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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "The MATS Satellite Mission – Gravity Waves Studies by Mesospheric Airglow/Aerosol Tomography and Spectroscopy" *by* Jörg Gumbel et al.

**Anonymous Referee #1**

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This manuscript describes a new soon-to-be-launched Swedish satellite mission. This mission will combine UV (for NLC) and IR (for the O2 (0,0) airglow emission band) limb observations with IR nadir imaging, to study the dynamics of the upper atmosphere, specifically gravity waves. This paper gives an overview of the scientific background and objectives, then it describes the instrument design and several analysis techniques, before explaining the operating modes and summarizing the mission. It is somehow unusual to comment on a paper giving an overview of a project which has probably been extensively reviewed before getting funded by the Swedish National Space Agency. I assume that most of the possible issues have been investigated already, so my comments will be more about lacking information, even if I understand



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that a simple paper cannot cover all the technical details involved in such a mission, and some personal remarks.

How can the second scientific question be answered since there is no thermospheric measurements above ∼96 km, no ionospheric measurements or modeling involved in MATS? Does it depends on external collaborations? I don't understand some of the instruments parameters. For example, Tables 5 and 6 gives 10x10 km for the nadir resolution. In section 3.4, it is said that the fov will be 200x50 km, and in section 3.2.4, that the CDD format is 512x2048 px, therefore the spatial resolution should be 100x100 m. Is there any binning involved? How much? Or will the images be cropped? The authors should give the speed of the satellite, it is important to understand the effects due to smearing. The readout times are close to the exposure times (tables 5 and 6), and up to 5s, which seem rather large for a satellite moving at probably several km/s. 4.2.2 briefly mentions readout smearing but doesn't give much information or references about desmearing. It also doesn't give any errors on the GW parameters measurements due to this effect. Table 1 shows the expected measurement precisions. 5-20K for the O2 nighttime temperature is very large given that this range will correspond to the temperature perturbations expected for the most impactful GWs. What will be the error on momentum flux calculation? The satellite will fly on a sun-synchronous, near-terminator, polar orbit, which means it will be complicated to look at tidal effects. Several corrections rely on climatologies or models. Is it planned to improved the corrections in the future? Figure 9 shows the sensitivity to GW horizontal and vertical wavelengths for the limb instrument. The best "region" is for 3<Lz<10 km and Lh>∼60km. These waves won't be observable by the nadir instrument because of the integration through the O2 layer. How do you plan to combine limb and nadir results? Furthermore, a large part of the important GWs (the ones transporting a lot of momentum) will be poorly characterized, especially GWs with Lh<60 km. What is the expected impact on the GW and MF climatology? I understand some of these questions/comments may be out of the scope of this paper, but it would be interesting to provide some answers or clarifications.





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Minor edits p3 l.11: Ern et al., 2011 p4 l.16: first sentence sounds weird l.20: Forbes et al., 2009 l.23: Funke et al., 2010 l.30: ...satellite measurements... p5 l.4: could include Azeem et al., 2015 l.13: Gong et al., 2012 l.15: combining p6 l.3: by Song et al. l.25: remove "in" p7 l.4-6: looks like there is only 1 science question concerning NLC p8 l.6: Sheese et al., 2010 l.9: Mlynczack et al., 2001 l.11: patterns l.13: von Savigny et al., 2005 p9 l.13-14: change [] to () for the references l.21: Llewellyn p15 l.12: line stops too early, maybe pdf issue p16 l.17: analog-to-digital l.22: section 0??? p17 l.12: ...is better than... l.17: Figure 6 shows... p21 l.7: field of view p22 l.14: a priori... a posteriori l.31: 175 km p23 l.5: a priori l.8: change +- to normal sign p26 l.1: in terms of... l.3: excited l.9: provide l.21: retrievals l.31: ratio p28 l.19: MATS

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