Correlation Between L-band Scintillation and HF-band Doppler at the Time of Daytime Es Occurrence Over the Kanto Area in Japan

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INTRODUCTION

Ionospheric intensity scintillations (**ISN**) of GPS/GNSS signals at the L-band introduce errors and sometime cause inabilities in positioning due to lock-off. The quasi-periodic L-band ISN of geostationary satellite was reported by Karasawa et al. [1], and its origin were related to sporadic E (Es) phenomena in daytime by Maruyama [2]. It is difficult to avoid the positioning errors caused by the Es phenomena because occurrence timing, drift parameters and structure of Es are not predictable. It is therefore requested to investigate the relationship between ISN and Es characteristics. Some initial observation results are described in this paper.

OBSERVATION SYSTEM

We have set up the ISN observation system with three parabolic antennas at Sugadaira Space Radio Observatory of UEC in Nagano as shown by line-of-site directions to INMARSAT (SBAS), or MTSAT-2 (MSAS) and ETS-8 to observe drift of Es as shown in Fig.1. We have also set up the HF-band Doppler (**HFD**) observation network around the Kanto area in Japan as indicated by solid stars in Fig.1.

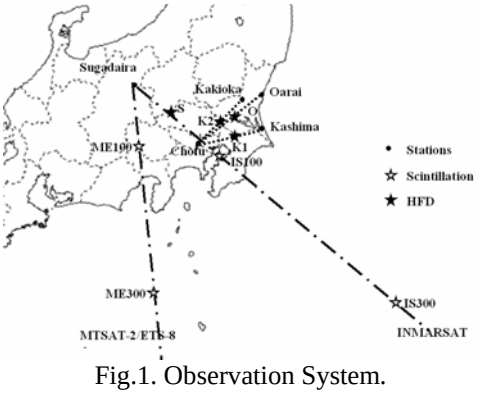

Fig.1. Observation System.

RESULTS AND DISCUSSION

Kamata and Tomizawa [3] reported the first observation results using this measurement system with INMARSAT (SBAS) that the relationship between the ISN and the HFD drift measurements of the daytime Es showed good agreement in the time sequence and the horizontal speed of 70 m/s to south.

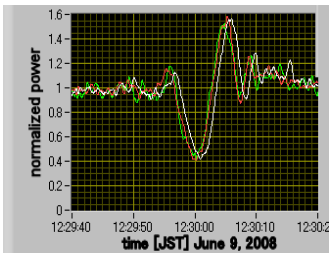

Fig. 2 L-band ISN at Sugadaira

Here we describe another example of the ISN observed using MTSAT-2 (MSAS) as shown in Fig.2 that indicates deep fading and time differences at three antennas. In the same time the HFD network observed the blanket-type Es accompanying the drift-type Es patch as shown in Fig.3. Estimating the drift parameters by the two methods we have obtained the good agreement both in speed and direction, given in Table 1, which suggests the close-relationship of two measurements concerning the strong Es traveling over the Kanto Area..

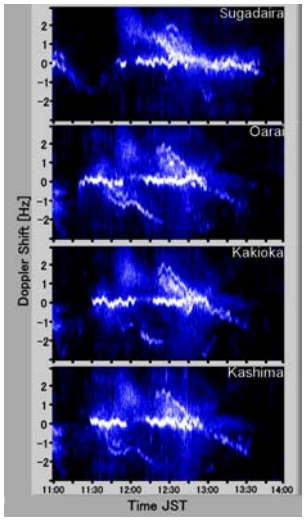

Fig.3. Simultatneous HFD observations over the Kanto Area

Table 1. Estimated drift parameters of Es on June 9, 2008.

Method	Speed	Direction from north
ISN	54 m/s	10 deg
HFD	54 m/s	20 deg

Assuming that an east-west cylindrical Es structure were passing the ME100 point in Fig.1 at 12:30 from south with the speed of 54 m/s in the NNE direction, the time delay of approximately 30 minutes to the S point coincides with the zero-crossing time observed by the HFD method in Fig.3. Then it is concluded that the blanket-type Es accompanying the cylindrical structure with the high electron-density core caused both the quasi-periodic ISN and the drifting HFD trace. Therefore a L-band deep fade caused by Es can be traced by combining the ISN and HFD methods even in blanket-type Es.

REFERENCES

[1]Y. Karasawa et al. (1985), Radio Sci., *20*, 643-651.
[2]T. Maruyama (1991), Radio Sci., *26*, 691-700.
[3]H. Kamata and I. Tomizawa (2006), Proc. of the 2006 SGEPSS meeting, B005-P028.