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Atmospheric Measurement Techniques Discussions

Interactive comment on "Sky cover from MFRSR observations: cumulus clouds" *by* E. Kassianov et al.

Anonymous Referee #3

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The paper describes a new method for deriving cloud fraction of the upper hemisphere from spectral global irradiances measured at two narrow-band wavelengths in the short-wave visible region (415 nm and 500 nm) by the Multi-Filter Rotating Shadowband Radiometer (MFRSR). Its performance is discussed and derived cloud cover compared with independent measurements from other instruments for 13 days of observations at the Atmospheric Radiation Measurement Site in Oklahoma. The new algorithm is promising, because it uses all-sky input data that are affected by clouds of the whole sky, not only zenith clouds, and because it uses data from the widely distributed MFRSR instruments. Therefore, its application could provide a valuable amount of additional cloud data for different climatic regions of the world.

The main criticism refers to two aspects:

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i) As the method is innovative, the algorithm itself and, in particular, the instruments and data used for comparison should be more clearly presented. An adequate division into chapters, e.g. method, instruments and data for comparison, results, conclusions) would make it easier for the reader to understand the value and significance of the results In the present version, the different aspects have been mixed such that understanding the separation between input data to the method and independent data for comparison is hampered.

ii) The cloud algorithm has been applied to data of 13 days only. Therefore, the results presented may not represent the natural variability of atmospheric conditions at the site. Differences of spectral diffuse irradiance E500 – E415 strongly depend on solar zenith angle and optical characteristics of atmospheric aerosols. The differences of spectral diffuse irradiance can vary within a wide range of values between about – 0.15 and +0.15 W/m^2. They depend in different ways on atmospheric aerosols. Moreover, if no data of atmospheric optical depth are available close to the cloud decision time due to lasting overcast conditions, a reasonable estimate of clear sky irradiance difference is needed. Under conditions of high variability of cloud cover and/or fast changes in aerosol optical depths, the cloud algorithm may become problematic. This issue should be addressed to what extent it may affect the results.

Page 717, line 15: The performance of the cloud algorithm is illustrated for days with typical aerosol loading. What will be the result of the cloud algorithms, if the optical characteristics of atmospheric aerosols differ from the climatological means?

Page 719, line 13: If there are longer periods during which no aerosol information can be derived, what input data are used for the cloud algorithm?

Page 720, line 6: . . . Spectral changes of the solar constant . . . Do you mean changes in extraterrestrial spectral irradiance? Solar zenith angle should provide a large contribution to the changes in the difference of spectral irradiance F(500) – F(415), but it is not mentioned.

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Page 721, line8: Does the normalization procedure work at all solar zenith angles?

Page 723, line 8: It is said that both NVIS and NSW represent a hemispherical measure of cloud amount, which is quite sensitive to a cloud location within the hemispherical field of view (FOV). Is that statement not contradicting to what has been said on page 718, line 5, that the TSI has a hemispherical FOV and provides hemispherical sky images for a large area neighboring the ACRF site?

Page 725, line 2, Better specify what 'majority of cases means'. It can be any value greater than 50%.

Page 725, line 2 and 10: It is said that the method can be applied for estimation of fractional sky cover for different cloud types, including cumulus and optically thin clouds with small horizontal size such as shallow cumulus clouds. Are other optically thin clouds such as Cirrus, which is of high importance, also included? It does not become really clear to the reader, for what type of clouds the methods is applicable and how the algorithm will recognize the right cloud type that is detectable by that method.

Quite a number of writing errors need to be corrected for.

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 715, 2011.