

Characteristics of plasma bubbles detected by ground-based GPS receivers and the Equatorial Atmosphere Radar

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Spatial structure of plasma bubbles were studied with GPS Total Electron Content (TEC) data, GPS scintillation data, and coherent echo data of the Equatorial Atmosphere Radar (EAR).

EAR is located at 0.2S and 100.2E in West Sumatra, Indonesia. Its frequency is 47.0MHz and it observes the backscatter from two-dimensional distribution of field-aligned irregularities (FAI) whose scale size is about 3m.

Scintillation monitors for 1.6GHz GPS radio waves and a GPS dual frequencies receiver for 1.2 GHz and 1.6 GHz were also installed at EAR site. The scale size of irregularity which causes the GPS scintillations is about 300m. The irregularities whose scale size is about ten kilometer can be estimated from Rate of TEC Index (ROTI), which is defined as standard deviation of time derivative TEC.

We compared ROTI with FAI echo and scintillation data that were observed at EAR site in March and April, 2004. A good agreement between FAI observations and ROTI was found. It is expected that various scale sizes of irregularities exist inside of plasma bubbles. Eight GPS dual frequencies receivers were distributed from 98.7E to 103.7E and 6.5S to 18.3S. The field of view of this GPS network is about 1,000km and 3,000km, in longitude and latitude, respectively. ROTI which was obtained from these receivers revealed distributions of plasma bubble. On March 23, 2004, plasma bubbles occurred simultaneously in the field of view of the GPS receivers soon after sunset. They propagated eastward. On March 13 and 31, 2004, plasma bubble occurred near the dip equator soon after sunset and also propagated eastward.