

How does the Magnetic Field of Mars affect the Ionosphere?

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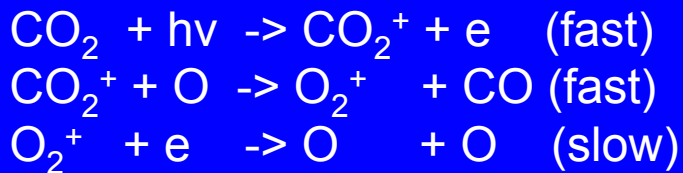
CSP Journal Club Talk
2004.09.27
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Introduction to Martian Ionosphere and MGS RS Data

MGS RS Data Coverage

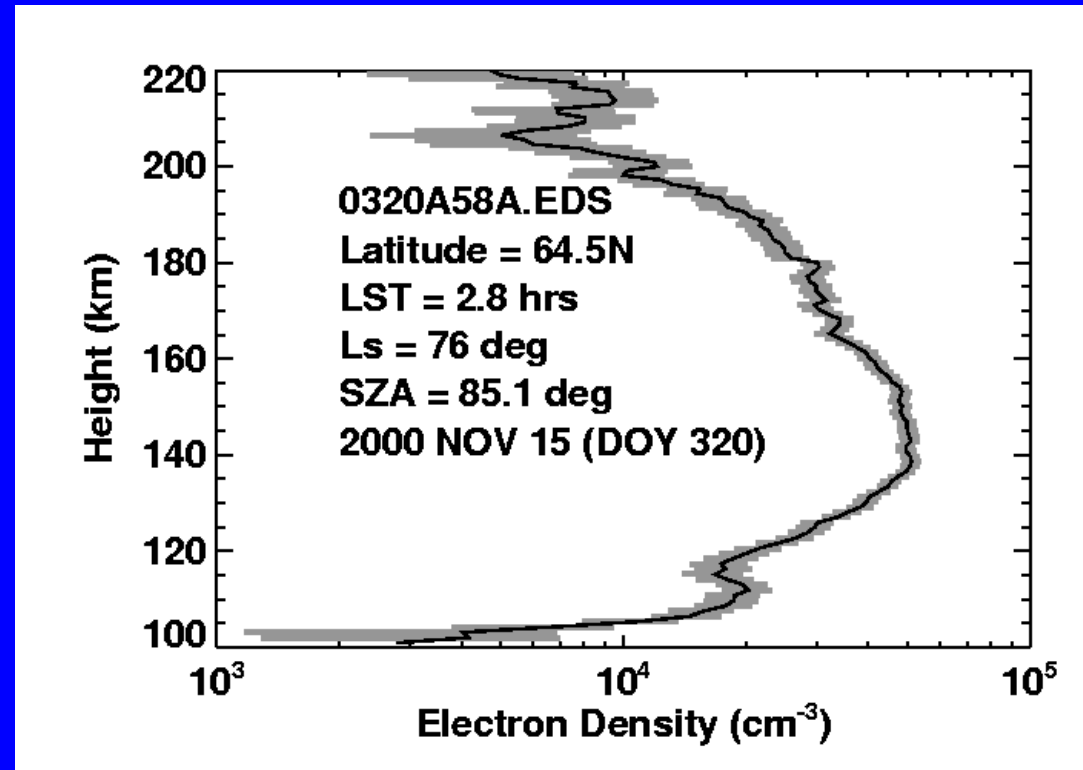
60-85N, 60-70S
2-9, 12 hrs LST
70-180 deg Ls – over 2 yrs
70-87 deg SZA
Dec 98, Mar 99, May 99,
and Nov 00 – Jun 01

