## Author's response to the reviewer comments on the manuscript "Validation of spectral sky

## radiance derived from all-sky images – a case study" [Manuscript: AMT-2013-258]

We would like to thank the reviewer for the useful comments and suggestions to improve the quality of the manuscript. A list of all reviewer comments and questions (written in italics) as well as our response (written in regular and beginning with >) is given below.

## Specific comments:

- Line 10-23, p.11: In this paragraph the results from Fig.4 should be described. However, this is not the case. In fact, the given information in the text can also be found in the caption of Fig. 4 (it is more or less the same text). Try to describe the results from the figures in the text (as you did for Figs. 6-9) and reference in the text to the respective figures 4(a)-4(d). The same is also valid for Fig.5. on page 12, line 3-8.
  - > We agree and described the results in the text as:

"A rim at the horizon with higher values of spectral sky radiance can be observed, in contrast to the spectral sky radiance at the zenith. For the spectral sky radiance distribution, in general, the brightness of the horizon which is dominated by the Rayleigh scattering (Liou, 2002) increases with increasing wavelength and can clearly observed in the measurements with the CCD spectroradiometer. From the results of the spectral sky radiance derived from the HSI system, the horizon brightening could not be identified at short wavelengths (400 nm) but could be distinctly observed at longer wavelengths (600 nm), which is not shown in the plots. The variation of the spectral sky radiance distribution at the wavelength 500 nm deviates up to 10% for the whole hemisphere excluding the circumsolar region as shown in the ratio plot Fig. 4(c)."

The result of the validation under overcast sky as shown in Fig. 5 was already described in page 12, line 3-5.

• An additional raw image in Fig. 6 (cloudy conditions) showing the sky conditions might be helpful for the reader

> The spectroradiometer requires about 12 minutes for measuring the spectral sky radiance of entire hemisphere, whereas the HSI system takes the image of every 20 seconds. 35 images of the HSI system were used to construct one synchronized all-sky image corresponding to 113 points of the spectroradiometer as shown in Figure 6(d). Therefore the sky condition cannot be characterized by a single all-sky image. Since the sky conditions change during the intercomparison we did not follow the suggestion to

add a (non-representative) raw all-sky image. Moreover, the comparison between both instruments has been done by point to point.

- Figs. 7-9 nicely illustrate the discrepancies between HSI and spectroradiometer at selected zenith and azimuth angles for the whole visible spectrum. Could you also give a more general statement in this section about the discrepancies between HSI and spectroradiometer for all directions and zenith angles?
- ➤ We added the additional summary of the validation between the HSI system and the spectroradiometer:

"The deviation between the camera-based spectral radiance by the HSI system and the measured spectral radiance from the spectroradometer for all directions and zenith angles (whole hemisphere) was up to 20% for wavelengths less than 700 nm. Sample results can be found in the Sect. 4.2 for the wavelength of 500 nm. For wavelengths greater than 700 nm, the deviation can be up to 40% when some parts of scanning point were covered by clouds."

The wavelength shift (of the maximum) between cloud-free and cloudy conditions discussed on p.14 (line 3-7) is clearly visible in Fig.7 (upper left panel, for cloud-free conditions) and in Fig. 8 (overcast) and Fig.9 (lower left panel, for cloudy conditions). However, this is not the case in Fig. 7 (lower left panel, for cloud-free conditions) and Fig.9 (upper left panel, for cloudy conditions). Can you comment on this? What about different zenith angles and directions?

> In the case of Fig. 9 (upper left panel), it may be caused by obscuration of the clouds, which covered some parts of this scanning point that may result in the wavelength shift in this case. In Fig. 7, it might be caused by the horizon brightening. For different zenith and azimuth angles (different directions), a wavelength shift could be recognized if the scanning point has been fully covered by clouds or for cloud-free scanning points.

- Add latitude and longitude of the measurement site
  - > The latitude and longitude of the measurement site have been already added
- Use "cloud-free" instead of "clear-sky" throughout the manuscript
  Cloud-free was used instead of "clear-sky"

## Technical corrections: some of the spelling and grammatical errors:

• p2, line 7: "was validated using" instead of "was validated by"

- > Done
- p.5, line 2: "through" instead of "though"?
- > Done

• p.6, line 10/11: the sentence "a total of 35 images can be in the time of one measurement" may need tobe reformulated. For example " a total of 35 images is within a complete measurement cycle of the CCD spectroradiometer...".

> Done

• p.6, line 12: "a synchronized HSI image" instead of "a synchronized HSI images"

- > Done
- p.6, line 24: rather "consisting of" than "consisting in"
- > Done
- p.7, line 20: define ISO
- > The definition of ISO number was added.
- p.10, line 3: "the correlation coefficients of each channel vary depend..." should be read as "the

correlation coefficients of each channel vary depending ... "

- > Done
- p.10, line 7: "at wavelengths less than" instead of "at the wavelength less than"
- > Done
- p.10, line 8: delete "long"  $\rightarrow$  "...and in the 680-760 nm wavelength range"
- > Done
- p.10, line 9: "ranging" instead of "ranged"
- > Done

• p.10, line 22: "the blue channel yields the best correlation coefficients in the 380-450 nm wavelength

range.." instead of " the blue channel provides the best correlation coefficients for the wavelengths from 380 nm to 450 nm..."

> Done

• p.10, line 26: use "...obtain the spectral sky radiance in the 451-620 nm wavelength range" instead of

"recover the spectral sky radiance at the wavelength region of 451 nm to 620 nm."

- > Done
- p.12, line 2: "distinctly" instead of "distinct"
- > Done
- p.12, line 7: "which can be seen" instead of "which can see"
- > Done
- p.12, line 11: May replace "occupied" with "covered"
- > Done
- p.12, line 18: "the HSI system overestimates"
- > Done
- p.12, line 25: "...than for completely cloud-free and overcast skies"
- > Done
- p.13, line 11: "... less than 10 % in the 380-700 nm wavelength range as shown in the ratio plots in (of)

Fig.7"

- > Done
- p.13, line 12: "For wavelengths..."
- > Done
- p.13, line 15: "Figure 8 shows the radiance spectra for the overcast..."
- > Done
- p.13, line 19: "...less than 10 % in the visible spectrum."
- > Done

• p.13, line 22: May replace "occupied" with "covered"

> Done

• p.13, line 23: The sentence ",...which leads to selecting the regression model for cloudy conditions." may need to be reformulated: For example: "The Sky Index was found to be close to 0.22. Therefore the regression model for cloudy conditions was selected."

> Done

• p.13, line 25: "deviation" instead of "derivation"

> Done

• p.13, line 27: use "covered" instead of "occupied"

> Done

• p.14, line 2: "For wavelengths greater than 700 nm..."

> Done

• p.14, line 3: May reformulate this sentence, e.g.:".., the maximum radiance during (in) cloudy situations is shifted from 400 nm for a cloud-free sky (Fig.7, upper left panel) to 450 nm (Fig.9, lower left panel) as described in Lenoble (1993)"

> Done

• p.14, line 6: "...to longer wavelengths..."

> Done