Electron density perturbation by Fixed Bias Probe on S-520-27 sounding rocket

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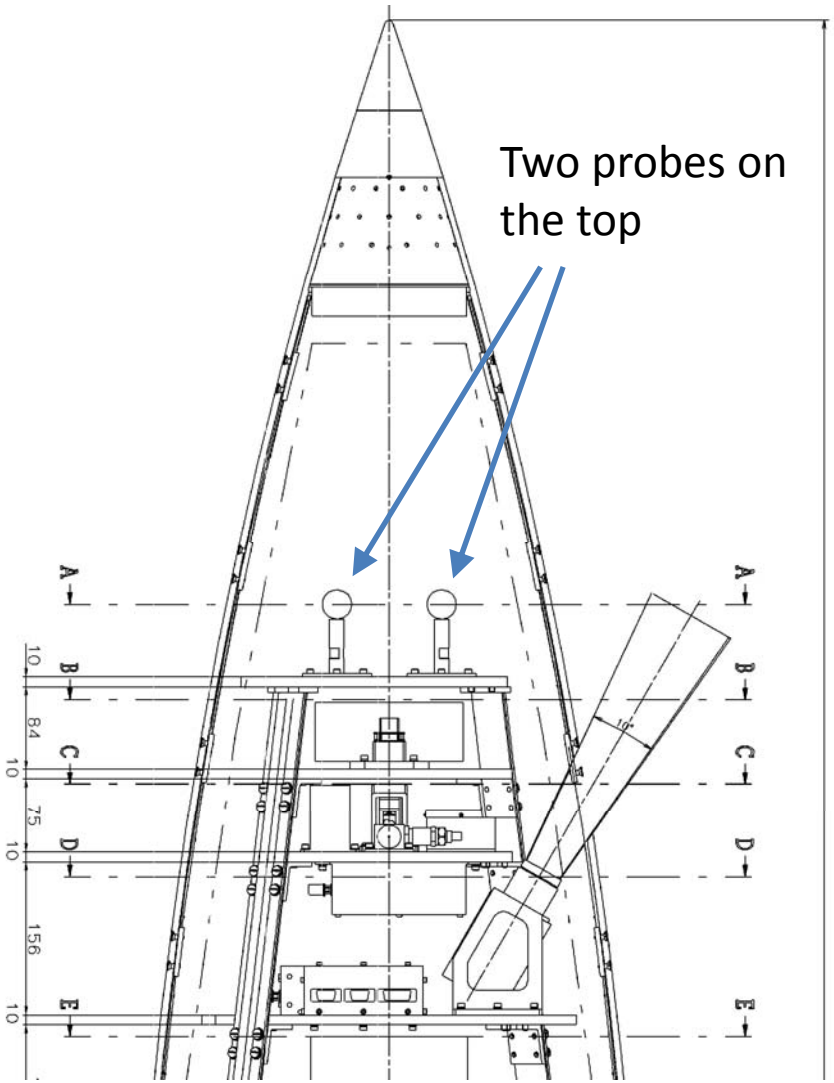
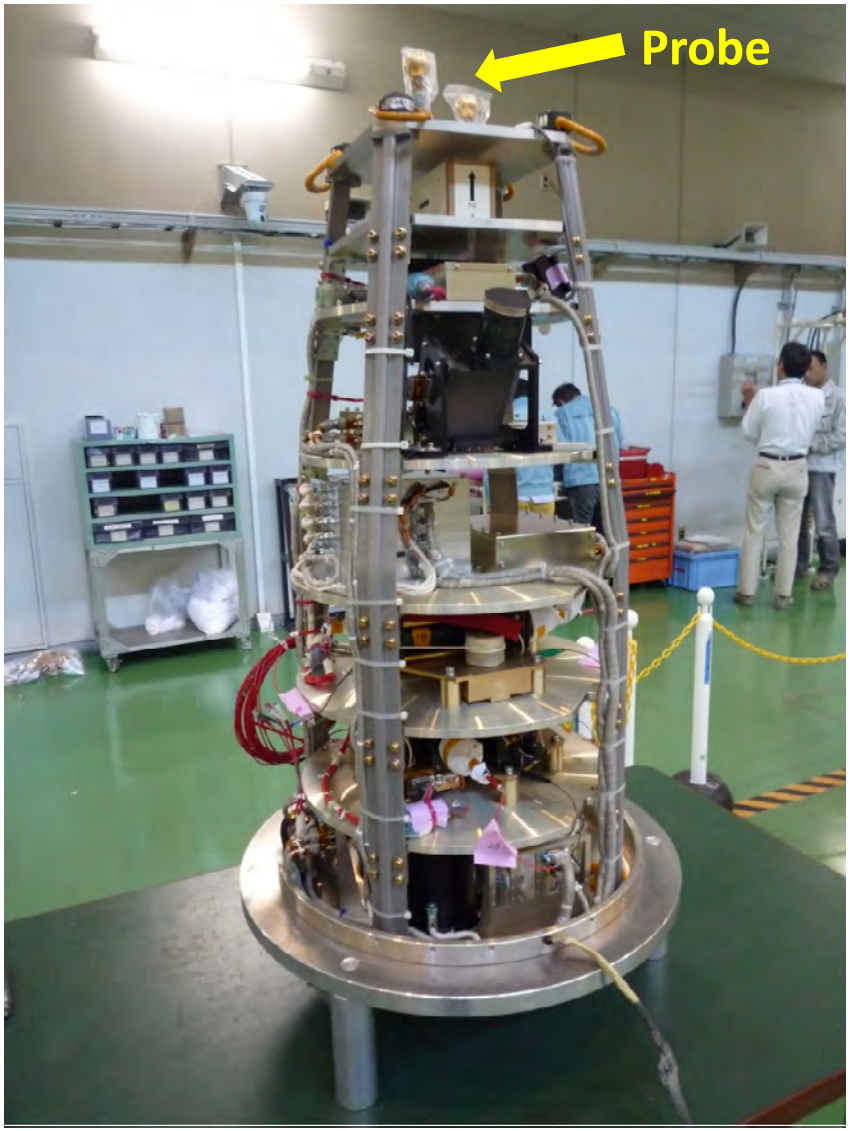
Fixed Bias Probe





