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Investigation on Properties of Ionospheric SF at High and Low Latitudes

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Digisonde (DGS) has advantage to measure the ionospheric Spread-F (SF) as different types. It can show the SF type in ionogram and make the authors to understand the concerning physics mechanism. Accordingly, the SFs are divided into four types (i.e., Frequency SF (FSF), Range SF (RSF), Mixed SF (MSF), and Branch SF (BSF)) that are described in the URSI's handbook. In this study, the DGS-4 data from 2012 to 2024 measured at high and low latitude are used to analyze the properties of SF with different types. The results are as followings.

At high latitude, the SFs mainly took place in the Winter and are almost not in the Summer. As we know, almost all day is daytime in the Summer and almost all day is nighttime in the Winter. This implies that the SF mainly take place in nighttime despite different season at high latitude. The types of SFs were totally the same as that in the URSI's hand book.

At low latitude, the SFs mainly took place in nighttime (18:00 – 08:00 LT) in each season, and easy took place with low magnetic activity index Kp < 3. However, the type of SF appeared as FSF, RSF, MSF and SSF (strong range SF) at low latitude, which was not the same as that described in the URSI's hand book. The SSF was drawn from the RSF and had high correlation with ionospheric scintillation. It implies that the SSF was resulted from the equatorial plasma bubbles (EPBs).

Some storms seem to enhance the SF and some storms seem to suspend the SF despite of latitude. Several cases with SF appeared in the storm time were studied. In these cases, the SF occurred at the stations from higher to lower latitude. It seemed as that the lower the latitude is, the later the SF appeared. This implies that the factor to result in the SF was propagating from the higher latitude to the lower latitude. By further analyzing, it was found the ionospheric TID propagation was the main factor to result in this phenomenon, which showed an example of ionosphere-thermosphere coupling in the storm time.

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