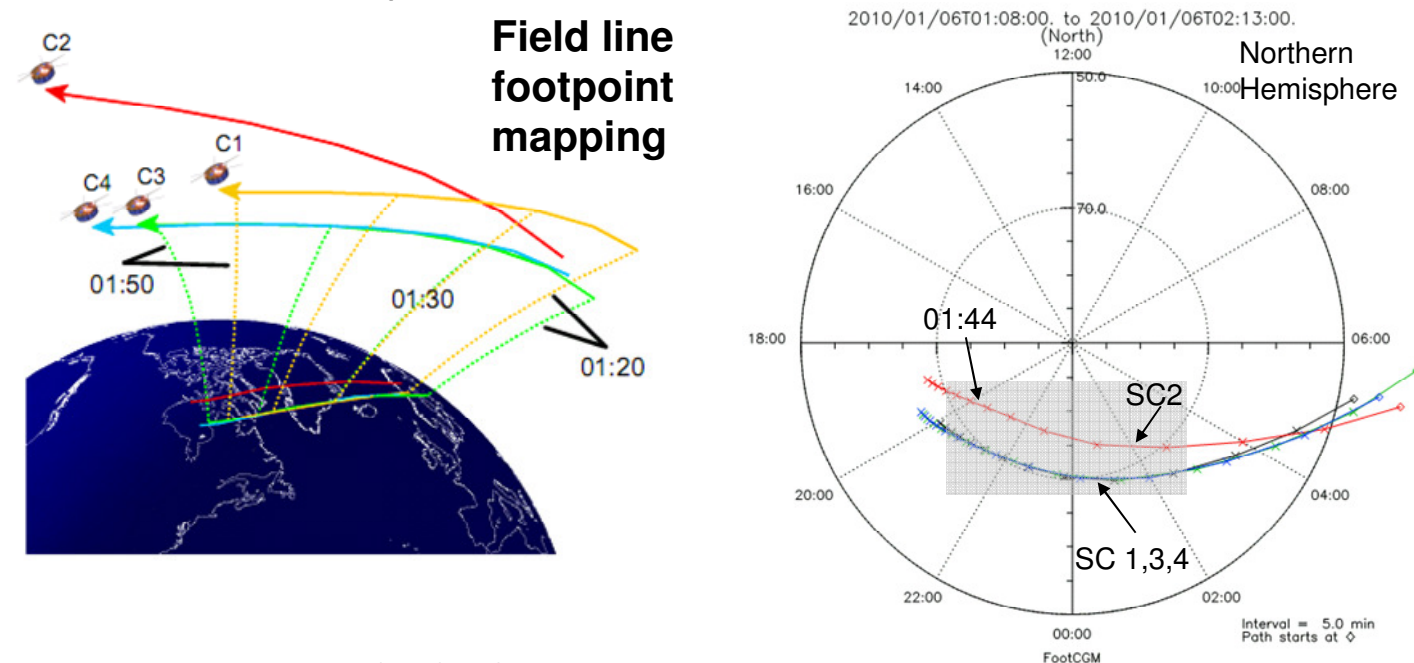


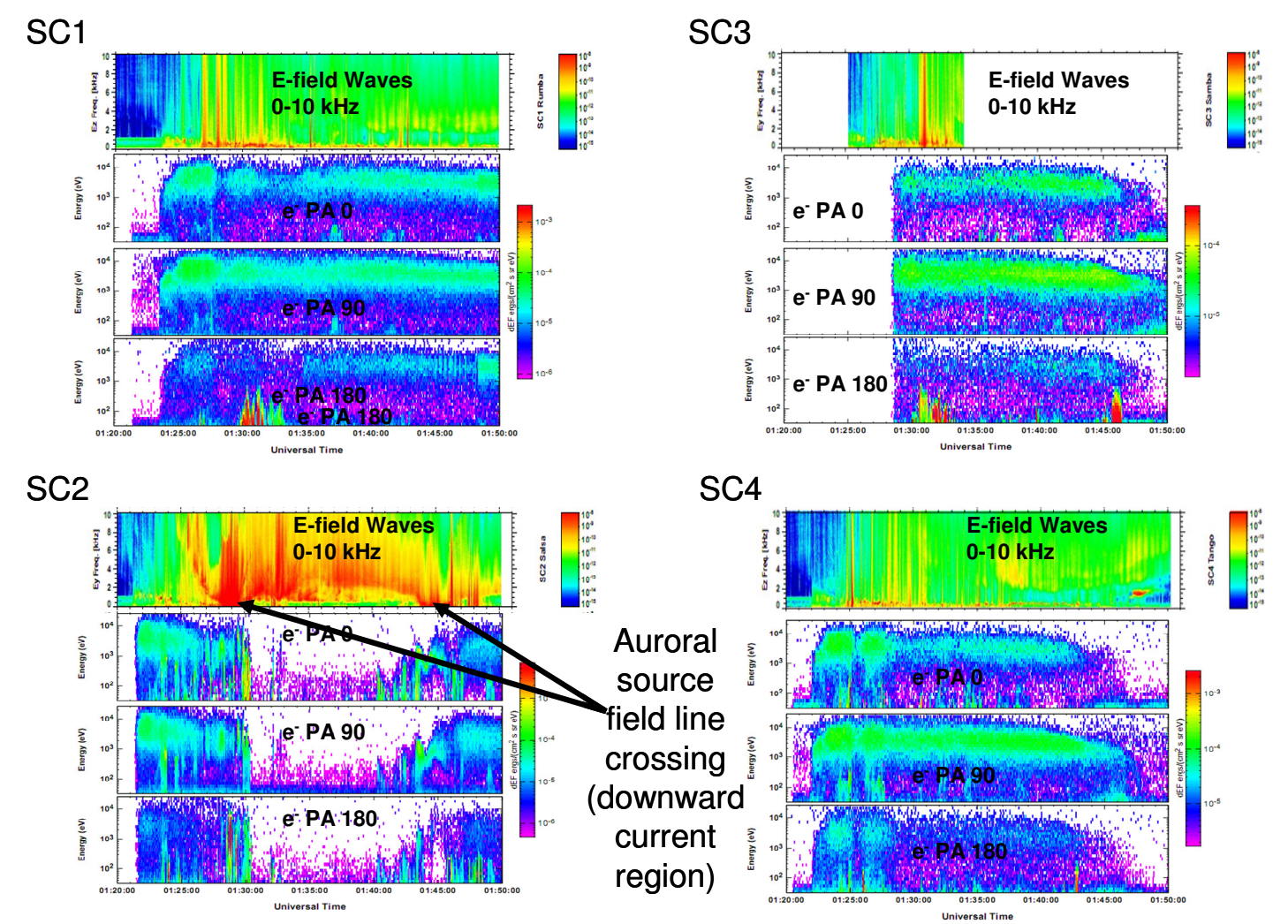
5. Orbit and Configuration 2010-01-06

Cluster Spacecraft Trajectory January 6, 2010: 01:20-01:50 UT