Specification of Fixed Bias Probe

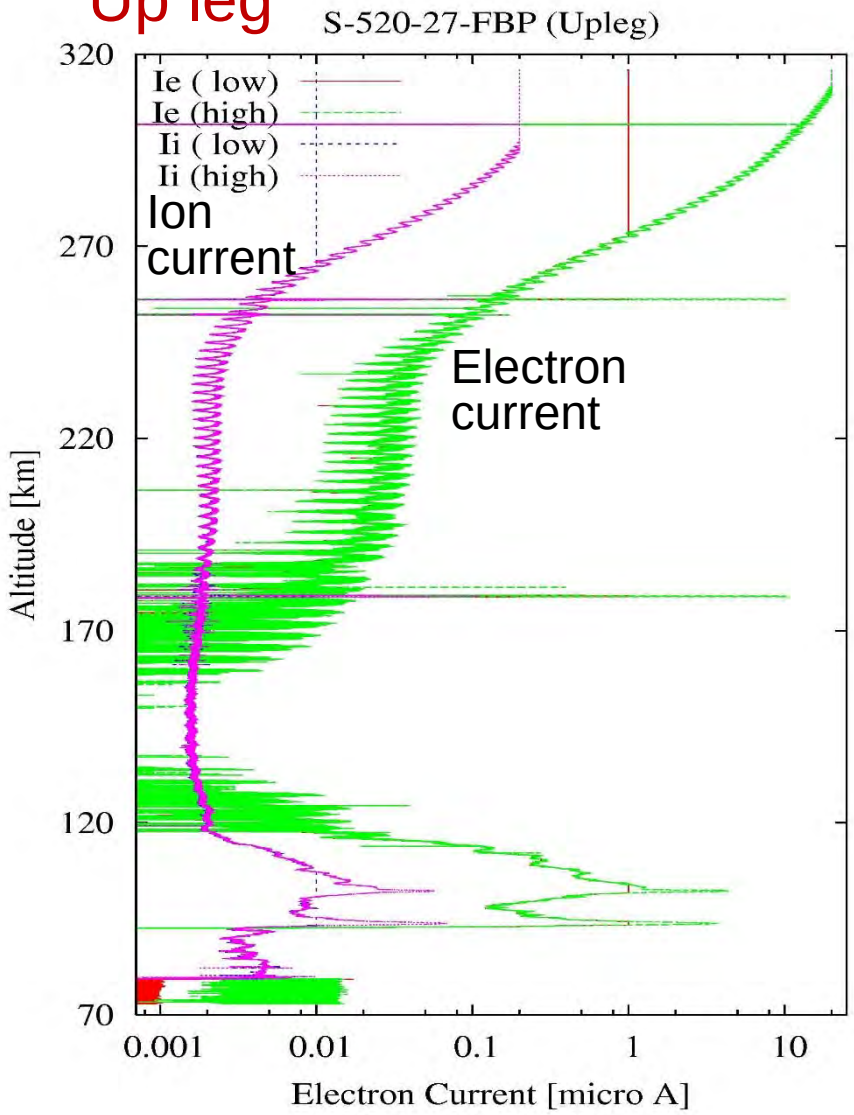
Purpose： To observe small-scale (< 1m) electron density perturbation by measuring electron current with a high-time resolution on the rocket

Specification：

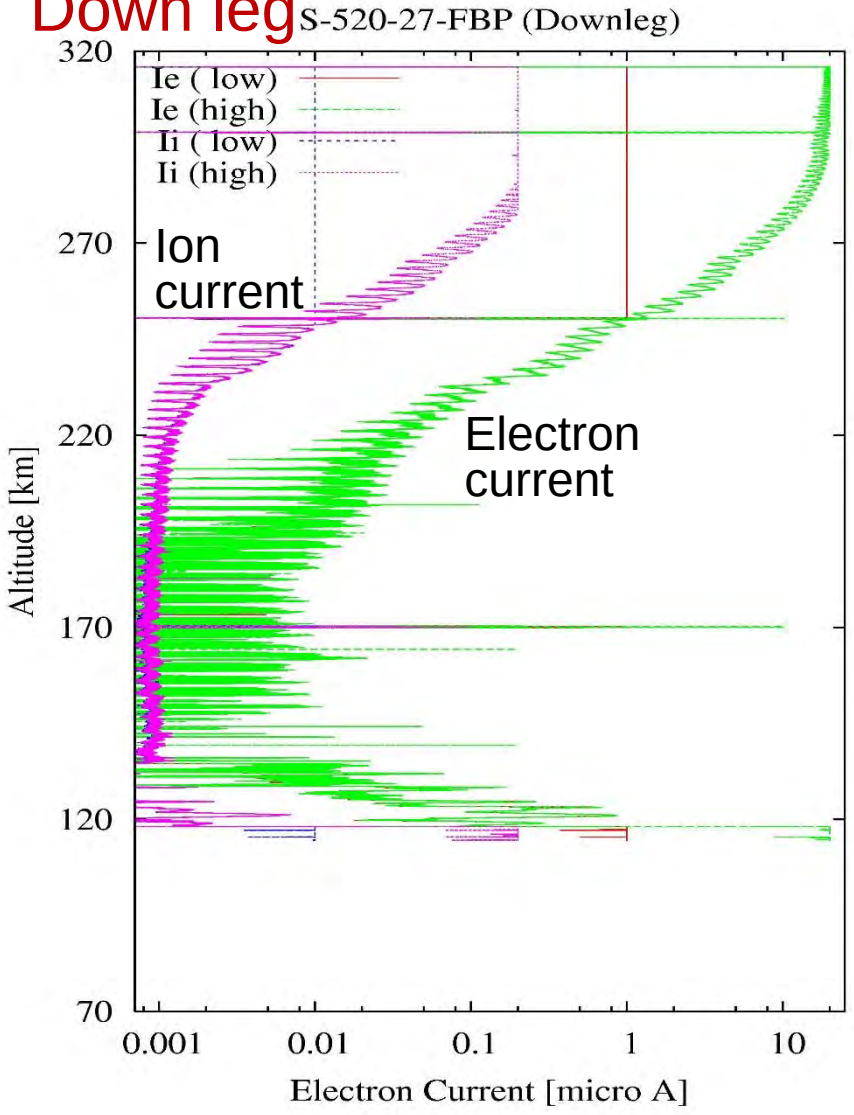
Item	FBP-1（electron current）		FBP-2（ion current）	
	Low gain	High gain	Low gain	High gain
Sampling	3200 Hz	3200 Hz	3200 Hz	3200 Hz
Current (full scale)	20 μA	1 μA	0．2 μA	0．01 μA
Probe dimension	Spherical probe with a diameter of 3 cm		Spherical probe with a diameter of 3 cm	
Applied voltage	＋4 V		－3 V	
Calibration signal	50% of full scale voltage is applied to the electronics once every 60 sec			

