REVISION LIST (Referee #1)

Title: Extending the Coverage Area of Regional Ionosphere Maps Using a Support Vector
          Machine Algorithm

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Dear Referee #1

Thanks for your comments on this manuscript. The authors have incorporated all the comments in revised manuscript, which are very helpful to improve the manuscript. The revised or new sentences are colored in red in the revised manuscript.

< REVIEWER 1 >

1) In the introduction (before the reference of Leandro and Santos) you write: "Ionospheric delay observations were used as the input parameters, and the TEC outside the coverage area was predicted". Therefore I would assume that the output is TEC, but looking at figure 4 on the y axis is written ionospheric delay. Therefore it would be better to eliminate this incongruence writing . . ... and the ionospheric delay outside the coverage area was predicted.

2) In section 2, Parameter modelling, you write "An extrapolated ionospheric delay, TECext, may be represented. . .." Why you label the ionospheric delay as TECext? Again, after Eq. (3), you talk about ionospheric delays but then in Eq. (4) you refer to observational parameters as TEC obs. It seems that you identified ionospheric delay with TEC. This sounds me strange because, to be meticulous, the ionospheric delay is proportional to the TEC therefore they are not exactly the same thing. To avoid this "incongruence" I suggest to replace in Eq. (4) TEC1 obs with ID1 obs, TEC2 obs with ID2 obs, TECN obs with IDN obs.

3) In section 3, subsection 3.1 again you write "y is the target that represent the true TEC in the extrapolation region". For the reasons written above I suggest to replace true TEC with true ionospheric delay.

TEC values were used as the model parameters and it is why TEC terminology is used in the manuscript. However, all the TEC has been replaced with "ionospheric delay (ID)" to avoid possible confusion. Thanks for your tip.

<Sec.1~6>

4) In section 3, subsection 3.1, in Eq. (5), in the term WT the meaning of T is missing, T stands for? Moreover in Eq. (5) x should be replaced with xSVM to follow the same nomenclature adopted in the flow chart of figure 1 where you write xSVM = [xt xe xobs].

We have added the description of wT where T stands for 'transpose'. Also, we have replaced 'x' with 'xSVM'.

<Eq.5 & 6, p.3>

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5) You write, at page 4 after figure 1, "Targets include the true TEC in the j-th extrapolation point", and looking at the flow chart of figure 1, I read ySVM = TECJext.. Therefore I ask you if it is not the case to replace in Eq. (6) and subsequently in the text, y with ySVM .

We have changed "y" to "ySVM".

<Eq.5 & 6, p.3>

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6) At the end of subsection 3.1 you write ". . .using the interior point method", please provide a reference here.

A Reference has been added.

<Sec.3.1> <Ref> (Ferris and Munson, 2004).

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7) At page 7 you write: ". . .the high ionospheric delay season is more appropriate when evaluating the extrapolation algorithm than the low ionospheric delay season". This sentence is not clear. Could you explain in other words this concept? What do you mean with "more appropriate ".

When the ionospheric delay (ID) values and its variations are small, the extrapolation values become small, and the extrapolation errors become small as well. For the performance evaluation of the extrapolation algorithm, large extrapolation errors are preferred for comparison. Sentences are added for explaining this issue.

<Sec.4, p.7>

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8) Looking at the caption of figure 4, I note some incongruences : a) you write "One year variation. . ..(October 01, 2013 to October 30, 2014)" . This period is made by 13 months so it is a year + one month. Probably it would be better to write the caption as: Ionospheric delay for the training period (01 October 2013 - 30 September 2014), and prediction period (01 - 31 October 2014). This is compatible with what you write before figure 4, i.e, "The training period is set to one year from October 1, 2013 to September 30, 2014."and "The prediction period is set to one month from October 1 to 31, 2014".

Thanks for your comment. We have changed the text label.

<Fig.4, p.7>

9) At the beginning of Section 5.1 you write "the variation of the TEC and the. . .". But given that the figure 5 shows on the y axis the ionospheric delay, again, I think it would be better to write: "ionospheric delay variations and the extrapolation results are analyzed for the data from October 28 2014, when. . .. "

We have changed the "TEC" to "ionospheric delay"

<Sec. 5.1, p.9>.

10) In figure 5 the acronym BRDC is not defined, it should be defined in the caption.

BRDC is the acronym of "GPS broadcast message" and represents the GPS Klobuchar model from GPS broadcast ephemeris. We have replaced "BRDC" with "Klobuchar" to avoid possible confusion.

<Fig.5, p.8>

<Table 2, p.12>

11) After looking at figure 5, showing the ionospheric delay trend for the direction north (N5) and south (S5), I would have expected to see in figure 6 the extrapolation error trend still for the direction north and south, but strangely you provide the results for the east direction (E5). Why?

E5 results were selected because its error variation pattern is different from N5. However, for the consistency S5, we have replaced the E5 results with S5 results. Thanks for your suggestion.

<Fig.5, p.9>

12) At pages 8 and 9 you provide the coordinates only for N5 and S5, then you mention the points E5, W5, N15, S15, E15, W15 without giving any info about their coordinates. For completeness, I suggest to delete the info about the coordinates of N5 and S5, providing however a table where are reported all the coordinates of the key points involved in this analysis.

A table of the key points has been added to list the coordinates and related sentences have been revised.

<Table 1, p.7>

<Sec.5.1, p.8>

13) For completeness, in addition to figures 7 and 8, I suggest to insert also a new figure showing the results for 10∘ extrapolation regions.

A new figure and paragraph presenting the results for 10 degree extrapolation points have been

added.

<Fig. 8, Sec.5.1, p. 10>

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14) With regard to Table 1, you write: "In the east and west points. . .. . . but the improvement increases as the distance of the extrapolation region increases". If I look at the errors for the direction east and west for SVM and NN, I note the following differences: 0.03, 0.20, and 0.13 (east direction), and 0.01, 0.01, and 0.17 (west direction) for $5°$,$10°$, and $15°$ respectively. So, to be meticulous, it is not fully true what you say, because in the east direction 0.13 < 0.20 and in the west direction practically there is not difference between $5°$ and $10°$. Therefore I suggest to delete the sentence "but the improvement increases as the distance of the extrapolation region increases".

Thanks for your suggestion. The sentence has been deleted.

<Sec.5.2, p.12>

(References)

a) The reference Kim and Kim (2014) is in the text, but it is missing in the list of reference
 ; The reference year in the list has been corrected from 2014a to 2014.
  <Ref., p.13>

b) The reference (Kim et al., 2014) is in the text, but it is missing in the list of reference
c) The reference Kim et al., 2014b is in the list of references, but it is missing in the text
   ; The reference year has been corrected from 2014b to 2014, and corresponding sentence has
    been changed from (Kim et al., 2014b) to (Kim et al., 2014).
    <Sec.5.1, p.8> <Ref., p.13>

d) Please replace in the list of references McKinella with McKinell
 ; Corrected. Thank you.   <Ref., p.13>