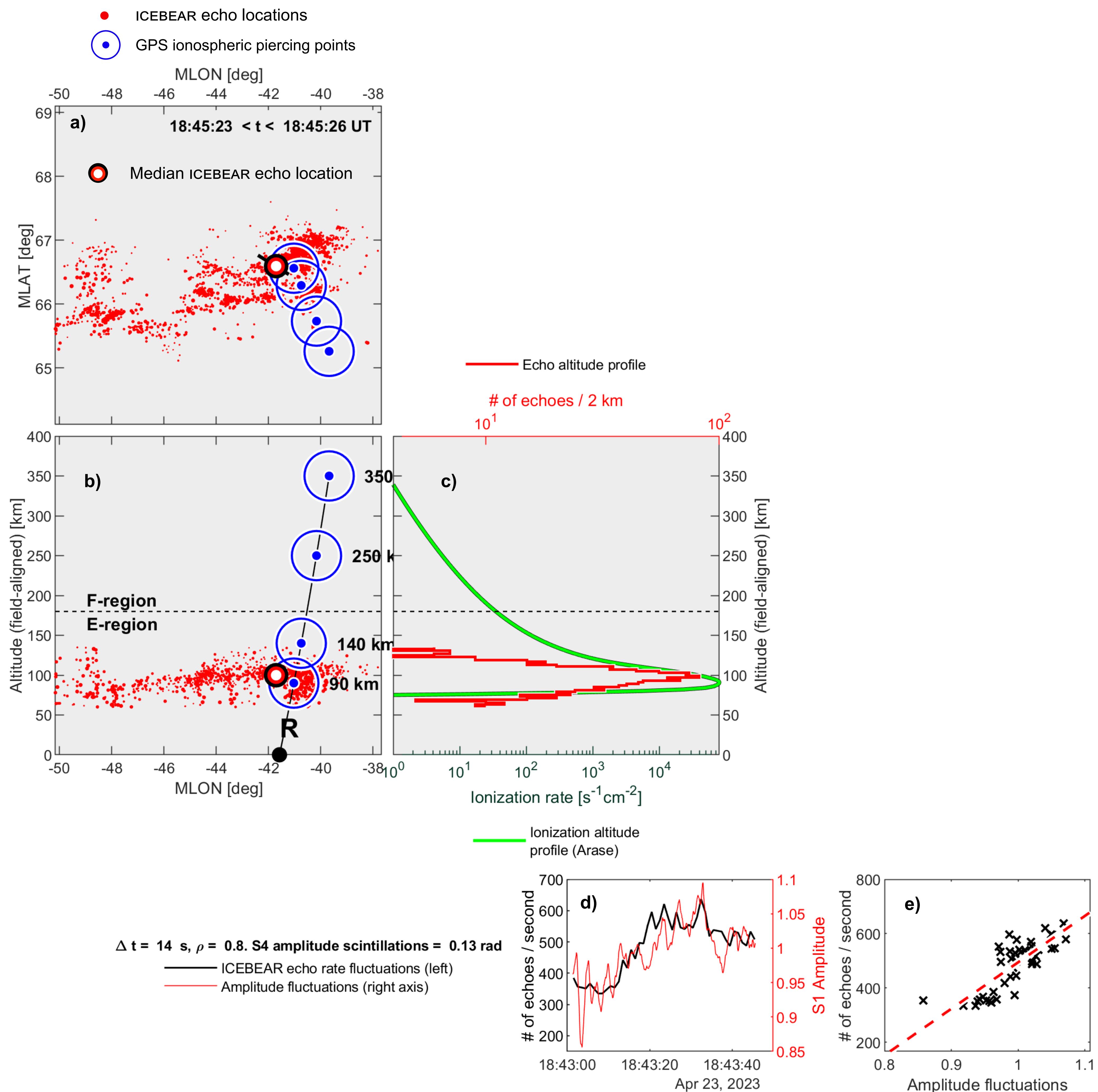


Supplementary data

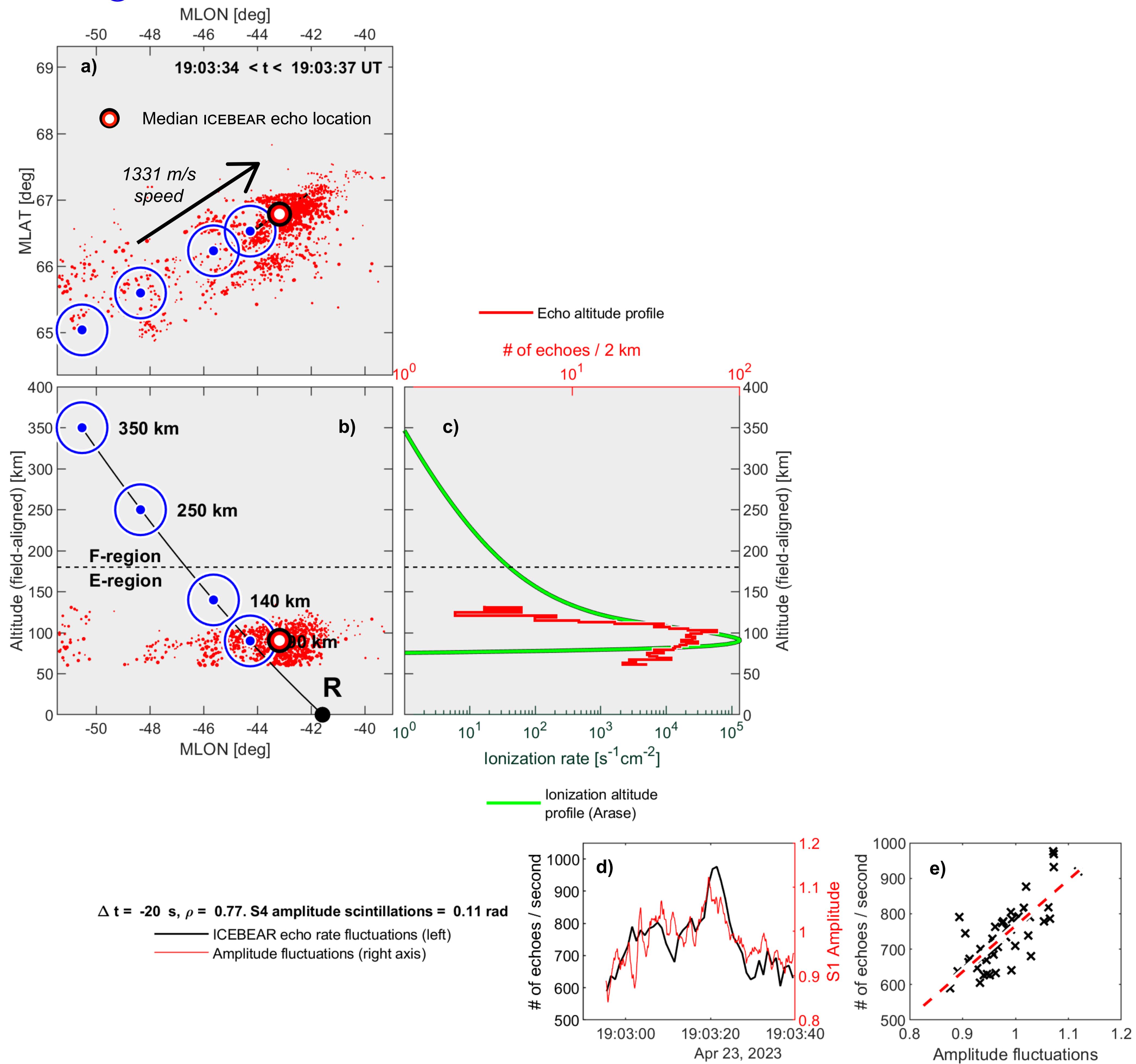
This document contains three additional examples of conjugate observations by icebear, Arase, and chain GPS scintillations, akin to Figure 6 in the Main Paper. For detailed key, see Figure 6 in the Main paper.



v9-cluster 524 on 2023 Apr 23 with 2419 echoes. Cluster velocity not determined.

Figure S1. See Figure 6 in the Main Paper for detailed key.

- ICEBEAR echo locations
- GPS ionospheric piercing points



v9-cluster 1030 on 2023 Apr 23 with 10124 echoes. Displacement: $\Delta x = 11 \text{ km}, \Delta y = 9 \text{ km}, \Delta t = 10 \text{ s}, v = 1331 \text{ m/s}, E = 74 \text{ mV/m}$.

