

# The nightside ionosphere of Mars

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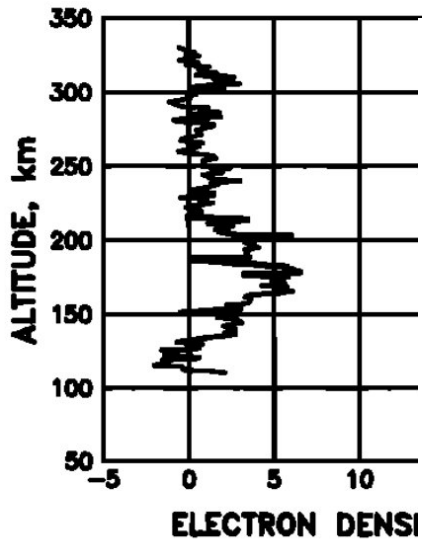
MEX/VEX Radio Science Meeting  
2010.03.18-19  
Bonn, Germany

# Observations

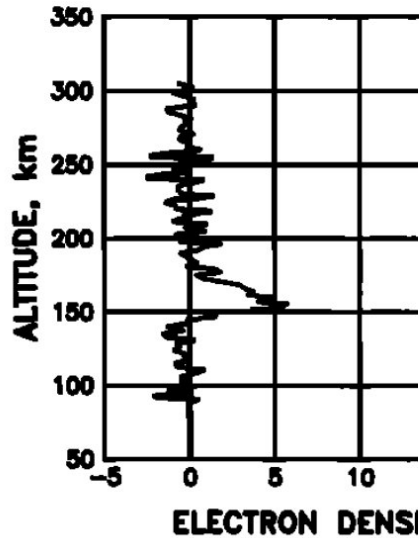
- Pre-MGS radio occultations (Viking, Mariner 9)
- MGS radio occultations
  - No profiles reported for  $SZA > 90$
- MARSIS AIS mode ( $N_{max}$ )
- MARSIS SS mode (TEC)
  
- MARSIS has recently shown that nightside plasma exists, but is highly variable
- What do MEX MaRS radio occultations show?

# Zhang et al. (1990) JGR, 95, 17095-17102

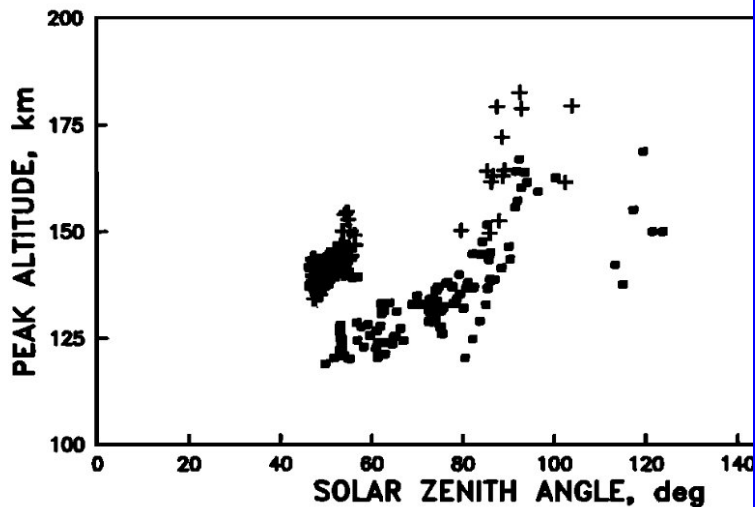
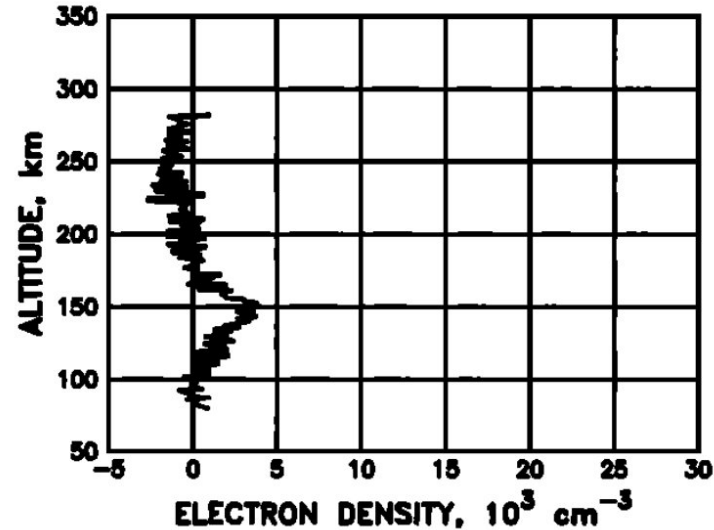
V2 216, SZA=104