Altitude profile of probe current

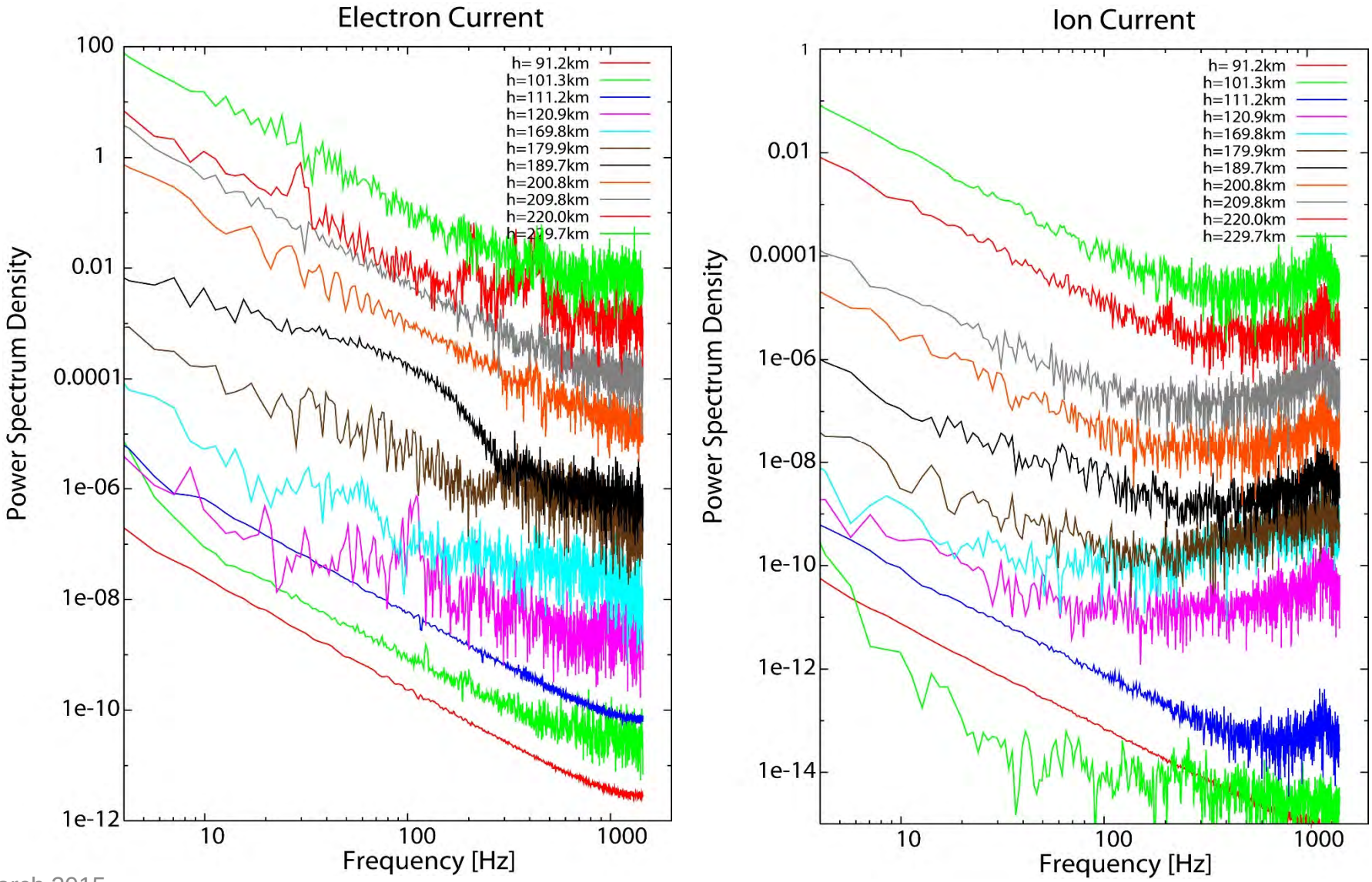
Up leg



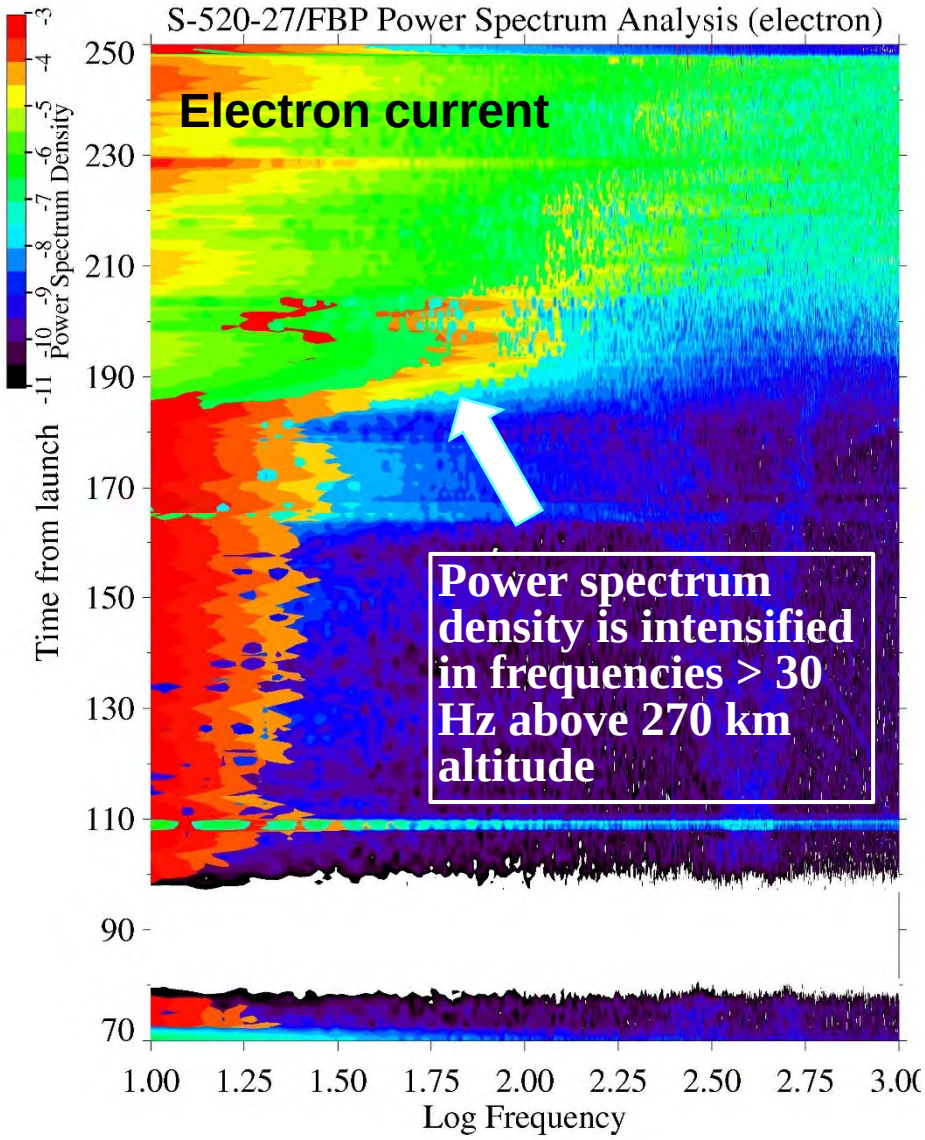
