



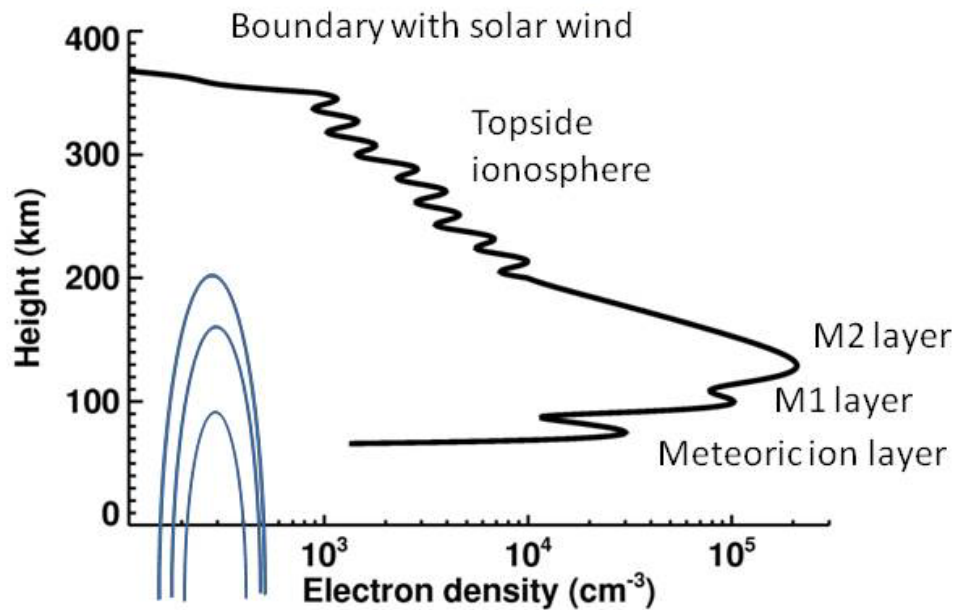
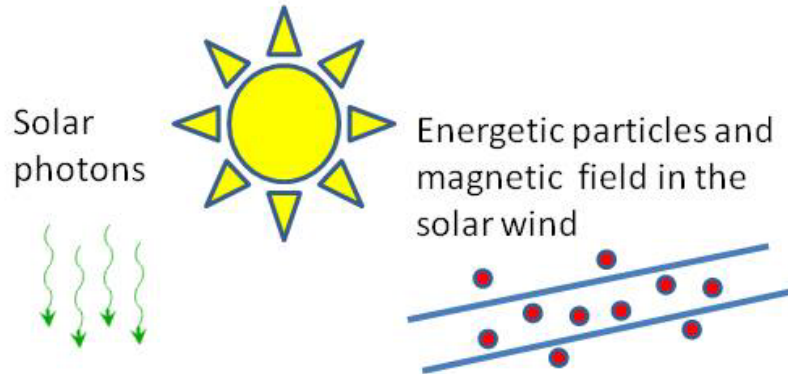
Variability of the Martian upper ionosphere and factors controlling this variability

E. DUBININ¹, M. FRAENZ¹, M. PÄTZOLD², J. McFADDEN³, L. ANDERSSON⁷, J. HALEKAS⁴, J. CONNERNEY⁵, D. ANDREWS⁶, F. EPARVIER⁷, P. MAHAFFY⁵, O. VAISBERG⁸, L. ZELENYI⁸

¹ Max-Planck-Institute for Solar System Research, Germany, ² Rhenish Institute for Environmental Research, Germany, ³ University of California, Berkeley, United States, ⁴ University of Iowa, United States, ⁵ NASA Goddard Space Flight Center, United States, ⁶ Swedish Institute of Space Physics, Sweden, ⁷ Laboratory for Atmospheric, and Space Physics, University of Colorado, Boulder, CO 80303, USA, ⁸ Space Research Institute, Moscow, Russia



MAX-PLANCK-GESELLSCHAFT



Crustal magnetic fields

MEX:

MaRS : ne-Alt

MARSIS : ne-Alt, ne, B

MAVEN:

NGIMS : ni

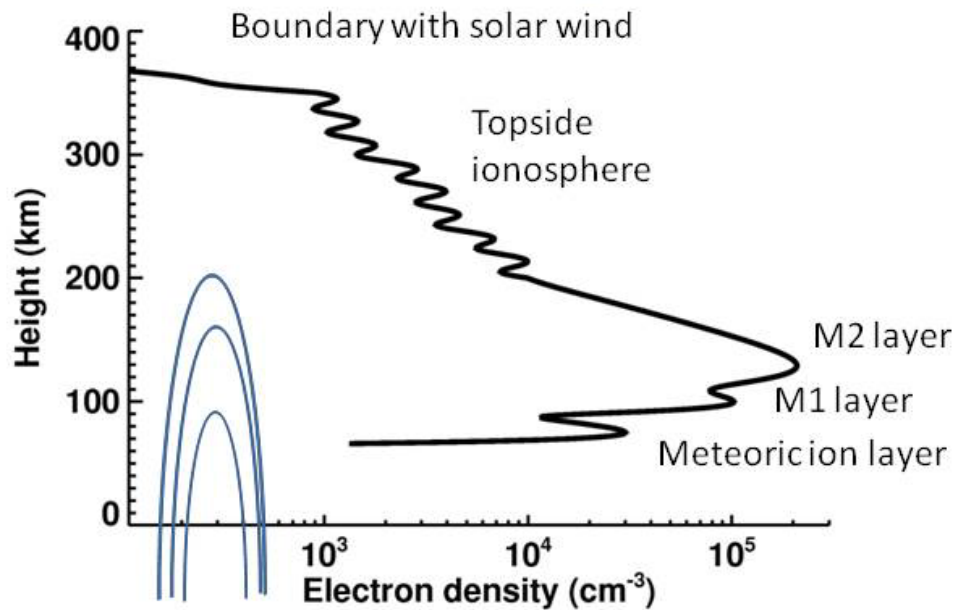
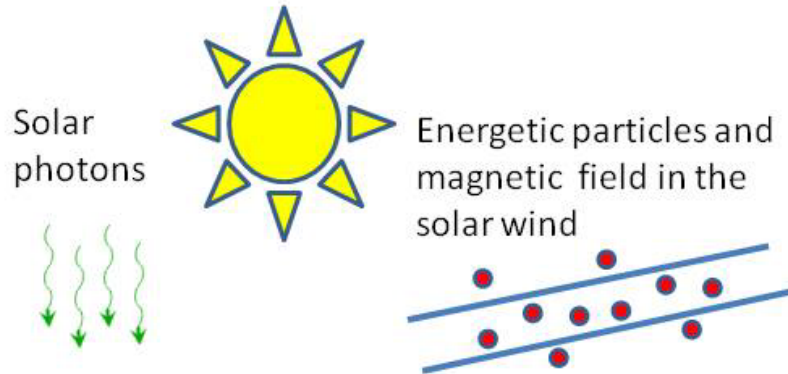
LPW : ne, Ti, Te

STATIC : ni, Vi, Ti

courtesy of P. Withers



MAX-PLANCK-GESELLSCHAFT



MEX:

MaRS : ne-Alt

MARSIS : ne-Alt, ne, B, TEC

MAVEN:

NGIMS : ni

LPW : ne, Ti, Te

STATIC : ni, Vi, Ti

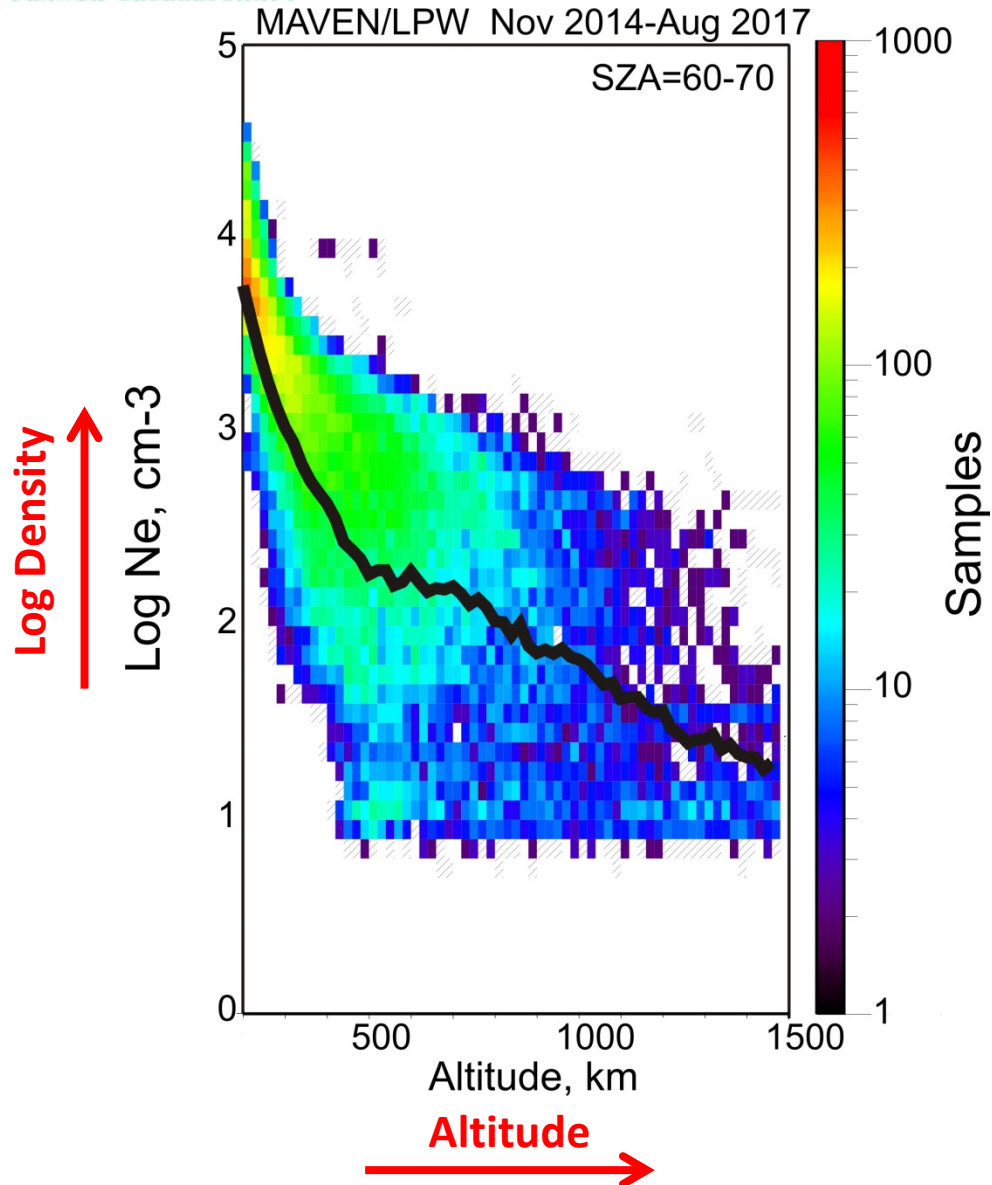
MAG : B

SWIA : SW

LPW/EUV : EUV



MAX-PLANCK-GESELLSCHAFT



- EUV
- SW
- IMF
- Crust. Field

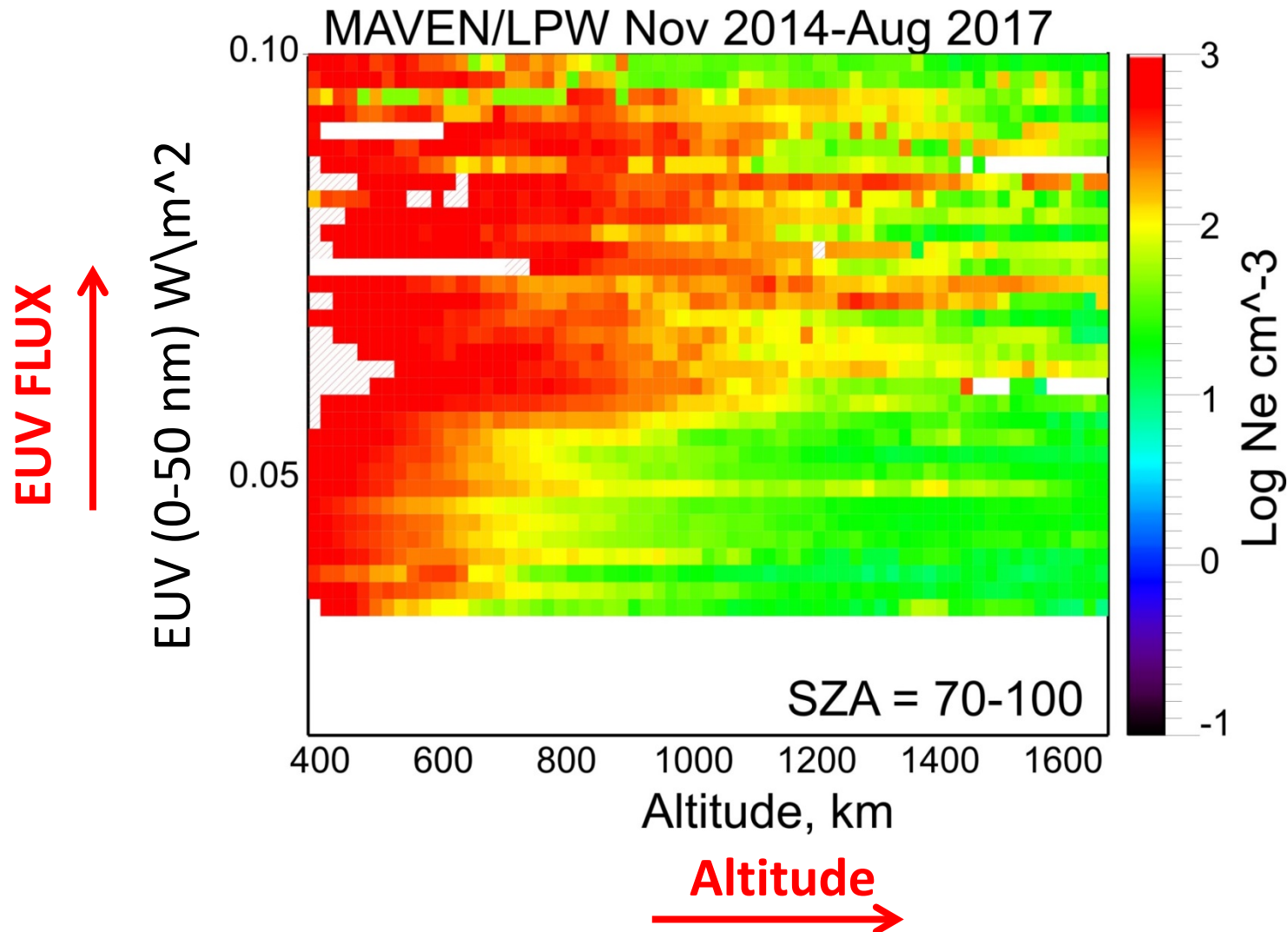


MAX-PLANCK-GESELLSCHAFT



VARIABILITY WITH EUV

LPW



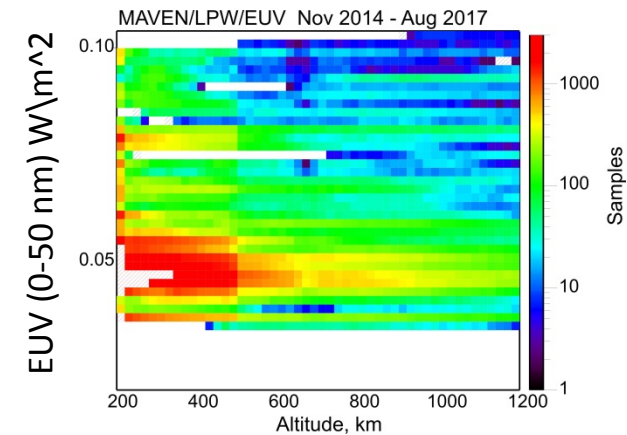
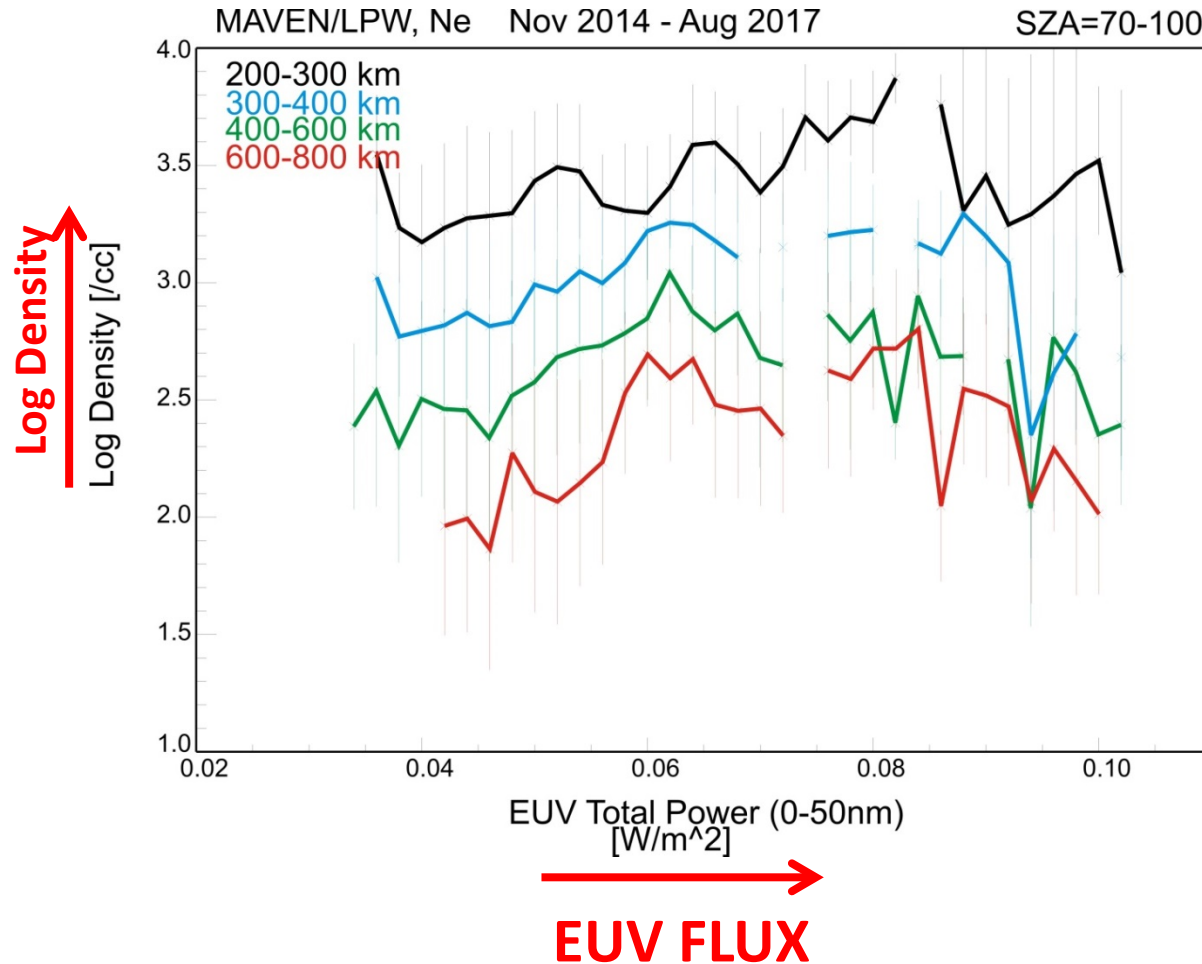