V1 539, SZA=117

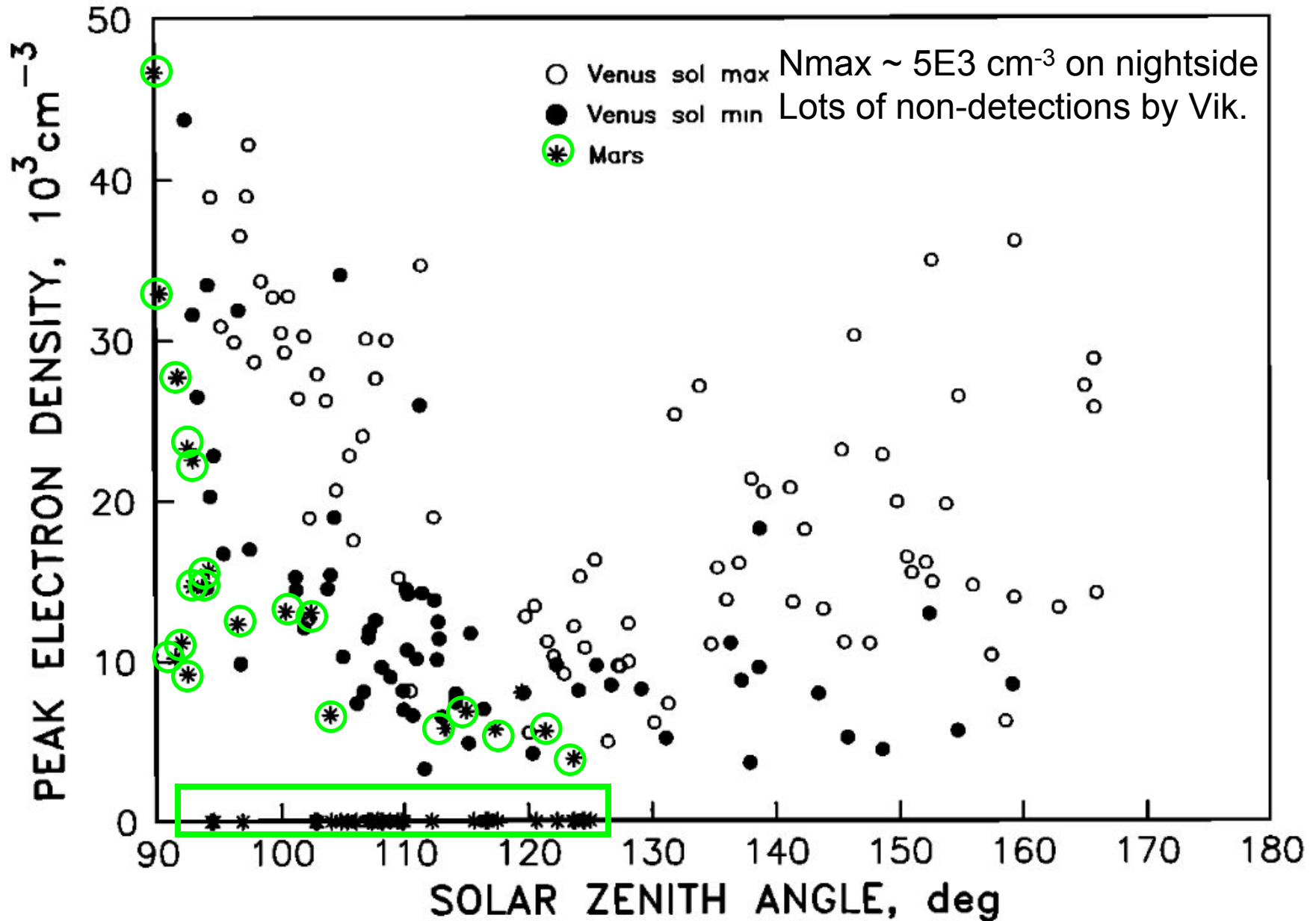


V1 374, SZA=124



Nightside peak altitude doesn't depend on SZA  
Nightside peak altitude is highly variable

# More Zhang



# MARSIS AIS mode

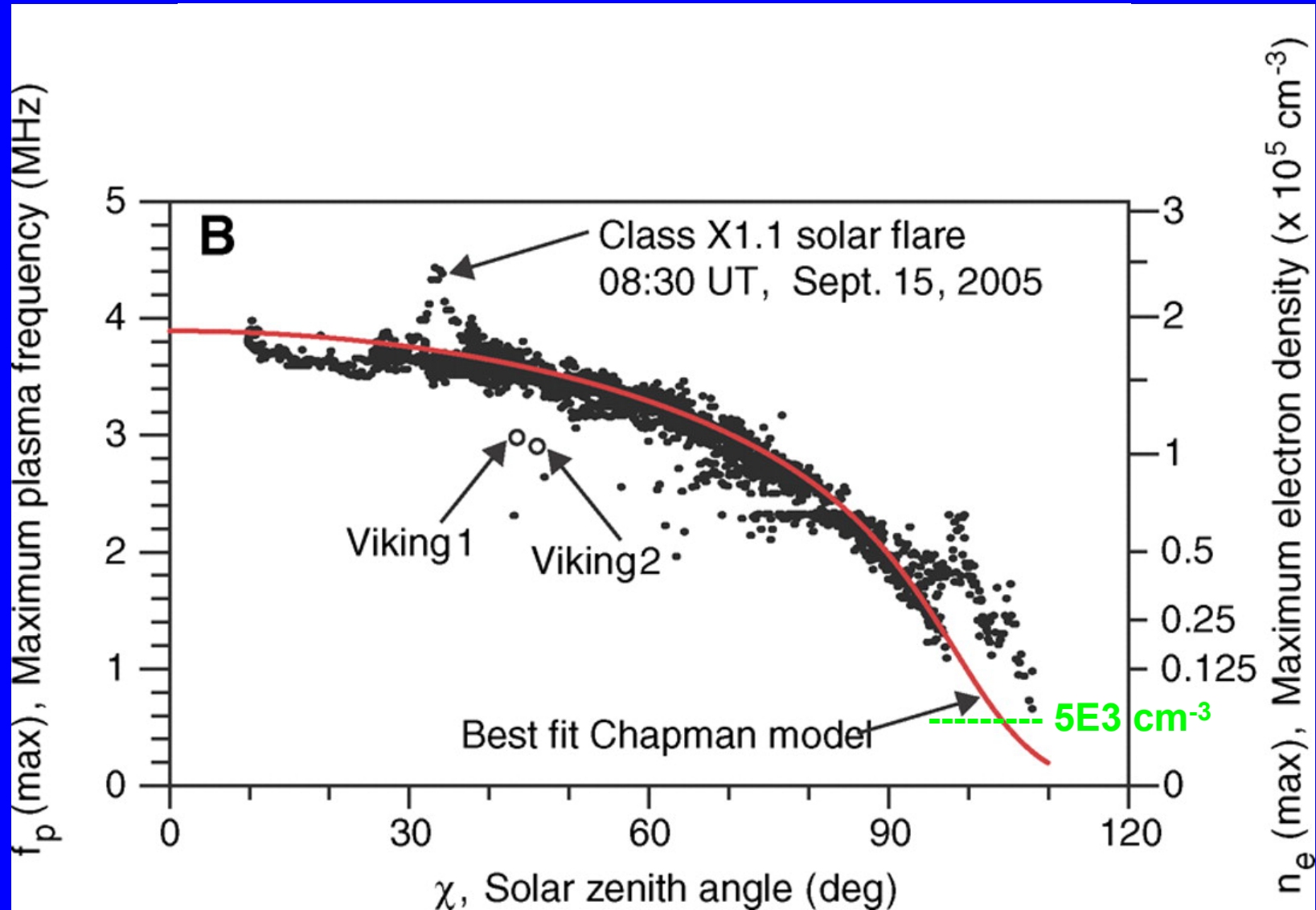


Fig 3 of Gurnett et al. (2005)

