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Interactive comment on "Sodankylä ionospheric tomography dataset 2003–2014" *by* J. Norberg et al.

Anonymous Referee #3

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The paper gives a good description of tomographic methods and in particular those used on a dataset between 2003-2014. The specific objective of the paper is to investigate the solar cycle variations in the vertical total electron content (VTEC) from this method, which is done well. The other result is the comparison as reference with VTEC derived from the IRI-2012 model, sunspot number and solar flux. The tomographic estimates correspond well with the model results in the way that they vary with the solar cycle, which is an interesting and worthwhile result. However, there is a discrepancy between the two in magnitude, with the estimates based on the model being the higher by 40% on average. The implication is that there is a systematic error, but little discussion is provided on what is the most likely cause, and whether it is in the model or the tomography method, or data. Further studies are suggested, which is indeed a

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Interactive Discussion
Discussion Paper

sensible route to take, but more detail is needed on what these studies might be.

The figure numbers are strangely organised, or at least the references to them. Figs 3 and 4 are referred to early in Section 2. I can find no specific discussion of Fig 4. Then follows a detailed discussion of Fig 1 then Fig 2. If Fig 4 is important for this paper it should have more than a link to a webpage.

When the detailed discussion of Figs 5-8 is given, it would be helpful to refer to the exact figure that is relevant. For example, when mentioning the summer results, please refer to Fig. 6 in the text. The second paragraph of Section 3 could be ordered better to aid the reader. Maybe it would help if the figures were combined into one figure with 4 rows. It is also worth considering if the results would be easier to interpret in a two colour format, since the gradations between blues and greens are very subtle. But mainly the text needs to be more specific and clearer. Another example is the sentence at the top of page 391 – does this refer to all seasons? In the sentence "At the magnetic local night time the differences are in general somewhat smaller and in both directions" the colours are certainly not very easy to interpret as values. An estimate of the differences would be useful, and better worded as "the differences are both positive and negative". Regarding "especially at the higher latitudes", the statement at line 8 that the difference at equinox and winter is likely associated with auroral activity should be expanded if important. There are differences in the summer plot across latitudes as well.

In describing Figs 9 and 10, it states that differences between stations are "almost indistinguishable" in this type of plot. It would be better to state that the large-scale features are the same for all stations.

Figure 9 again suffers from the problem of colour differentiation. Also, if 2003 is indeed a special year of extra magnetic activity, then it is important to consider in more detail what might be happening to make the results different. To this end it would be better to display the data so that direct comparisons can be seen by the reader, perhaps as line

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plots over MLT. How different are the midnight hours in 2014?

In the conclusions, the question arises at page 392 line 13 whether “error” is the correct word, unless more can be provided as a discussion of what the source of the error might be. There is certainly an almost systematic difference, but as has been pointed out there are exceptions, and these events may well be clues to what is happening.

One suggested rationale for the method is to assess the changes to the thermosphere from possible cooling effects, such as increases in methane and carbon dioxide. The tomography measurements are suggested as having a “crucial role in refining” a previous result (Lean et al., 2011) in the high latitude region, known to be a region where GPS measurements are less accurate. Such a claim should be assessed in the light of the results presented.

Technical corrections by page and line number

386

12 perhaps “descending” and “ascending” would help on first usage, at least

18 model results are on average 40% higher than those of. . .

387

12 consists of

388

3 in the ionosphere

5 statistics (or a statistic)

9 too far south

11 ‘also’ is not needed as implied in ‘include’

15 over the global ocean, but what does this mean?

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16 comma not needed after ‘paper’

20 the data

389

15 compared to a strictly polar orbit

16 could put “descending” here, and “ascending” at line 19

390

23 In the tomography results

391

6 ‘and in both directions’ but this expression needs clarifying.

392

21 consists of

Interactive comment on Geosci. Instrum. Method. Data Syst. Discuss., 5, 385, 2015.