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Atmospheric Measurement Techniques Discussions
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Interactive comment on "Application of the Full Spectrum Inversion Algorithm for Airborne GPS Radio Occultation Measurements" *by* L. Adhikari et al.

Anonymous Referee #2

Received and published: 12 April 2016

The manuscript discusses the airborne GPS radio occultation technique. Here the standard geometric optics retrieval do not typically work for multipath conditions. The manuscript develops a method to handle cases with multipath behavior and discusses the performance based on simulations.

This is an interesting manuscript containing important results and it should be published. Different approximations and assumptions goes into the method and I would suggest that the manuscript is updated along those lines before publication. Please see more details below.

General comments:

Printer-friendly version

Discussion paper

Abstract: The first paragraph of the abstract discusses measurements but the results in the paper are based on simulations. I suggest to rewrite the abstract such that it focuses on the results obtained in the paper. The word "measurement" is also used in the title (and could confuse).

Top of page 3: There is a brief discussion of the influence of the ionosphere and why this should not be important. For the standard RO retrieval, the ionosphere could have some impact in the troposphere due to the extrapolation of the signal. Would this also be the case for ARO?

Page 4 lines 27-30. The assumption behind FSI is that multipath is unfolded for a given value of the satellite-to-satellite angle "theta" (not time). Please rewrite.

Page 6 lines 5-6: The application of the FSI retrieval is not limited to circular geometries. The limitation of the FSI and other similar methods is discussed in the article: M. E. Gorbunov and K. B. Lauritsen, Analysis of wave fields by Fourier integral operators and their application for radio occultations, Radio Science, Vol. 39, RS4010, doi: 10.1029/2003RS002971, 2004.

Page 6 line 7: I do not understand why these terms are referred to as "acceleration terms" (since they are also present for a constant velocity). Please explain this in the paper.

Page 6 lines 17-21: The modified FSI method uses a projection onto circular orbits. To what extent are the "corrections" in eqs. 7-9 approximations or exact? In principle I guess one could calculate the corrections from the diffraction integral when moving a signal from one orbit to another one (a circle). How is this linked to these corrections in the paper?

An alternative method could have been to use the method introduced in the article by Gorbunov and Lauritsen. This method is similar to FSI but performs better for generic orbits so it may be applicable to the orbits for ARO.

Page 9 lines 5-8: Please explain why sharp gradients cause difficulties for ray tracing.

Page 9, line 16: Please add a discussion of this approximation to the manuscript.

Page 11 line 12: Why do the "tapering" create this low amplitude?

Page 11 lines 14-16: How is this expected to behave for real signals which might be more complicated than simulated signals?

Page 11 line 25: The errors from the projection are mentioned here. Why do they explain the deviations in the figure? Does it mean that one should aim for a better method, e.g., trying using the one above by Gorbunov and Lauritsen, or the diffraction integral?

Page 15 line 2: Refers to a red curve in Fig. 4(b). But my version only has a blue curve; if the two curves are on top of each other please write this.

Technical comments:

Page 3, line 31: remove "new" and write "modified".

Text and e.g. eq. 7, etc.: Please use one-letter symbols for physical quantities (and not: ph, phs, exphs, etc.) such that equations become easier to read.

Eq. 7, etc.: Please typeset trigonometric (and other elementary) functions in roman (and not italics). This will also make equations easier to read.

Eq. 16, etc.: In "k.a" etc., please remove the period (".").

Caption Fig. 2: Please write "does not".

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