Down leg

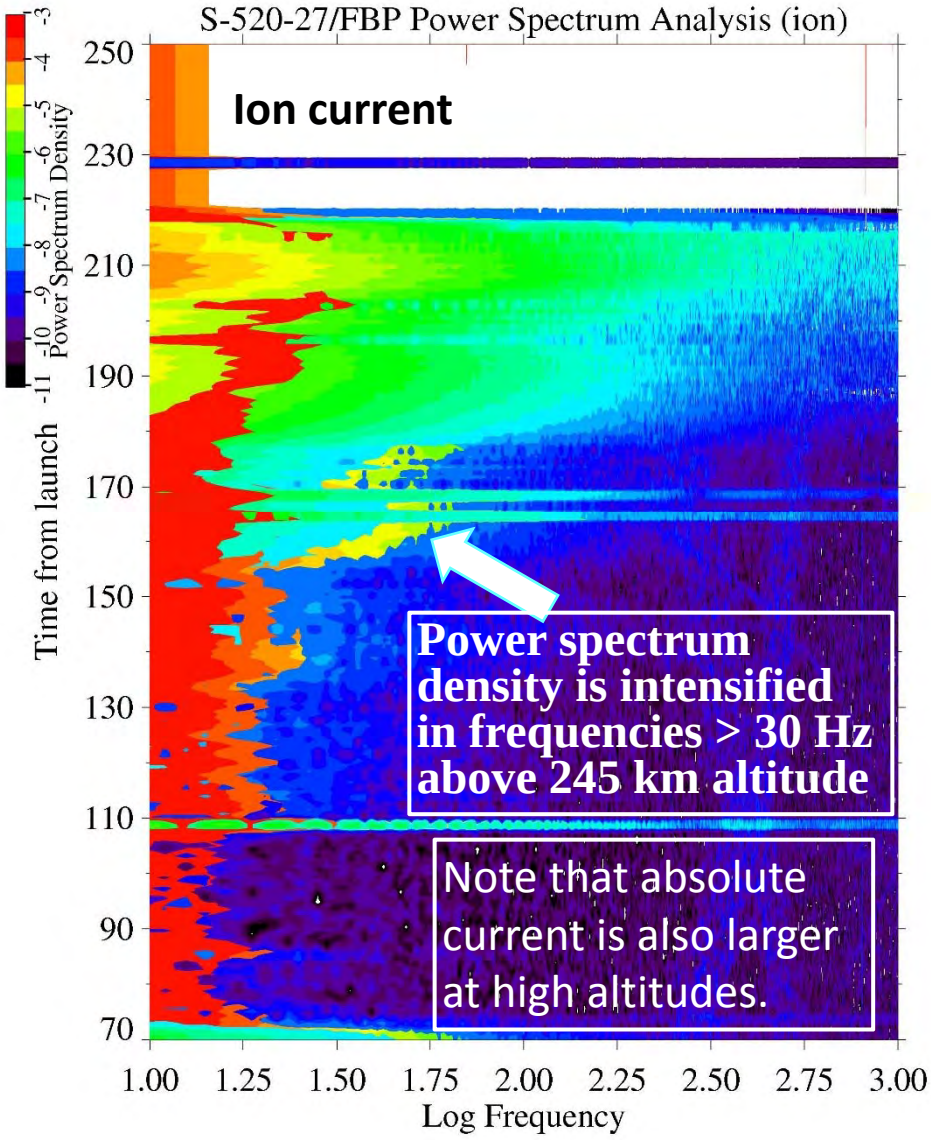


Power Spectrum of Electron/Ion current

