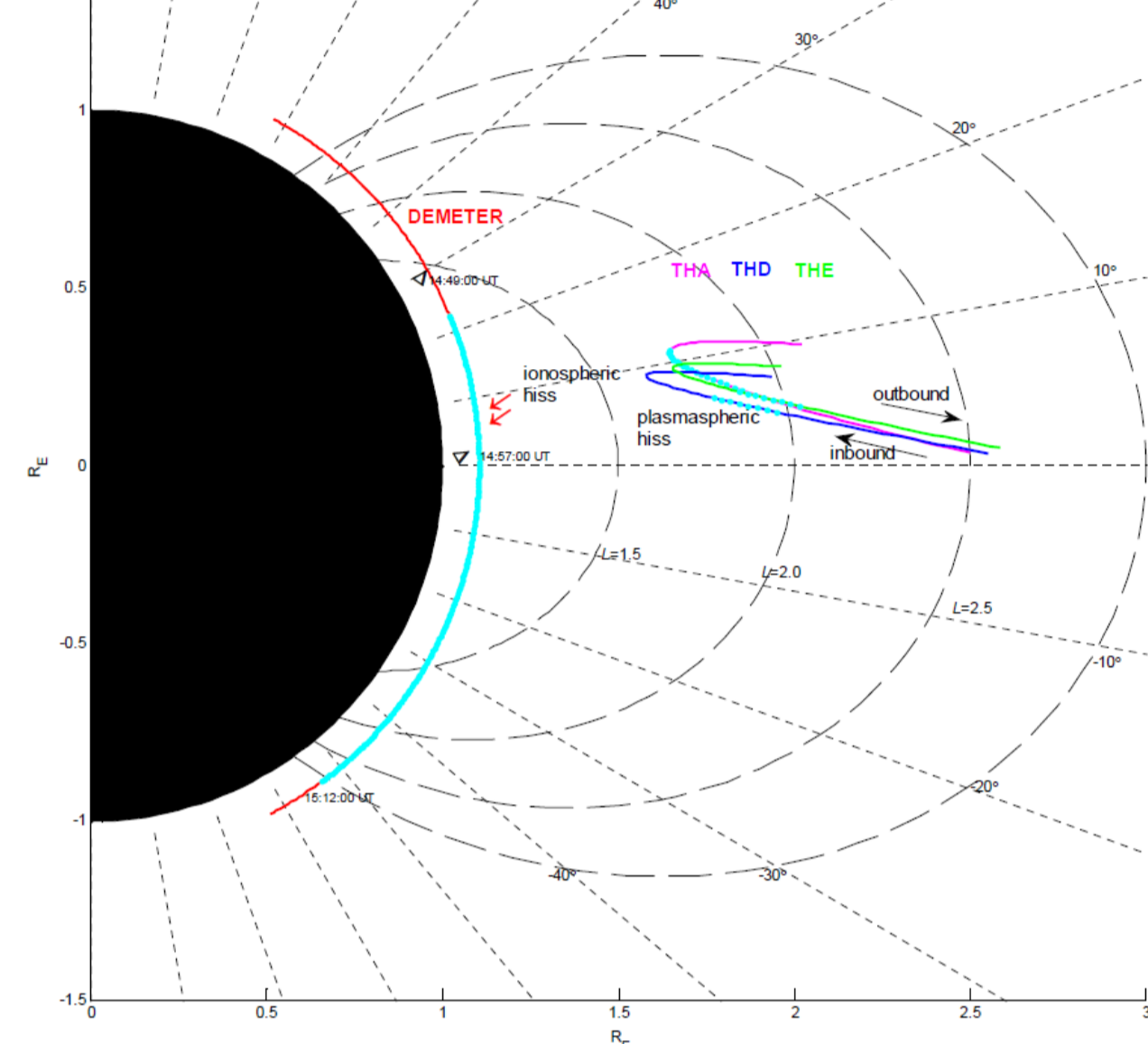


Conjugate observations of hiss waves by DEMETER and THEMIS

1. Conjugate event

A conjugate event on June 15, 2010, captured both ionospheric and plasmaspheric hiss at conjugate positions of DEMETER and THEMIS probes.



The conjugate event occurred on June 15, 2010
 The red line: orbit trace of DEMETER satellite
 The magenta line: orbit trace of THA
 The blue line: orbit trace of THD
 The green line: orbit trace of THE
 The cyan line: conjugate period
 Triangles: DEMETER's burst-mode observation.
 Red arrows: propagation direction of the ionospheric hiss.