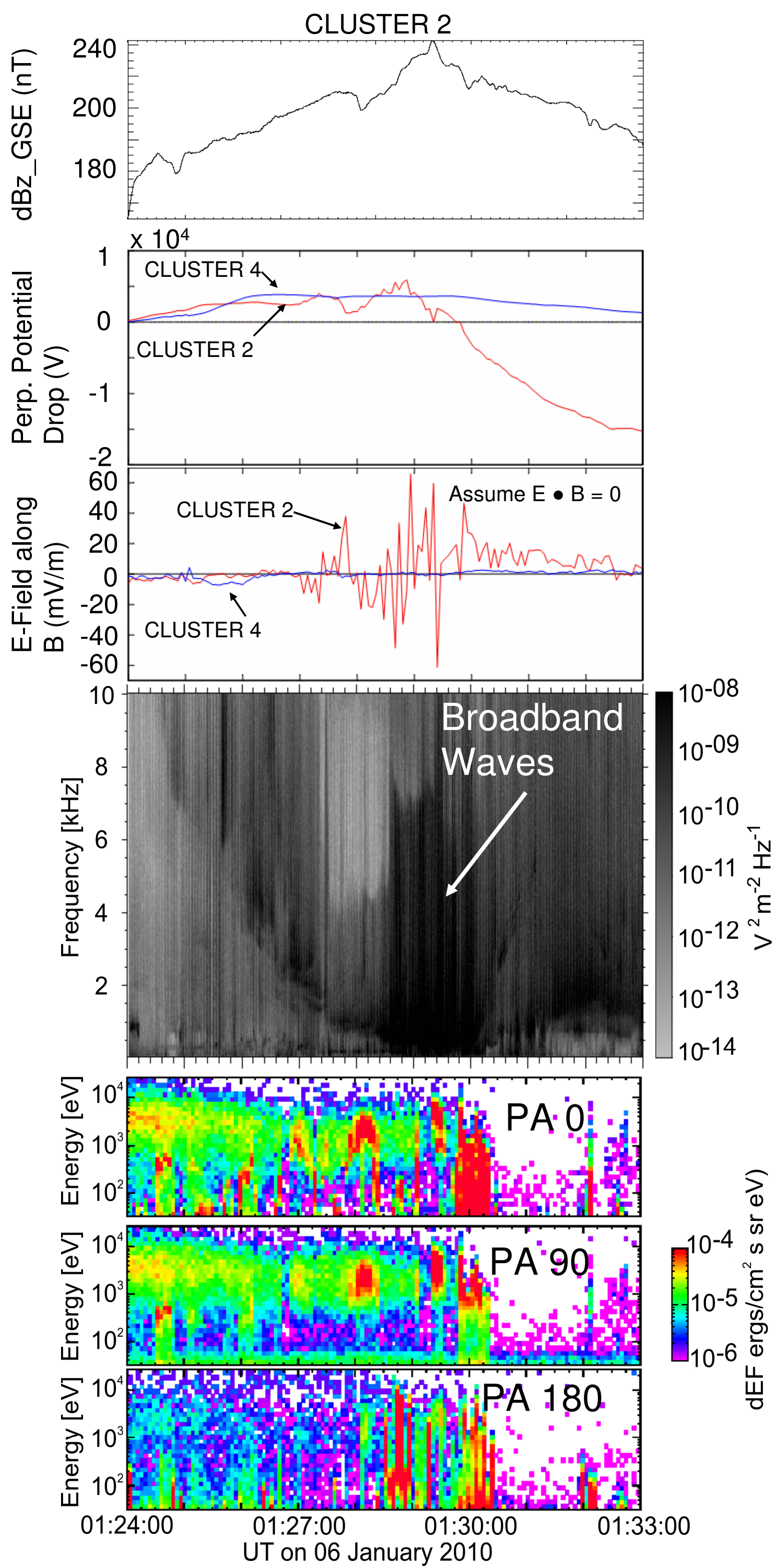


- Altitude ~7300 km (C2/C3/C4)
- C1 higher altitude by ~ 1100 km
- C2 most poleward by ~ 5-7 deg.
- C3 follows C4 through AAR with ~ 3 minute lag
- Footpoint:
Centered on Midnight
C1/C3/C4: 67-72 deg. GM Lat.
C2: 68-78 deg.
- SC separations: ~1300-3400 km

