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Re: Manuscript Number: AMT-2023-186
Title: Simulation and detection efficiency analysis for polar mesospheric clouds measurements using a spaceborne wide field of view ultraviolet imager
Author: Ke Ren; Haiyang Gao; Shuqi Niu; Shaoyang Sun; Leilei Kou; Yanqing Xie; Liguo Zhang; and Lingbing Bu

Dear Reviewer,

Thank you for your review of the manuscript entitled “Simulation and detection efficiency analysis for polar mesospheric clouds measurements using a spaceborne wide field of view ultraviolet imager” pending revision as well as for your valuable suggestions to improve the paper. We have tried every means possible to improve the presentation and increased the readability. We have also made all the changes suggested by the reviewers and addressed all the comments in the notes below. Please note that the reviewer’s comments are shown in bold type and our responses in plain type.

Best regard,
Ke Ren and Haiyang Gao

This paper proposed a compact and cost-effective wide field-of-view ultraviolet imager (WFUI) for future PMCs observation and a forward model to evaluate the detection capability and efficiency of the WFUI. The lightweight imager mounted on the further small Cubesat for PMCs observations has great application prospects. The paper is well-written and comprehensive.

Comments:

1. Line 300: Fig.5 should be Fig.4.

Thanks the reviewer for pointing this out.

We have modified the error in this sentence (line 314).

"*... The data were fitted, and the resulting image is shown in Fig. 4 ...*"

2. Some discussions should be mentioned in the manuscript. The paper should look into the possible problems in the on-orbit calibration and geolocation of the observations, such as the exposure time for the CCD camera and the orbital altitude of the satellite.

Thanks for pointing this out. We have discussed this issue, and the information has been incorporated.

For in orbit calibration, we have added some description to Section 2.6 (lines 349 to 354) as:

"*... On-orbit calibration primarily focuses on camera flat-fielding and normalization ... Ideally, obtaining an accurate estimate of the Δ-flat field requires a uniformly illuminated camera image. On-orbit is condition is best approximated at the subsolar point and in nadir viewing geometry (Lumpe et al., 2013). Images are captured multiple times throughout the year at the subsolar point with the camera for calibration of other images. For each measured subsolar image, a simulated image is calculated from a Rayleigh scattering forward model using identical viewing geometry. The measured image is then divided by the model image, and the resulting ratio is normalized to unity at the image center, to isolate the pixel-to-pixel variation...*"

We modified the title of Section 4.4 to "Parameter Sensitivity Analysis and Discussion", and have added some description to lines 457 to 461 as:

"*... The satellite velocity V varies with changes in the satellite altitude H, given by* $V=\sqrt{\frac{GM_e}{R_e+H}}$ *, where G is the gravitational constant,* M_e *is the mass of the Earth, and* R_e *is the radius of the Earth. As orbit altitude increases, satellite speed decreases, resulting in smaller phase shifts during image capture with the same exposure time, and reduced distances moved with the same measurement cadence. We can adjust the exposure time and measurement cadence to maintain the geolocation of the observations. In addition, while altering the satellite altitude, factors such as photon reception efficiency, and CCD pixel resolution change ...*"

For the identification of pixels with weak PMCs and multi CubeSats observations, we also added some description to Section 4.4 (lines 491 to 496) as:

"*... WFUI with only one camera cannot achieve the level of CIPS with four cameras when detecting small particles in weak PMCs. However, using a single camera significantly reduces costs and minimizes payload space. Also, WFUI is potential to be installed on multiple CubeSats to detect the same sampling PMCs region with variation scattering angle when different CubeSats are orbiting in the same orbit with a certain delay time interval. This would*

allow obtaining multiple views of each position from different SCA, thereby improving the detection of weaker PMCs. ..."

Special thanks to the reviewer for his/her good comments.

We have tried our best to revise and improve the manuscript and made a few changes in the manuscript according to the reviewer's good comments. Again, many thanks for your valuable comments and suggestions. We would like to have our paper at your disposal.

We appreciate for reviewer's spending more time on reviewing over paper and offering valuable suggestions, and hope that the modification and corrections will meet with approval and hoping that our paper will be published in *Atmospheric Measurement Techniques* as soon as possible.

We look forward to your information about my revised paper.

Yours sincerely,
Ke Ren and Haiyang Gao