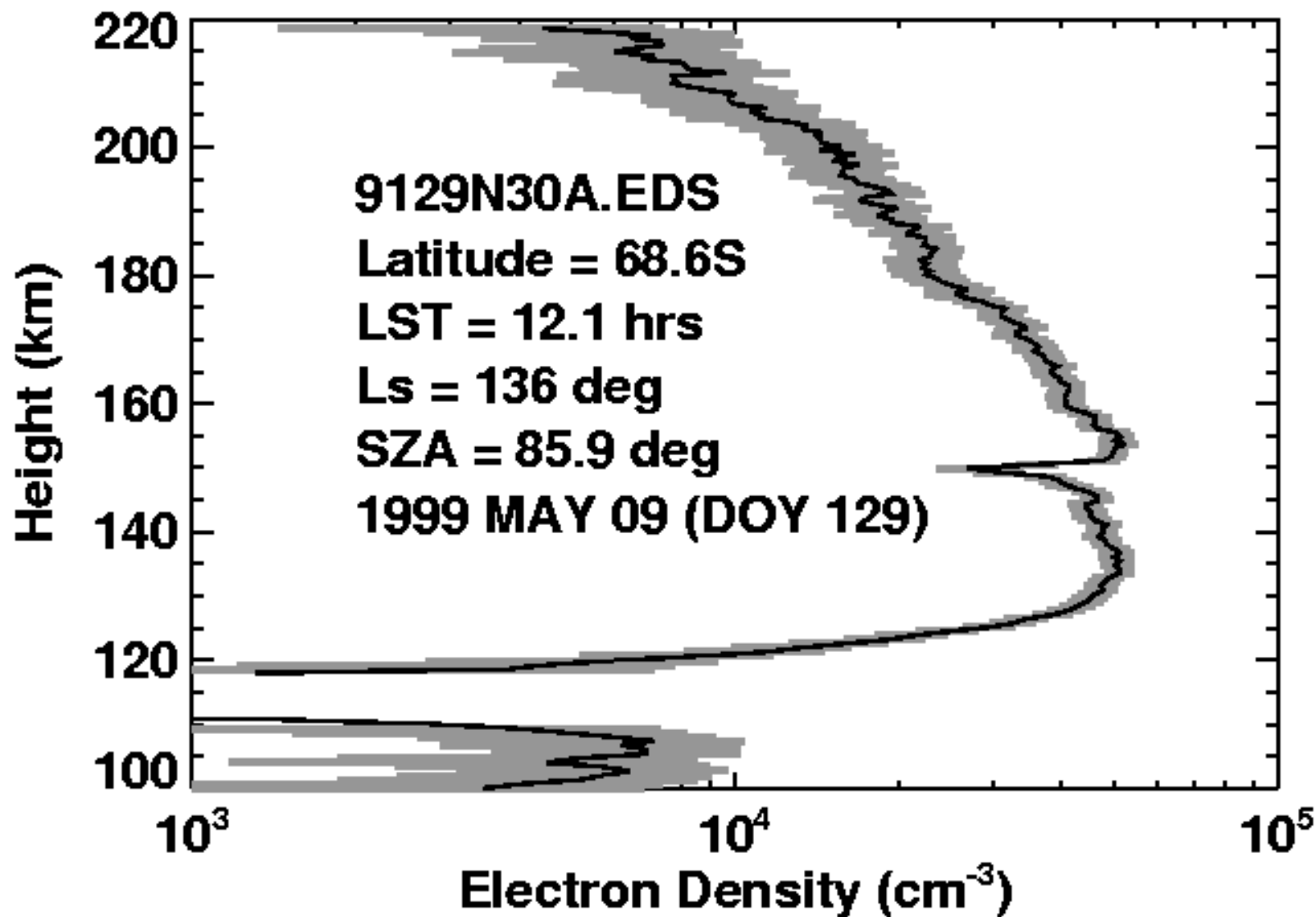
Simplified chemistry

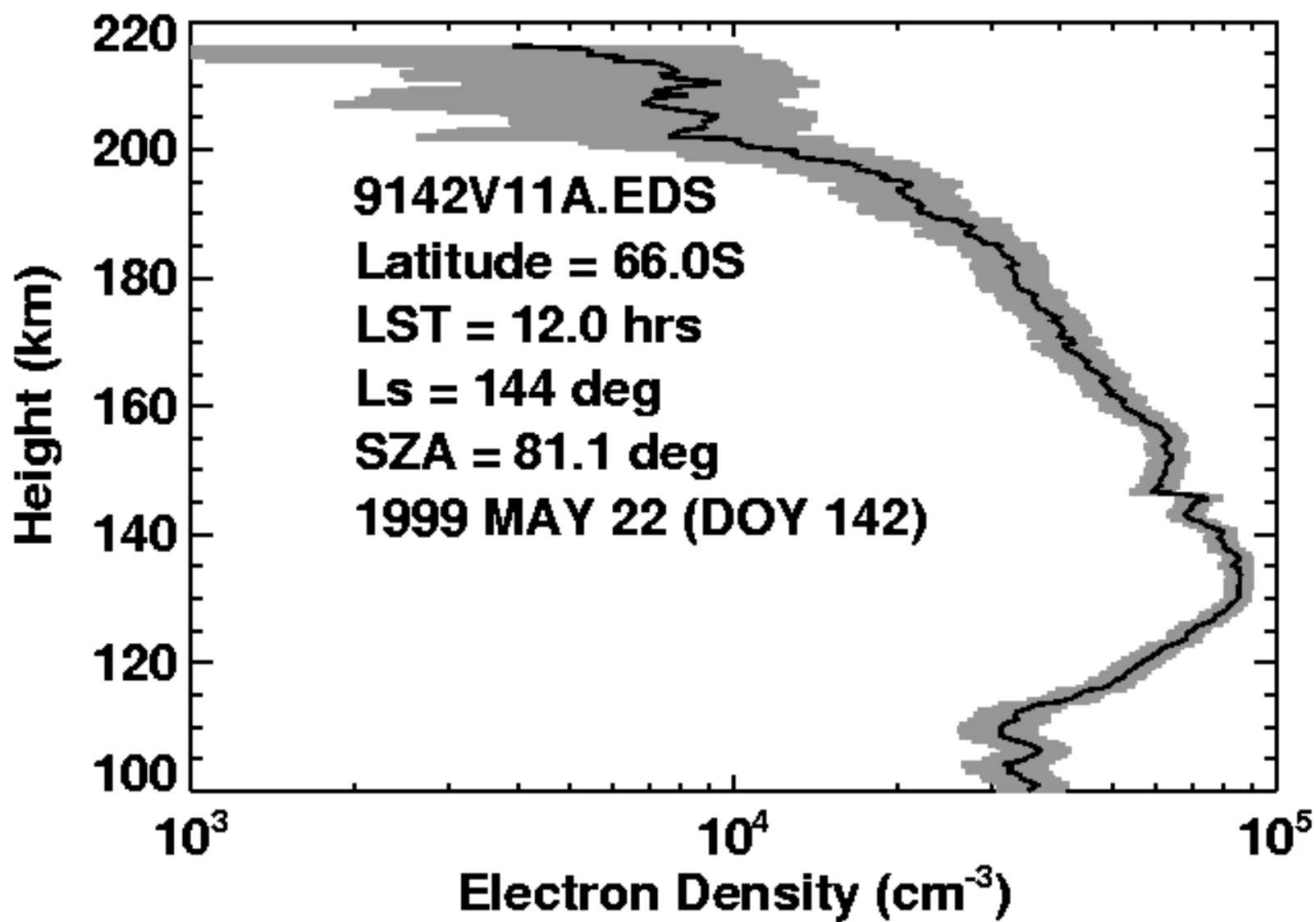


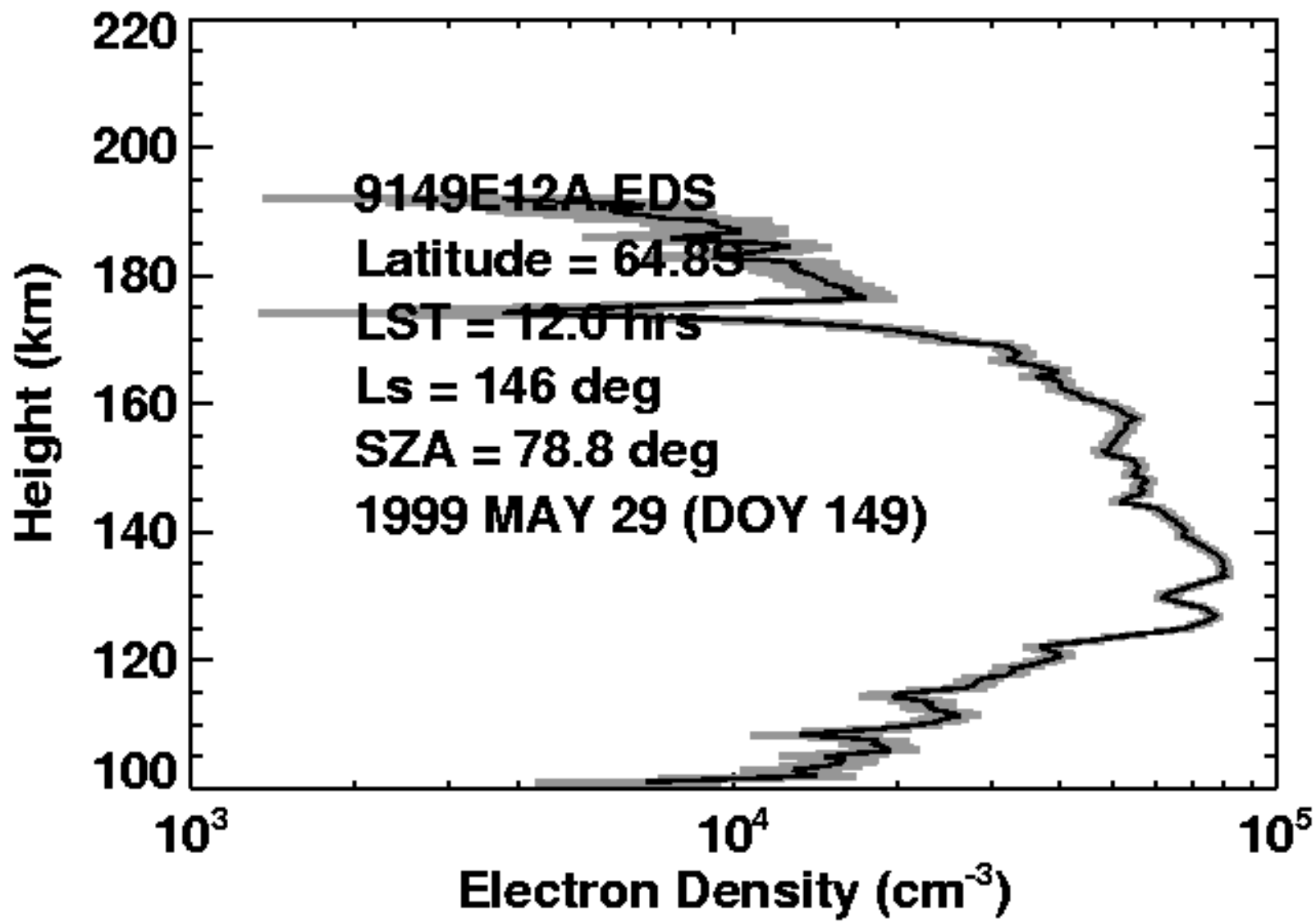
Typical Profile

Primary peak, well fit by alpha-Chapman function, 130-150 km, $(4-14) \times 10^4 \text{ cm}^{-3}$
Secondary feature (ledge, peak, etc) of variable significance, 110-120 km
Primary peak mainly from 30.38 nm (Helium) flux, secondary peak from few nm X-rays
Wavy topside with H decreasing as altitude increases