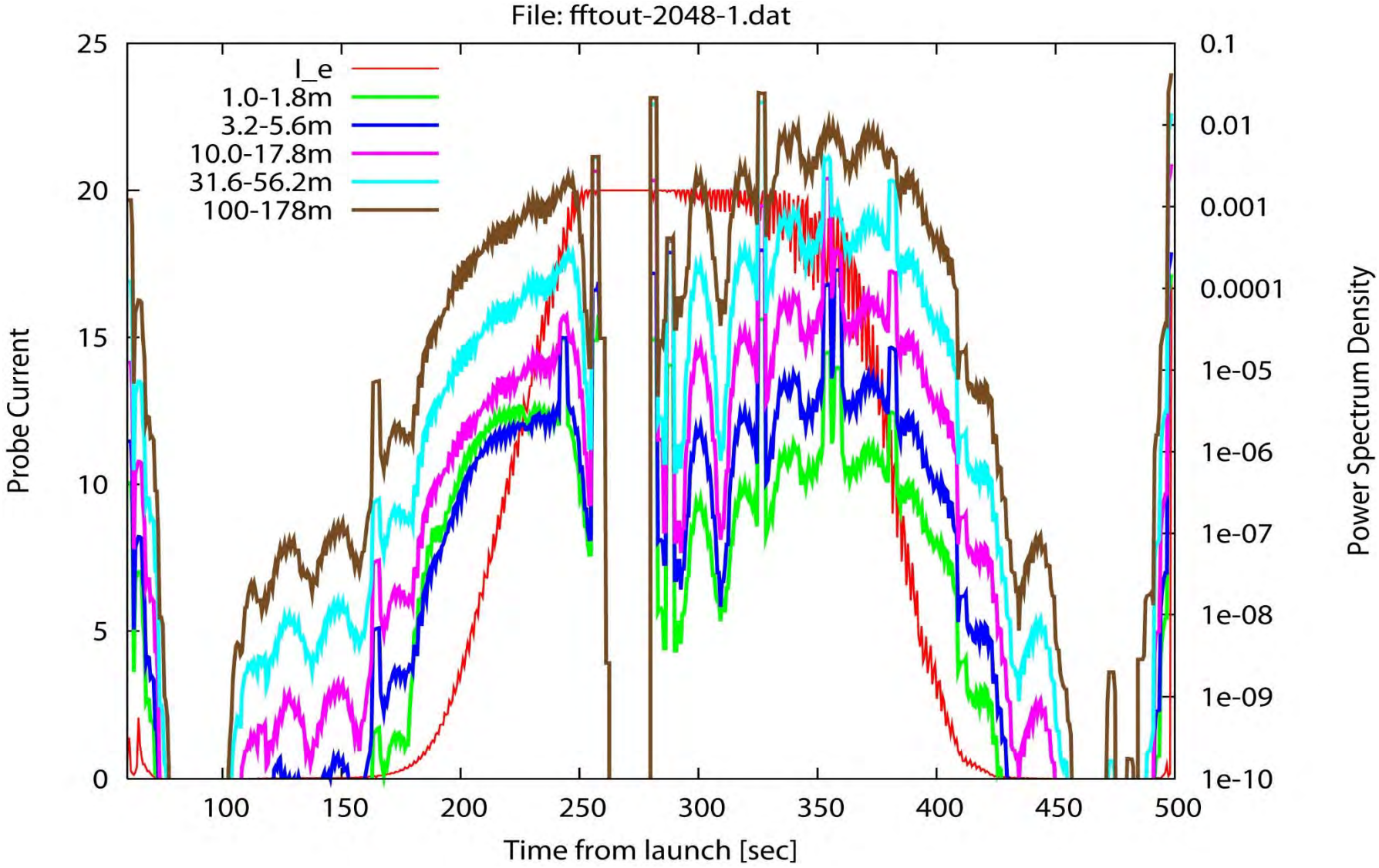


Power Spectrum Analysis

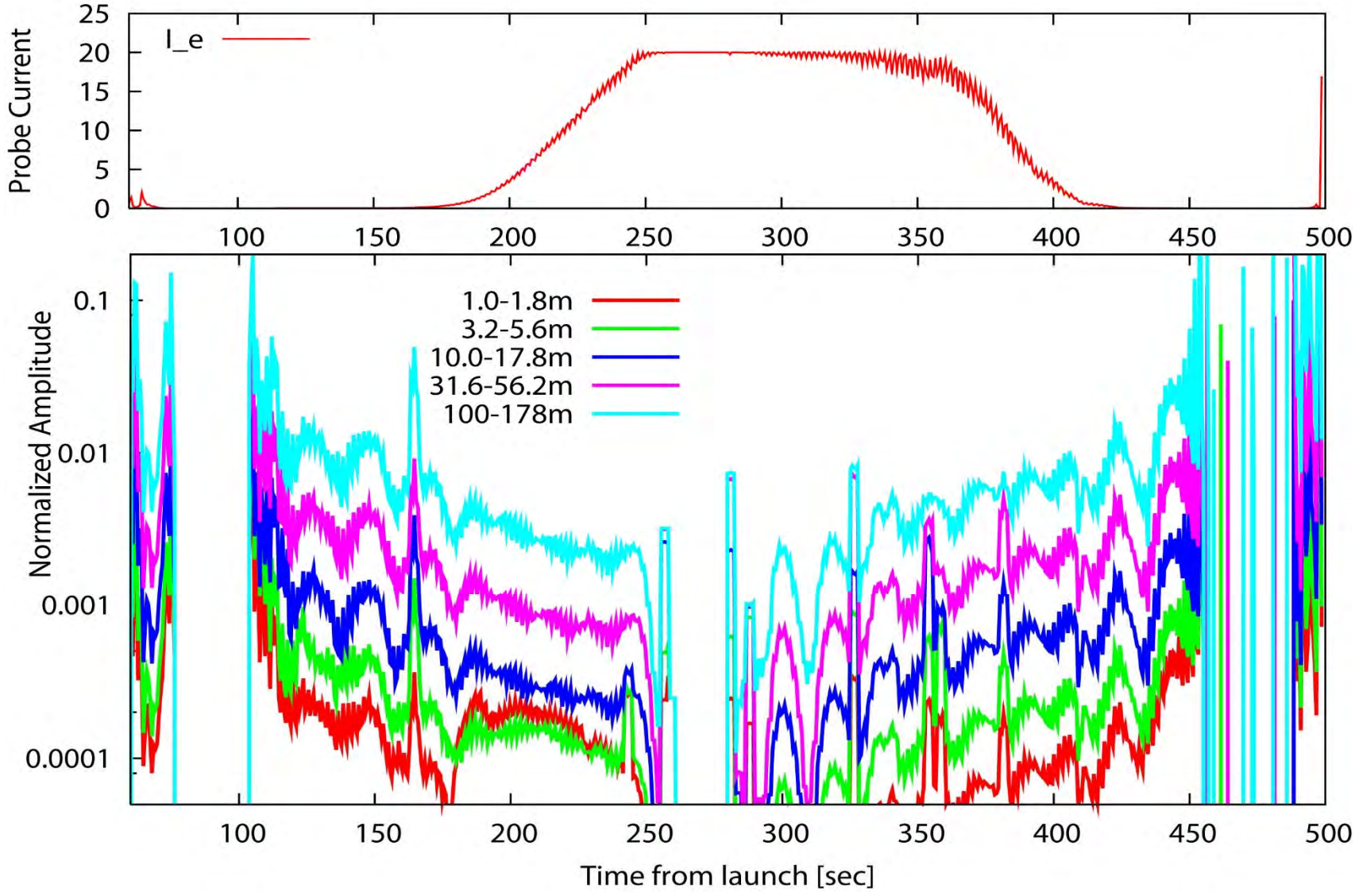