6. Overview 2010-01-06



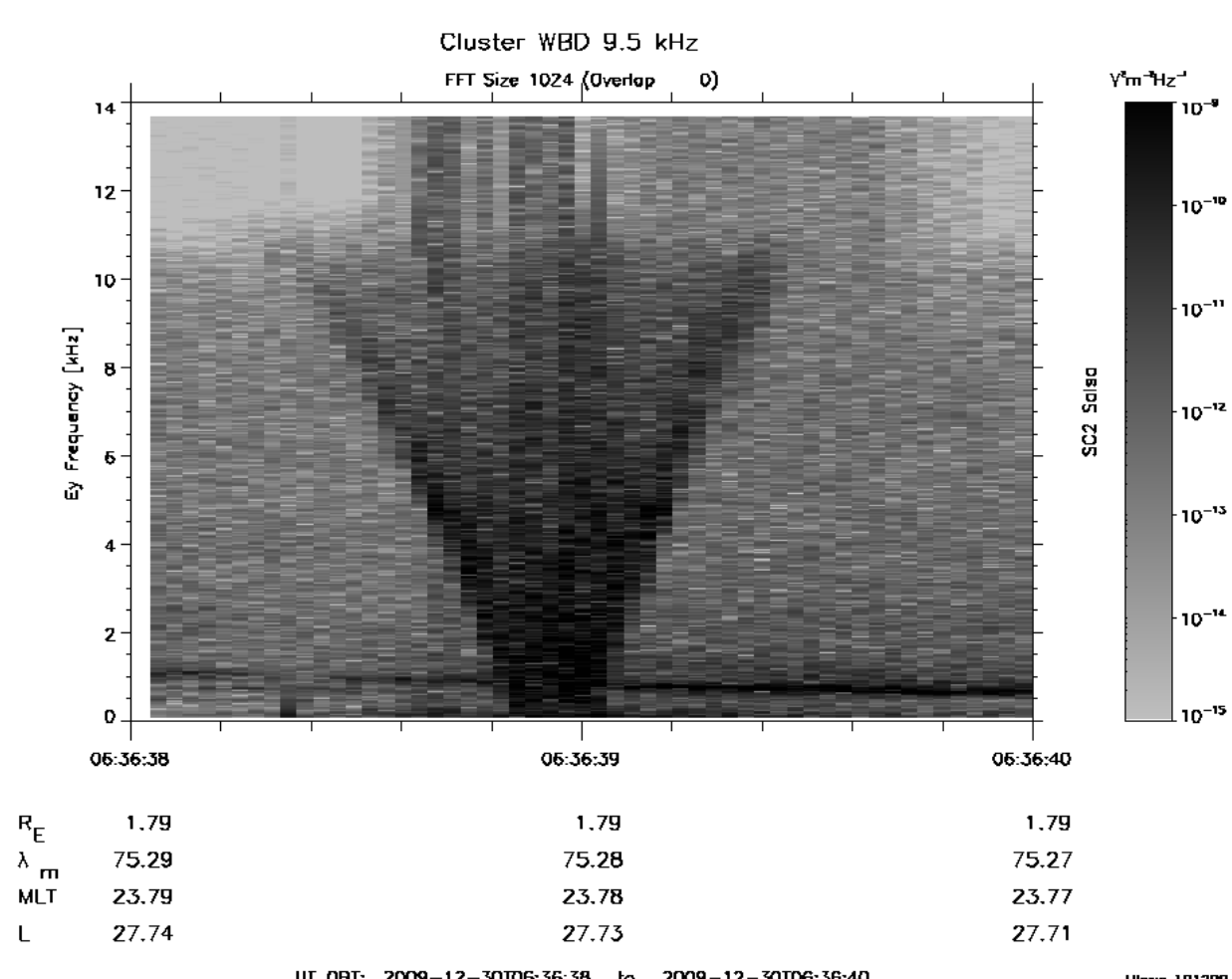
7. Saucers and Supporting Data 2010-01-06



