Reply to authors

The paper details a technique called MSMVA which is used to disentangle parameters at various scales when analyzing the inherently multiscale FAC phenomena observed in the auroral zone by satellites. The technique is tested on both simulated and real data, with results as well as sources of error discussed in the manuscript. After revision by the authors, the work is significantly improved and this referee would recommend the paper for publication after the minor technical corrections detailed below.

Please note that I am working off the manuscript named 'angeo-2018-70-manuscript-version2' with the corrections deliberately shown as crossed out in multiple colors as detailed in the authors' response. The line numbers are accordingly the ones for that particular manuscript, not for the final version with the corrections hidden.

Below, the single quotations marks '' enclose my suggested phrasing, while double quotation marks "" are direct quotes from your paper.

Page 1

Line 9 'For both synthetic and Swarm data' (comma unnecessary)

Line 10 'namely the linear and the logarithmic scanning' (commas unnecessary)

Line 14 'complex FAC signatures that complements' (comma unnecessary)

Page 2

Line 1 'The multiscale character is observed also in the measurements'

Line 2 'associated in turn with'

Line 8 'The TV and ASI observations also correspond to'

Line 15 'found to peak around 400-500 m with an average of 615 m' (comma unnecessary)

Line 16 'below 1 km and 1 s' (not bellow)

Line 27-28 'associated with' (not associated to)

Page 3

Line 2 'also have' (not have also); 'also compare' (not compare also)

Line 26 "the rate of variation is significantly higher" – what is meant in this sentence? Do you mean the uncertainty is higher, or do you mean the rate of the variation of the structure lifetime is much higher? Which figure are you referring to in Gjerloev et al. (2011) to make this sentence? Please clarify

Line 26-27 "the minimum relevant scale size" – the minimum relevant scale size for what? Please clarify. Do you mean the separation between the quasi-static and non-stationary perturbations?

Line 27 "about 20 km" where in the paper is this obtained from? Please clarify. Do you mean 200 km, or 20 sec? 200 km is in the mesoscale range; 20 km is only 2-3 sec in LEO.

Page 4

Line 2 'arc orientation from the east-west direction' (not form)

Line 32 'both quiet and more dynamic, smaller scale' (the second 'and' sound strange upon reading the text)

Page 7

Lines 3-4 'FAC scales in the cross-track direction' (missing 'the')

Line 19 'obtained' (not obtain)

Line 20 'over an array' (not over and array)

Line 21 'on small-scale FAC signatures' (not at small-scale FAC signatures)

Line 29 'FAC density in the FAC's own reference system' (not FAC density into the FAC own reference system)

Page 8

Line 14 'separated into invariant information, which depends' (not separated into invariant, depending)

Line 14 'in the local frame, and' (please add comma)

Line 15 'which depends' (not depending)

Line 20 '(Section 3)', '(Section 4') not section4

Line 24 'to inclined FAC observations' (not inclined FACs observations)

Line 33 where does the ionospheric mapping factor of 1.1 come from? Is there a reference for this number by any chance?

Page 9

Line 1 'provided the high resolution needed' (not a high resolution)

Line 12 'the largest scale samples the entire oval' (not sample)

Line 12 'second-largest scale' (not second scale)

Line 20 'reflects the jump'

Line 23 'sampling schemes rely on non-orthogonal basis functions' (not relay on a non-orthogonal basis functions)

Page 10

Line 19 ξ_0 needs to be defined if it is used in equations

Page 11

22 'associated with' (not associated to)

Page 12

Lines 12-13 "at the center of the two structures" is it really at the center of the two structures, or is it just the maximum of their summed contributions? Please clarify

Page 13

Line 19 'the scale is more consistent' (not better consistent)

Line 33 'This behavior' (not this behaviors)

Page 15

Line 9 'small scale FACs' (not small scale FCAs)

Line 18 'also show' (not show also)

Line 34 'FAC signatures' (not FACs signatures)

Page 16

Line 1 'engaging in such a development' (not engaging on such a development)

Line 2 'several real events' (not several data events)

Line 27 '~7 km'

Page 17

Line 2 'the THEMIS mission'

Page 18

Line 26 'does not capture' (singular; not do not capture)

Page 19

Line 3 'associated with' (not associated to)

Line 19 'associated with' (not associated to)

Line 28 "about 300 km" – the authors use km but in Figure 5 for both linear and logarithmic methods, the y-axis is in seconds. It is not easy to see where 300 km would be if they are not marked on the axis in the proper units. Please clarify whether the scale is in terms of km or in terms of seconds. This also applies to other figures. Figures 1 and 2 (with simulated data) have the y-axis in km on a linear scale (for the linear method) but the figures thereafter (with real data) have the y-axis in seconds and on a logarithmic scale. What is the reason for changing the setup between the two sets of figures?

Page 21

Line 4 'agree' (not agrees; plural)

Lines 20-21 'better quantify' (not quantify better)

Line 27 'The event was observed'

Page 22

Line 13 'associated with'

Line 32 'associated with'

Page 23

Line 17 'associated with'

Page 24

Lines 5-6 'separated the observations into two categories' (not in two categories)

Line 11 'The event was observed' (past tense)

Page 25

Line 30 '(locally planar)' (please enclose "locally planar" in brackets)

Page 28

Line 2 'is by filtering' (not if by filtering)

Line 9 'well-suited for' (not well suitable for)

Line 16 "sections 4.3 and 4.3" – repetition. Do you mean sections 4.2 and 4.3?

Page 29

Line 7 'and can provide' (not an can provide)

Figures

Figure 1

It would be good to add a legend to panels a, b, g, and h or remind the reader in the caption which component is which

Would it be possible to make larger labels, especially for the colorbars? Also, would it be possible to make the figures bigger? There is a lot of information in them and it would benefit the reader to have larger figures.

Figure 4

The hodograms (e) seem to have multiple shades of green, orange etc. which do not appear to have a correspondence with the legend colors. Please clarify. This also applies to other hodograms in the manuscript.

Figure 5

As discussed earlier, please clarify whether the scale is in seconds or km, and if it is in seconds, please comment on why it was in km for the synthetic data earlier. This applies to all subsequent spectral plots in the manuscript which use scale as the y-axis.

Figure 6

Caption: 'blue line in (a) indicates a reference level ' (not "blue line in (a) indicate a reference level")