

Interactive comment on “Using sparse regularization for multiresolution tomography of the ionosphere” by T. Paniciari et al.

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We thank the reviewer for the time taken to review the paper and for their helpful comments. We have replied to the comments/suggestions below.

1 - Question. The authors supposed a fixed ionosphere in their tests while the method used is time dependent.

1 - Answer. We added the following comment to clarify better the points that you came across in Sec. 3: “[...] Although the inversion method is not time-dependent, there is the necessity to collect data within a relatively short time window (in our case 8 minutes long). The reason for the time window was to increase the data coverage otherwise there would be insufficient data for a reliable inversion. Effectively this assumes

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the ionosphere is static over 8 minutes, which can be considered more valid during quiet ionospheric conditions. However, with the anticipated increase in GNSS satellite numbers the size of the time window could be reduced. [...]”. We apologise for any misunderstanding this may have caused. For clarity we have also added the GNSS acronym in Sec. 1: “[...] Global Navigation Satellite System (GNSS) [...]”.

2 - Question. For that reason, I recommend to the authors to make additional tests with a ionosphere changing with time (e.g. for a full day of observations, with and without structures) in order to validate the method.

2 - Answer. This is actually a good point and an important step toward a final assessment of the method that we are also currently studying. We are working on an extension of this method for 4D tomographic reconstructions of the ionosphere and have some results but using a different software framework. General methods in ionospheric tomography exist where the time interpolation is taken into account with a smoothing factor. This is not an ideal solution when the algorithm (like FISTA) relies on a solution that should be the sparsest one. For this reasons we would prefer to split the work where we assess the sparse regularization over space and then where we assess it with main focus over time. We also consider the difficulties imposed by simulating a temporally dynamic ionosphere and prefer to validate the temporal regularization using real data. We are also worried that the inclusion of the temporal variation would make the paper significantly longer.

We amended few sentences in Sec. 4 for to clarify the context: “[...] The work in this paper shown the potential of the method when the ionosphere does not considerably change within a short time window, e.g. under quiet geomagnetic conditions. For more active conditions a full 4D imaging would be required [...]”.

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