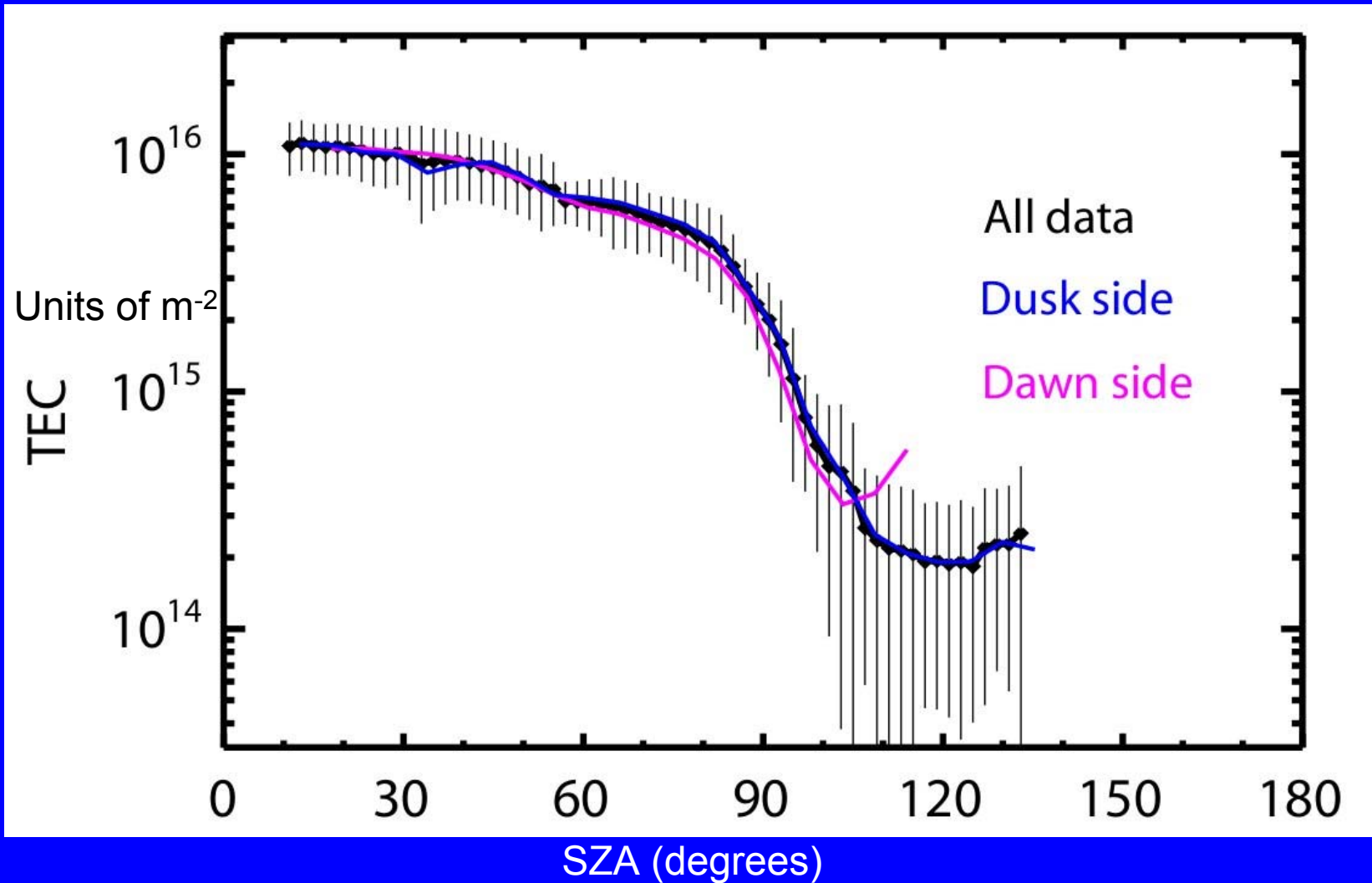
Variability on the nightside again

What is smallest Nm detectable by MARSIS?

Any increase in data volume since 2005?

Why no data beyond SZA=110?

# MARSIS SS mode



Lillis et al. (unpublished)

If TEC is proportional to  $N_{max}$ , then decrease in TEC from  $1E16$  to  $2E14$  corresponds to decrease in  $N_{max}$  from  $2E5 \text{ cm}^{-3}$  to  $4E3 \text{ cm}^{-3}$