Figure S2. See Figure 6 in the Main Paper for detailed key.

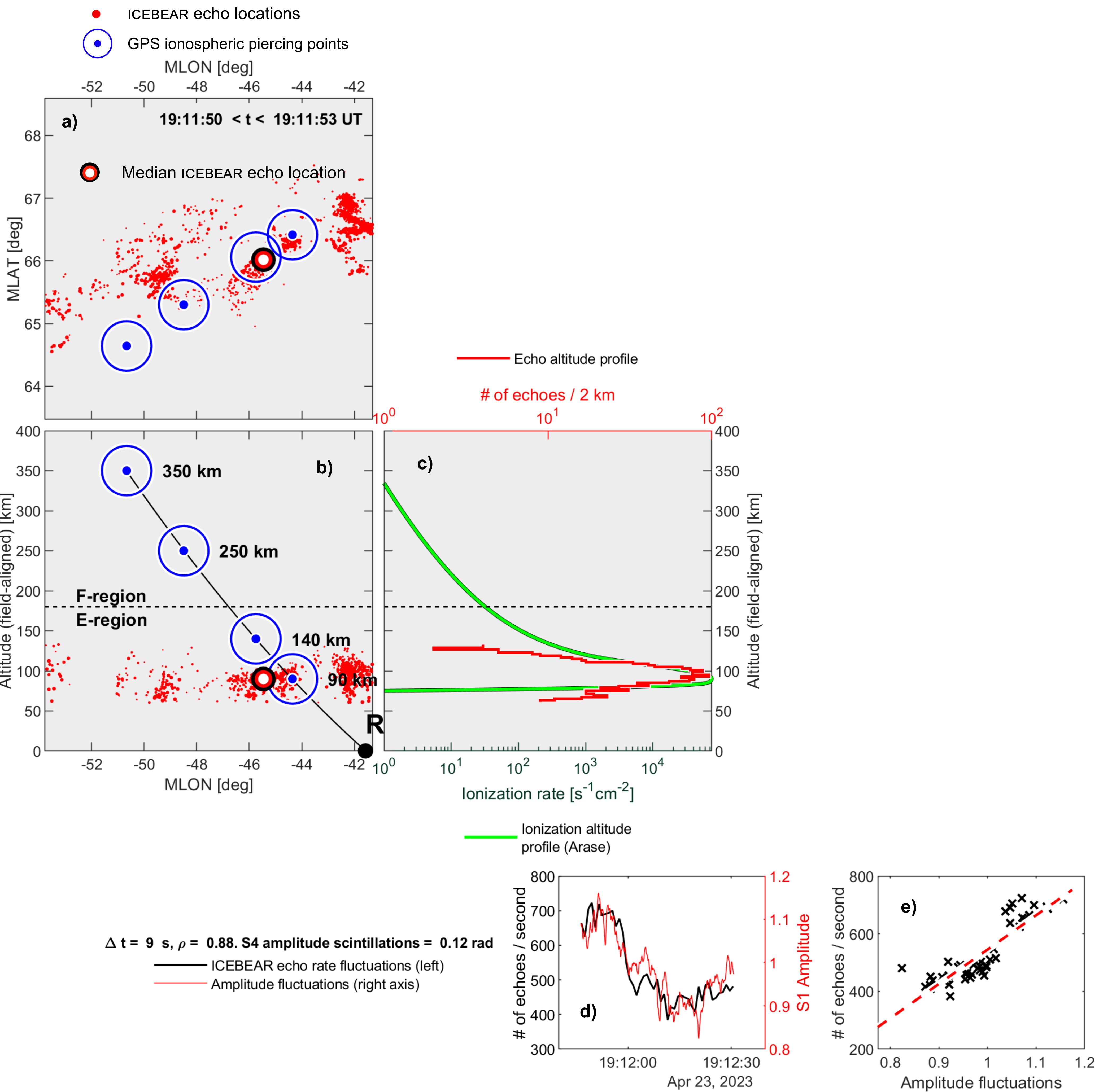


Figure S3. See Figure 6 in the Main Paper for detailed key.