Figure 1. The meridian projection of satellite orbits on June 15, 2010

2. The electromagnetic field observations

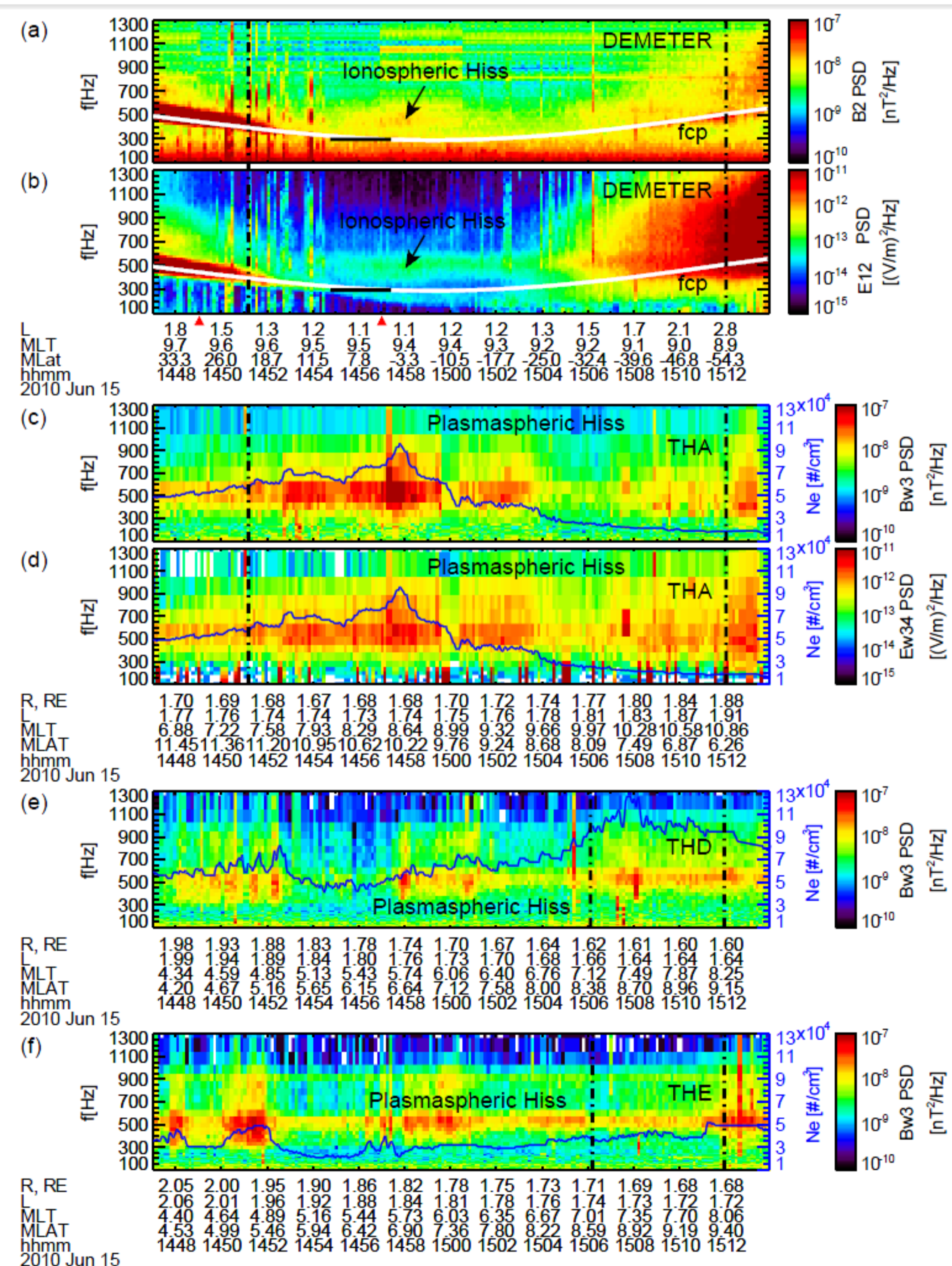


Figure 2. Overview of electromagnetic