# Consistent story so far?

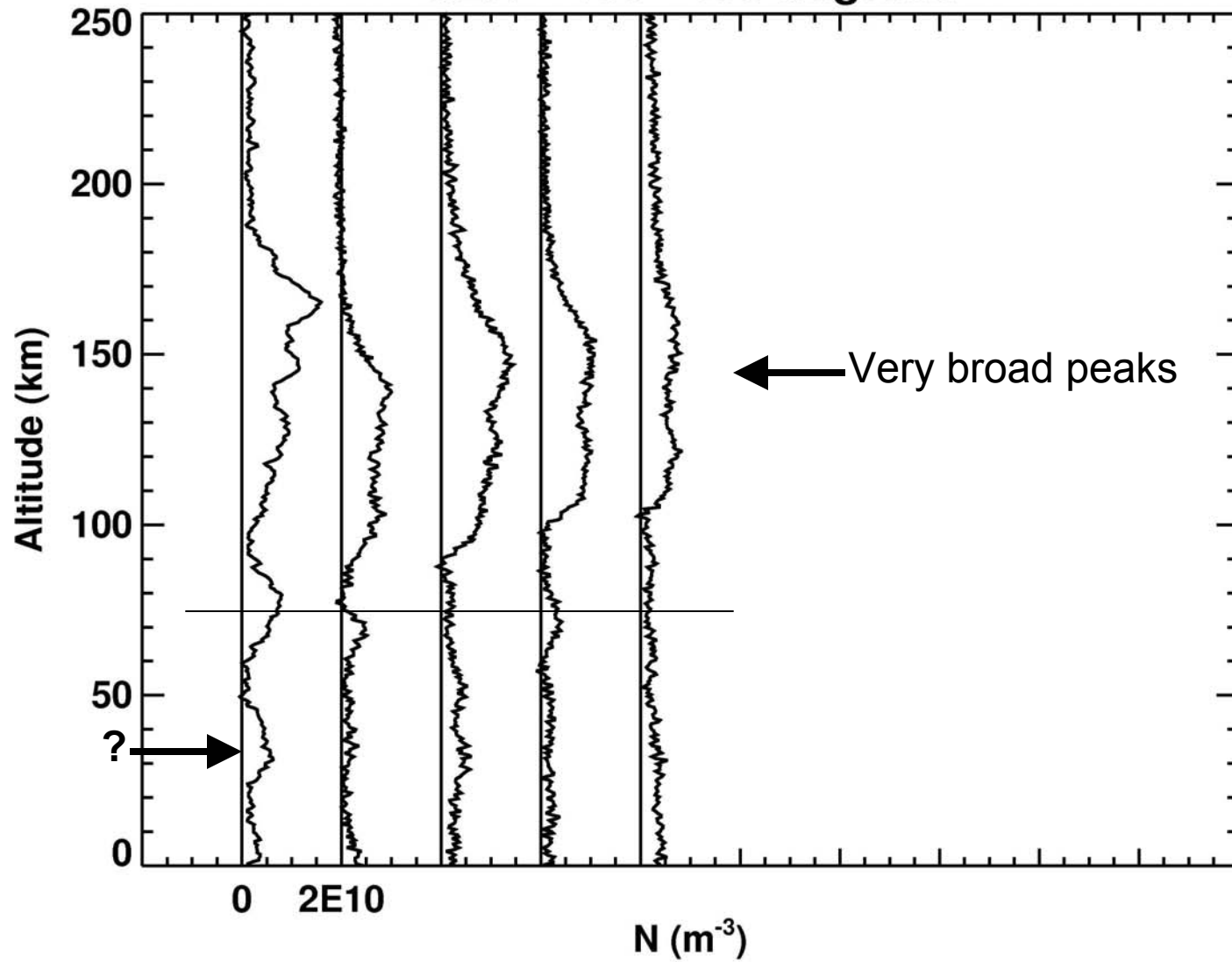
- Variable nightside (all)
- SZA = 100,  $N_{\max} \sim 1E4 \text{ cm}^{-3}$  (Vik, SS)
- SZA > 110,  $N_{\max} \sim 5E3 \text{ cm}^{-3}$  (Vik, SS)
- MARSIS AIS mode generally has higher plasma densities than these
- Or is it wrong to interpret MARSIS SS mode data by TEC proportional to  $N_{\max}$ ?

# MEX MaRS nightside data

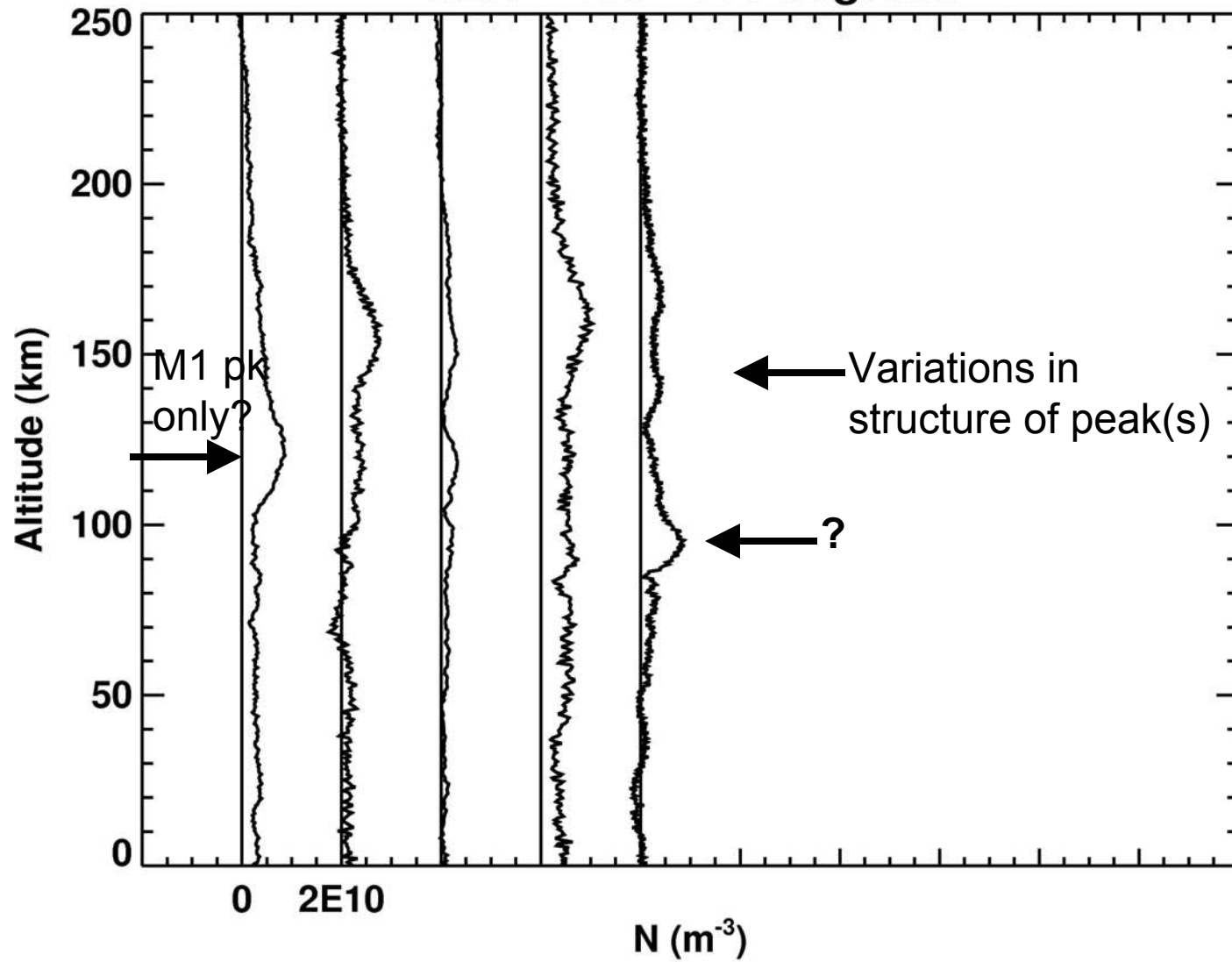
- Focus on 39 DIX profiles from August-September 2005 at SZA=100-123 degrees
- Other nightside profiles exist, but this set had good data quality
- Nmax, zmax, shape of profile



