

Review on manuscript " Probing the sensitivity of polarimetric O<sub>2</sub> A-band measurements to clouds with emphasis on potential OCO-2 and GOSAT retrievals" by S. Sanghavi, M. Lebsock, and G. Stephens

The manuscript contains some interesting insights and it covers the topics appropriate for Atmospheric Measurement Techniques. The authors discuss sensitivity of the cloud parameters using measurement of the reflected radiance at the top of atmosphere. They have demonstrated a possibility to evaluate an important cloud properties such as the cloud optical thickness and effective radius, the cloud layer geometry (height and thickness). The authors conclusion are based on result of numerical simulation and simple analytical models.

The manuscript is well structured but written with negligence; the abstract clearly summarizes the main results. The authors use 34 figures, the usefulness of most of them are quite questionable. I recommend to delay the manuscript publication until a significant revision of the manuscript text and figures made to achieve a clear and precise presentation of the authors ideas and results.

Major comments:

First and foremost drawback of the manuscript that it lacks of reality. Without stating the instrument characteristics (signal to noise ratio, spectral resolution) the author findings and conclusion are hardly useful since an ideal instrument can measure anything.

The other drawback is that most figures show how a given characteristic (intensity or polarization component, or their combinations) depends on the cloud parameters (optical thickness and effective radius, cloud top height etc) which do a poor job to present the authors points.

Minor comments:

Selected particular comments:

page 9606. " GOSAT measures both orthogonal components  $I_h = 1/2 (I+Q)$  and  $I_v = 1/2 (I-Q)$ ." This is completely wrong. Please check any GOSAT L1B file the GOSAT measures  $I_h = 1/2(s_i I + s_q Q + s_u U)$ , where (s<sub>i</sub>, s<sub>q</sub>, s<sub>u</sub>) are the Stokes coefficients while s<sub>i</sub>~1, s<sub>q</sub> and s<sub>u</sub> can be quite different from 1 and 0, correspondingly.

page 9610. It has to be mentioned that the cloud properties is evaluated at wavelength ~765 nm.

page 9614. "whereas the degree of polarization is reduced to levels close to  $p = 0$ " It is not true if the "rainbow" scattering angles are under observation. The degree of polarization at 142 is used to identify a cloud pixel for the POLDER product.

page 9618. " GOSAT could also be potentially combined with its more comprehensive polarimetric coverage (measuring both  $1/2(I-Q)$  and  $1/2 (I+Q)$ ) to obtain information on cloud droplet size." See comment to page 9606 regarding GOSAT measurement.

page 9628. "Cloud height has practically no influence on the intensity of reflected light for a non-absorbing atmosphere in the spectral range of the O<sub>2</sub> A-band". The authors have to write their ideas more carefully. Everyone knows that the oxygen A-band is used to measure the cloud top height among other parameters.