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. $f_x F_2$
- ionospheric reflections when $f < f_x F_2$
- surface reflections and ground-noise breakthrough when $f > f_x F_2$

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 N\(_e\)(h) profile from mid-latitude ISIS-2 ionogram

Distribution of topside N\(_e\)(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)