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

Anonymous Referee #1

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The manuscript "Traits of sub-kilometer F-region irregularities as seen with the Swarm satellites" by Aol et al. reviews post-sunset equatorial fluctuations identified in electron density time series obtained by the TII faceplate technique onboard the Swarm satellites with 16Hz sampling rate. The results are distributions of the occurrence rate of the identified fluctuations over local time separately for 4 seasons (not separated by longitude), and of the amplitude of the identified fluctuations over longitude and latitude separately for 4 seasons (not separated in local time). The authors further conclude that the solar flux and geomagnetic activity and these amplitudes are weakly correlated.

General comments:

The results shown confirm earlier published findings, and some other analyses do not

seam fully consistent (see specific comments). The submitted manuscript provides an excellent report to indicate that identified fluctuations in electron density time series obtained by the TII faceplate technique onboard the Swarm satellites with 16Hz sampling rate are most probably related to equatorial post-sunset plasma irregularities. But it is unlikely that the report enhances present scientific knowledge and evidence.

My major concern is, however, that this analysis does not show any findings based on the 16Hz samplings that could not have been achieved with the 2Hz samplings onboard Swarm. The authors are encouraged to exploit the high value of the 16Hz sampling.

Selected specific comments:

The concept of deriving electron density from the TII faceplate technique is an extended product in the concept of the Swarm mission. A bit a more detailed description of the retrieval and the data shall be added, next to refering to "Buchert, S.: Extended EFI LP data FP release notes, ESA Technical Note, 2016." (I did not find the document in the web, and do not know if/where it is accessible.)

P2, L1-14: The authors have access to the full Swarm mission data to perform orbital analyses, such as the spacing of Swarm A/C or the local time processing. Alternatively, they may refer to classical papers, such as provided in doi:10.5047/eps.2013.07.001 if needed. You might reconsider, if Kil et al. or Xiong et al. are suitable references in this broad context.

P2, L25ff: The proposed detection method identifies amplitudes of deviations from a 2s-average and attribute a level of higher than 0.25*10ˆ10 mˆ-3 of its RMS as being an irregularity. By this method, identifying an RMS over a time window of 2 seconds (15km), information from the 16Hz seconds are smoothed out.

Figure1/P5, L3: 'multi-peak' variations appropriate to the 16Hz samples in comparison to the 2Hz samples cannot be identified in either the zoomed figures in Figure 1. Many peaks are equally visible in the 2Hz data.

Page 10,L9: “Large values of both ∆Ne and ∆Ne /Ne often occur in locations of large depletions in Ne.” It is not clear, where else they could be expected?

Page 5, L15-23: The effect of relative variation compared to absolute variation was extensively discussed, e.g., for polar patches in DOI: 10.1002/2017JA024811 .

P7, L3: The authors describe that the irregularities occur between 18-06LT, however, no other LT is shown in Figure 3.

Figures 6,7,12 base on color scales that lie below the detection threshold by at least to 50%.

Figure 9 shows along track gradients of electron density, that are by nature directly related to ∆Ne for the detections. It is maybe not helpful to discuss their coincidence.

Figure 12 divides below and above F10.7=140sfu. It is questionable if a significant amount of data is available for conclusions above F10.7=140sfu. See figures 10, 11 of the submission and https://services.swpc.noaa.gov/images/solar-cycle-10-cm-radio-flux.gif. Also, P 14 L 20ff: The authors mention similar comparisons by Huang et al., Su et al., Stolle et al. To the knowledge of the referee, these papers discussed the occurrence rate, not the amplitude of irregularities. Amplitudes are discussed by Wan et al., 2018. However, conclusion (iv) of the submitted paper mentions occurrence rates which is not compatible with Figure 12.

Palmroth et al., 2000 and Stolle et al., 2006 did first analyses on the relation between the occurrence rate of irregularities and the Kp index, that are not discussed in the submitted manuscript.

The authors might reconsider the added value of P11 L6ff to the concerned study.

Selected technical comment:

dNe, ∆Ne, and (nabla)Ne are used to express the same parameter.

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