observations during the conjugate event

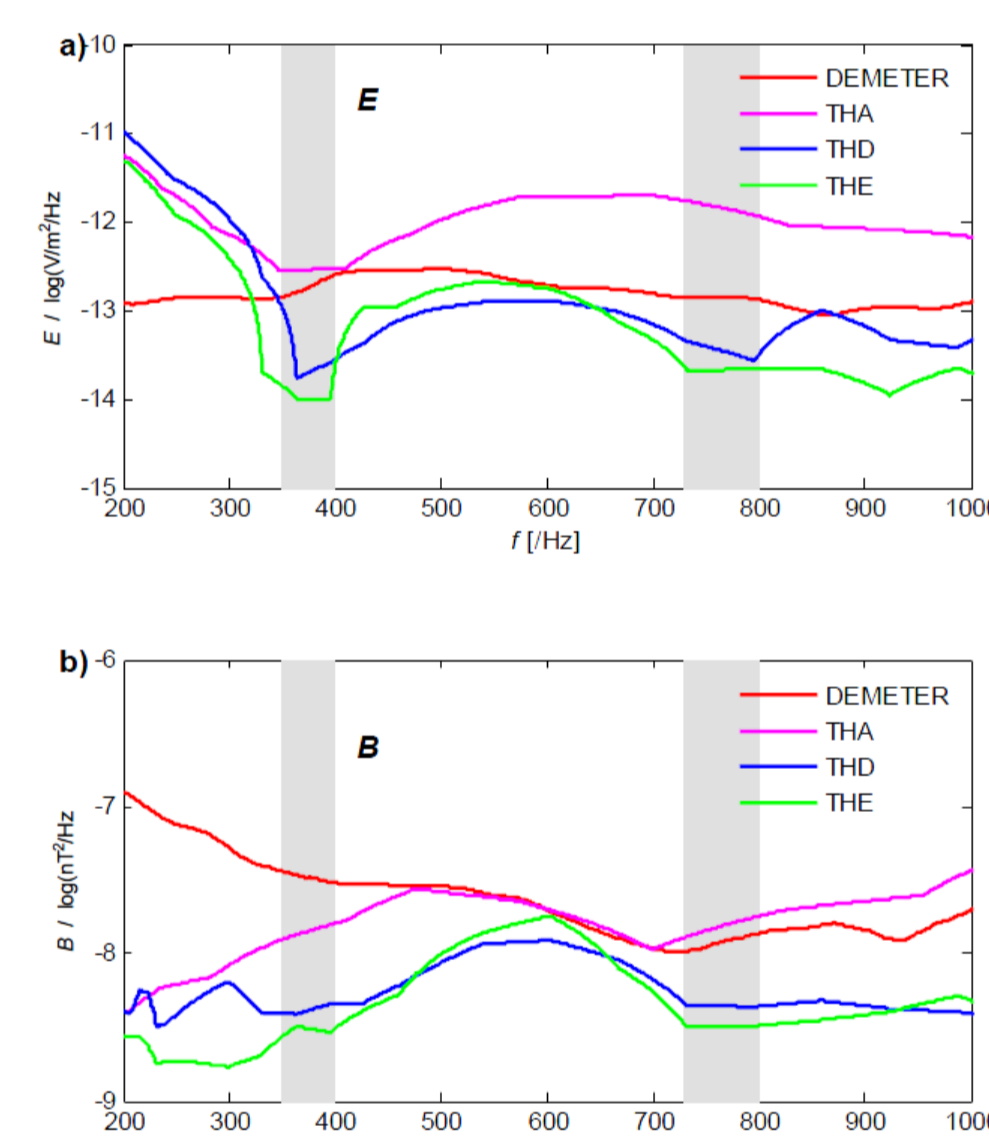


Figure 3. Comparison of wave structures between the ionospheric and plasmaspheric hiss observed at 14:59 UT.

