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Interactive comment on "In-Flight Calibration of SCIAMACHY's Polarization Sensitivity" *by* Patricia Liebing et al.

Anonymous Referee #2

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This is an extensive and detailed study on the inflight polarization calibration of SCIA-MACHY. A statistical analysis of inflight observations is used with radiative transfer model simulations to diagnose changes in the polarization calibration from pre-flight observations and over course of the Envisat mission. These changes are identified as being consistent with various instrument components through a detailed analysis. The results of the study are to be implemented in the operational version of the level 0 to 1 processor and represent a significant improvement over previous calibrations.

The paper is very well written and although long and somewhat tedious in nature, the formal development of this substantive body of work will be quite helpful for future instrument characterization and modelling work. The equations and nomenclature are clear and the figures are well done. In my opinion, other than the one point detailed

below, there are no real outstanding issues with the paper and I recommend publication in AMT.

The vector radiative transfer model is used to calculate maximum possible polarization values for the analysis with several assumed atmospheric state terms and boundary conditions. The approach uses the model to derive limiting values for the polarization of the nadir and limb radiances and is a good idea, in my opinion. The question that arises is about the accuracy of the model, both with regard to the assumed states and boundary conditions as well as the algorithm itself (for example, overestimation of multiple scattering in a plane parallel atmosphere as pointed out by the authors). The model reference paper, Rozanov et al., 2014, shows relatively large differences between SCIATRAN and other vector RT codes for limb radiances, especially in certain geometries. This should at least be mentioned in this paper and if possible the potential impact on the results quantified.