

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.

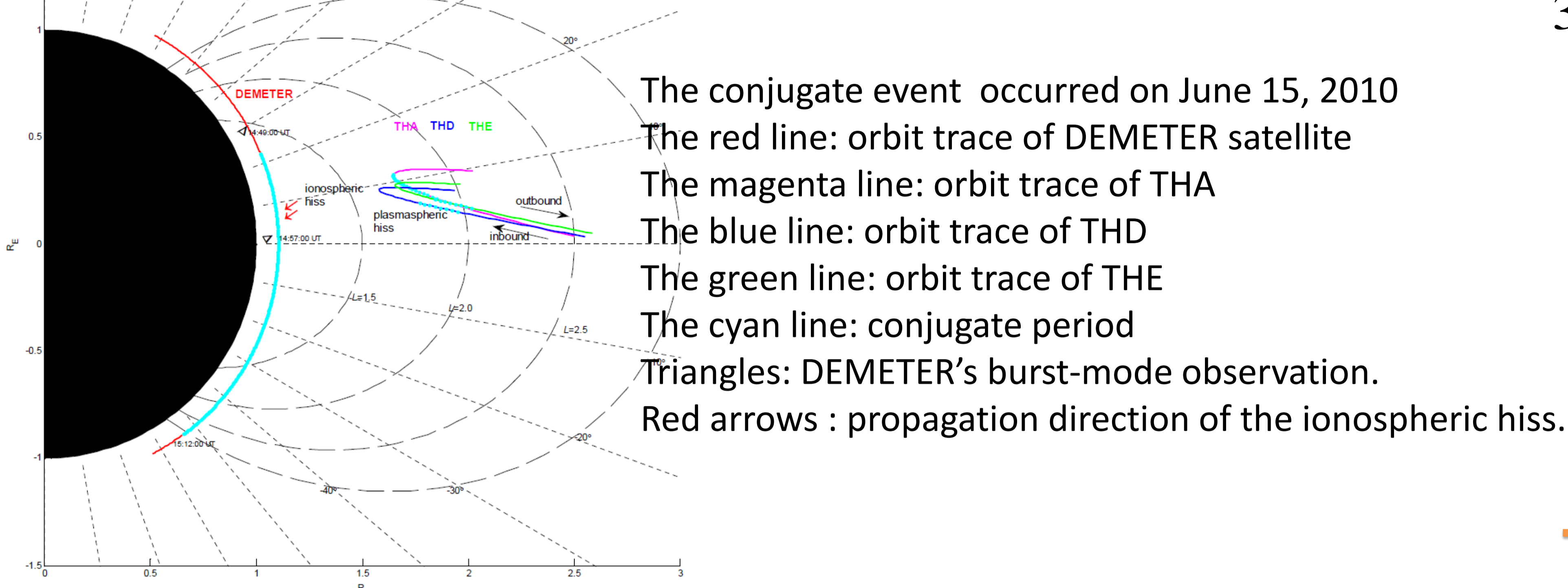


Figure 1. The meridian projection of satellite orbits on June 15, 2010

2. The electromagnetic field observations

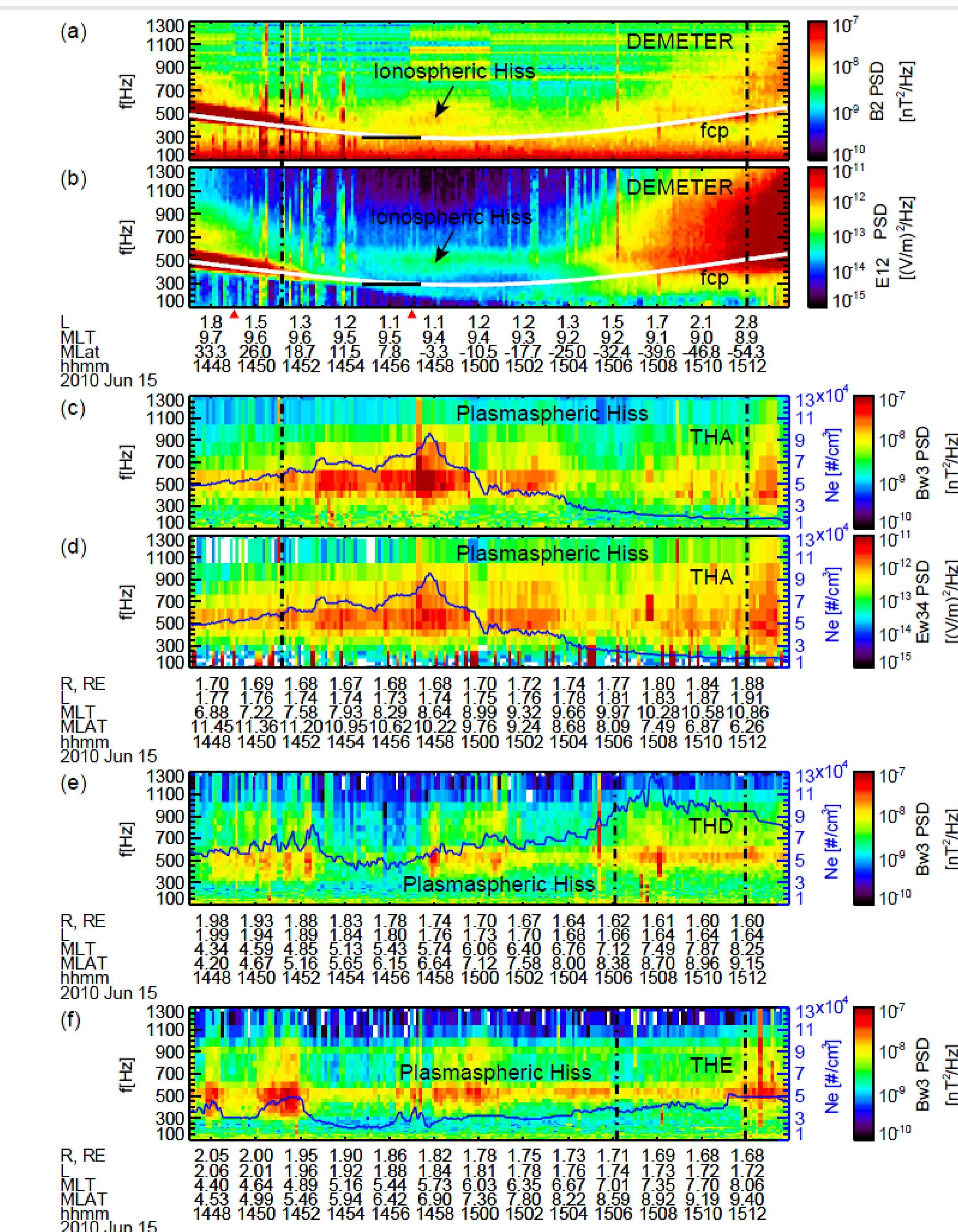