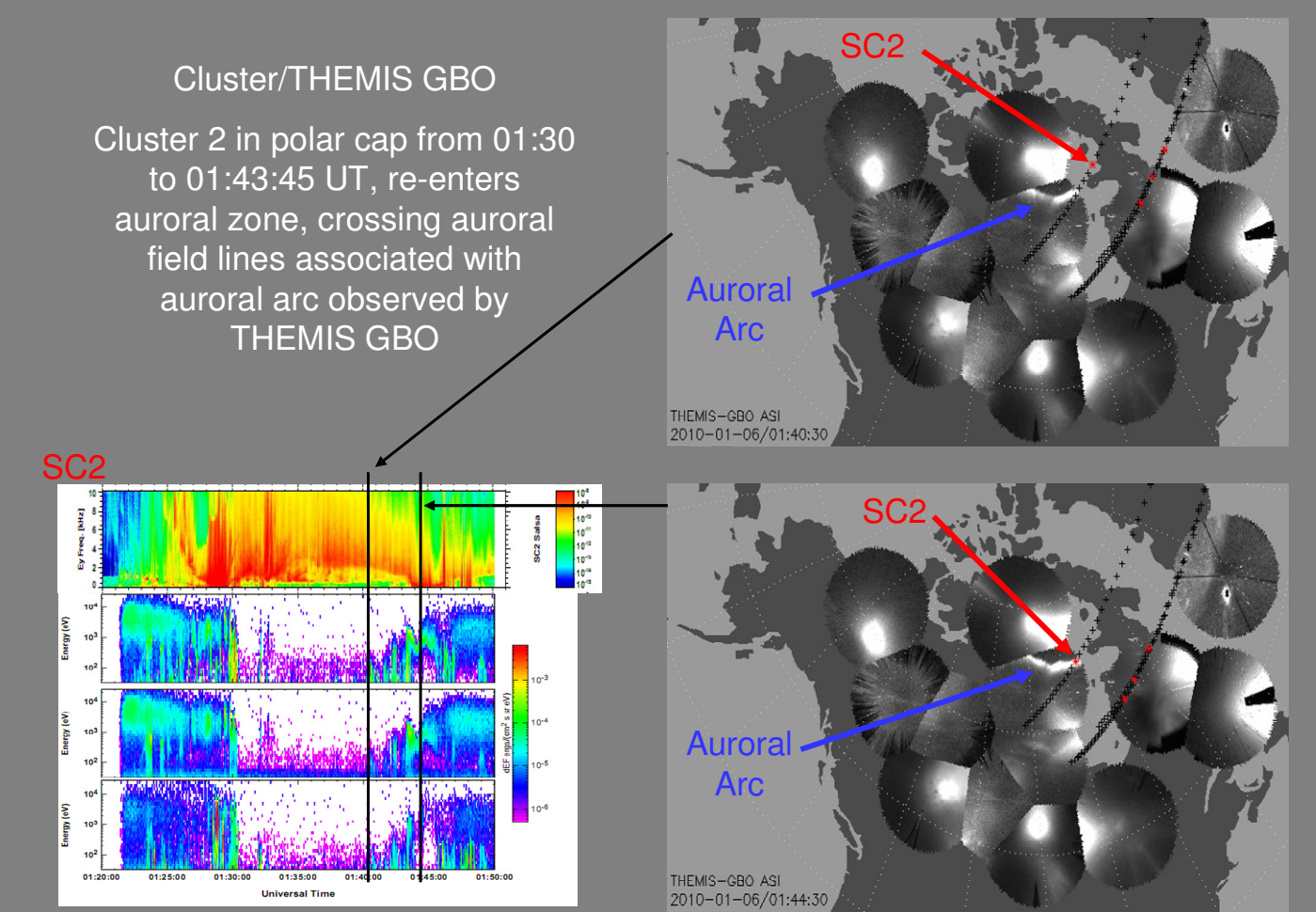
Format and description same as Sec. 4, with the dB magnetic field added at the top, indicating crossing of current system

9. Short Time Duration Saucer

A saucer on SC2 on 30 Dec. 2009 is crossed in ~1 s implying a distance scale of ~5 km. Broadband waves are also seen at the vertex at 06:36:39 UT.