MAX-PLANCK-GESELLSCHAFT



VARIABILITY WITH EUV

LPW





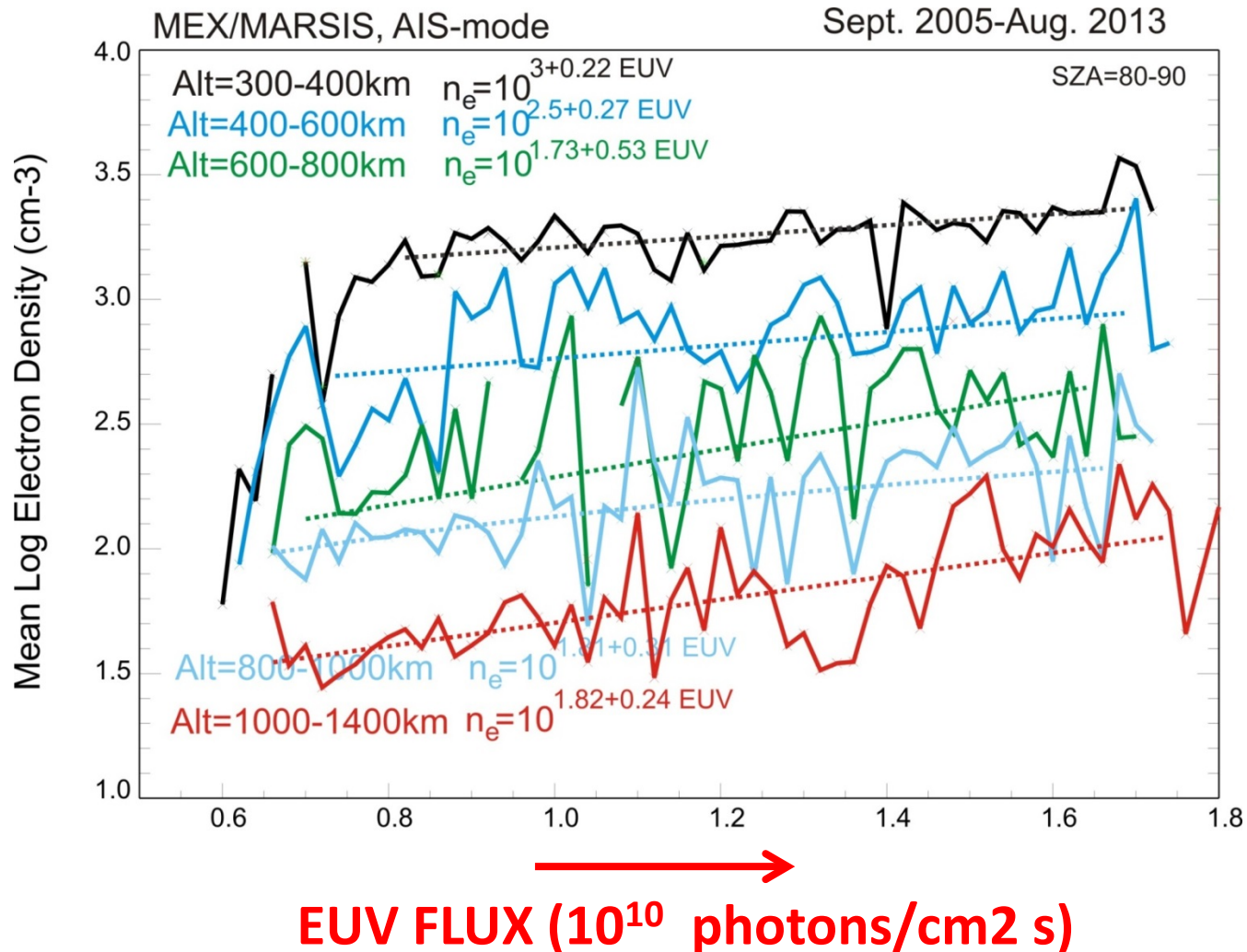
MAX-PLANCK-GESELLSCHAFT



VARIABILITY WITH EUV

MARSIS

Log Density ↑





MAX-PLANCK-GESELLSCHAFT

O⁺ FLUXES IN THE TAIL AS FUNCTION OF SOLAR EUV



EUV



EUV=0.04-0.05W/m²

EUV=0.045-0.06W/m²

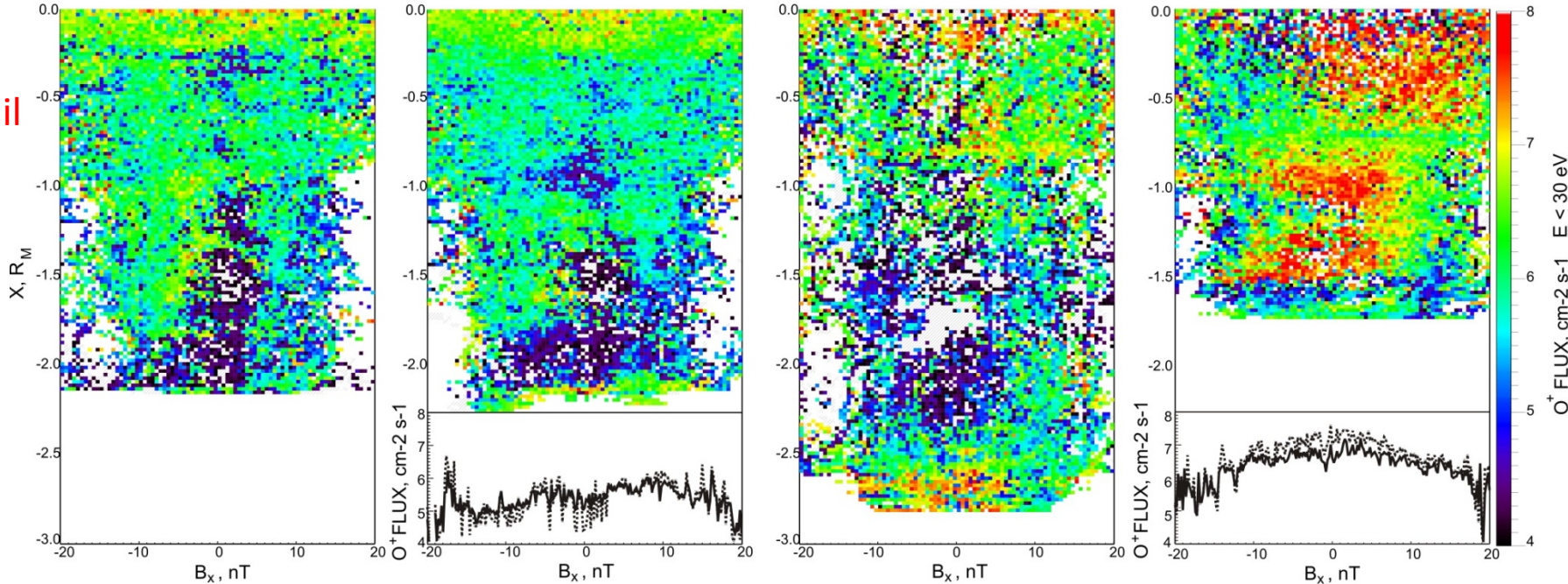
EUV=0.07-0.08W/m²

EUV=0.08-0.1W/m²

To tail



X, R_M



B_x, nT

B_x, nT

B_x, nT

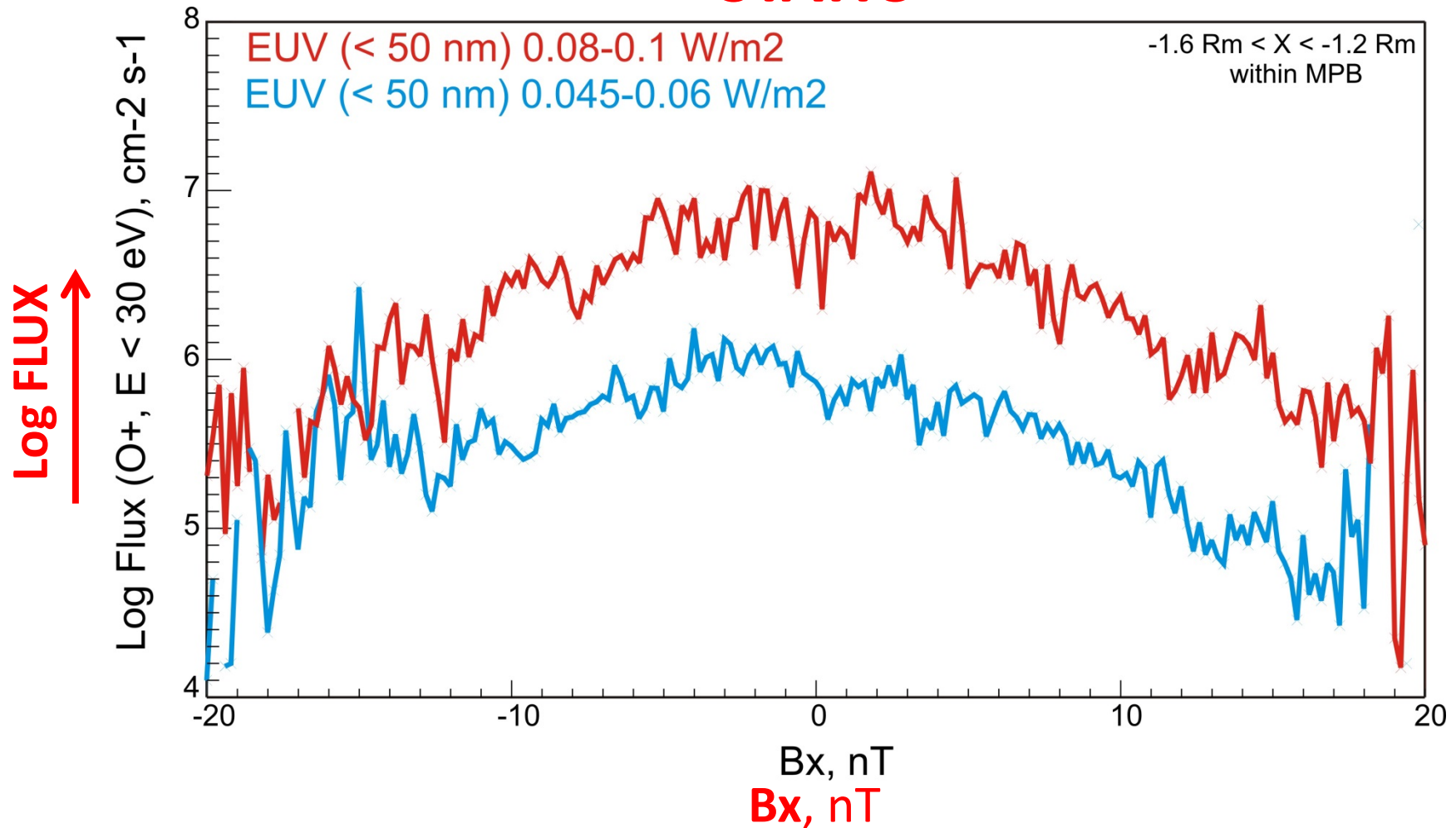
B_x, nT



MAX-PLANCK-GESELLSCHAFT



EFFECTS OF EUV VARIABILITY ON ION ESCAPE STATIC



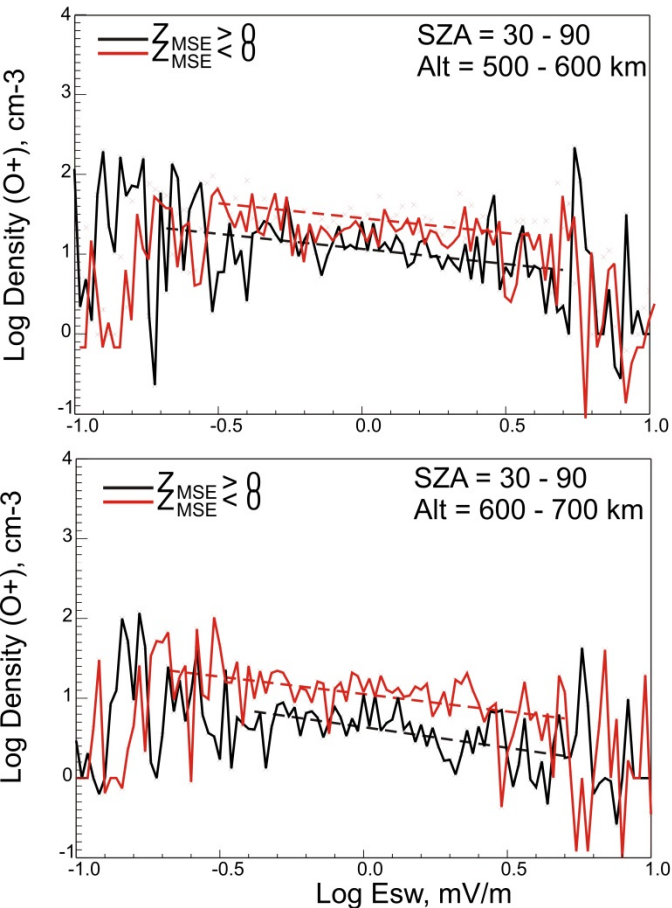


MAX-PLANCK-GESELLSCHAFT



VARIABILITY WITH SW

O⁺ Density



E_{sw}

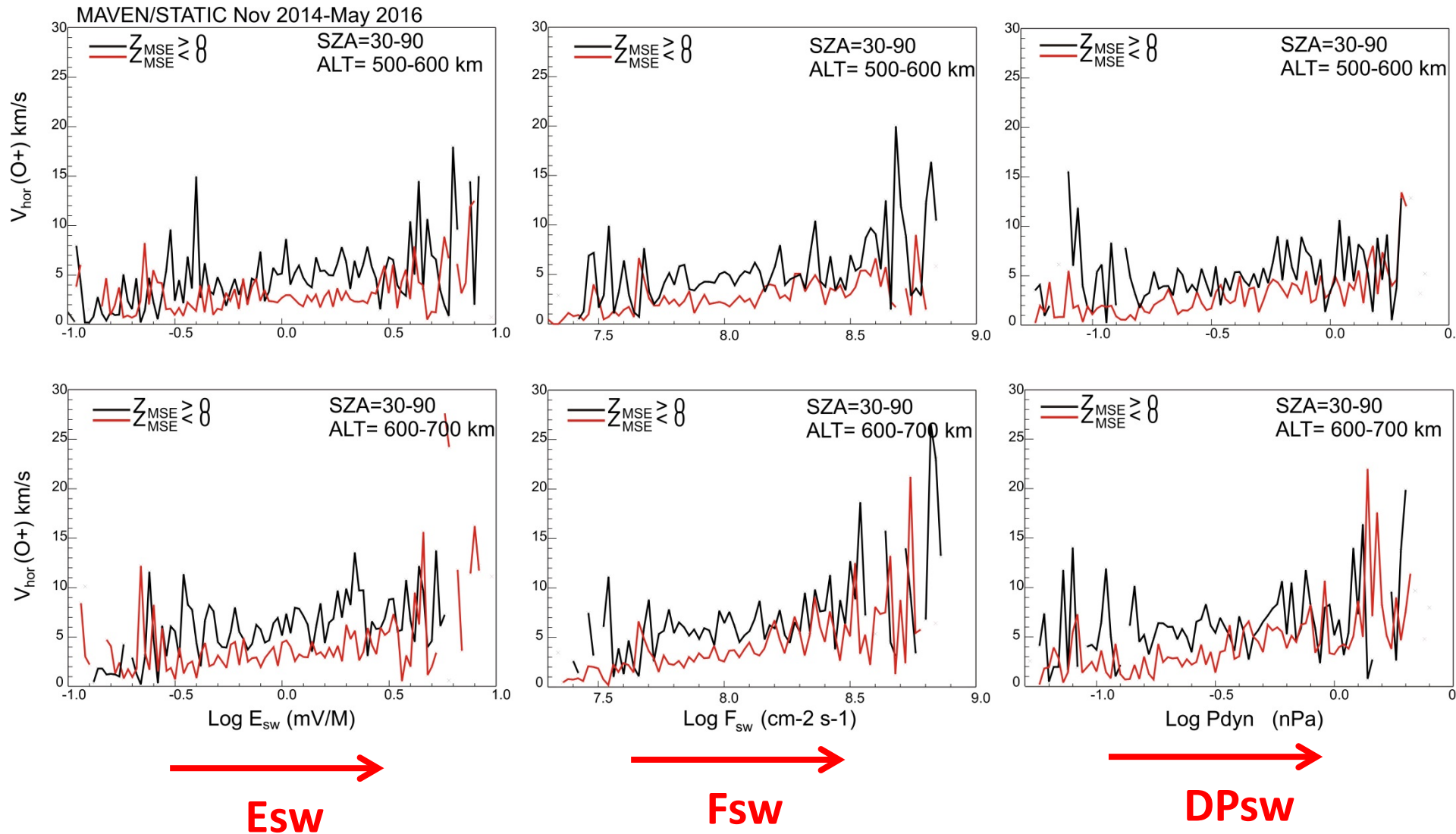


MAX-PLANCK-GESELLSCHAFT



VARIABILITY WITH SW

O⁺ Velocity



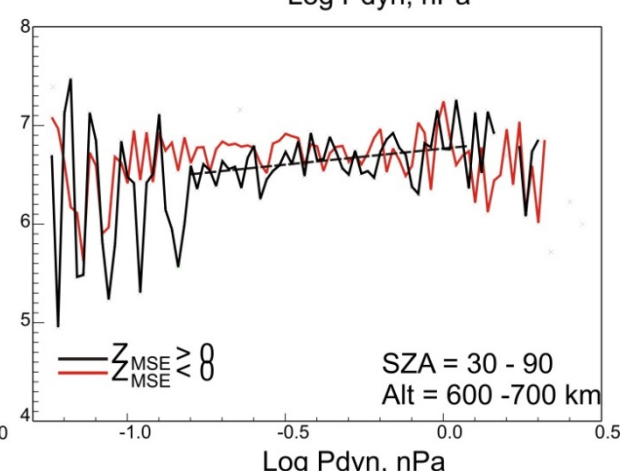
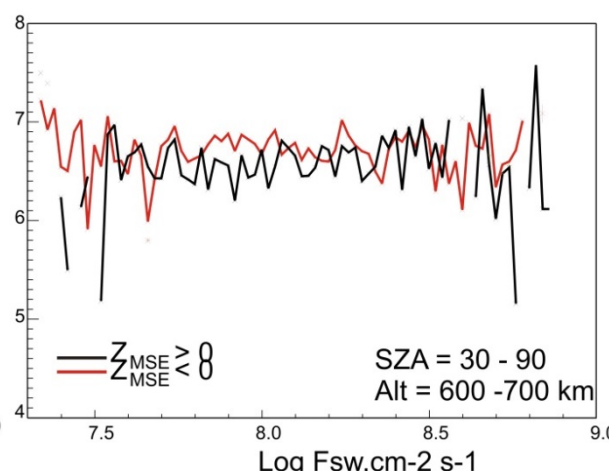
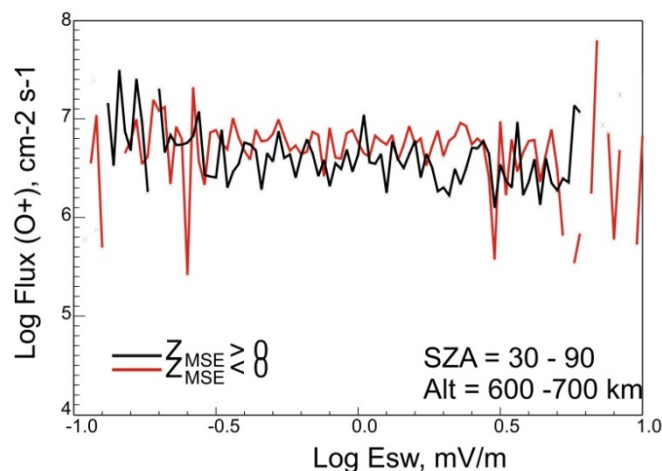
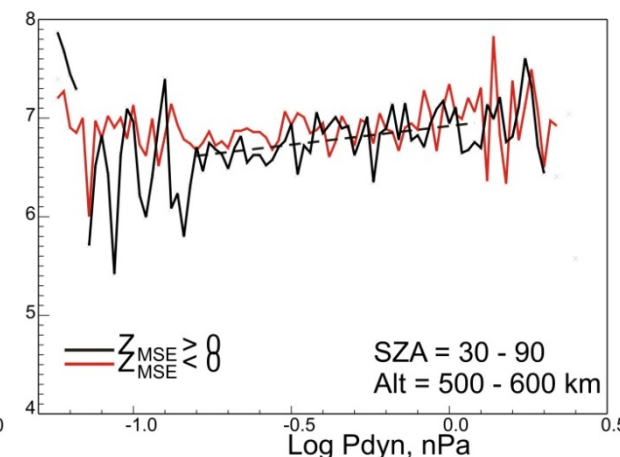
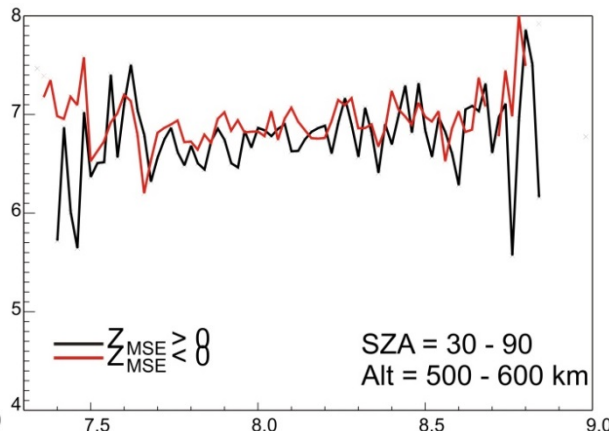
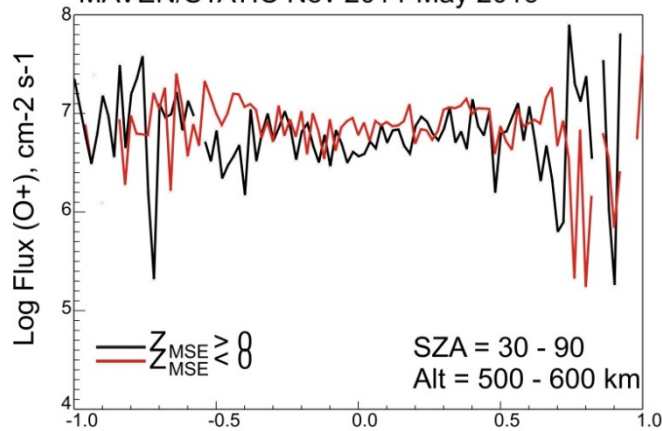


