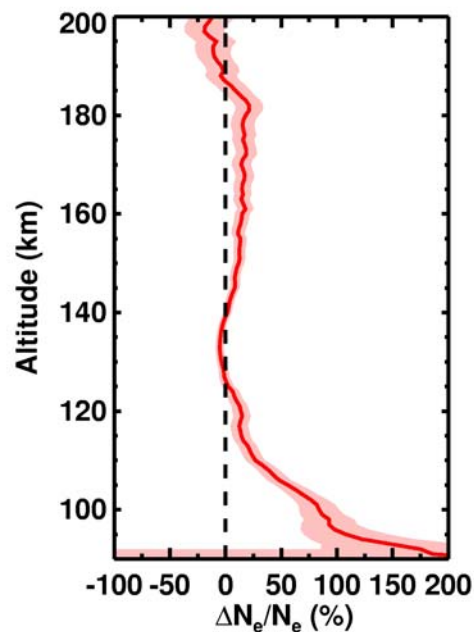
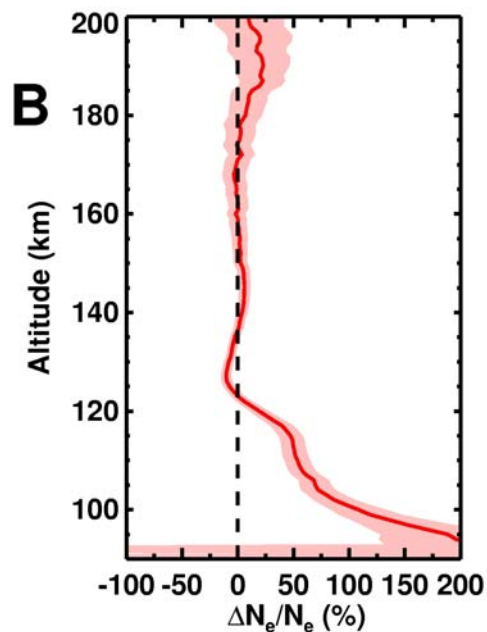
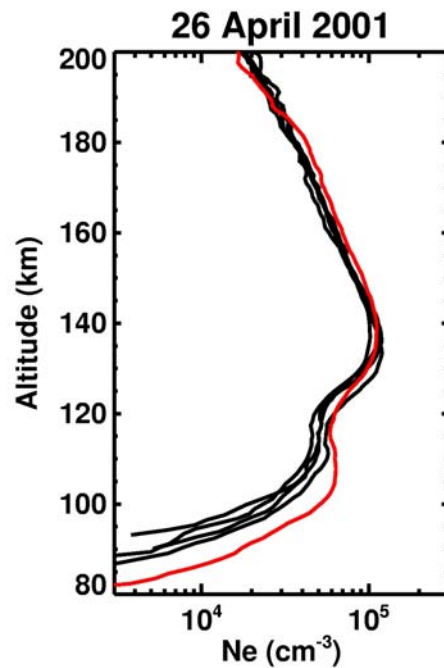
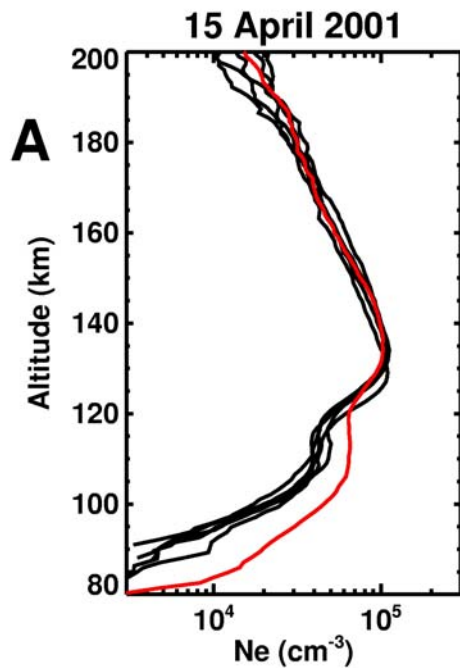


Simultaneous Radio Sounding of the Ionospheres of Earth and Mars During a Solar Flare

Michael Mendillo
Boston University
(mendillo@bu.edu)

Sunday 2007.04.29 11:20-11:40
University of Massachusetts – Lowell
“Radio Sounding and Plasma Physics”
A symposium on honor of
Professor Bodo Reinisch’s 70th birthday



