Solar-Cycle & Short-Term Variations of Topside Ionospheric Electron-Density Profiles

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Progress as of September 2006

• Extended ISIS digital ionospheric topside-sounder ionogram database
  – > 470,000 ionograms now in National Space Science Data Center (NSSDC)
  – Alouette 2, ISIS 1 and ISIS 2 digital ionograms extend over 19 years (1966-1984)

• Processed Digital ionograms into topside vertical electron-density profiles $N_e(h)$
  – > 115,000 TOPIST automatically-scaled ISIS-2 $N_e(h)$ profiles now in NSSDC
  – Supplements > 170,000 hand-scaled Alouette 1&2 and ISIS 1 & 2 $N_e(h)$ profiles

• Extracted $O^+/H^+$ transition heights from topside $N_e(h)$ profiles
  – Analysis applied to individual passes
  – Analysis also applied to the above hand-scaled $N_e(h)$ profile database
ISIS-2 digital topside ionogram (apparent range vs. frequency f) illustrating:
• plasma resonances
• ionospheric penetration freq. $f_xF_2$
• ionospheric reflections when $f < f_xF_2$
• surface reflections and ground-noise breakthrough when $f > f_xF_2$

Distribution of digital topside ionograms available from NSSDC by satellite:
• Alouette 2 launched in 1965
• ISIS 1 launched in 1969
• ISIS 2 launched in 1971

Ionospheric reflections used to derive topside $N_e(h)$
Example of O\(^+\)/H\(^+\) transition height determination from topside Ne(h) profile from mid-latitude ISIS-2 ionogram.

Distribution of topside Ne(h) profiles available from NSSDC based on:
- hand scaling of ionospheric reflections
- auto scaling (TOPIST) of reflections
Local nighttime O\(^{+}/\)H\(^{+}\) transition-heights from ~ 22,000 hand-scaled Alouette 1 & 2 and ISIS 1 & 2 Ne(h) profiles from NSSDC (satellite altitudes ≥ 1000 km)