MAX-PLANCK-GESELLSCHAFT



EFFECTS OF SW VARIABILITY ON ION ESCAPE

MAVEN/STATIC Nov 2014-May 2016



Esw



Fsw



DPsw



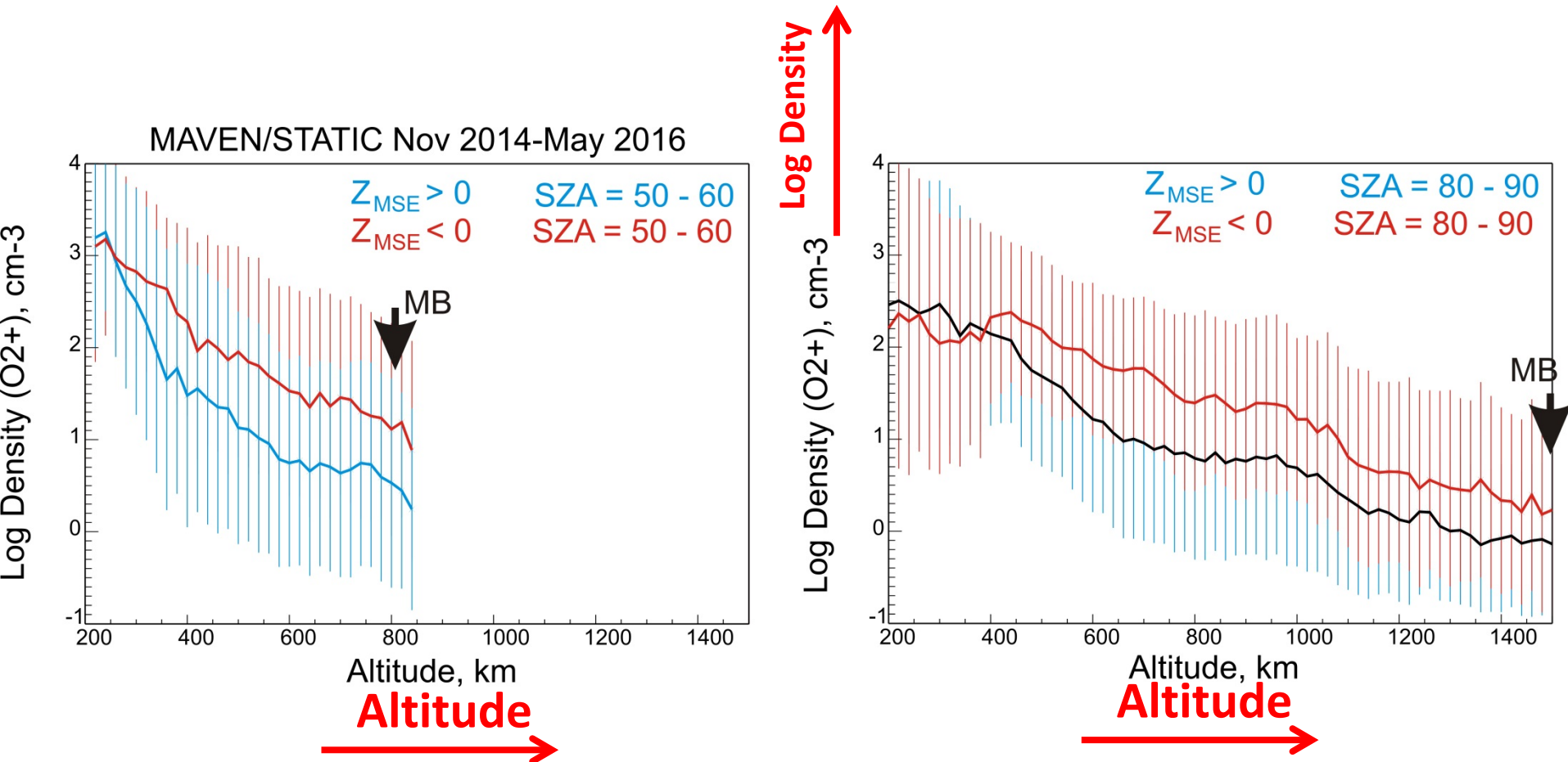
MAX-PLANCK-GESELLSCHAFT



VARIABILITY WITH IMF

Dayside Ionosphere

STATIC



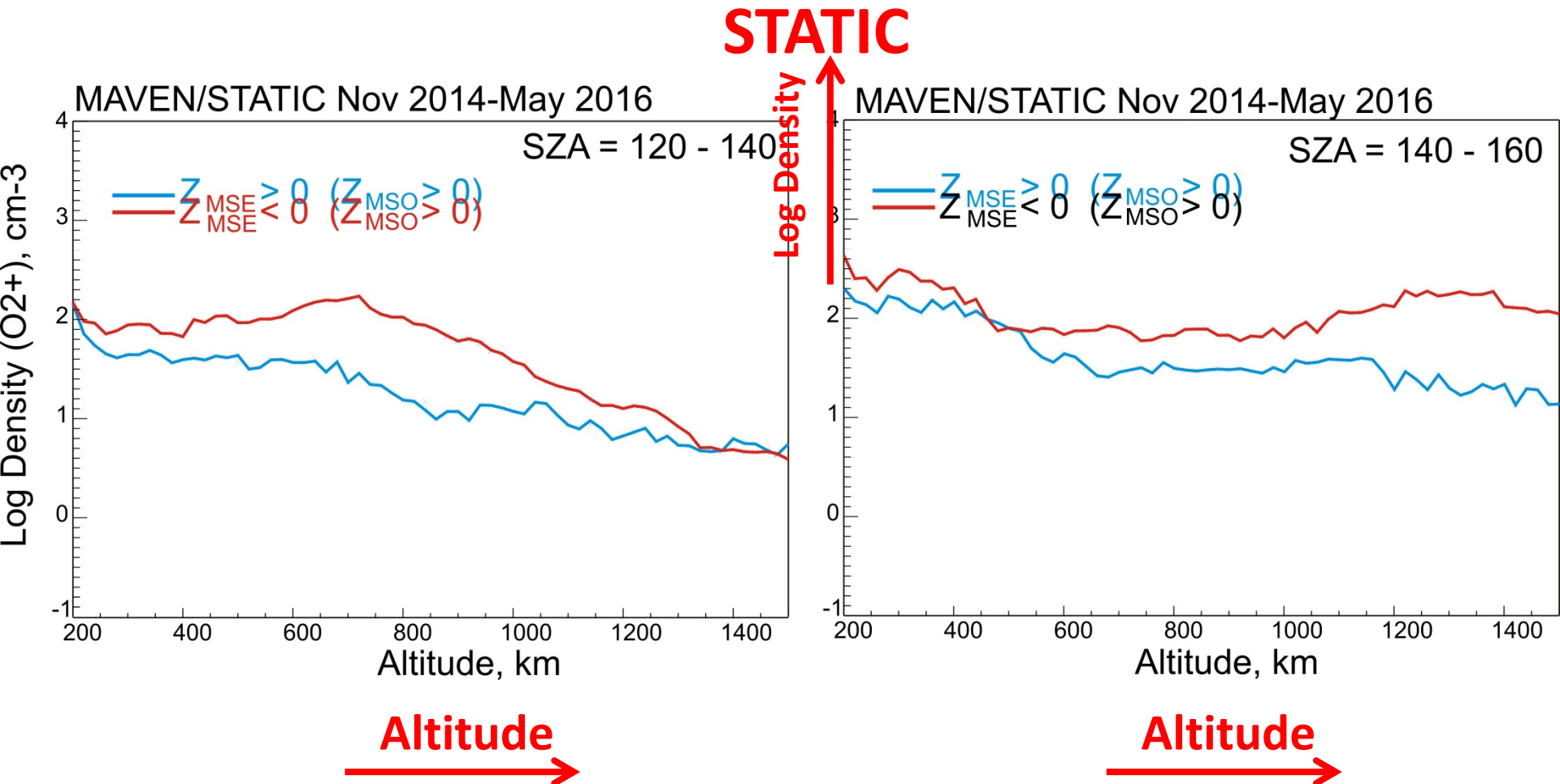


MAX-PLANCK-GESELLSCHAFT



VARIABILITY WITH IMF

Nightside Ionosphere

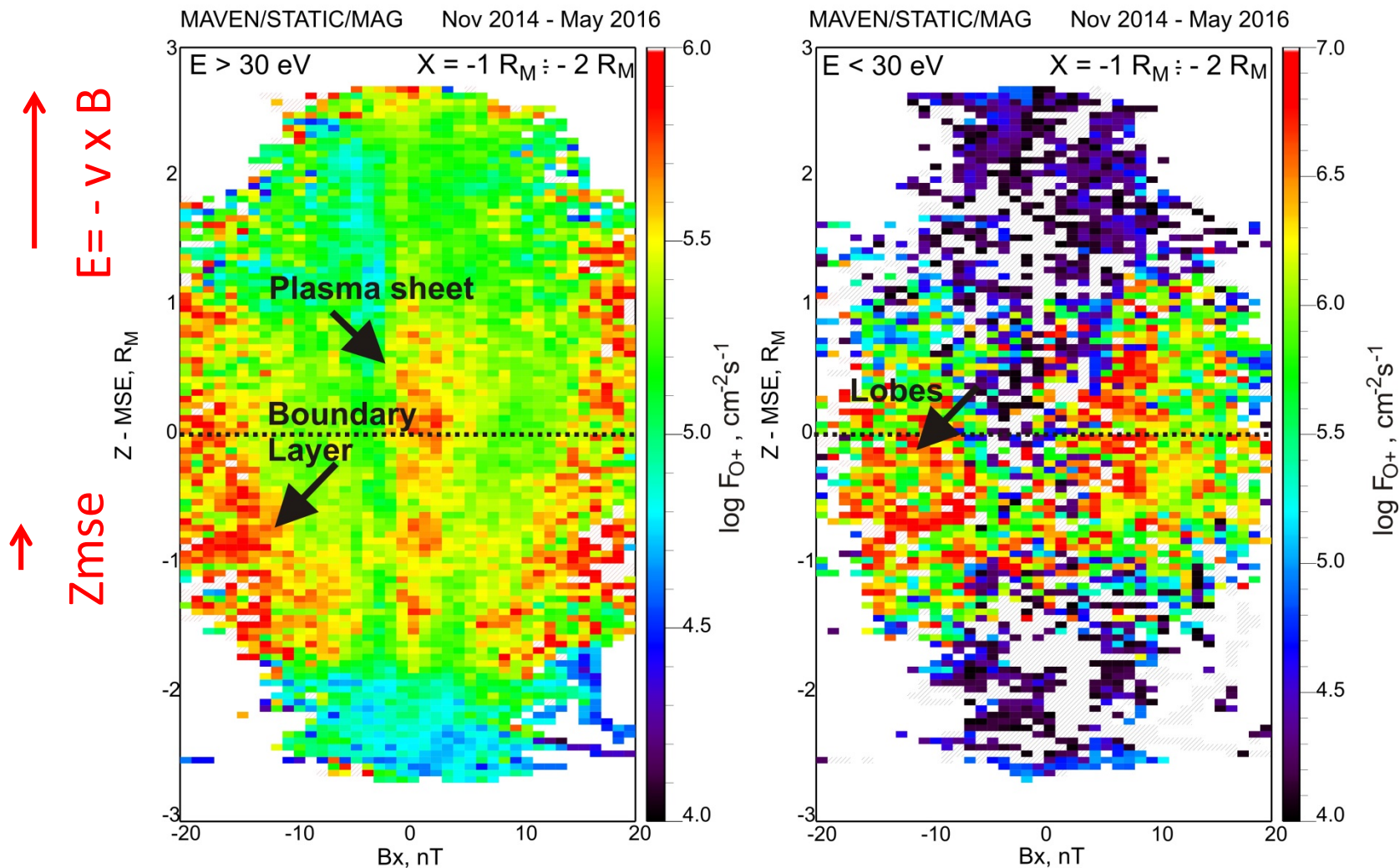




MAX-PLANCK-GESELLSCHAFT



EFFECTS OF IMF ON ION ESCAPE

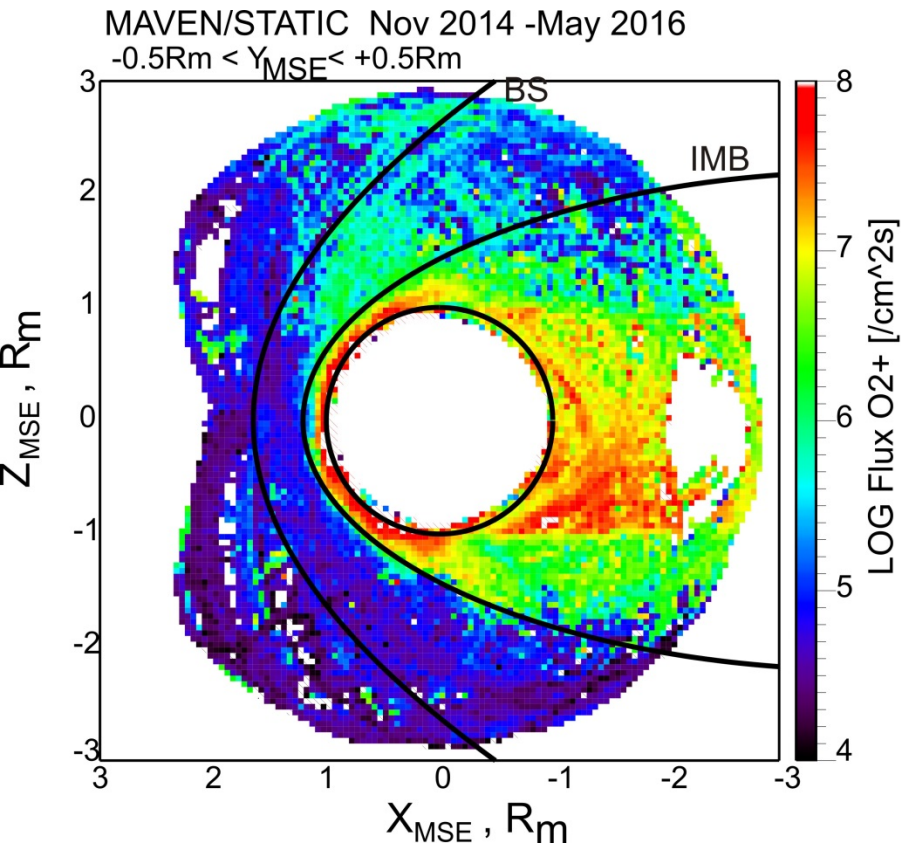




MAX-PLANCK-GESELLSCHAFT



EFFECTS OF IMF VARIABILITY ON ION ESCAPE





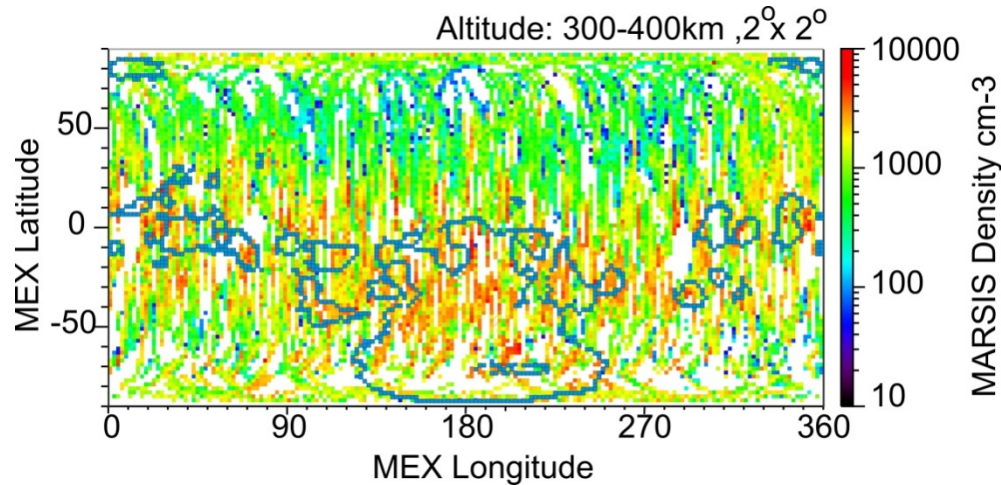
MAX-PLANCK-GESELLSCHAFT



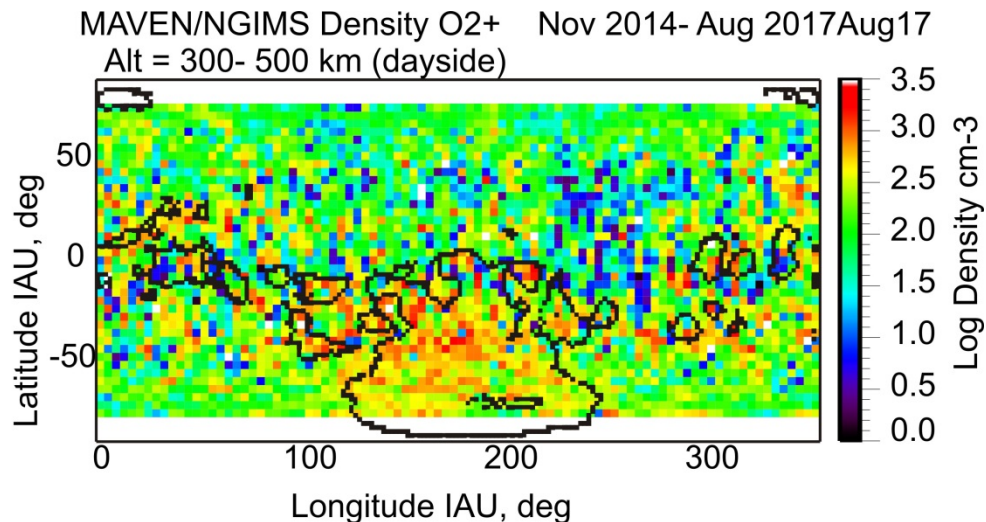
VARIABILITY WITH CRUSTAL FIELD

DAYSIDE

MARSIS



NGIMS





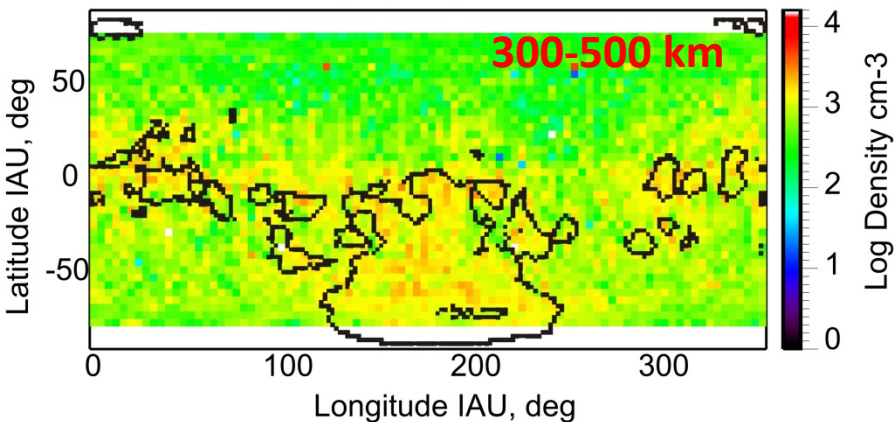
MAX-PLANCK-GESellschaft



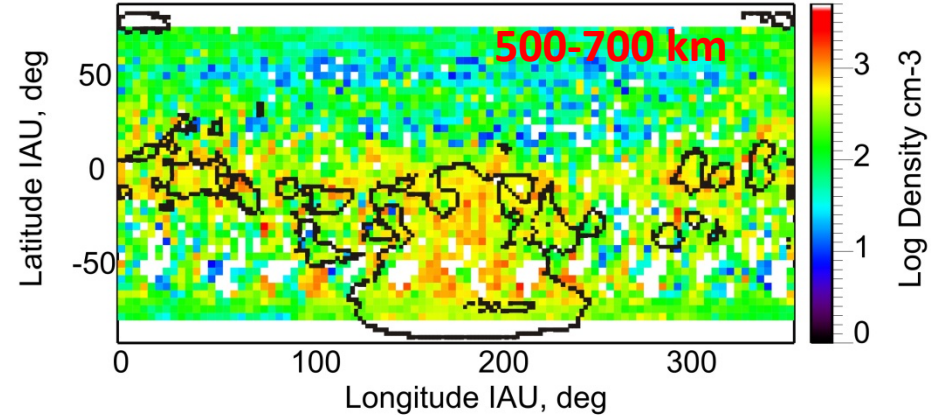
VARIABILITY WITH CRUSTAL FIELD

DAYSIDE LPW

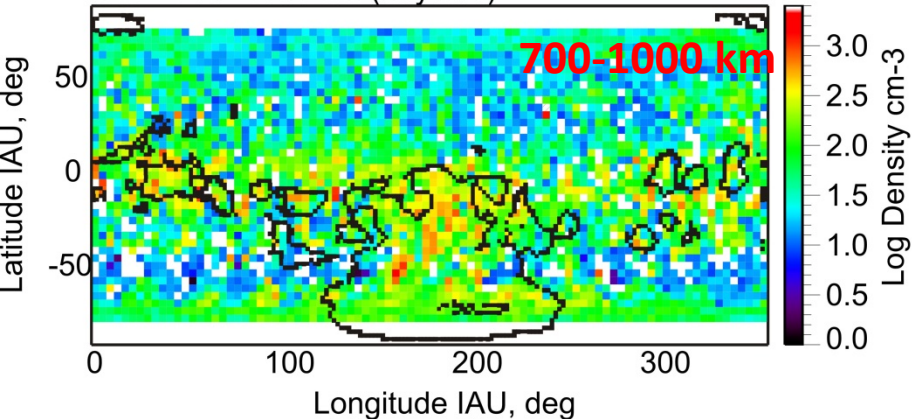