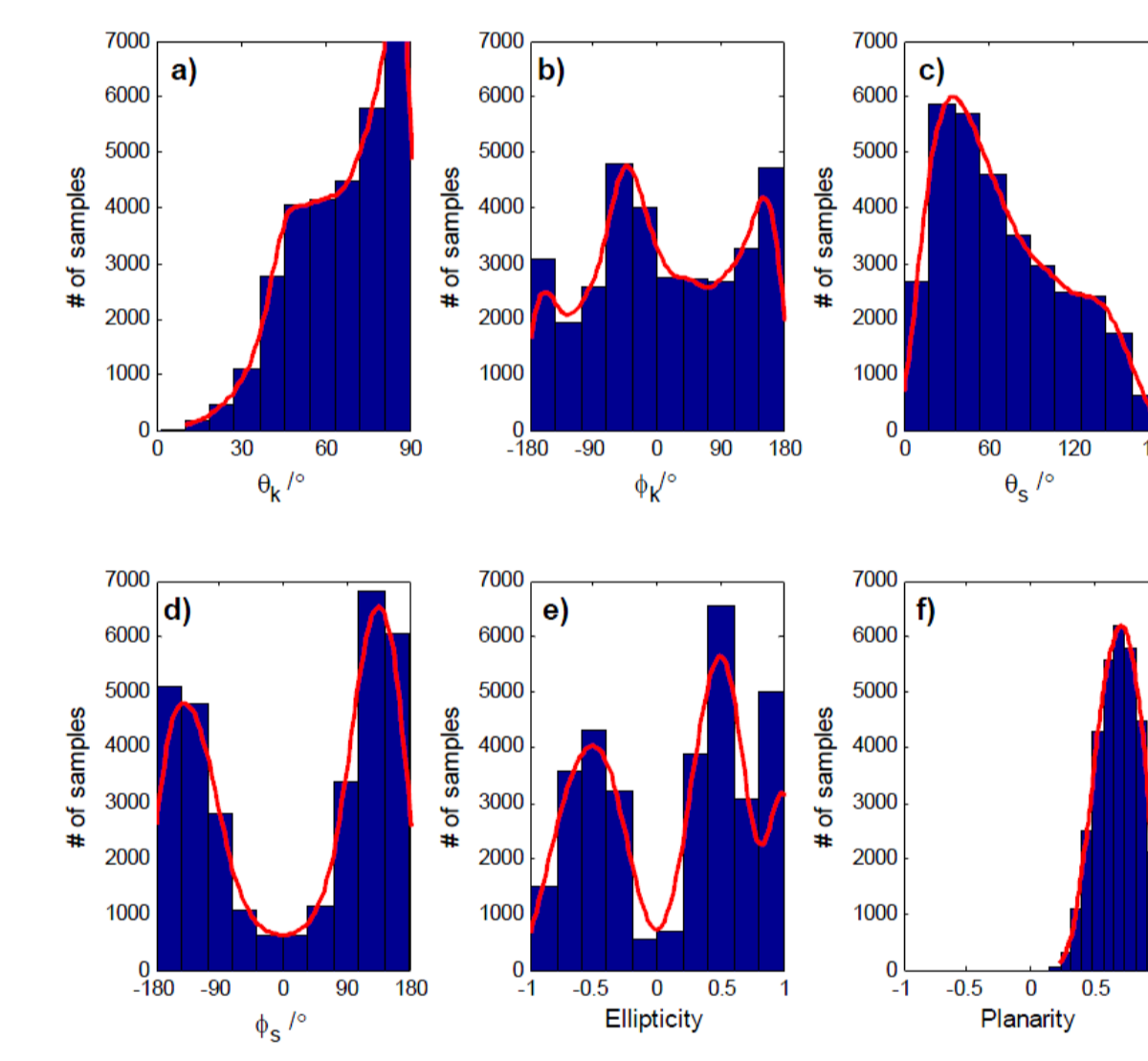


Figure 4. Distribution of wave propagation parameters of ionospheric hiss computed from burst-mode waveform at 14:55 to 14:57 UT

1) The observed ionospheric and plasmaspheric hiss have similar structures:

- lower cutoff frequencies near ~ 380 to 400 Hz;
- upper cutoff frequencies near ~ 730 to 800 Hz;
- wave intensity peak near ~ 500 to 600 Hz.

2) The wave propagation parameters of ionospheric hiss:

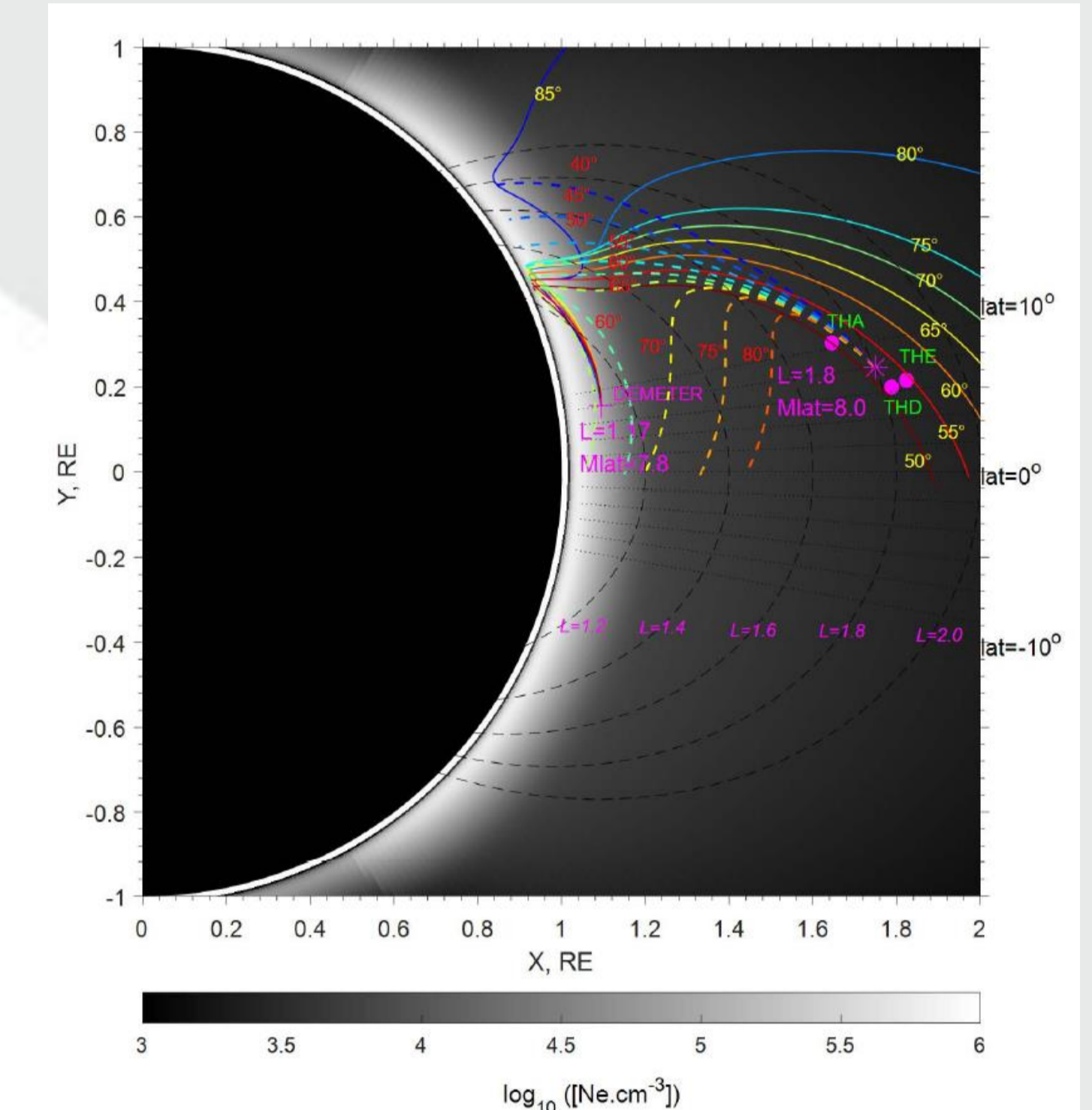
The major portion of the observed ionospheric hiss obliquely propagate downward to the Earth and slightly towards the equatorial region with right-handed polarization

0. Key Points:

1. A conjugate observation reveals that the ionospheric and plasmaspheric hiss share similar time-frequency structures and spectral properties.
2. Ray tracing simulations indicate that the connection between ionospheric and plasmaspheric hiss is physically possible through wave propagation.
3. This study suggests that the downward plasmaspheric hiss is one generation source for ionospheric hiss.

3. Simulation

Figure 5. Backward ray tracing simulation from DEMETER and forward ray tracing simulation from THEMIS.



The simulation was made for a fixed frequency of 500 Hz over a range of initial wave normal angles: backward ray tracing from 40° to 80° and forward ray tracing from 50° to 85° both in 5° increments.

The solid colored lines represent backward rays launched at DEMETER's location (MLAT=7.8, and $L=1.17$) and colored dashed lines denote forward rays launched at THEMIS's location (MLAT=8.0, and $L=1.8$).

Black dashed lines represent L shell and background grays represents the distribution of plasma density.