Figure 2. Overview of electromagnetic field observations during the conjugate event

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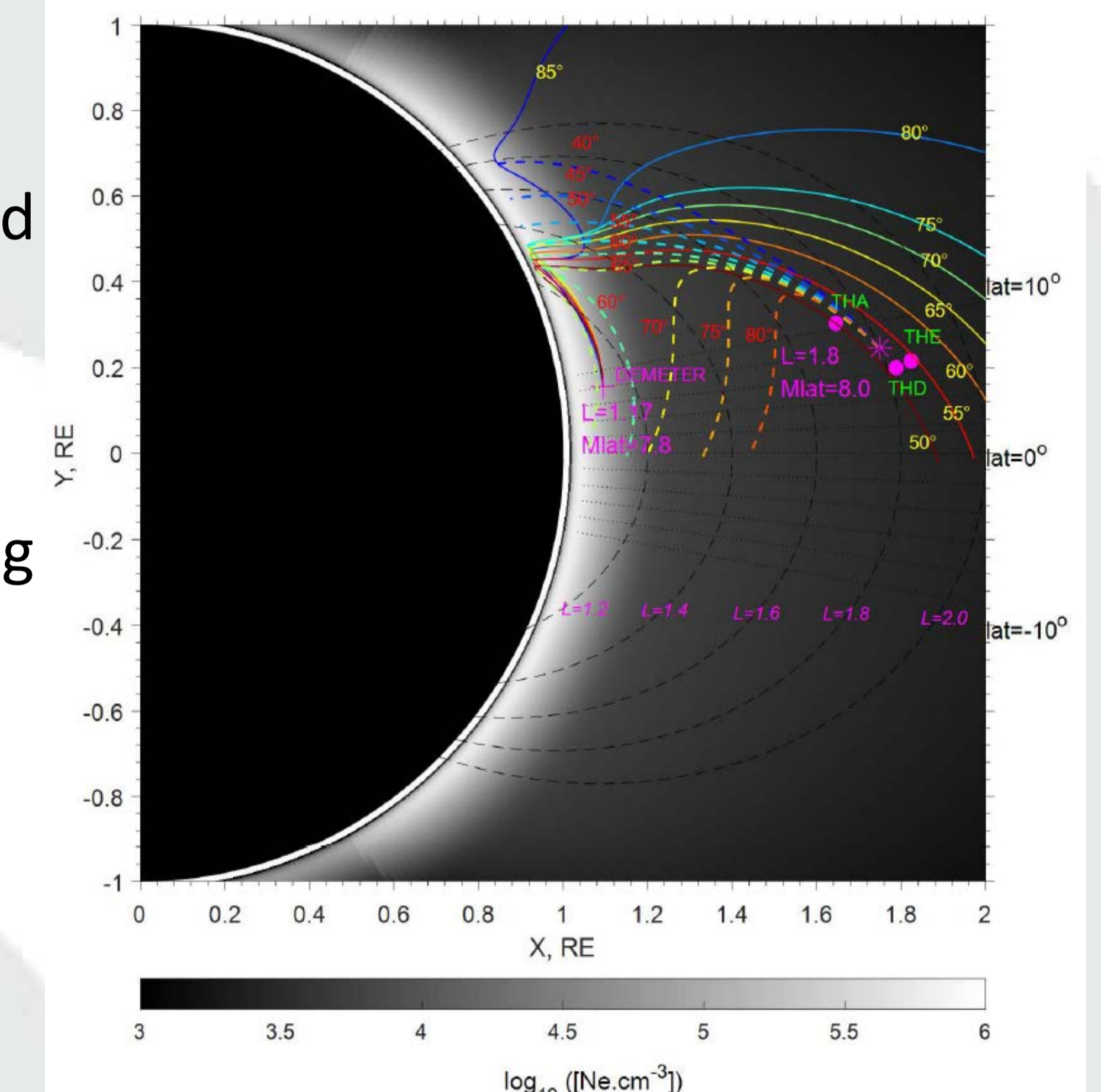
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0.Key Points:

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.

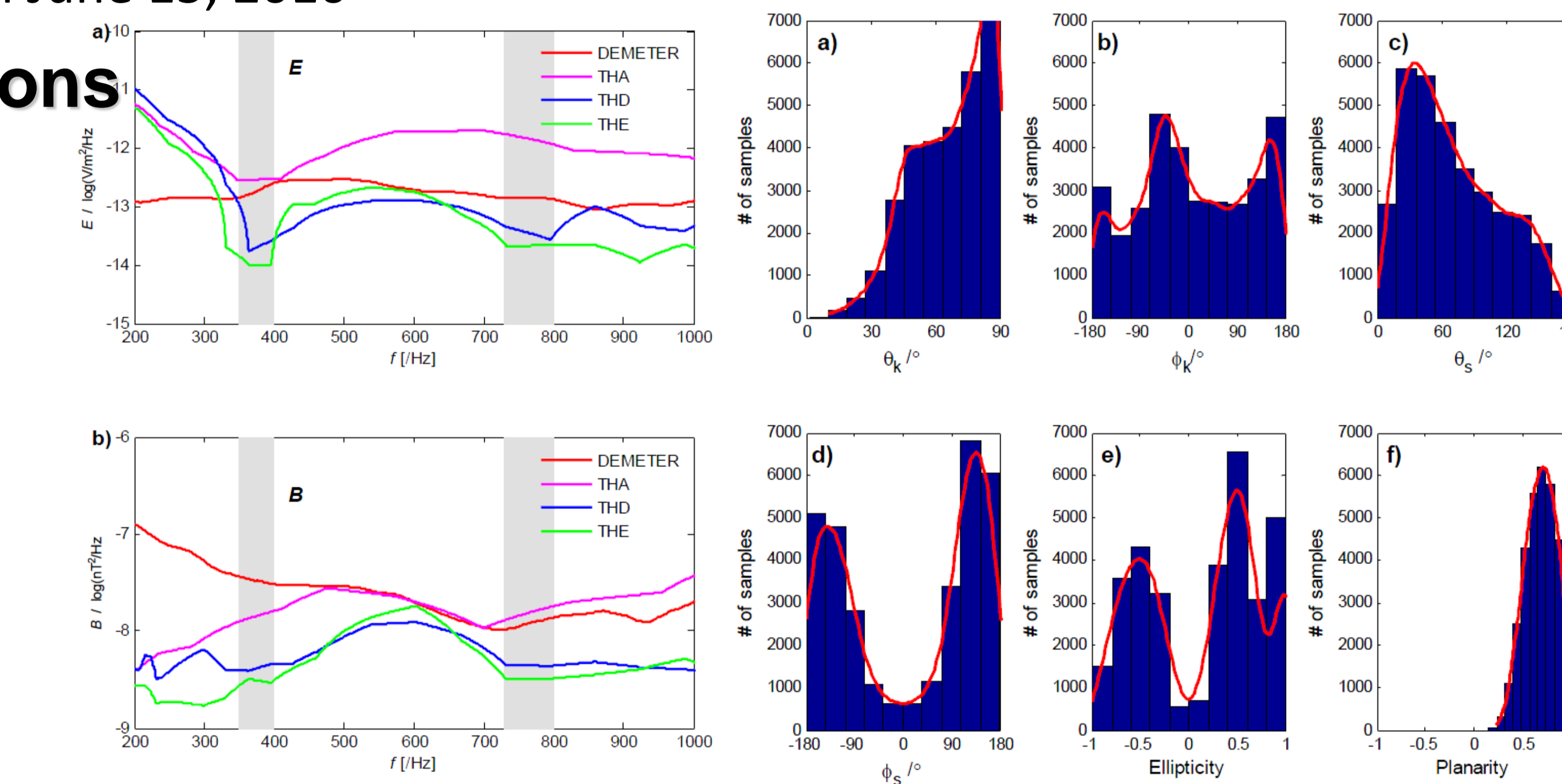


Figure 3. Comparison of wave structures between the ionosphere and plasmaspheric hiss observed at DEMETER and THEMIS probes.

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

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