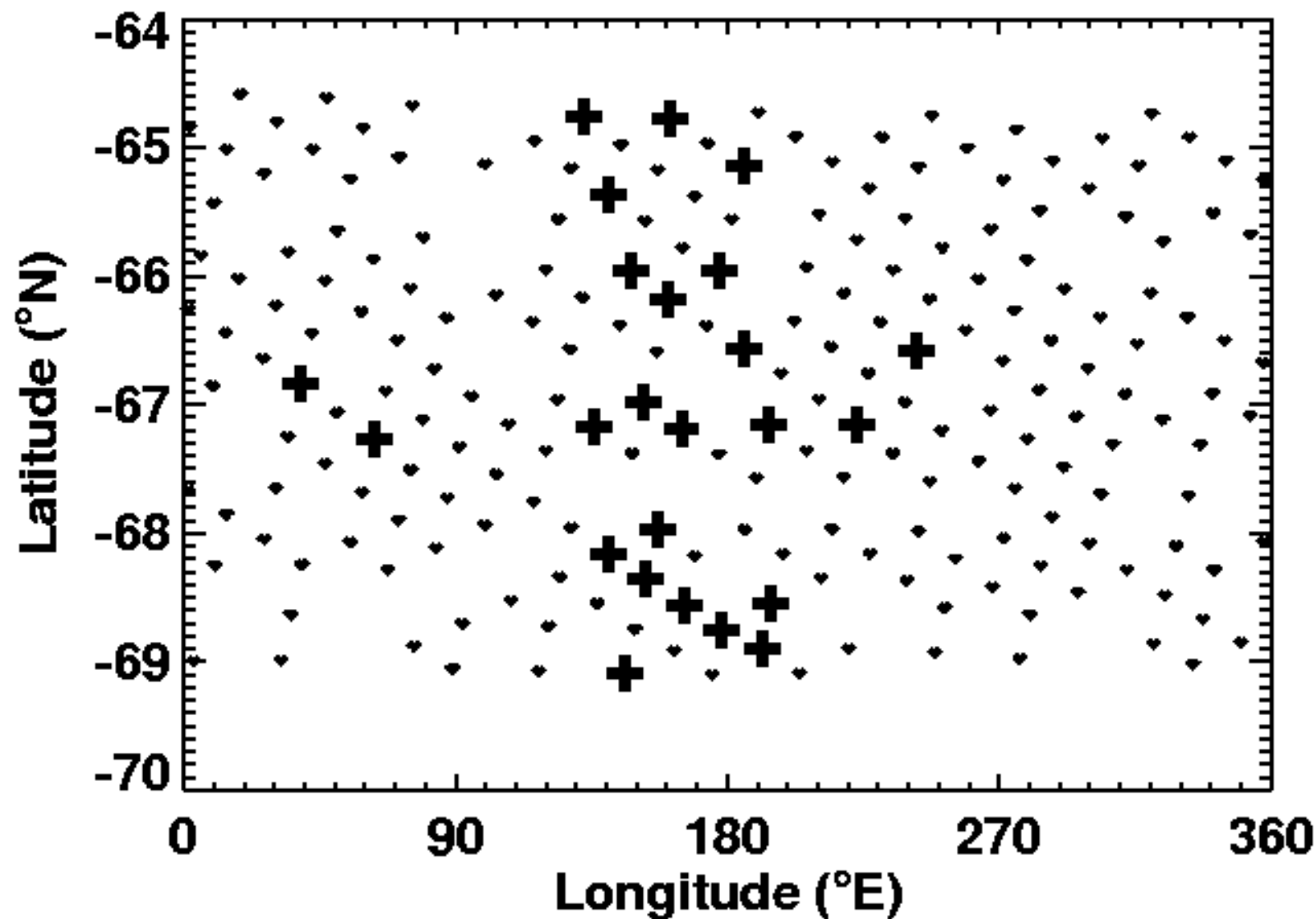








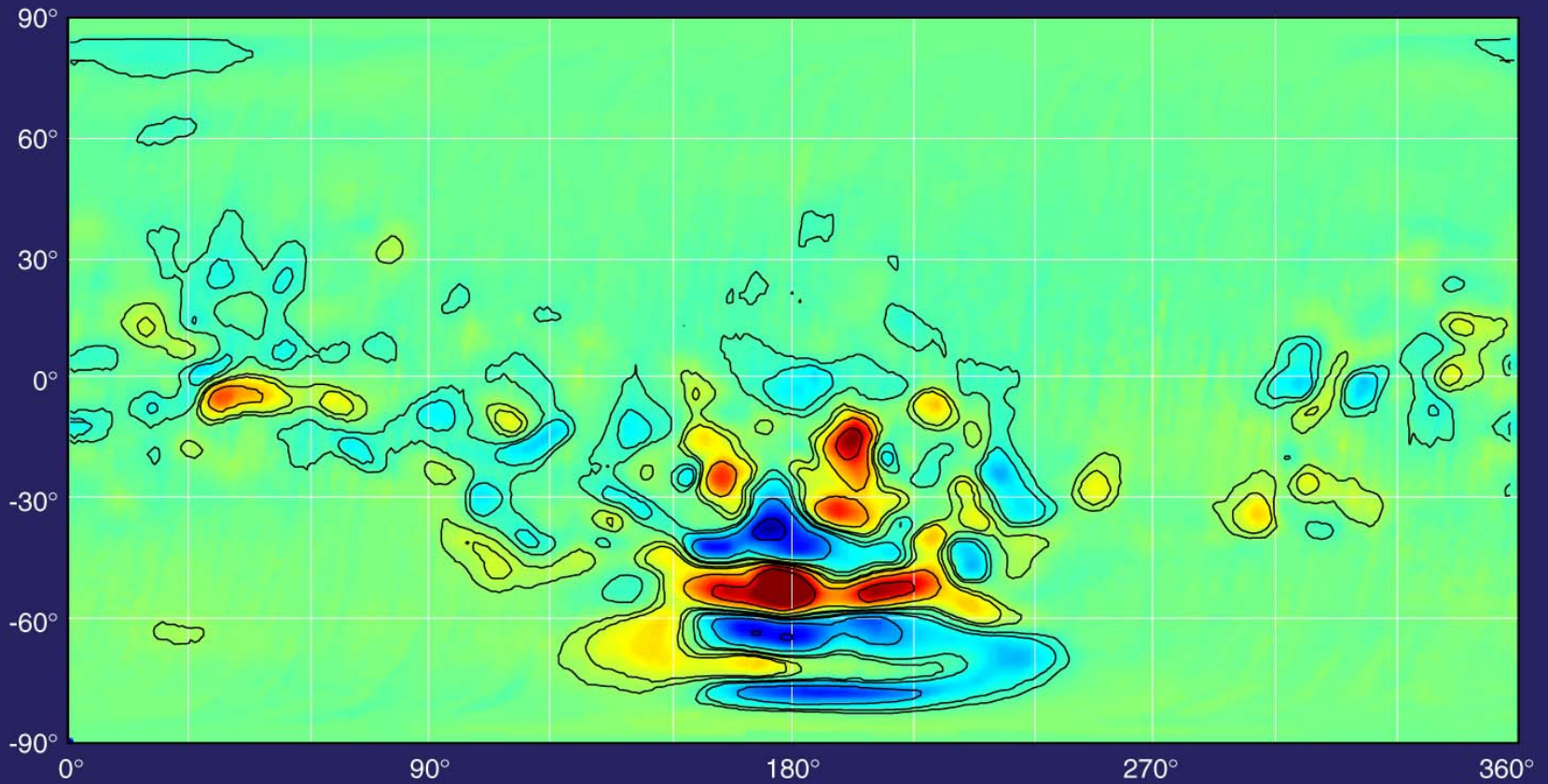
Distribution of Unusual Profiles



Mars Crustal Magnetism

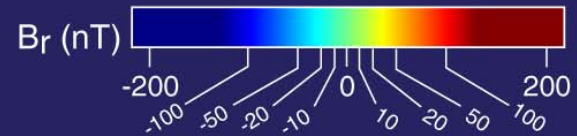
Mars Global Surveyor

MAG/ER



East Longitude

Br at 400 km altitude, max value ~ 200 nT

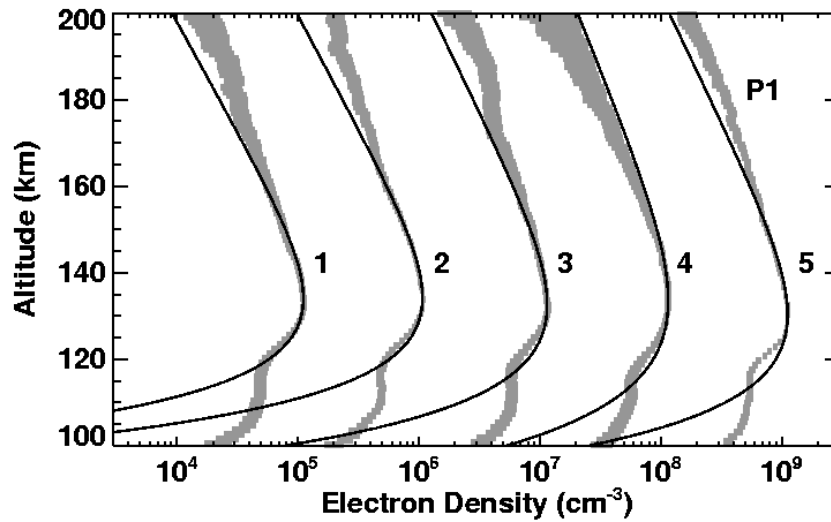


Effects of B on an Ionosphere

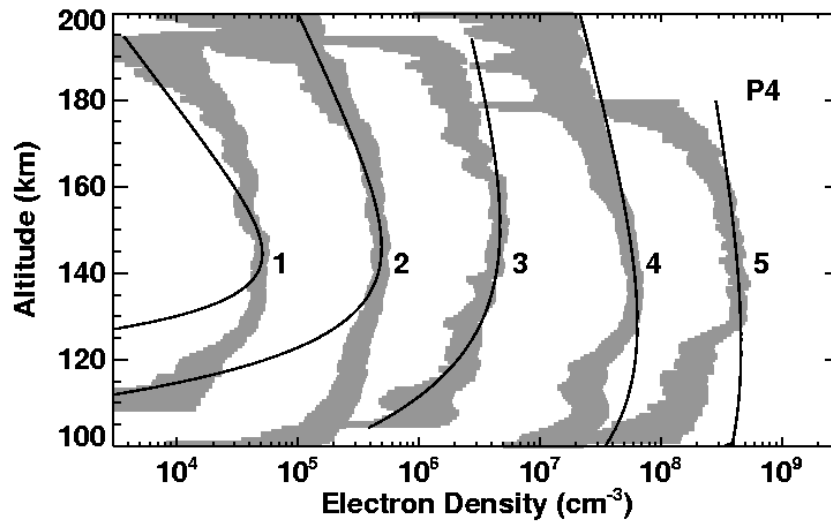
- Modify influx of energetic particles
- Modify ion/electron diffusion
- Modify ion/electron transport by winds

$$\begin{aligned} N_i m_i \nu_{in} (\underline{v}_i - \underline{u}) &= N_i e (\underline{E} + \underline{v}_i \times \underline{B}) - k \nabla (N_i T_i) + N_i m_i \underline{g} \\ N_e m_e \nu_{en} (\underline{v}_e - \underline{u}) &= -N_e e (\underline{E} + \underline{v}_e \times \underline{B}) - k \nabla (N_e T_e) + N_e m_e \underline{g} \end{aligned}$$

- plus Maxwell and Continuity ...
- u, B known, E unknown, want v_i, v_e when B is weak, moderate, and strong... suggestions welcome
- Textbooks always know E or have B weak/strong
- Question: What do you think is going on?



NH examples, Chapman
fit is good



SH examples, Chapman
fit is not good
65S, 12 noon, 80 SZA,
strong winds close to
boundary of winter polar night

What are dynamics doing?