MAVEN/LPW Density Ne Nov 2014- Aug 2017Aug17
Alt = 300- 500 km (dayside)



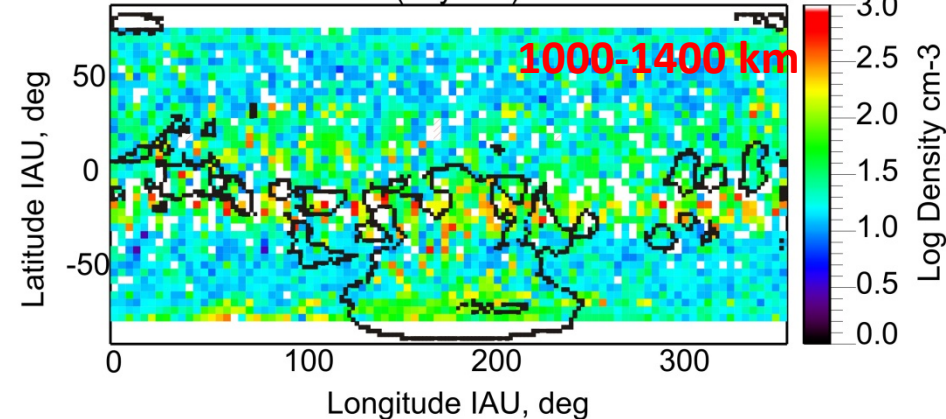
MAVEN/LPW Density Ne Nov 2014- Aug 2017Aug17
Alt = 500- 700 km (dayside)



MAVEN/LPW Density Ne Nov 2014- Aug 2017Aug17
Alt = 700- 1000 km (dayside)



MAVEN/LPW Density Ne Nov 2014- Aug 2017Aug17
Alt = 1000-1400 km (dayside)





MAX-PLANCK-GESELLSCHAFT

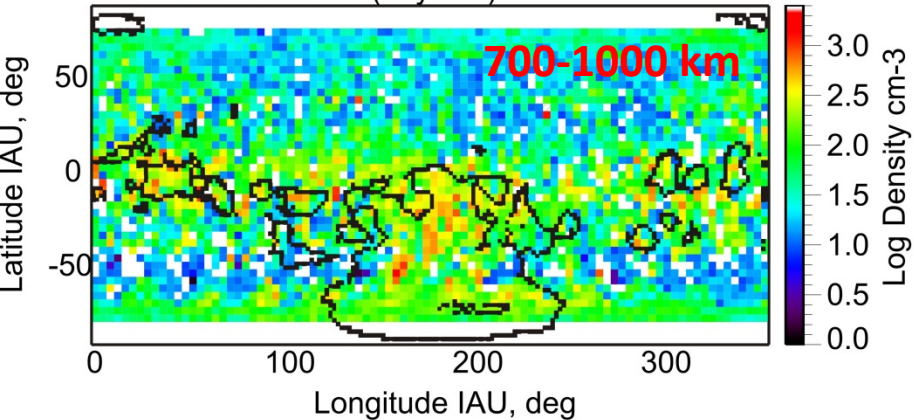


VARIABILITY WITH CRUSTAL FIELD

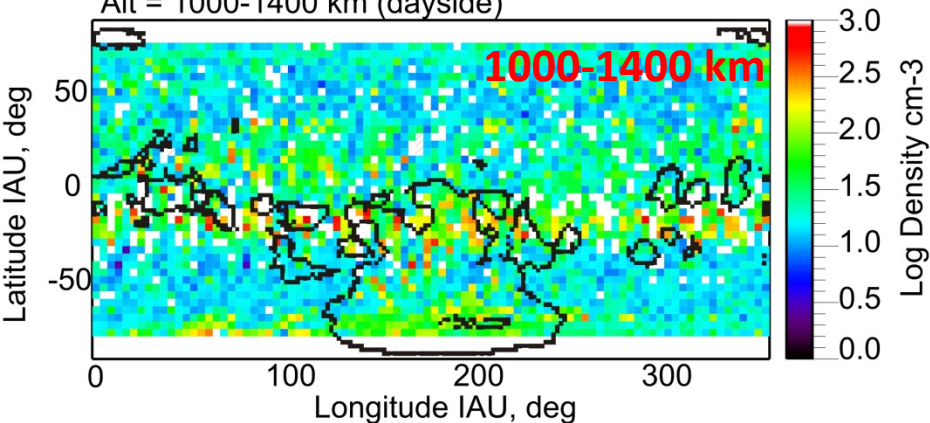
DAYSIDE

LPW

MAVEN/LPW Density Ne Nov 2014- Aug 2017Aug17
Alt = 700- 1000 km (dayside)



MAVEN/LPW Density Ne Nov 2014- Aug 2017Aug17
Alt = 1000-1400 km (dayside)





MAX-PLANCK-GESELLSCHAFT



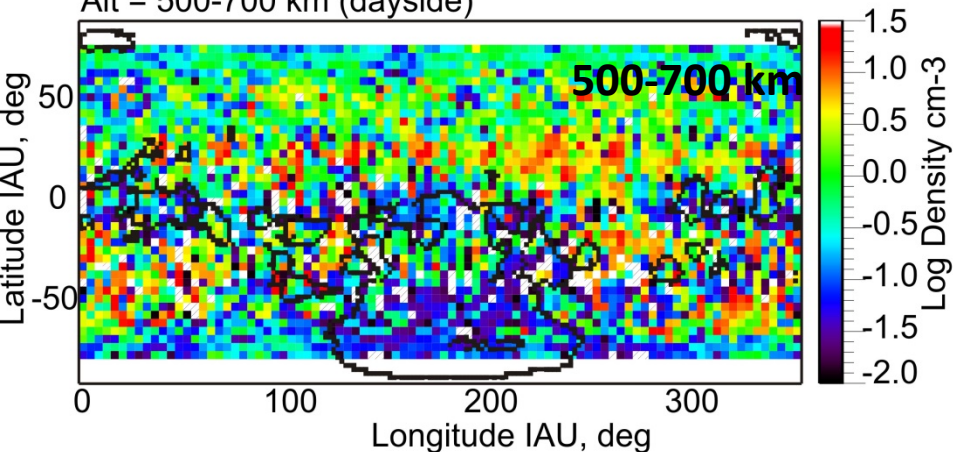
VARIABILITY WITH CRUSTAL FIELD

STATIC

DAYSIDE

SW H⁺

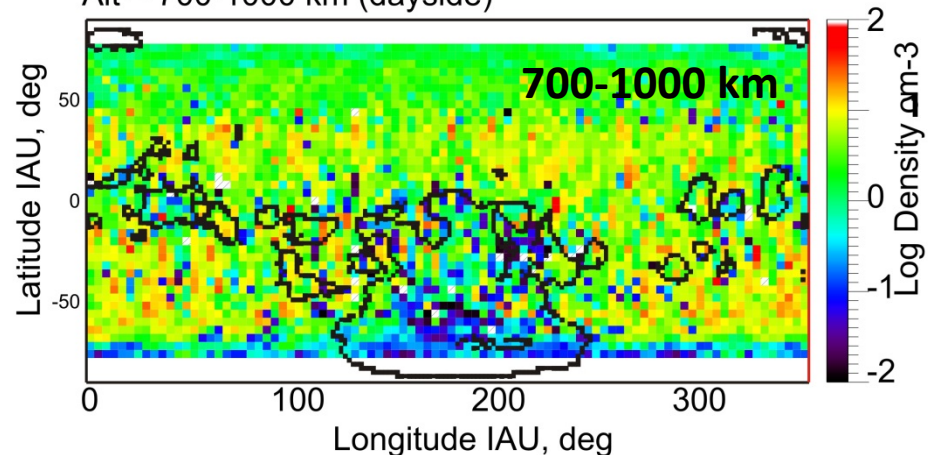
MAVEN/STATIC Density N(H⁺) Nov 2014- Aug 2017 Aug17
Alt = 500-700 km (dayside)