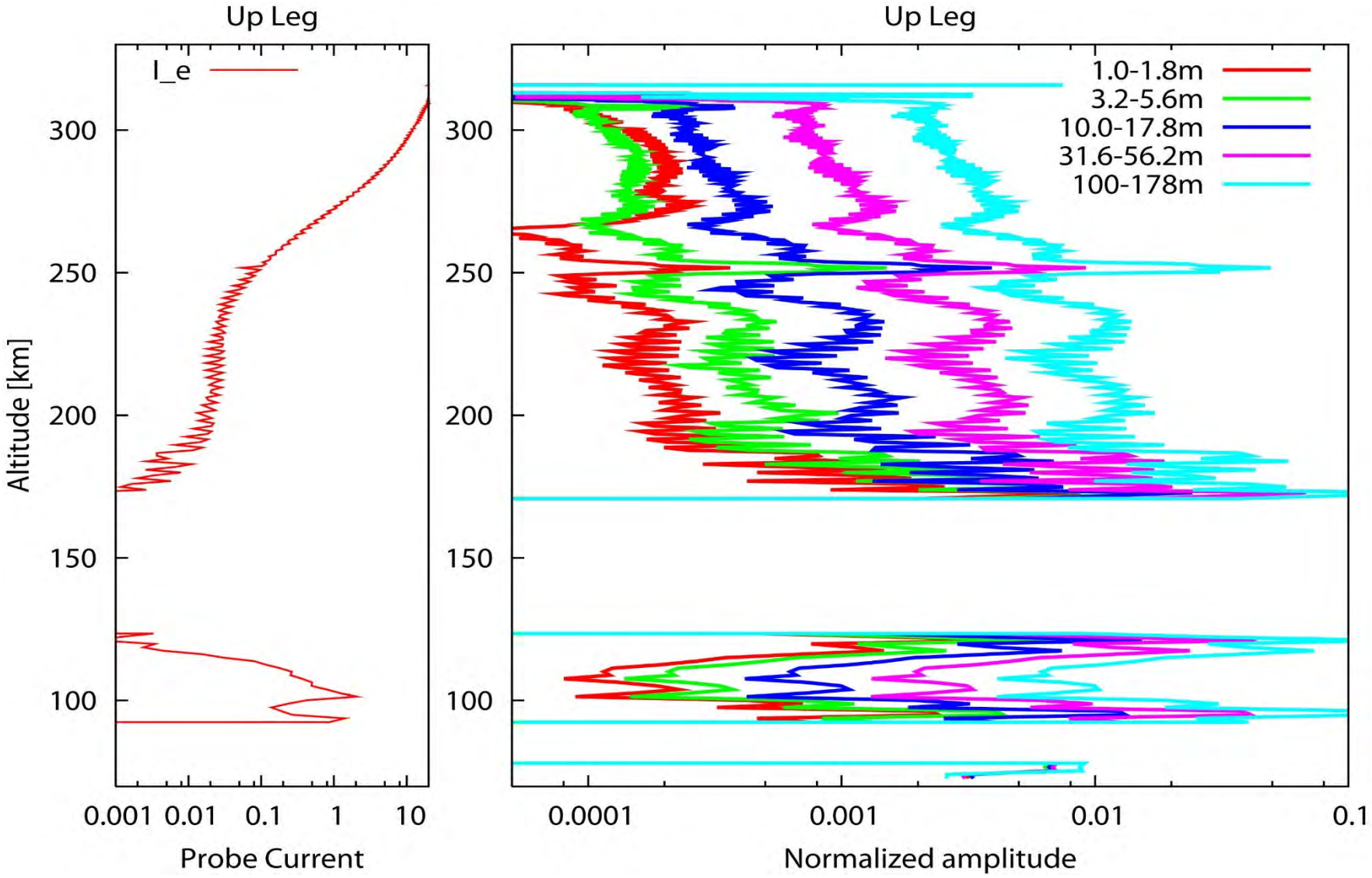
Variation of the electron density perturbation with different spatial scale