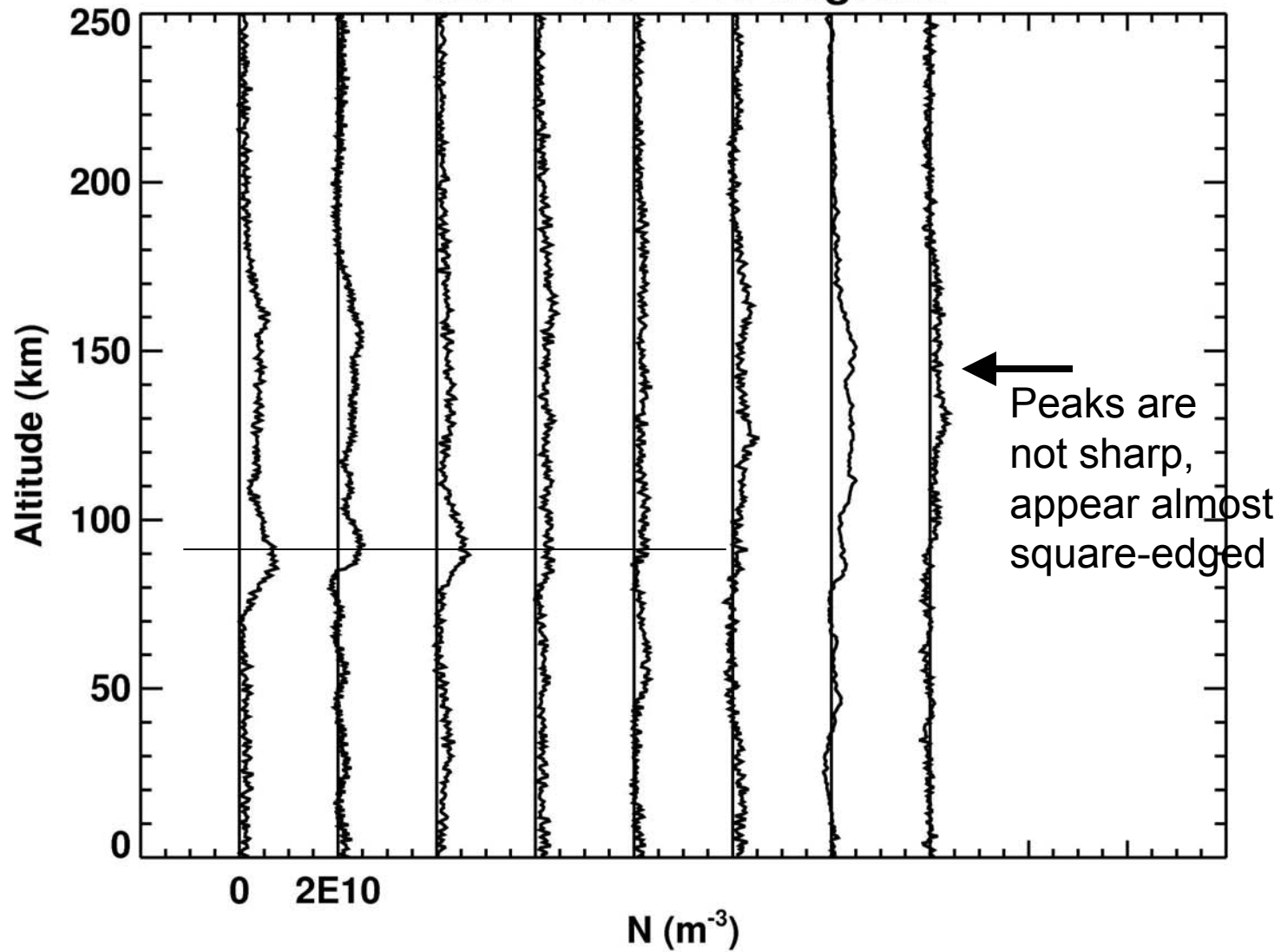
SZA = 100 - 105 degrees



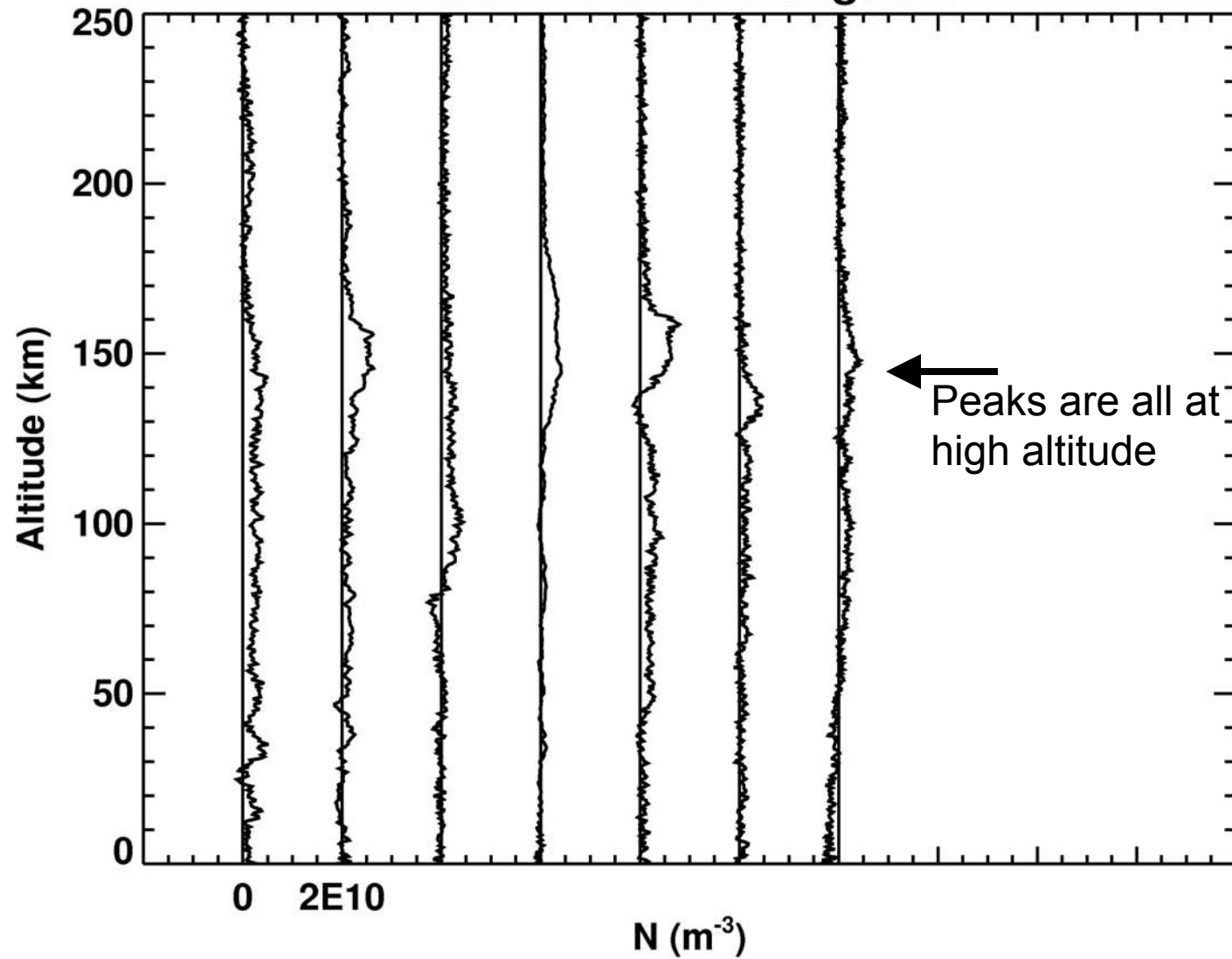
SZA = 105 - 110 degrees



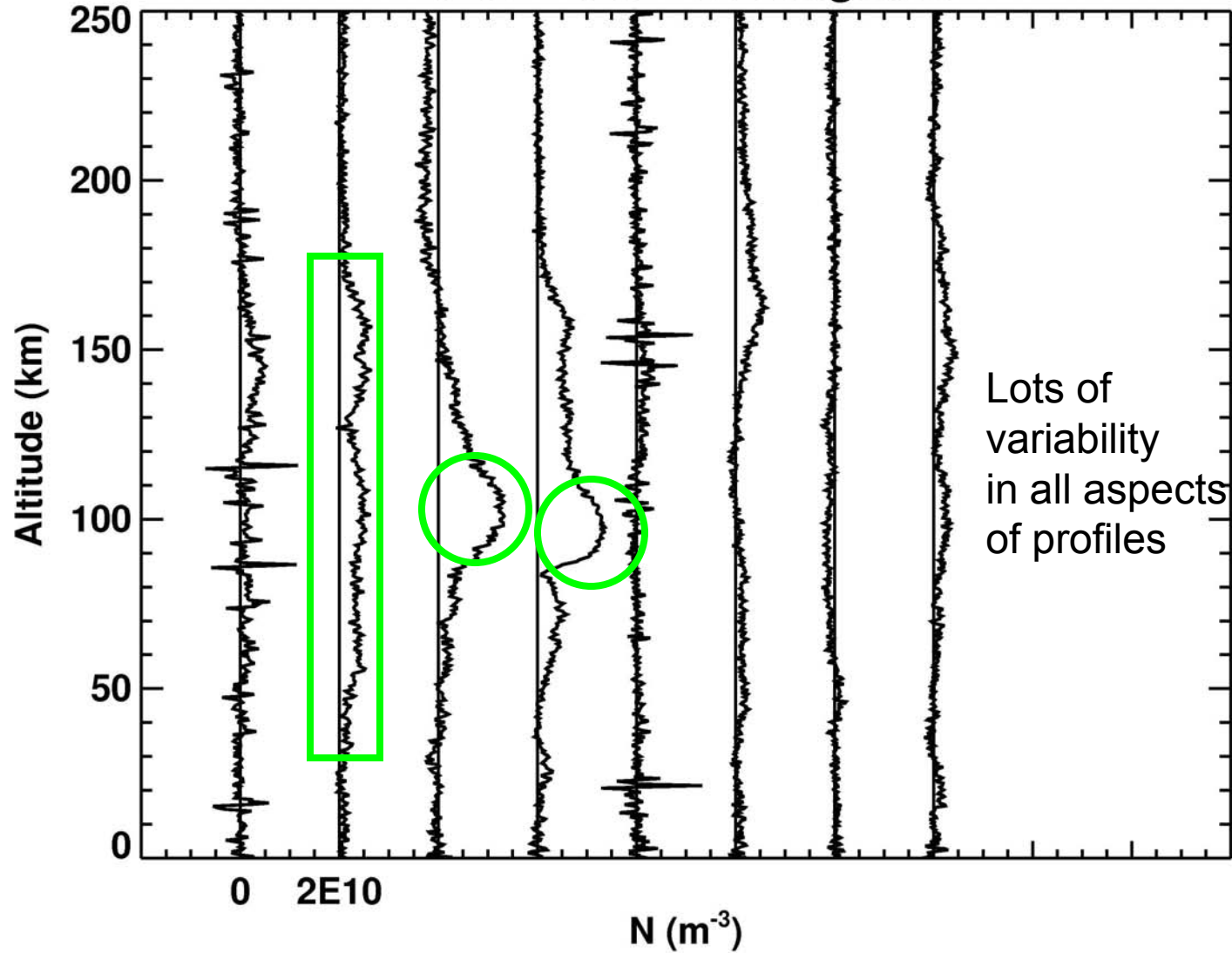
SZA = 110 - 115 degrees