MGS electron density profiles from 15 and 26 April 2001

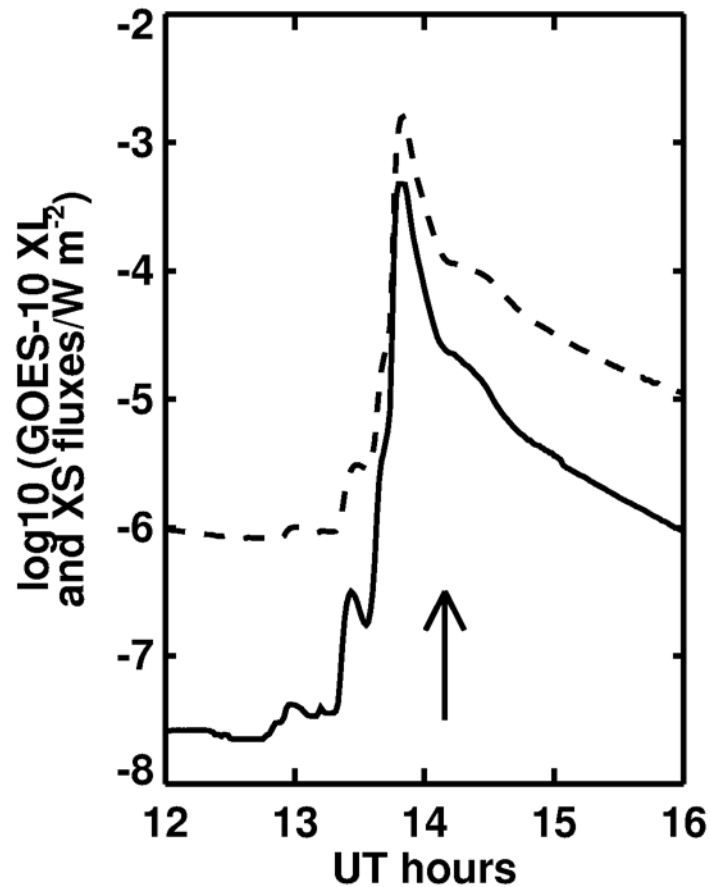
One profile on each day shows enhanced electron densities at low altitudes (red)

Percentage difference between the enhanced profile and the average non-enhanced profile

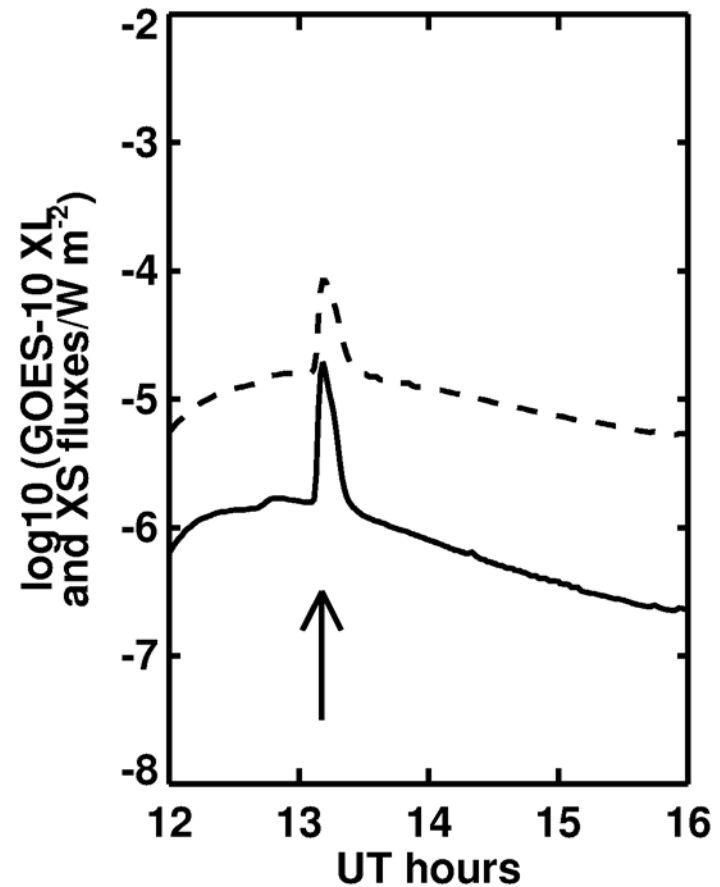
No difference above 120 km
100% difference at 100 km, so densities have doubled

