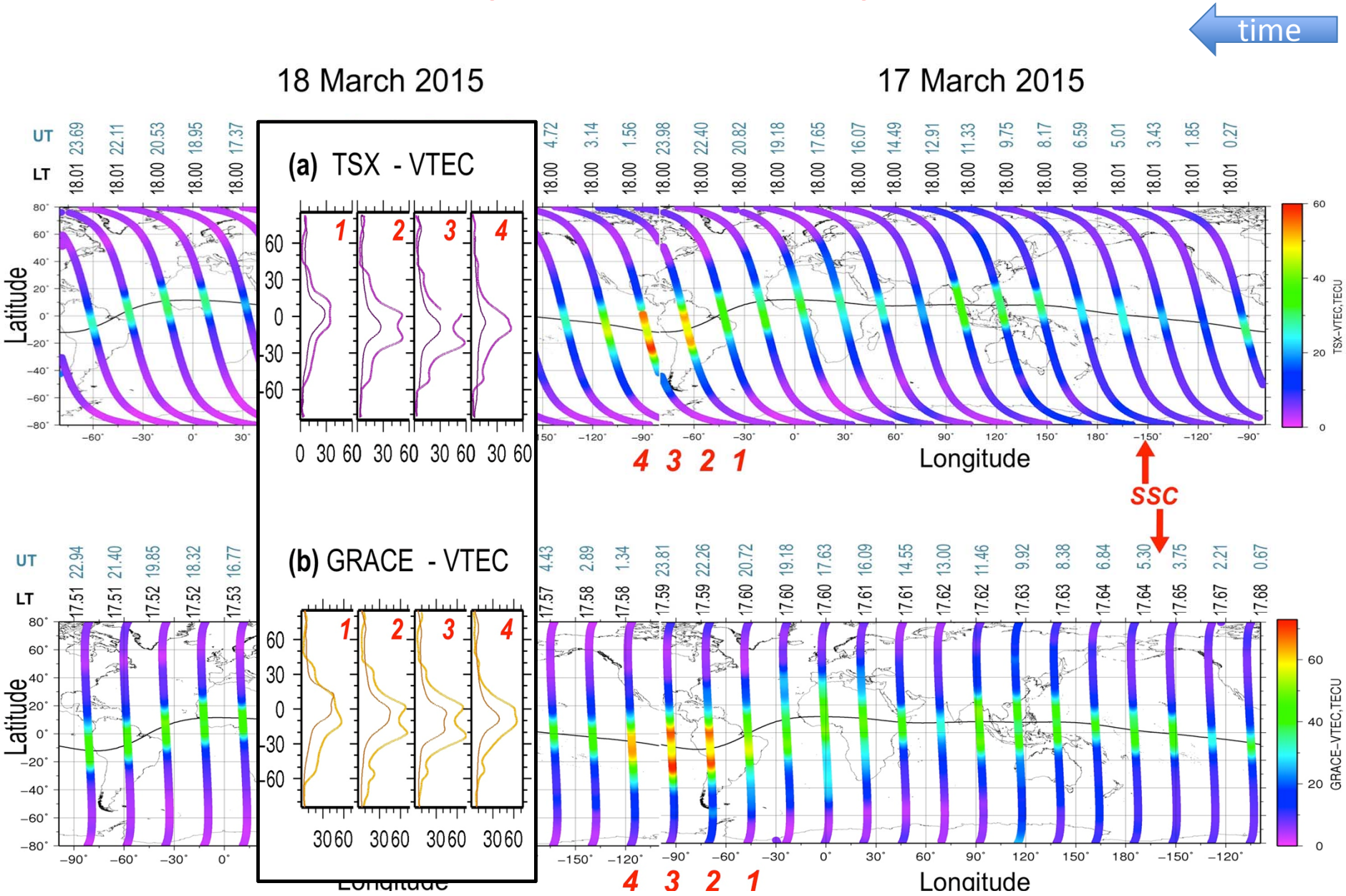
Ground-based observations:

1) Large negative storm at high-latitudes;
2) Inverse hemispheric asymmetries in the Am. & E-A sectors
3) Ionosondes show similar results