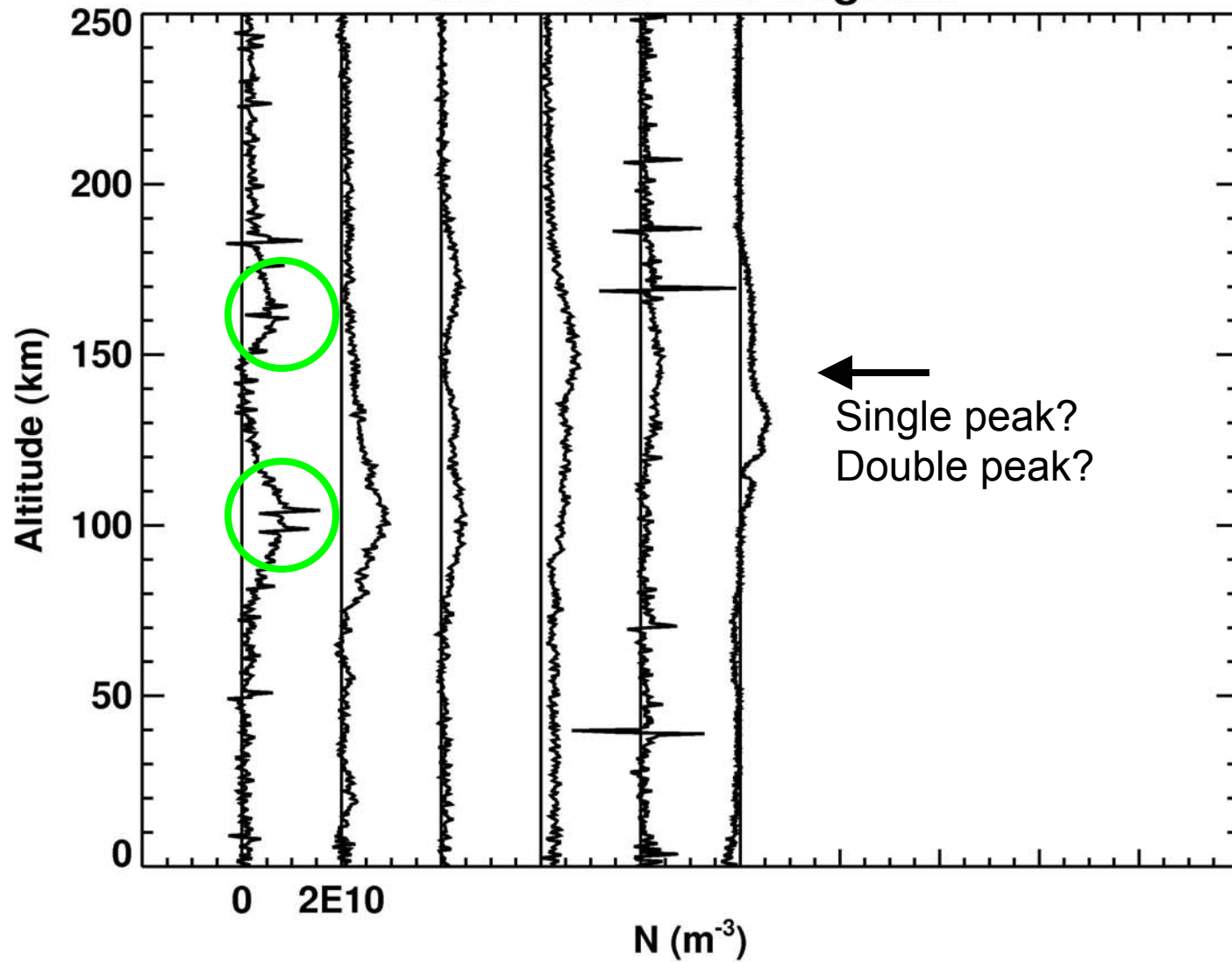
SZA = 115 - 120 degrees



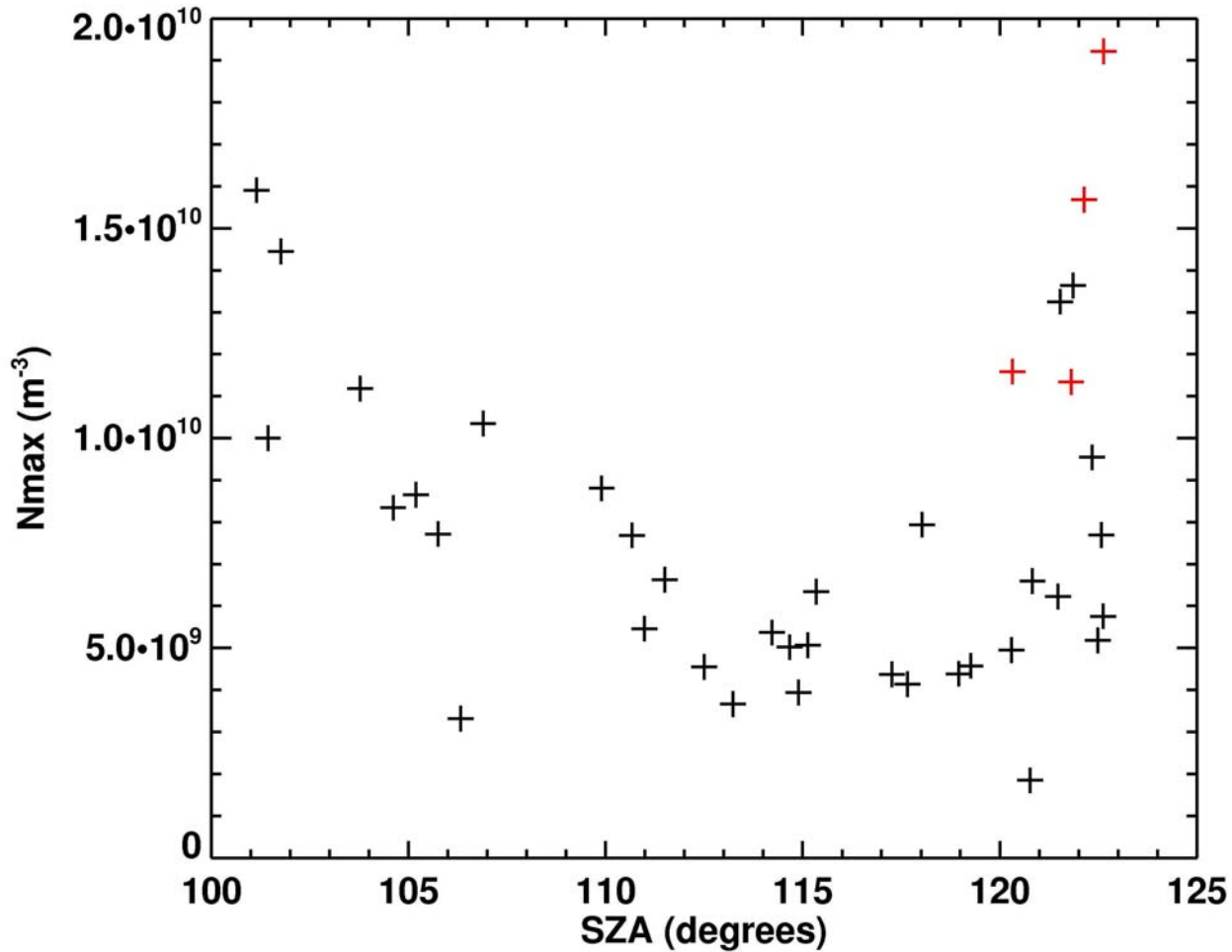
SZA = 120 - 122 degrees



SZA = 122 - 123 degrees



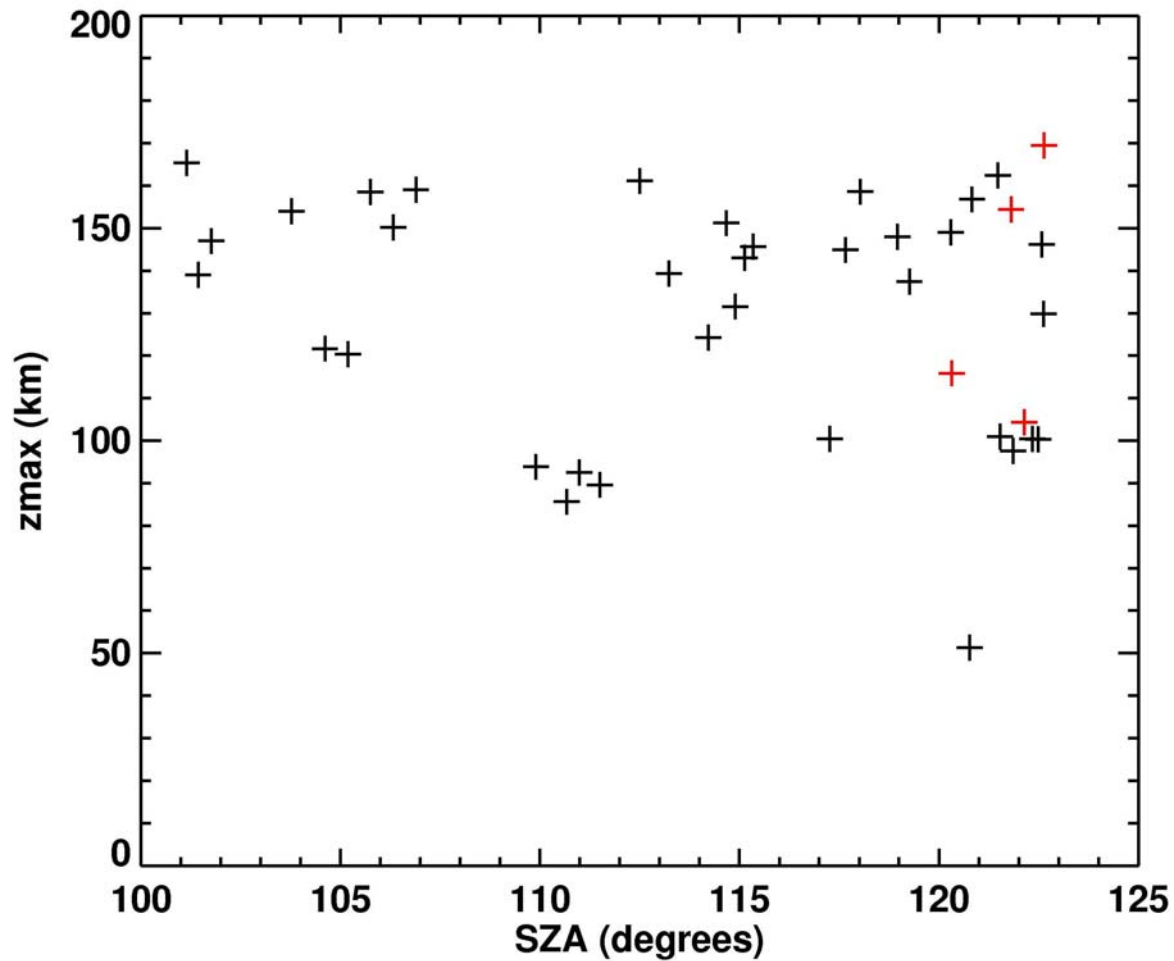
# Nmax vs SZA



Red points are "spiky" profiles

Nmax has minimum at SZA=115 degrees

# Zmax vs SZA



Red points are "spiky" profiles

Trends in Zmax are a mess



# Conclusions

- MEX profiles are derived assuming spherical symmetry...
- Even if that is invalid, they still contain information
- GRL article on shapes of profiles, trends in  $N_{\max}$  and  $Z_{\max}$ , consistency with other datasets?