

Atmos. Chem. Phys. Discuss., referee comment RC1
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Comment on acp-2021-779

Anonymous Referee #2

Referee comment on "Comparison of mesospheric sodium profile retrievals from OSIRIS and SCIAMACHY nightglow measurements" by Julia Koch et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-779-RC1>, 2021

Title: Comparison of mesospheric sodium profile retrievals from OSIRIS and SCIAMACHY nightglow measurements

Manuscript #: ACP-2021-779

Koch et al. have reported the comparison of sodium concentration profiles retrieved from sodium D-line nightglow measurements from OSIRIS and SCIAMACHY. They retrieved sodium concentration profiles with uncertainties between 2 and 15% in the year 2006 to 2011. The paper highlights the importance of satellite limb scanning of sodium D lines to derive the concentration of neutral sodium atoms in the MLT region. The authors used the OSIRIS/Odin mesospheric limb measurements to derive sodium concentration profiles and vertical column densities. They validated the results by comparing them to those measurements from SCIAMACHY/Envisat and GOMOS/Envisat. They also reported that the limb emission rates and volume emission rates exhibit a semi-annual cycle in the tropics. The authors have analyzed large volume data set which is a commendable job. The manuscript is also well written and well organized. However, there are few shortfalls of this paper. This paper can be published after a moderate revision.

1. My primary concern is that the authors should also focus on the science outcome and include one separate section based on the comparison of OSIRIS and SCIAMACHY retrieved sodium density profiles.

2. The authors have not mentioned about the location of measurements of both SCIAMACHY and OSIRIS (Figures 5). I can understand that these Limb Emission Rates (LERs) are monthly averaged. Are these LERs latitude-longitude averaged? If it is so, what is the scientific basis of doing so? What science outcome can be expected from latitude-longitude averaged LERs/VERs?

3. The authors have discussed on the semi-annual variation in VERs. They should also try to explore other features.

4. The authors have used average O₃ density profiles to retrieve sodium density at different altitude. There is a large latitudinal variation in O₃ density in the MLT region. Hence from Figure 11 (right panel), it is clear that the retrieved sodium density profile is quite sensitive with O₃ variation. How reliable are those sodium density profiles?

5. The authors should discuss how "effective branching ratio" affects the retrieved sodium concentration? They should carry out the sensitivity analysis.

6. Line 259-260: "... LERs and VERs undergo a semi-annual cycle in the tropics." The retrieved sodium densities do not show any semi-annual cycle clearly. Why is it so?

7. Line 262-263: "OSIRIS measurements only cover one of the hemispheres each month at around 6:50 p.m. local time." It appears to me that the LERs from OSIRIS have been measured during twilight time. How do the authors ensure that the contamination from solar background is eliminated?

Minor comments:

Line 27-28: Is the semi-annual cycle observed in density or emission profiles of sodium? Please mention.

Line 30: Maintain proper citation style throughout the paper.

Line 30-31: "The reason is thought to be connected to the semi-annual variation of the amplitude of the diurnal tide which has its maxima around equinox". The authors should provide references. Does semi-diurnal tide have any role?

Line 40: "Laboratory studies showed that this variability could be a result of a dependence on the O₂/O ratio" Please provide references.

Line 90: Why is the linear interpolation chosen to deal with variable tangent height?