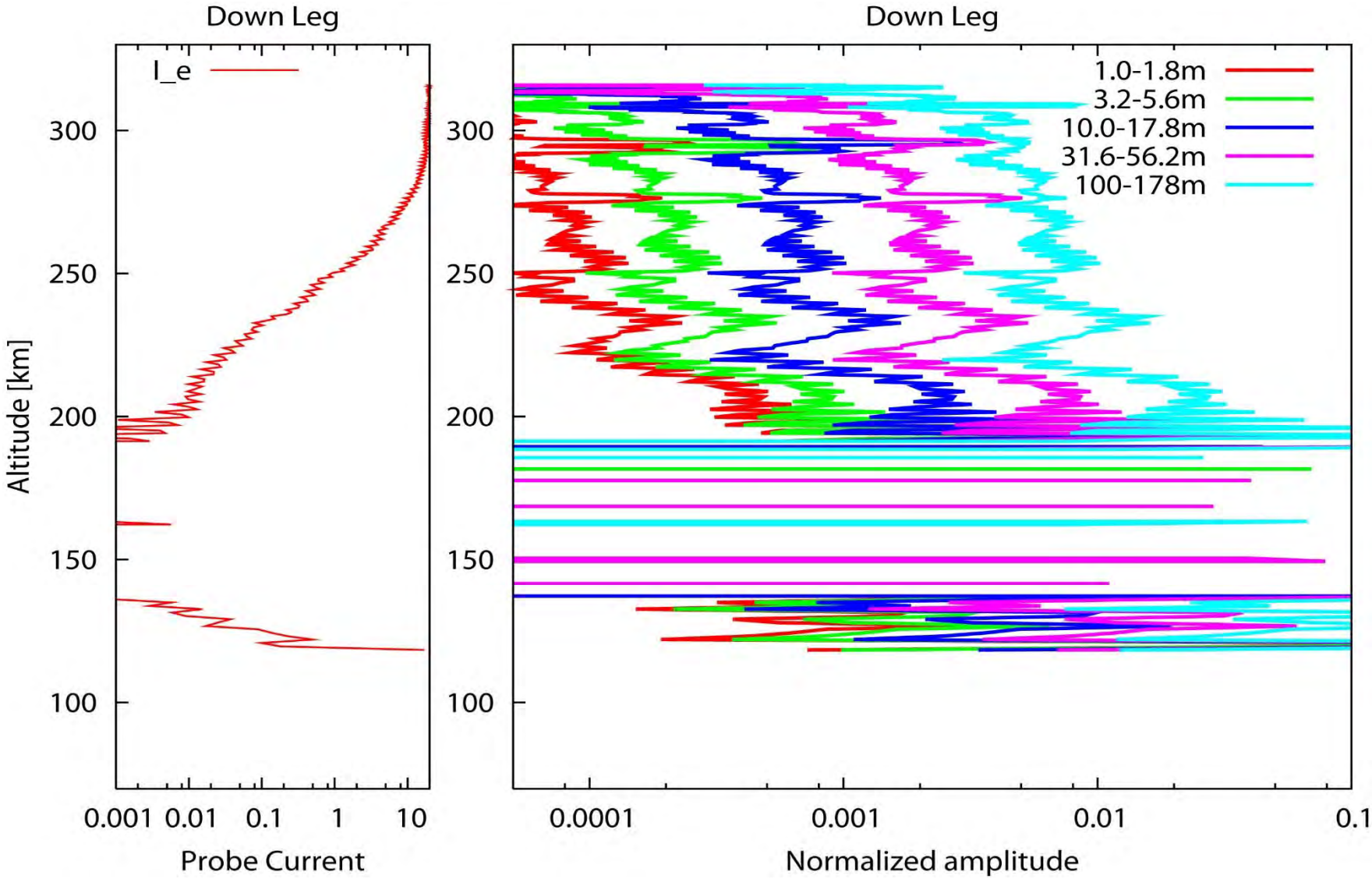
Variation of $\Delta N_e/N_e$(normalized by the background density)