Difference increases as altitude decreases

15 April 2001



26 April 2001

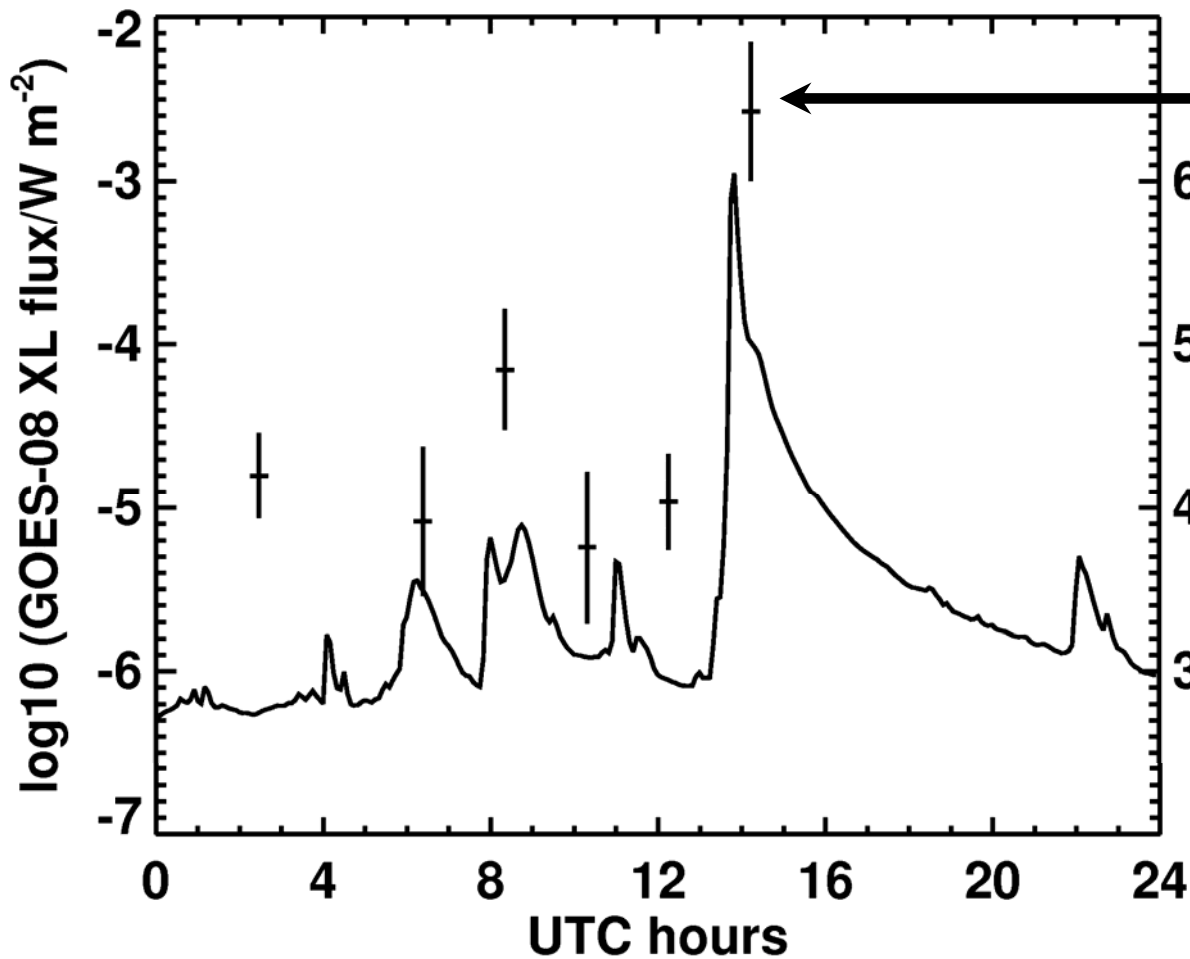


Solar flux at Earth measured by GOES satellites
Dashed line is 1 – 8 A, solid line is 0.5 – 3 A