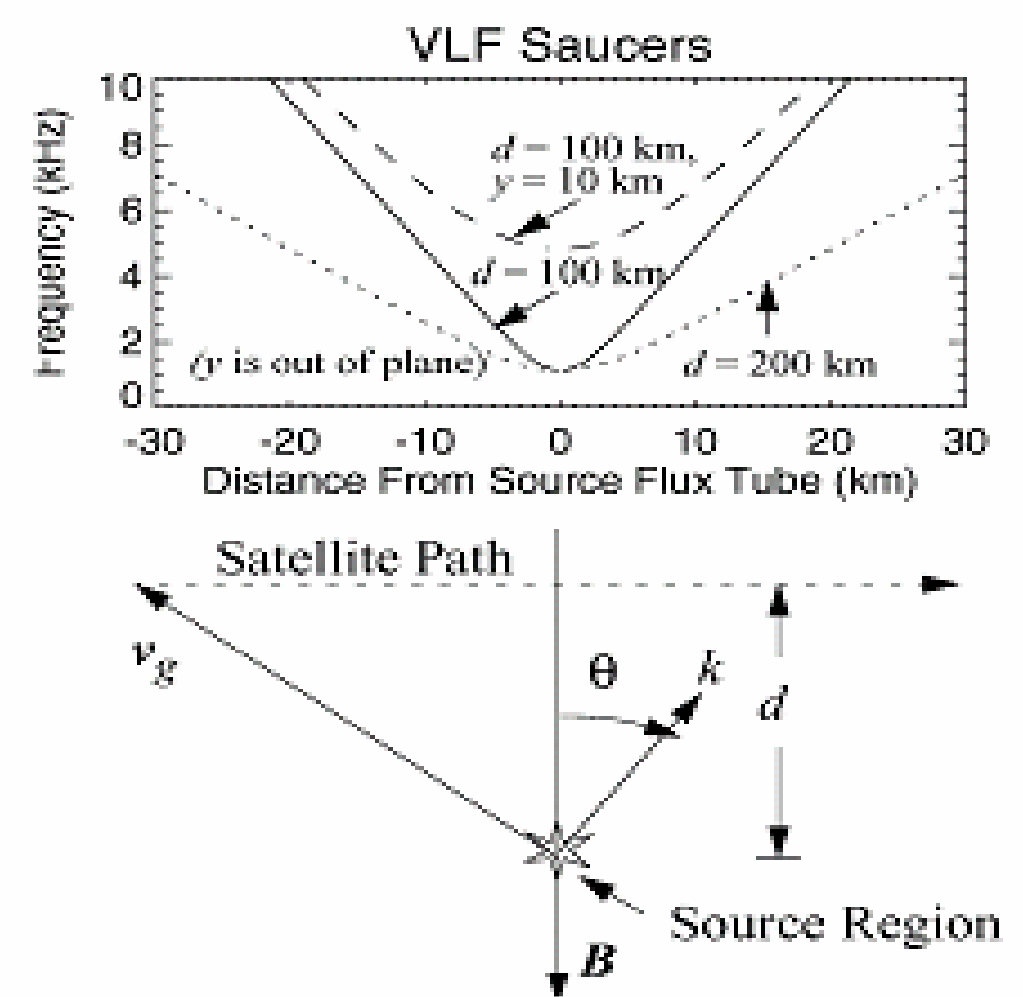


8. Cluster/THEMIS Ground Based Observatory Conjunction



10. Discussion and Conclusions

The top plot shows the relation between the frequency and horizontal distance between the satellite and the source flux tube. The solid trace is the peak in the wave spectra from a point source as measured by a satellite 100 km above the source region. The dotted trace is from a point source 200 km below the satellite, and the dashed trace is 100 km below the satellite and 10 km of out of the plane defined by the satellite's path and the magnetic field. The V- or saucer-shaped time-frequency-power spectrograms of electric field waves comes from the propagation characteristics of quasi-electrostatic whistlers. The slopes of the arms indicate the distance of the source from the spacecraft. The bottom plot shows the relation between the wave vector and group velocity for a saucer. From Ergun et al., *GRL*, 2001 and Pashmann et al., eds., *ISSI Auroral Plasma Physics*, 2002.



The intense broadband waves located at the vertex of a saucer (or source flux tube) consist of bursts of solitary structures per FAST observations. These solitary structures (ESWs) were found to be consistent with electron phase-space holes (Ergun et al., *GRL*, 1998; Ergun et al., *PRL*, 1998). The phase space holes travel upward on the same flux tube as the VLF saucer.

The Cluster fleet has observed saucers in the auroral acceleration region spanning from ~1 s to 100s of s (distances of ~5 km to > 1000 km) in the auroral downward current region. Almost all of these saucers have broadband waves at their vertex. Presumably these broadband waves are an indication of solitary structures, which cannot be resolved with the instrument mode used to observe the saucers. Future Cluster AAR observations will be run with a mode that can resolve these structures if they are present.