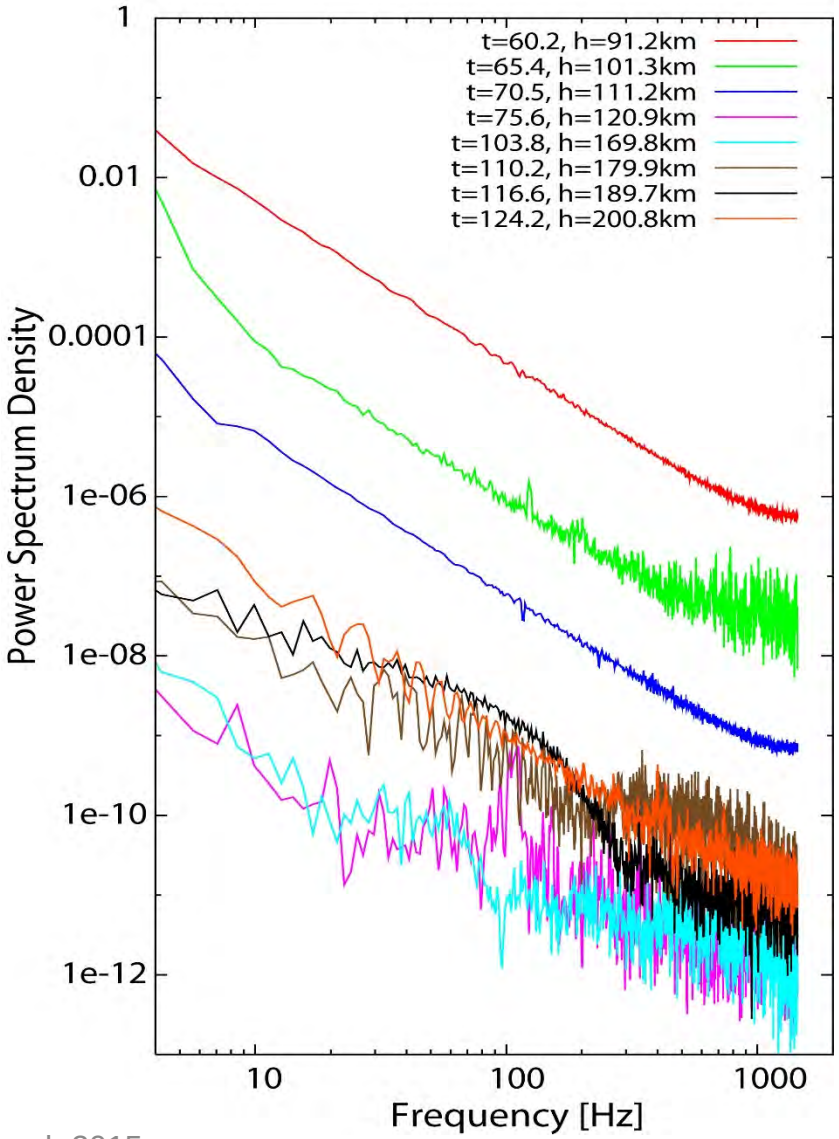
Altitude variation of $\Delta N_e/N_e$
- Up leg -

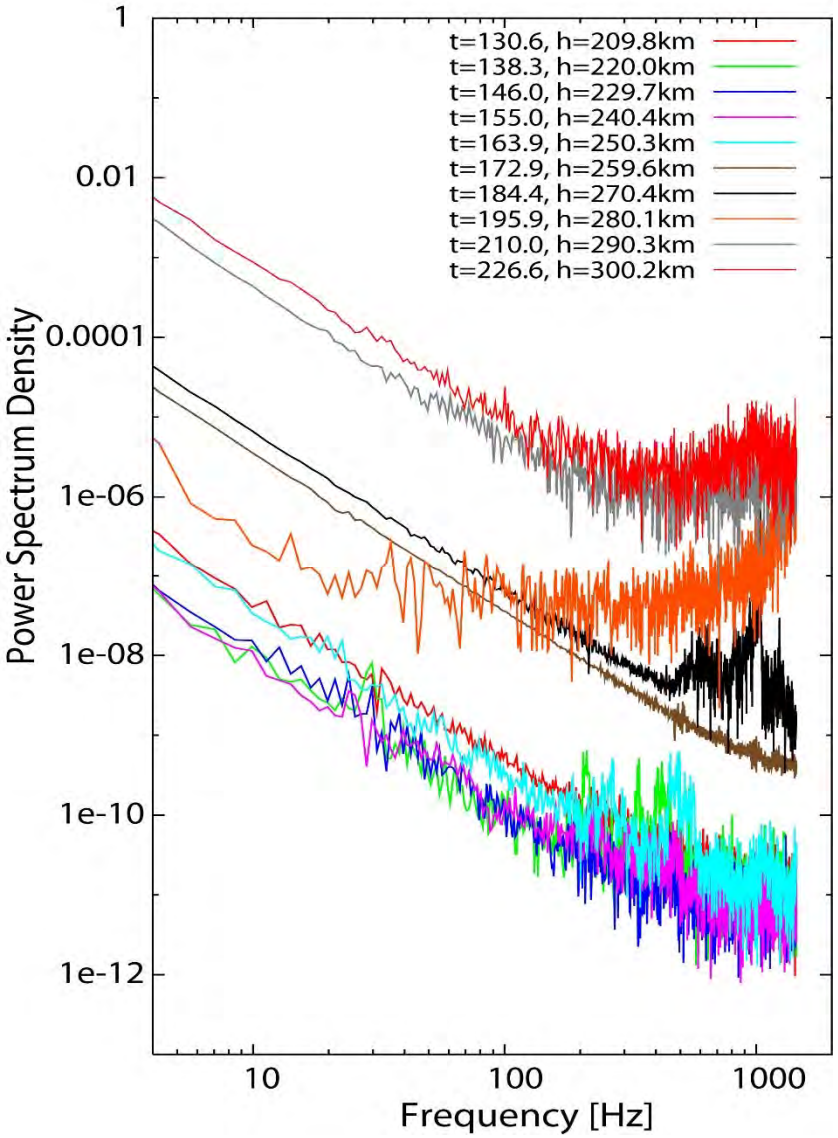


Altitude variation of $\Delta N_e/N_e$
- Down leg -



Power spectrum of electron current





Summary of FBP observations

- ΔN/N becomes larger at lower altitudes.
- Spectral index decreases above 260 km altitude during the up leg.
- The spectral power in the frequencies > 30 Hz increases above 270 km (up leg) and 245 km (down leg) altitudes. This frequency approximately corresponds to several 10 m spatial scale.
- This may imply a periodic spatial structure of the electron density perturbation in the ionospheric F region.
- What happened in the electron current between 130 and 170 km altitudes?