

Reply to Referee #1

First, we appreciate the positive review and, in particular, the detailed comments to improve the manuscript. The replies to the specific comments:

a) The accuracy of the radiance measurements usually is an important issue when comparing absolute radiances with modeled values. Measuring absolute radiances is a lot more challenging regarding radiometric calibration which was not performed for this campaign. Here, we are concerned with the precision (not accuracy) of the relative stability which has been included in elaborating paragraph 4, page 3, see below, under b).

In any case, since we compare ratios for our conclusions, the calibration requirement is relieved here. The primary reason for investigating ratios (besides the above advantage) has been worked out towards the end of section 3.1, i.e. that the albedo distribution at the coastline breaks the symmetry in the sky radiance. A very powerful way to display a break in symmetry is to show the ratio of values that are expected to be equal in case of symmetry. See page 5, lines 38pp *“In the following, we will investigate the respective ratios which highlight this asymmetry of the radiance above the albedo distribution”* .

b) This is a very valid point, since the polarization of the radiance may affect measurements. All three instruments used in this study are fiber coupled to the input optics with optical fibers (length of 10 m) that are not polarization maintaining. The insensitivity to polarization has been confirmed in the laboratory by rotating a polarizer between a light source and the input optics and monitoring the measured signal. Page 3, lines 33pp has been appended accordingly.

“The instruments were not calibrated in absolute radiometric units, since we will be considering relative ratios, where the absolute calibration is irrelevant. Only relative radiometric instrument stability has to be ensured, by temperature-stabilizing the instruments. Before the field measurements, DA1 and DA2 were operated together at the coastal site to check instrument stability. From this inter-comparison (and earlier campaigns, see Kreuter et al., 2014) we estimate the precision of these two instruments over the course of the day to about 1%. The precision for the PAN instrument is expected to be of the same order. All instruments are fiber coupled to their respective input optics, with optical fibers that are not polarization maintaining which ensures the instruments’ insensitivity to the polarization of the sky radiance.”

c) [rel. units] has been added to the y-label of Fig. 2.

d) Absolute radiances (and global and diffuse irradiances) could indeed be used to obtain more information about ground albedo, especially using advanced algorithms such as the General Retrieval of Aerosol and Surface Properties (GRASP) in combination with satellite information. But this direction is a little off-topic with respect to our goals here. In fact, the coastline is a particularly unsuitable setting to retrieve ground albedo.

However, the comment triggered some more thinking about the “next interesting questions”. Our study is focused on the effects of the albedo distribution on the sky radiance. As a further

step, it would be interesting to see the effect on the radiance's polarization (degree and angle of polarization). The polarization is often also measured as additional information for the retrieval of aerosol properties. The final paragraph of our conclusions has therefore be extended to mention this idea: *“Since the degree and angle of polarization may also be used in these retrievals, an interesting question for further studies in the future would be about the effect of inhomogeneous ground reflection on the radiance's polarization.”*

e) We only performed the measurements described in section 2.1. We do have RGB images of the whole hemisphere from the all-sky imager which we used to confirm cloud free conditions, but they are not ideal to show the radiance distribution (although the image, or one of the channels is closely related to the radiance). We have modeled radiance distributions, from the extensive model study prior to the campaign in order to estimate the effects that can be expected and to find the ideal measurement geometry.

So yes, the radiance of the whole hemisphere is of course interesting, but showing sky radiance distributions in a new figure in this study is problematic for many reasons: We could only show model data, and showing the model for one wavelength and SZA would somewhat be an arbitrary choice. Showing distributions for all wavelengths and SZAs would by far not justify the space required in relation to the increase of insight with respect to our conclusions.