Arrow marks the time of the enhanced profiles at Mars

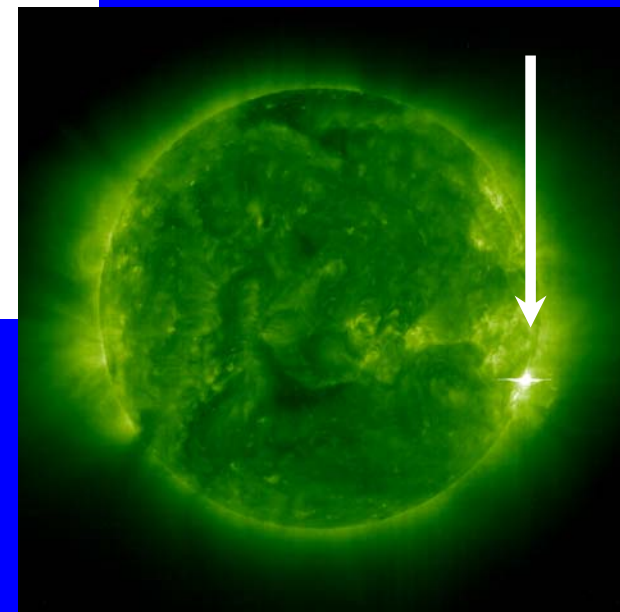
15 April = X14.4 flare

26 April = M7.8 flare

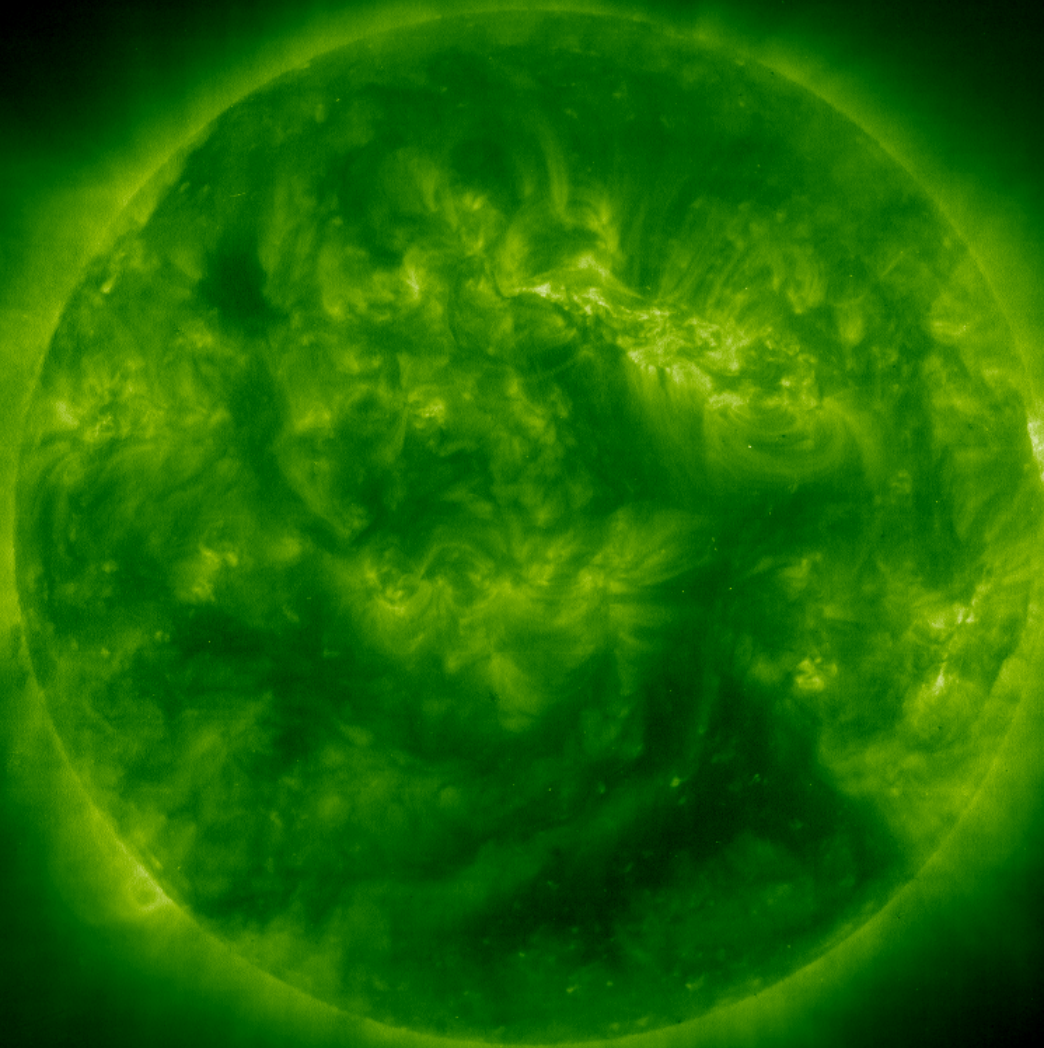


Electron density at 110 km for enhanced profile

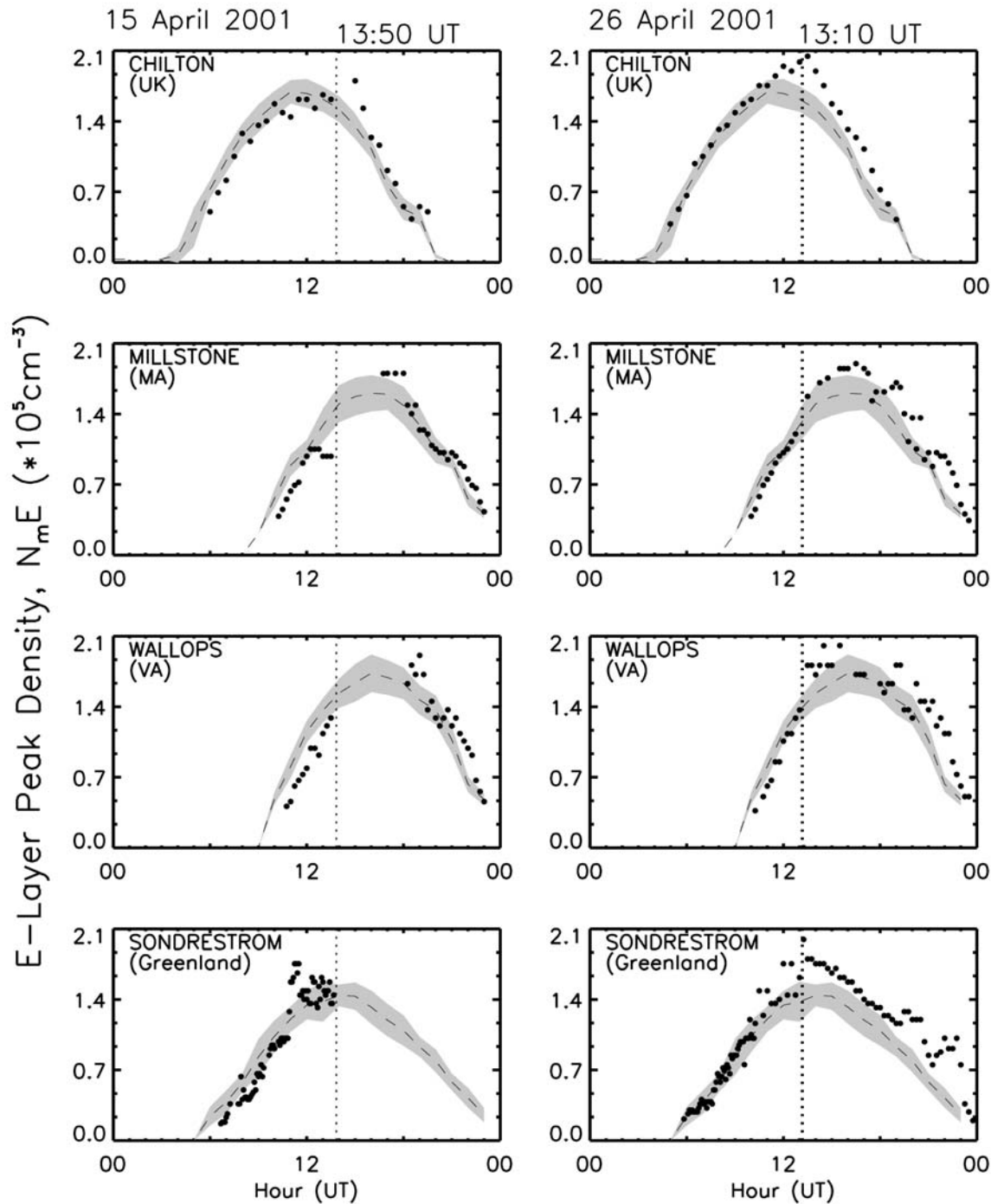
SOHO/EIT image at 19.5 nm at flare onset



X-ray flux (0.1 to 0.8 nm) measured in Earth orbit.
Flux increases by 2-3 orders of magnitude



This is supposed to be an animated gif of SOHO/EIT images at 19.5 nm from 12:00 UT to a few hours later.



Plots of NmE versus UT for Chilton, Millstone, Wallops, and Sondrestrom on 15 and 26 April

