

## 航空航法用 VHF 電波を用いたスποラディック E 広域モニタリングシステムの構築

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## Sporadic E monitoring system using anomalous propagation of VHF radio waves for aircraft navigation

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Sporadic E (Es) is a thin and dense layer in the E-region ionosphere at an altitude around 100 km. Es has been known as one of the outstanding ionospheric phenomena at mid-latitudes during summer months. Because of highly enhanced electron density within Es, obliquely propagating VHF radio waves for analogue TV and FM radio broadcasting are reflected by Es, and, in such a case, they propagate for a long distance beyond the range of ground propagation. Such an anomalous propagation can introduce significant interferences in broadcasting using VHF frequencies, which has been known as one of the space weather impacts of ionosphere at mid-latitudes. Recently, propagation of VHF radio waves used for aircraft navigation (108-118 MHz: VOR, ILS, GBAS VDB) can also be affected by the occurrence of Es (Sakai et al., 2019), which may cause an interference in the aircraft navigation system. To evaluate such an effect of Es on the aircraft navigation system and eventually mitigate it, we need to monitor the occurrence of anomalous propagation in a wide area routinely. For this purpose, we have operated VHF radio wave monitoring systems at 6 stations in Japan (Sarobetsu, Chofu, Oarai, Sugadaira, Kure and Okinawa) since May 2019. The monitoring system is equipped with a digital receiver handled by the software defined radio and covers a frequency range from 98 to 118 MHz. The obtained data are processed onsite and transferred to the University of Electro-Communications every 1 hour. All the data (i.e., the occurrence of anomalous propagation) are displayed on a website (<http://gwave.cei.uec.ac.jp/cgi-bin/vor/vhf.cgi>). In the presentation, we give an overview of the system and introduce several cases of anomalous propagation which happened in the summer months of 2019. We also show an ability of VHF radio observation for mapping the two-dimensional structure of Es in combination with GPS-ROTI observations.