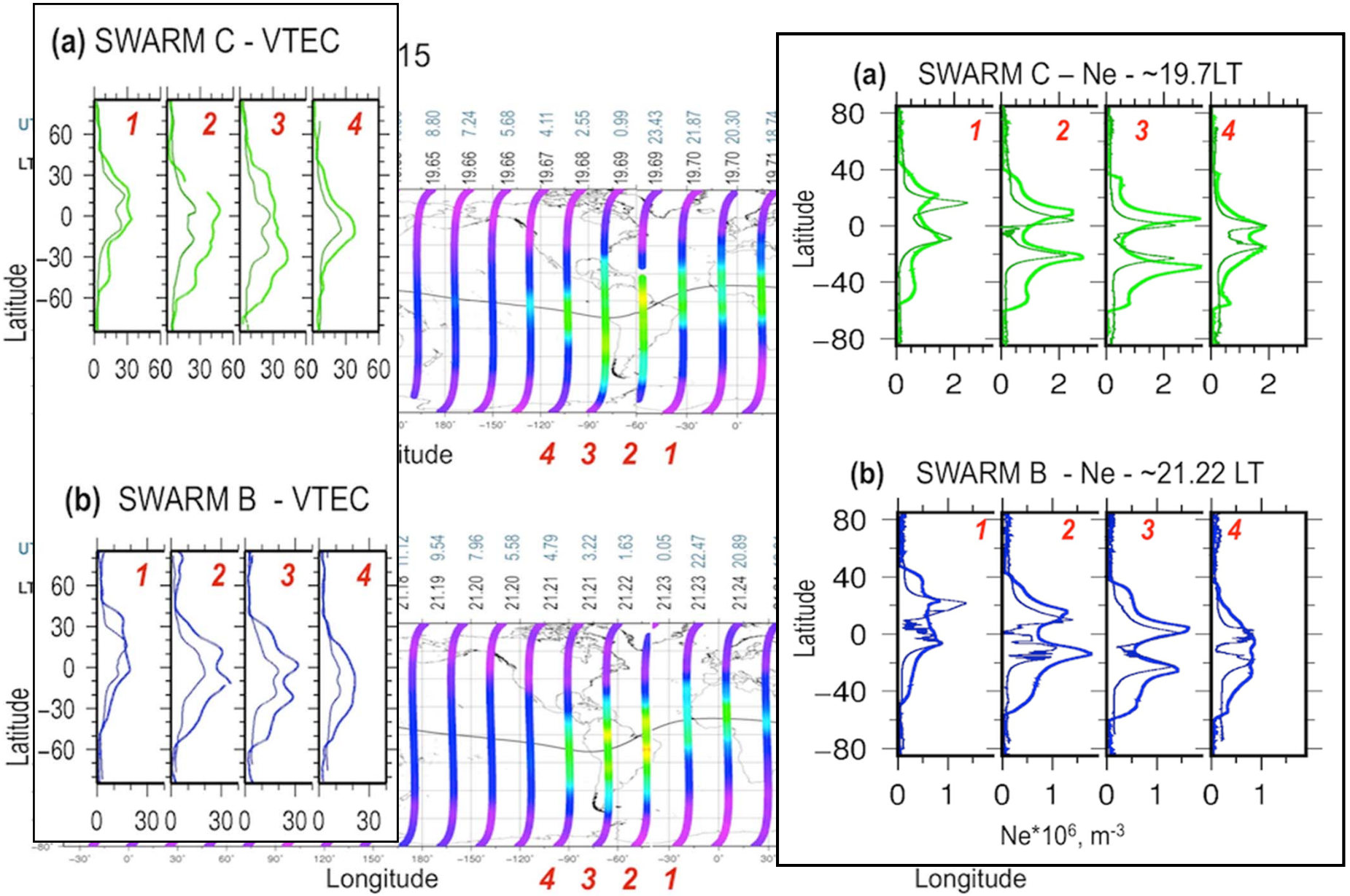
Satellite Observations (topside):



Evening (before sunset) sector: TSX & GRACE (18.0 & ~17.6LT)



Dusk & post-sunset sector: Swarm C & B (~19.7 & ~21.2LT)



SUMMARY

Ground-based + satellite observations:

At high latitudes: negative storm in ~all longitudinal sectors;
+ in Asian sector – reached low lats

At mid-latitudes: inverse hemispheric asymmetries in American & European sectors

At low latitudes: drastic effects over the Eastern Pacific region

Astafyeva et al., JGR, 2015

erc

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