Shaded areas represent one standard deviation about the mean for April 2001

Dots are ionosonde measurements

Vertical dotted line marks time of solar flare

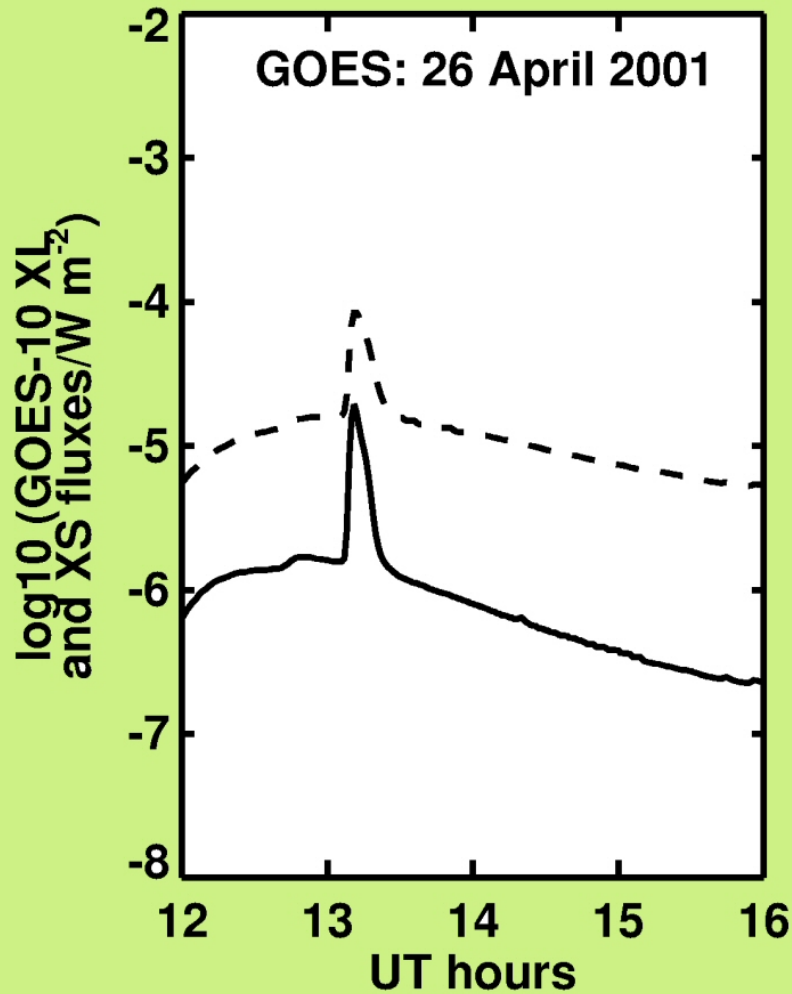
No data after X14.4 flare on 15 April

NmE increased after M7.8 flare on 26 April

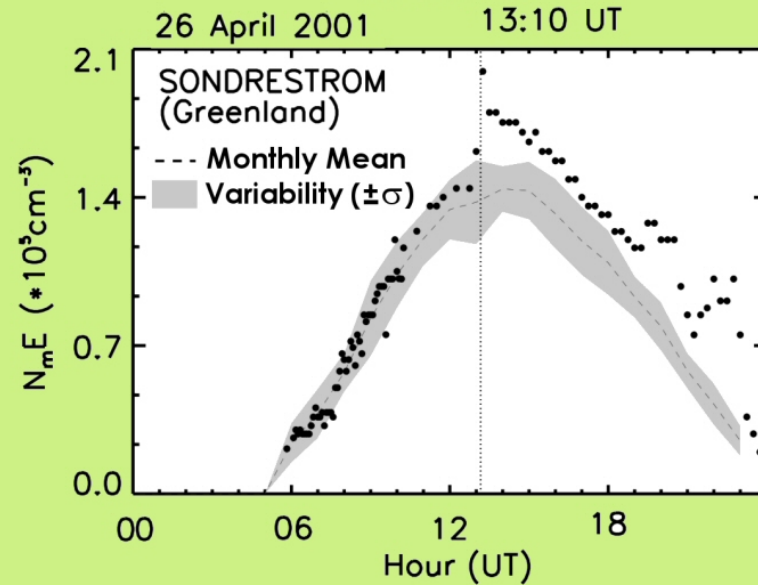
Backup Material