500-700 km

SW H⁺

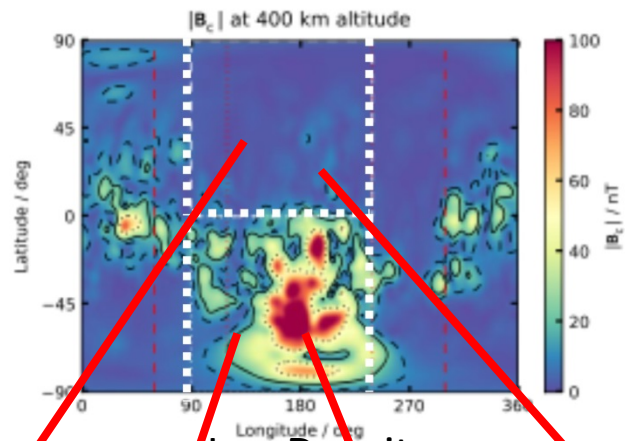
MAVEN/STATIC Density N(H⁺) Nov 2014- Aug 2017 Aug17
Alt = 700-1000 km (dayside)



700-1000 km



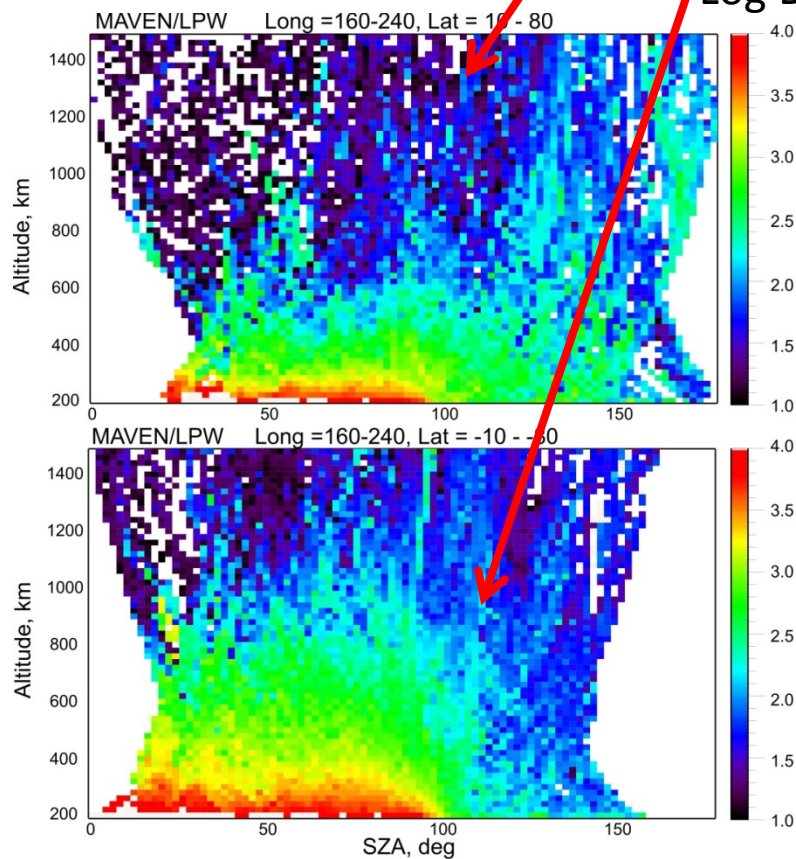
MAX-PLANCK-GESELLSCHAFT



LPW

SWIA

Log Density



SZA



MAX-PLANCK-GESELLSCHAFT

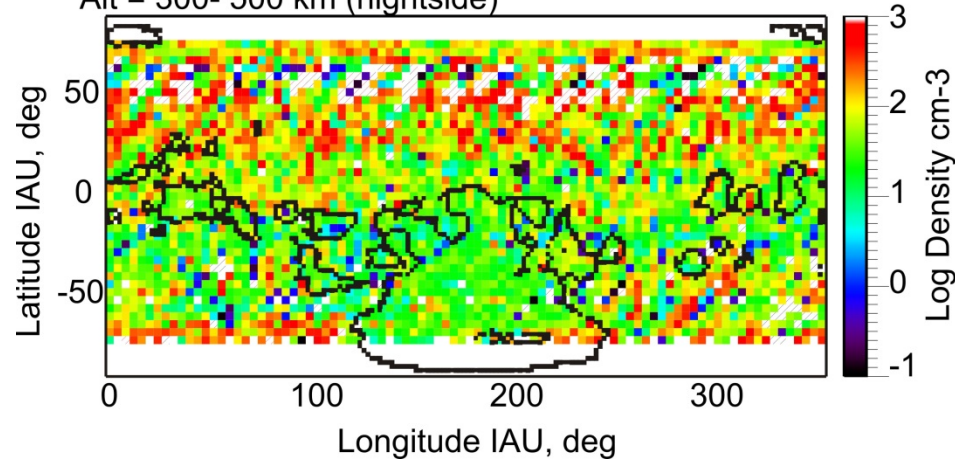


VARIABILITY WITH CRUSTAL FIELD

NIGHTSIDE

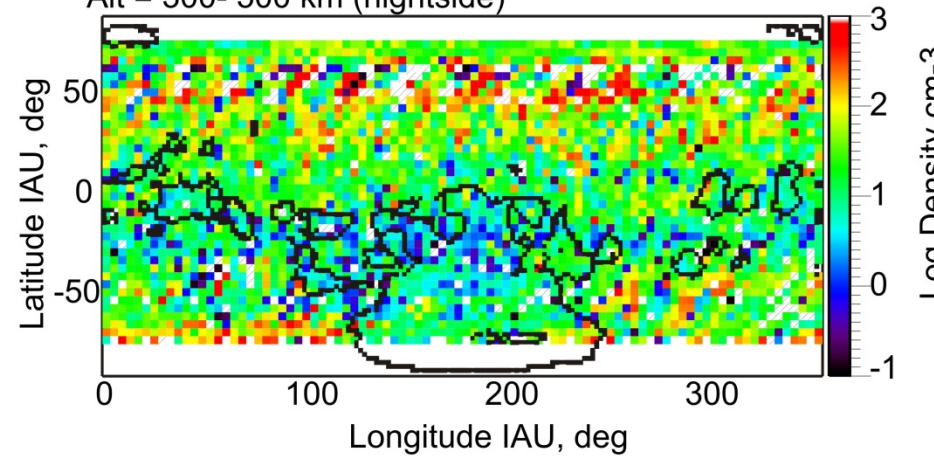
O₂⁺

MAVEN/STATIC Density O₂⁺ Nov 2014- Aug 2017Aug17
Alt = 300- 500 km (nightside)



O⁺

MAVEN/STATIC Density O⁺ Nov 2014- Aug 2017Aug17
Alt = 300- 500 km (nightside)





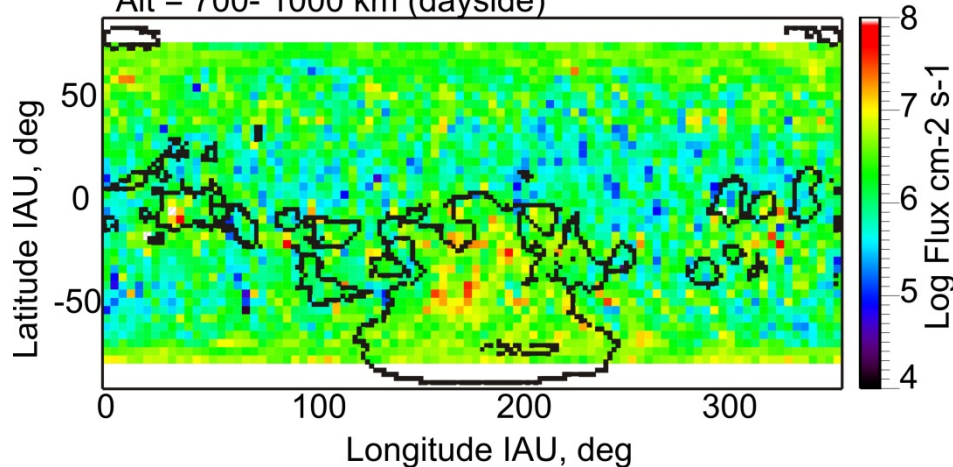
MAX-PLANCK-GESELLSCHAFT



EFFECTS OF CRUSTAL FIELD ON ION ESCAPE

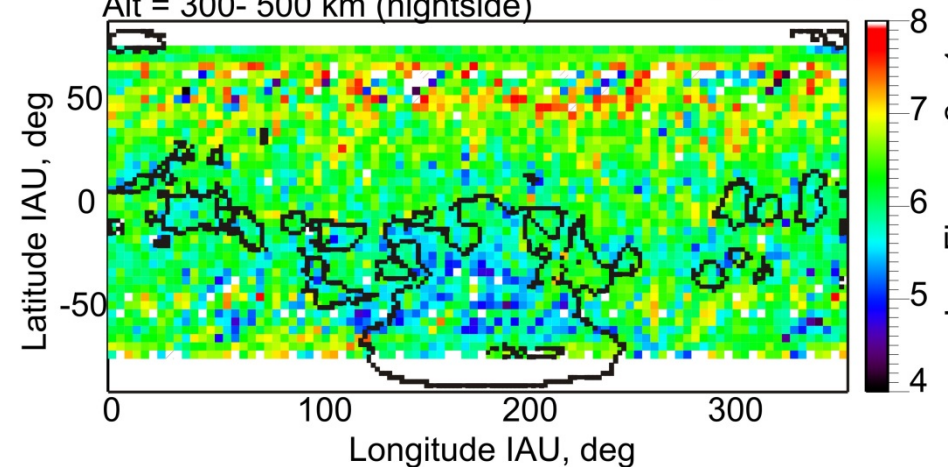
DAYSIDE

MAVEN/STATIC Flux O⁺ Nov 2014- Aug 2017Aug17
Alt = 700- 1000 km (dayside)



NIGHTSIDE

MAVEN/STATIC Flux O⁺ Nov 2014- Aug 2017Aug17
Alt = 300- 500 km (nightside)



