Ann. Geophys. Discuss.,
https://doi.org/10.5194/angeo-2019-50-RC2, 2019

Annales Geophysicae Discussions

Interactive comment on "Traits of sub-kilometer F-region irregularities as seen with the Swarm satellites" *by* S. Aol et al.

Anonymous Referee #2

Received and published: 12 May 2019

Using the 16 Hz Ne data of Swarm satellites, authors identify the small-scale F-region irregularities which is not distinguishable from those of large-scale, according to their algorithm. Authors investigated the local time variation of the occurrence rate, the seasonal/longitudinal (s/l) variation of absolute electron density perturbation as well as that of the relative electron density perturbation (∆Ne/Ne), latitude distribution of ∆Ne and ∆Ne/Ne, s/l variation of Ne gradient, correlations between the Ne perturbations with the Solar Flux as well as Kp are also presented. The works validated the quality of the Swarm 16 Hz Ne data and its capability of characterizing the small-scale irregularities. Some of the finds are in consistent with previous works. However, from my perspective, few critical issues need to clarify and improved.

Major comments:

First of all, I would like to make some clarification according to my understanding of the manuscript. 1. The small-scale irregularities are usually embedded in the large-scale irregularities (seen Figure 2 and from my experience), and they are actually the regional density fluctuation inside the plasma bubbles (PBs). 2. According to the authors' definition on the ∆Ne, that is, the standard deviation of the residuals between the original data with the mean fitting, in 32 data points (2 seconds, 0.6 degrees in latitudes, 14 Km in length). The ∆Ne quantified the density fluctuation in a spatial scale of 0.6ËŽ GLAT (normally inside a major PB), which is different from the conception of the depletion amplitudes, in my opinion.

(1) The author should emphasize in the article that these small-scale irregularities is not independent and has not been distinguished, from those of large-scale (PBs). (2) Authors compared the occurrence of scintillations (quantified by ROTI) in 9 stations with the small-scale irregularities which exhibit correlations. However, as noted in previous works (e.g. Xiong et al., 2016; Wan et al., 2018), the radio signal disruption is more likely to occur when there exists PBs with large depletion amplitude. In the same reason as described in my first clarified issue, I think authors should be careful to relate the two things up. (3) P13 Line10 – 12: Obviously, the s/l variation of âĹĞNe is similar to ∆Ne but not ∆Ne/Ne, authors should describe the plots objectively.

Minor comments: (1) Figure 1: I would recommend the author to plot all the profiles using the absolute scale. (2) P8, L19 - 20: in pre-midnight sector. (3) P8, L20 – P9, L2: It's not appropriate to explain that in a decayed sense, since the occurrence of irregularities at post-midnight is enhanced as authors found and claimed, the mechanism should be related to the lower depletion amplitudes. (4) Figure 5b: It seems that the scintillation data is less available during June Solstice compared to other seasons for some stations. E.g. RIOP is totally missing. The author should mention those in the article. (5) Figure 11& Figure 13: I suggest the authors do the correlation analysis regards to different latitudinal bins (i.e. equator and off-equator). (6) P13 Line 12, Linking word is missing. (7) P17, Line 11-12: It is not an accurate description. (8) In many

places, authors inappropriately describe the $\triangle$Ne and $\triangle$Ne/Ne as the 'irregularities' (e.g. the captions of Figure 13, 14).

References: Wan, X., Xiong, C., Rodriguez-Zuluaga, J., Kervalishvili, G. N., Stolle, C., and Wang, H.: Climatology of the Occurrence Rate and Amplitudes of Local Time Distinguished Equatorial Plasma Depletions Observed by Swarm Satellite, Journal of Geophysical Research, Space Physics, 123, 3014–3026, https://doi.org/10.1002/2017JA025072, 2018 Xiong, C., Stolle, C., & Lühr, H. (2016). The Swarm satellite loss of GPS signal and its relation to ionospheric plasma irregularities. Space Weather, 14, 563–577. https://doi.org/10.1002/2016SW001439

Interactive comment on Ann. Geophys. Discuss., https://doi.org/10.5194/angeo-2019-50, 2019.