Atmos. Meas. Tech. Discuss., 5, C3522–C3525, 2013
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Atmospheric Measurement Techniques Discussions

Interactive comment on "Zernike polynomials applied to apparent solar disk flattening for pressure profile retrievals" *by* E. Dekemper et al.

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Received and published: 9 January 2013

Dear Referee,

We would like to thank you for your interest in this work and for the balanced review you submitted. In this review, you raised a number of comments and questions. Please, find our answers in the following paragraphs. We hope our explanations will meet your expectancies.

1 Abstract content

We fully agree with this remark. We will provide more details on the inversion method based on a lookup table created from the CIRA climatology.

2 Limb darkening importance

The consideration of the solar limb darkening is absolutely mandatory for our method. This is the reason why section 2 is almost completely devoted to how the limb darkening can accurately be represented along the occultation. The Zernike moments definitely capture not only the shape of the disk, but also the intensity distribution across the disk. We will add a sentence in the abstract about the importance of the careful limb darkening representation.

3 3-D atmosphere simulation

According to us, the apparent width of the solar disk at the tangent point (25 km) makes the assumption of no horizontal gradient quite acceptable in the context of an ALTIUS or an ACE-like instrument. However, dealing with gradients along the line of sight, brings the simulation and inversion problems to a totally different level of complexity. As we are not sure about the consequences of a 3-D simulation of the atmosphere, we believe it would take us too much time to acquire confidence on this topic. Therefore we would propose to keep this aspect for deeper developments.

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4 Pixel intensity calculation

The pixel intensity is computed in two steps. First, the pixel is sampled into a grid of 30 x 30 subpixels. The ray tracing problem is solved for each grid node, providing 900 values of radiance for a single pixel. This level of detail is especially needed for pixels capturing the solar edge. Second, an average radiance is computed for the pixel, then converted into a flux of photons using the assumed optical parameters of the virtual instrument.
Accordingly, we will provide more details in the corresponding bullet at the end of section 2.5 in the reviewed version of the manuscript.

5 CIRA-86 climatology

In the early stages of this work, when the inversion strategy had converged towards the lookup table method, we selected the CIRA-86 as a standard climatology. Though, we probably did not realize it was not representative enough of the variability of actual independent pressure profiles. In that sense, the inversion algorithm in its current state, is not yet qualified for application to a variety of real profiles. Atmospheric states lying outside of the boundaries of the training dataset will be retrieved with larger systematic errors. According to us, this does not constitute a failure of the method, but shows the need for a consolidated training dataset. Future developments will use a larger collection of real profiles. The revised manuscript will stress this aspect in the beginning of section 4.
The Principal Component Analysis does not constitute a proof of the representativeness of the CIRA dataset. Instead, it serves two goals. First, it allows for a decrease of the number of variables representing the pressure profile, passing from 46 layers to 5 numbers (the Principal Components). This is done for numerical reasons. Second, it allows for generating a new dataset in which we can be sure that there are no iden-

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tical profiles: each of them differs at least by one of its 5 Principal Components, which avoids redundancies in the training dataset.

6 Slant occultations

The Referee is right in stressing that we did not consider slant occultations in this work. However, in this geometry, the triangle formed by the Sun, the Earth and the spacecraft still holds. The difficulty will then be to match the Sun-Earth-Spacecraft angle (w) of the actual measurements with the predefined ones in the training situation. Our answer to comment n°5 of Mr. McHugh could also apply to this issue.
On the other side, in the case of a slant occultation, the horizontal footprint of the measurements may reduce the validity of the "no-horizontal gradient" assumption. This should be addressed in future developments.

7 Figure 6 discussion

We agree with the Referee about the lack of description surrounding the testing of the method. The reviewed version of the manuscript should be based on a broader range of pressure profiles. We will then provide more explanation on the test results.

8 Discussion and conclusion section content

We agree with the remark of the Referee. The reviewed version of the manuscript will address the results of the test in a more accurate way.

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 7535, 2012.