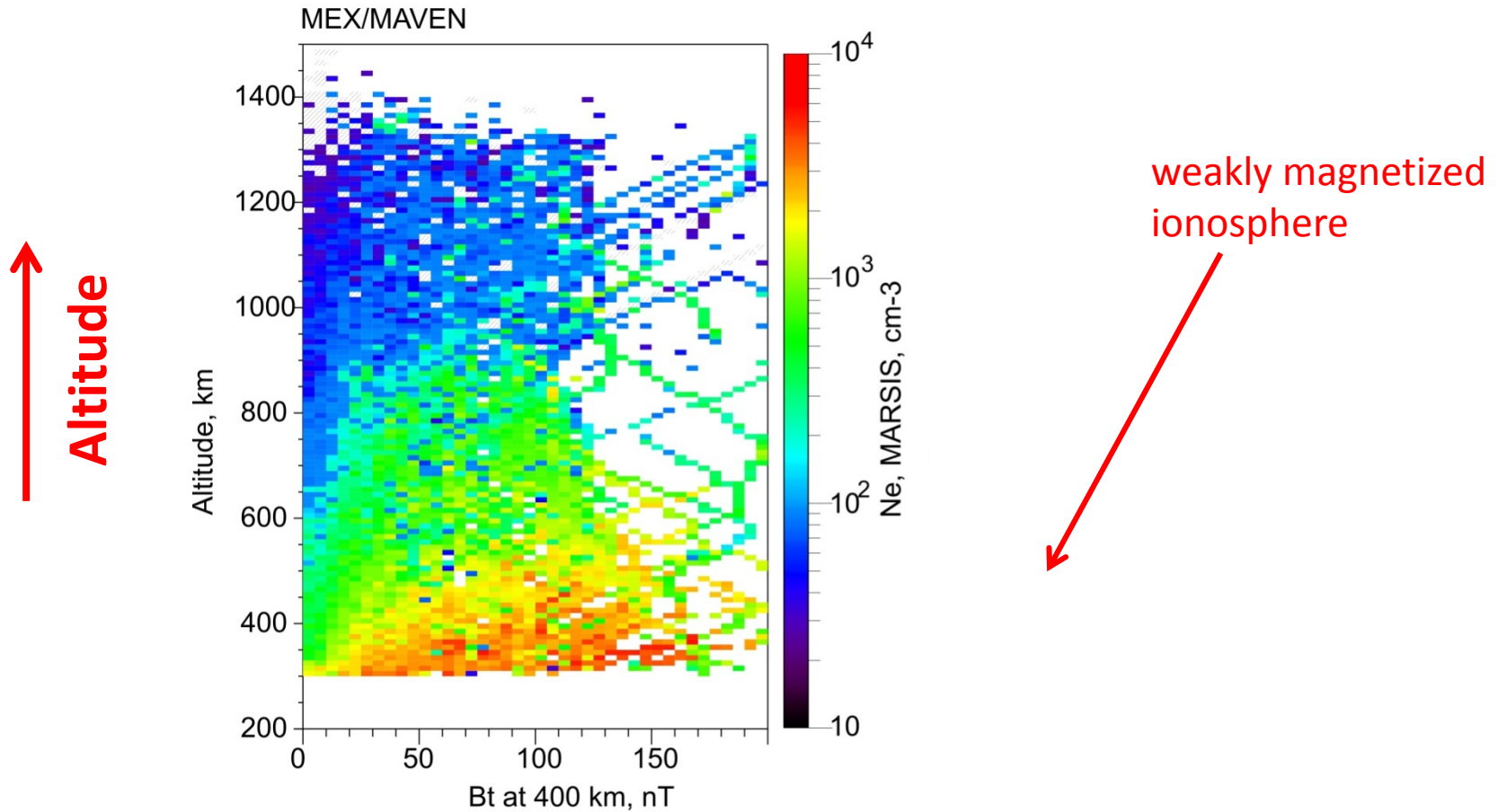


MAX-PLANCK-GESellschaft



VARIABILITY WITH MAGNETIC FIELD

MARSIS



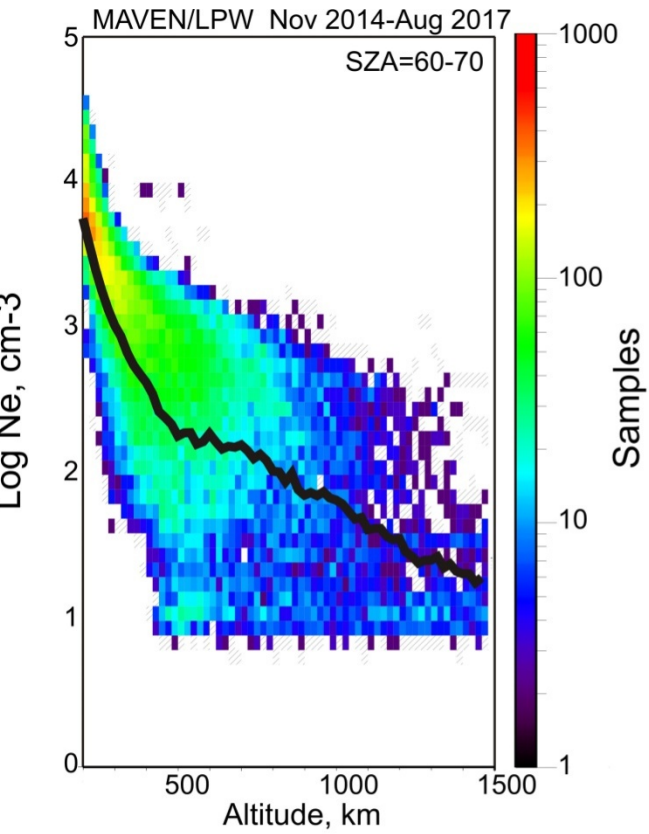
B at 400 km, nT



MAX-PLANCK-GESELLSCHAFT



CONCLUSIONS



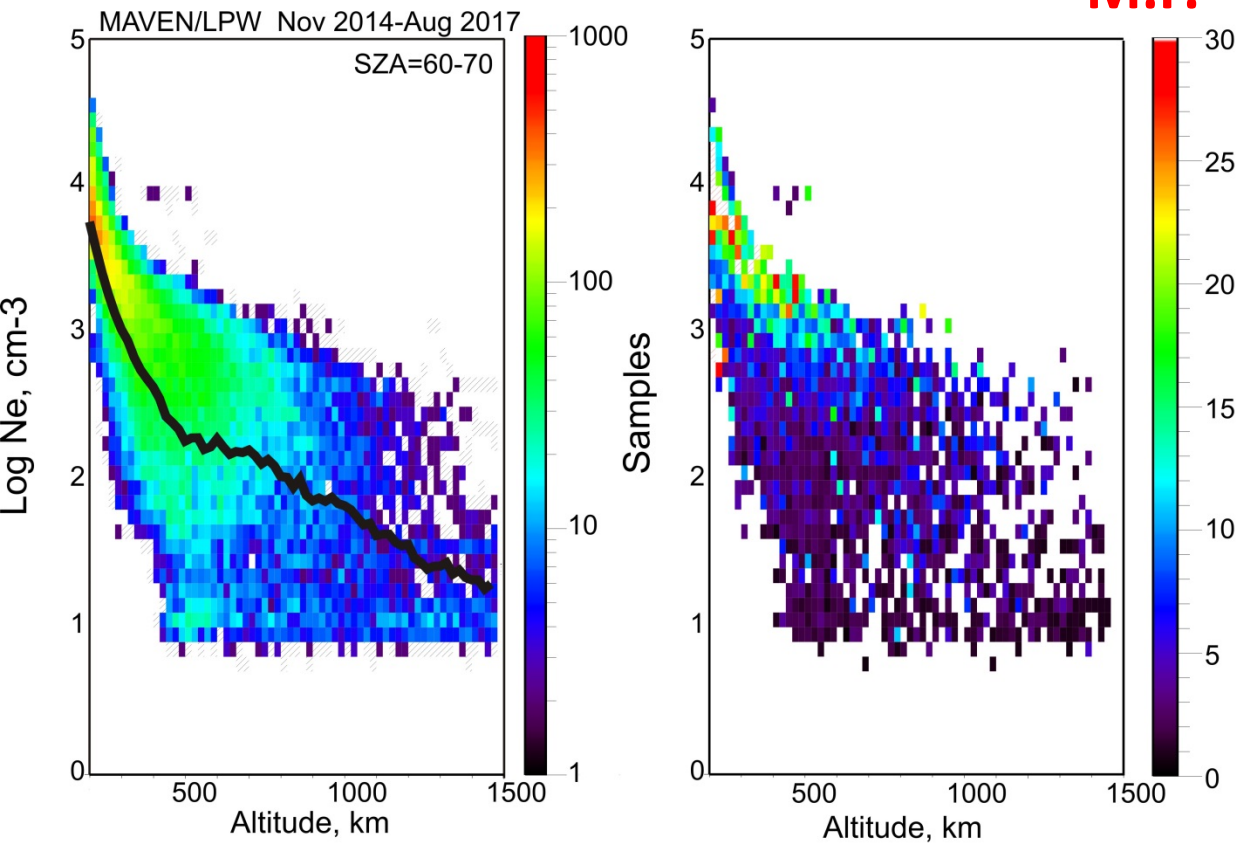


MAX-PLANCK-GESELLSCHAFT



CONCLUSIONS

**Crustal
M.F.**

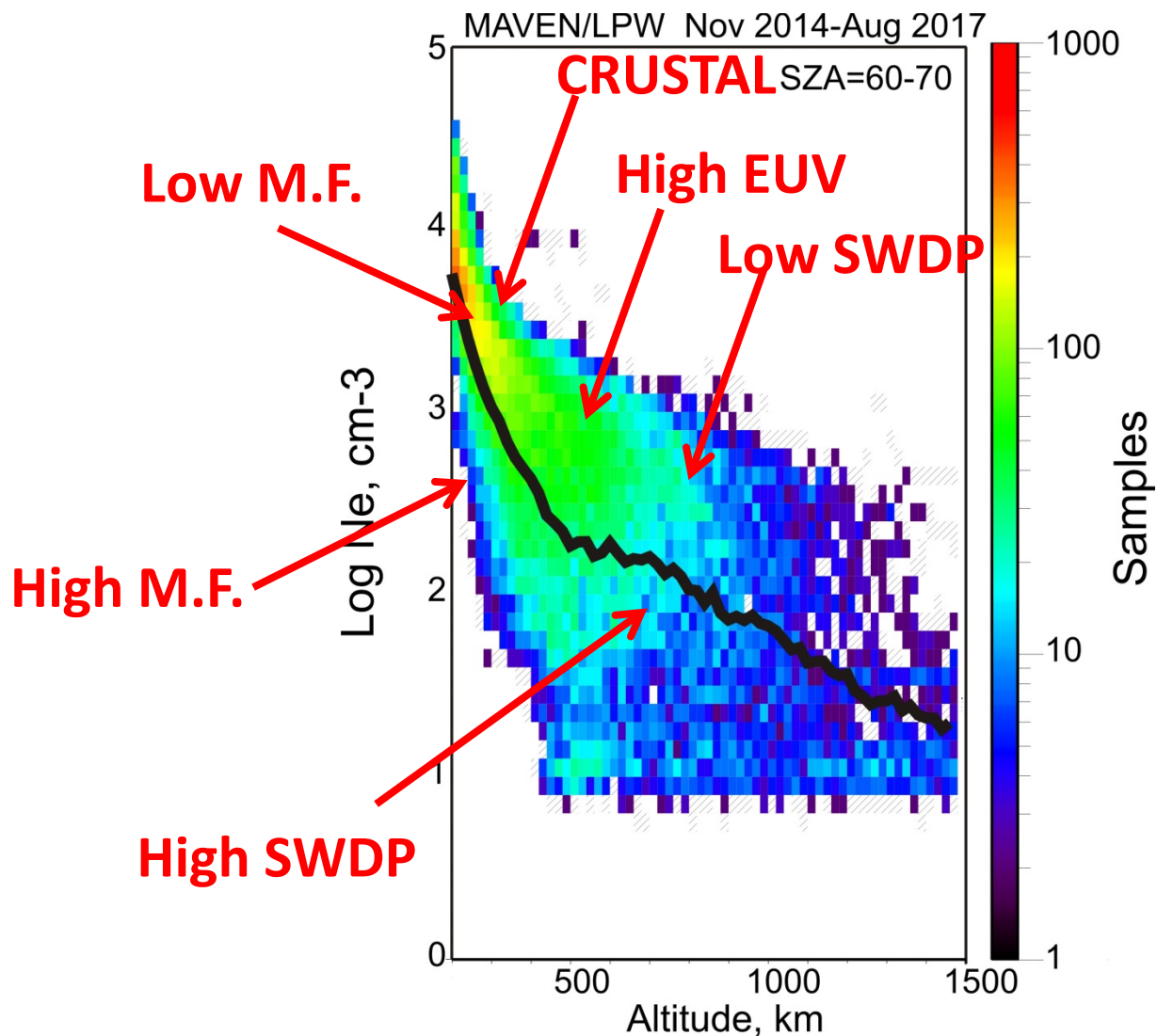




MAX-PLANCK-GESELLSCHAFT



CONCLUSIONS





MAX-PLANCK-GESELLSCHAFT





MAX-PLANCK-GESELLSCHAFT

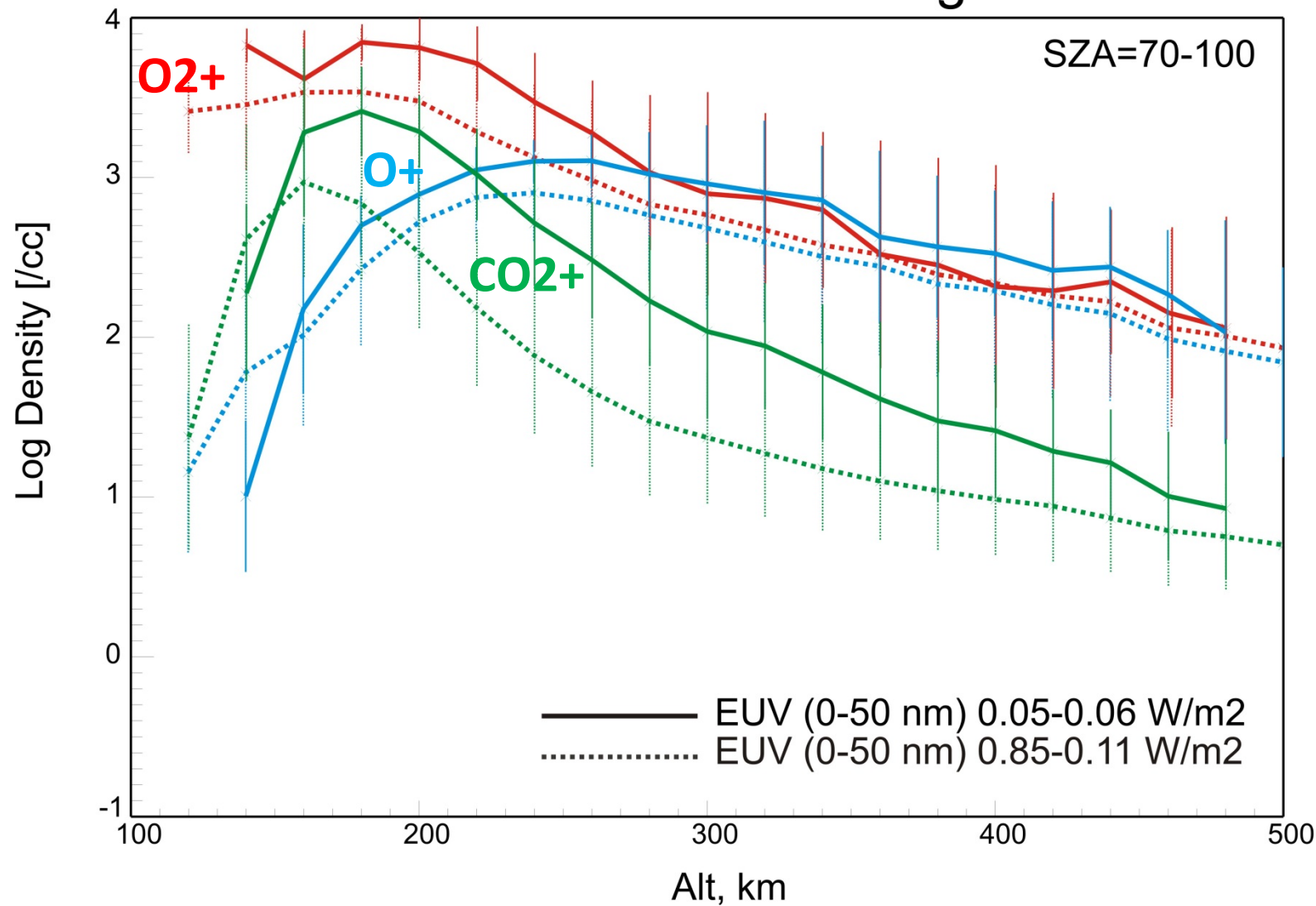




MAX-PLANCK-GESELLSCHAFT