Solar Flare Effects at Earth and Mars

26 April 2001

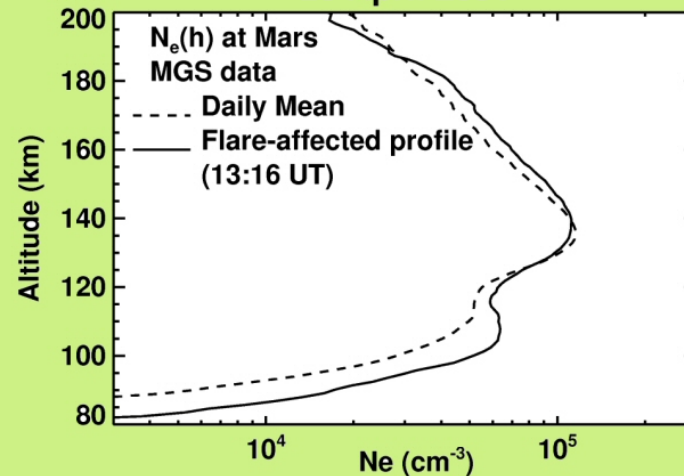


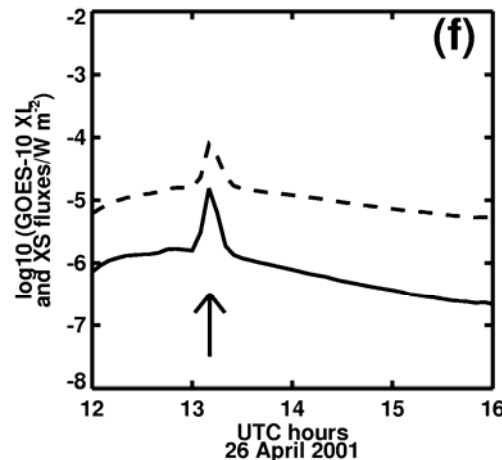
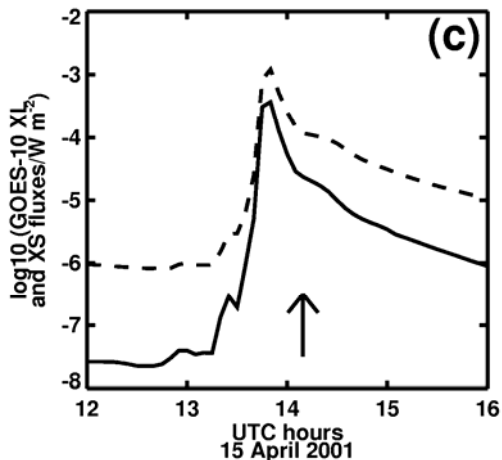
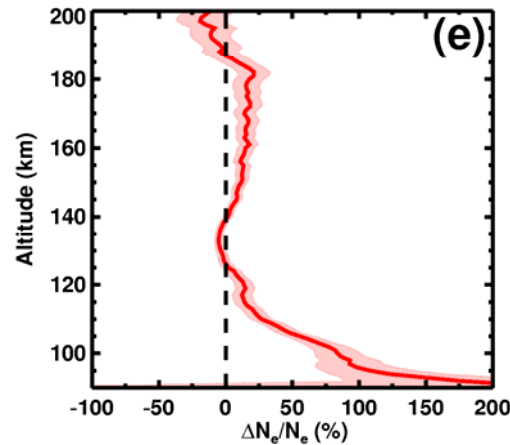
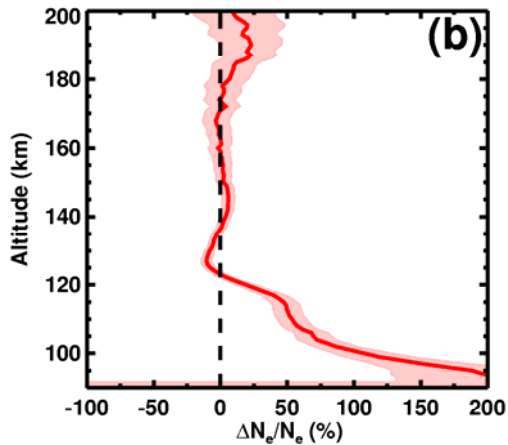
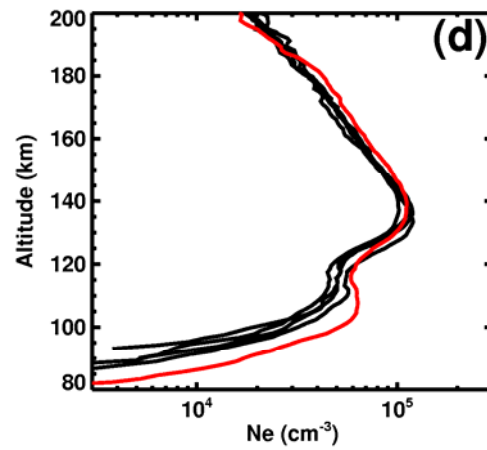
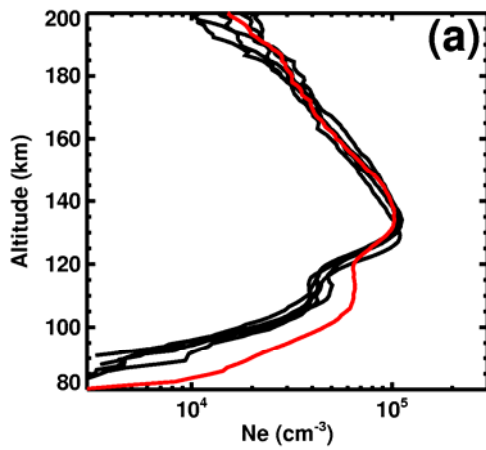
EARTH