MAVEN/NGIMS Nov 2014 - Aug 2017



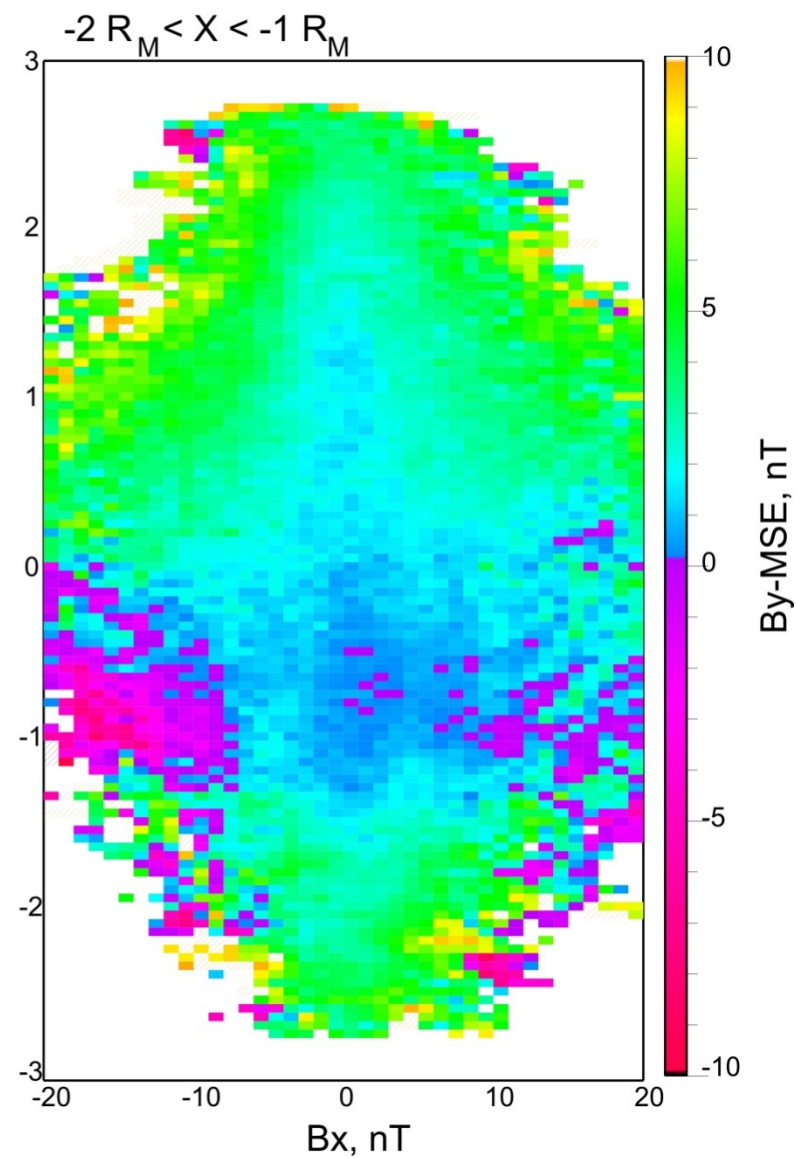
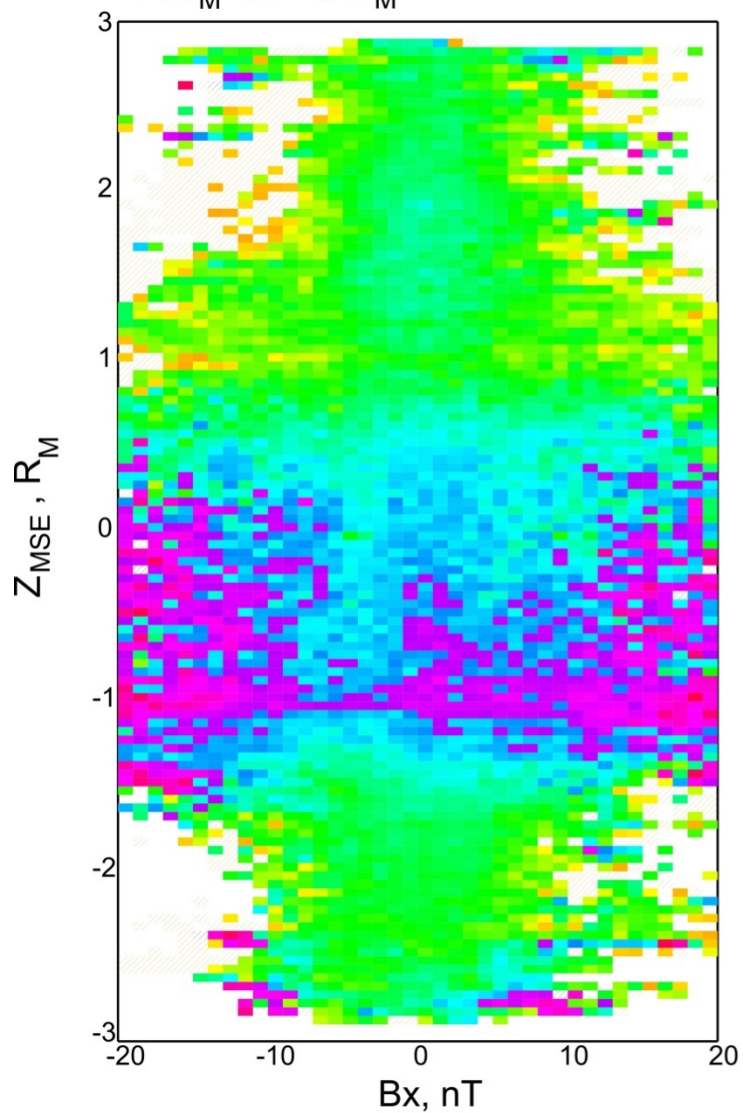


MAX-PLANCK-GESELLSCHAFT



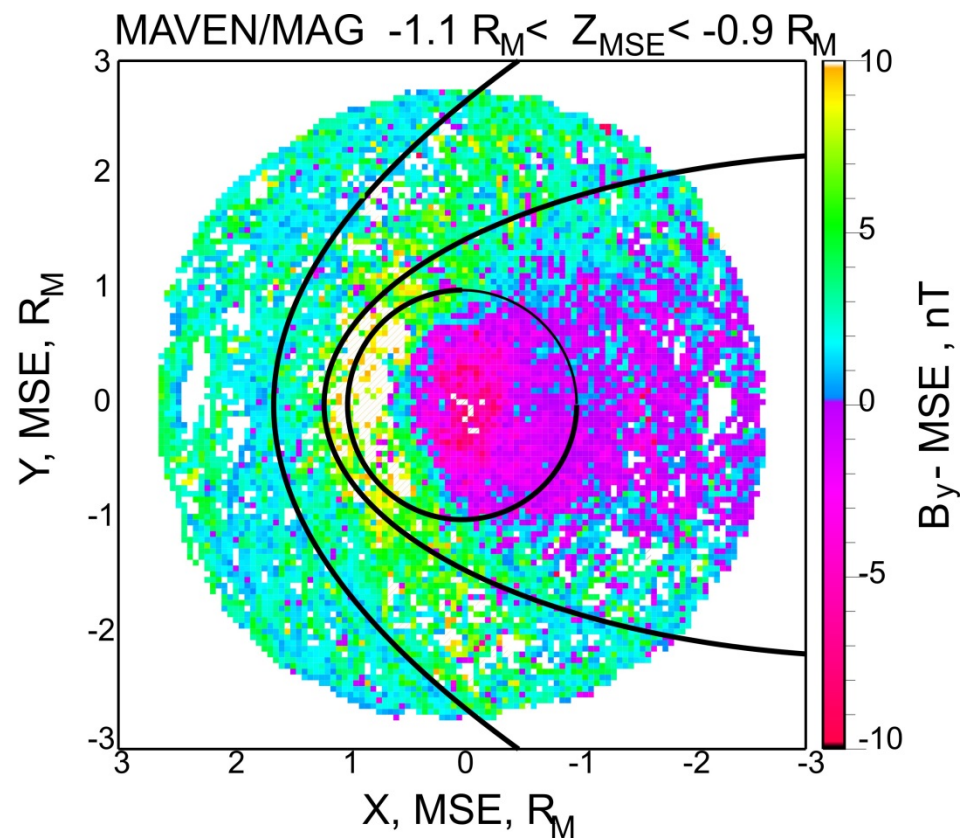
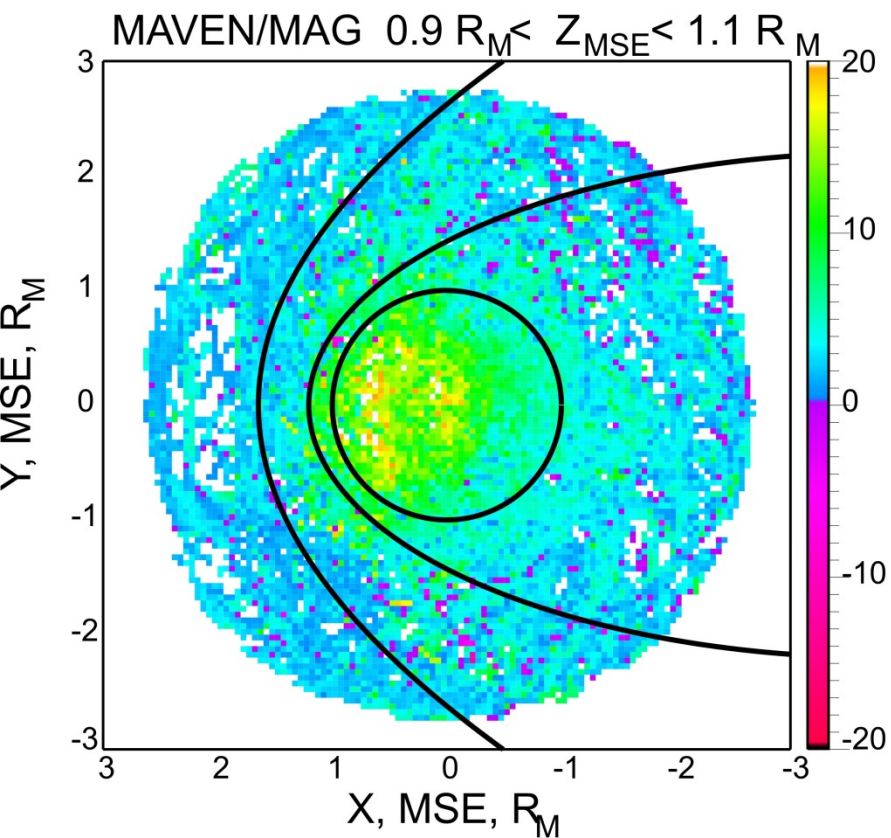
MAVEN/MAG Nov 2014-Aug 2017

$-1 R_M < X < 0 R_M$





MAX-PLANCK-GESELLSCHAFT





MAX-PLANCK-GESELLSCHAFT



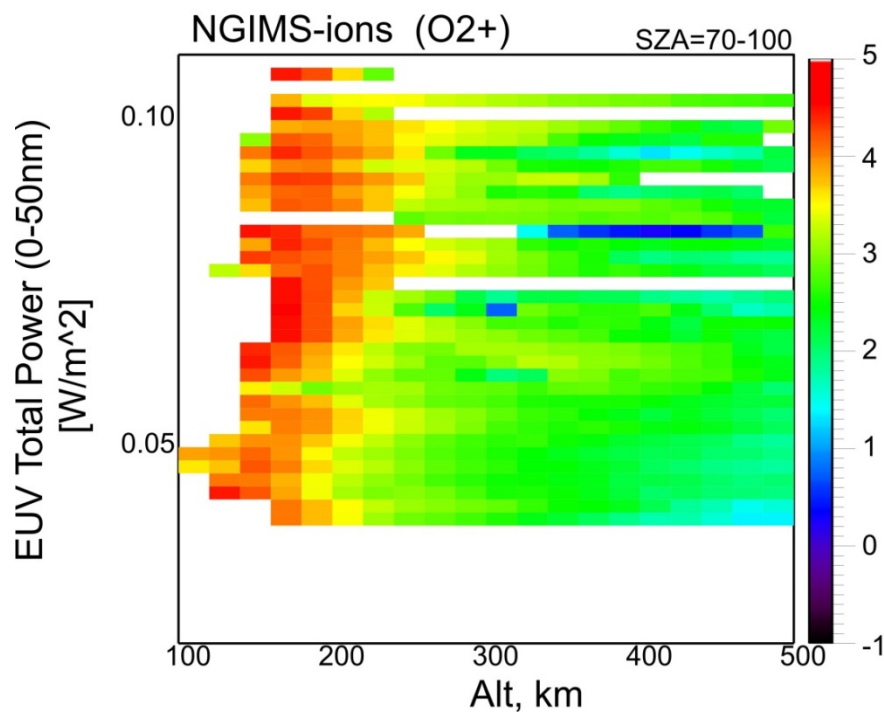
VARIABILITY WITH EUV

O₂⁺

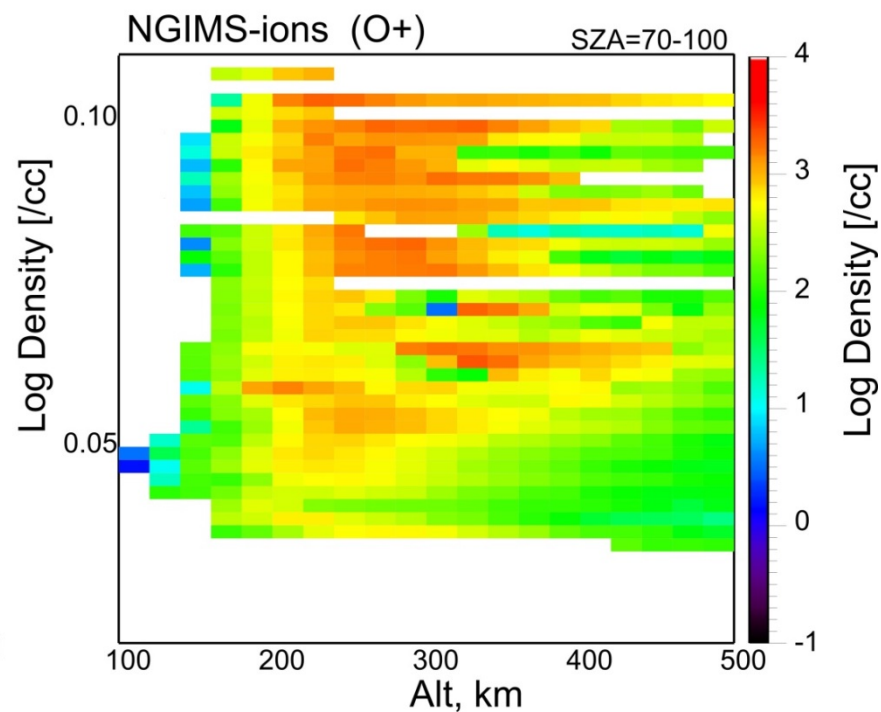
NGIMS

O⁺

EUV FLUX



Altitude



Altitude





MAX-PLANCK-GESELLSCHAFT