Mars

26 April 2001





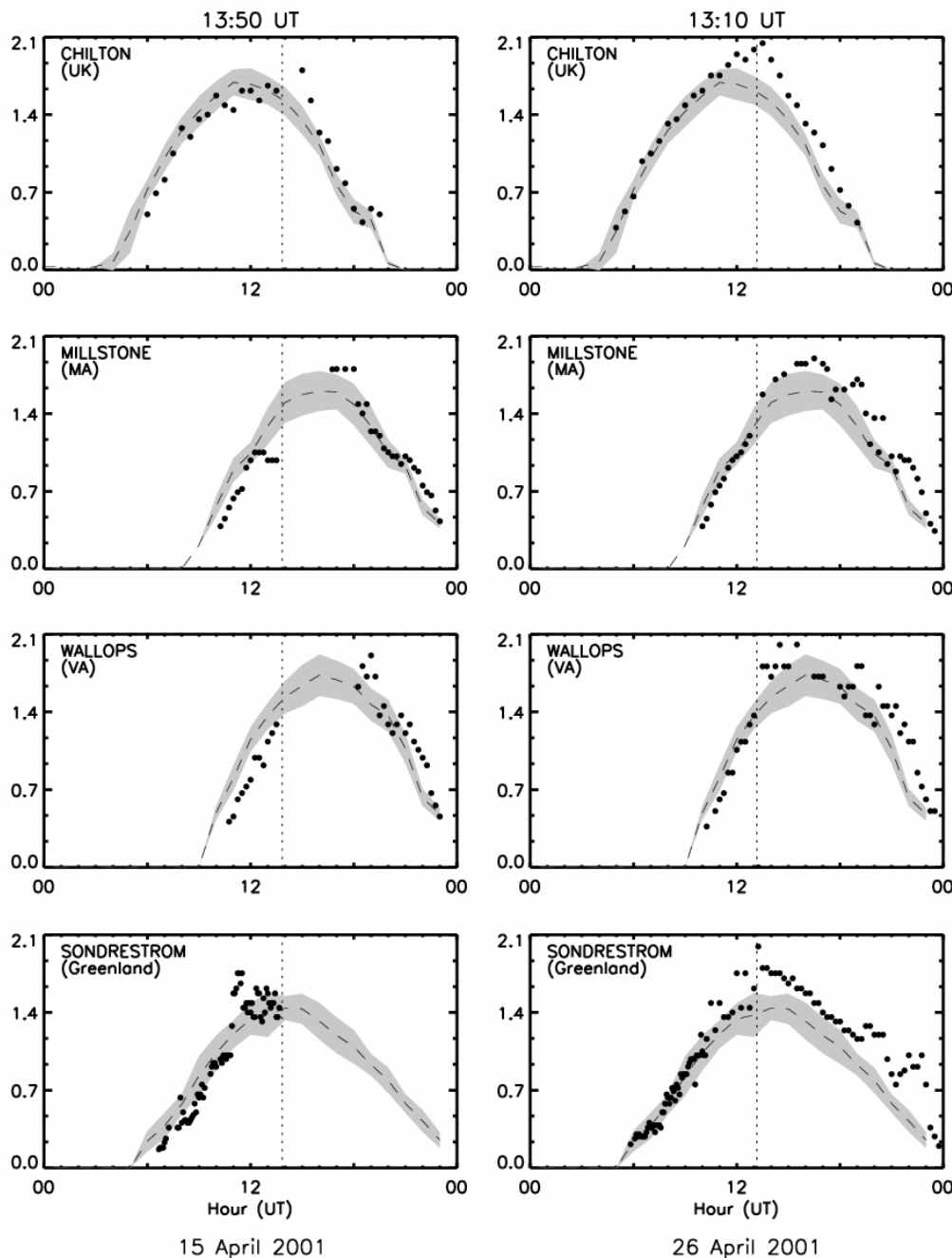
(a) MGS RS electron density profiles from 15 April 2001. Electron densities are enhanced at low altitudes for one profile, marked in red.

(b) Percentage difference between the red, enhanced profile and the mean of the black, non-enhanced profiles

(c) X-ray fluxes at Earth on this day between 0.5-3 A (solid, XS) and 1-8 A (dashed, XL). Arrow marks observation time of enhanced profile. Data from GOES satellites

(d), (e), (f)
As (a), (b), (c) but for 26 April 2001

E-Layer Peak Density, N_mE ($\times 10^4 \text{cm}^{-3}$)



Measurements of the terrestrial ionosphere on 15 and 26 April 2001, left and right columns respectively. Dots are observations, dashed lines and shaded areas are average values for the month. Vertical lines show times of peak flare fluxes.

The 15 April flare, X14.4 magnitude, was so strong that the ionosonde's radio signal was absorbed by increased electron densities in the D region and the E region was not observable

The 26 April flare, M7.8 magnitude, did lead to increased E region densities