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Measurements of High Energy Cosmic Rays and Cloud presence: A method to estimate cloud coverage in infra-red images taken from space and the ground

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Several projects and already-operative observatories aimed at detecting High Energy Cosmic Rays (HECR) are/will be equipped with instruments to monitor the atmosphere. Since cloud presence can affect the night-time indirect measurements of the HECRs and Cherenkov radiation, it is crucial to know the meteorological conditions during the observation period of the HECR detectors. Several meteorological satellites already provide useful information, however to obtain accurate reconstructions of the detected events it is more suitable using devices that operate synchronously with the main detector. To this purpose, infra-red cameras that acquire images of the whole field of view are thought to support the atmosphere monitoring during observations from both space and the ground. Meaningful parameters, like cloud coverage and cloud top/bottom height, can be retrieved from the analysis of those data. Multispectral information are typically analysed and combined to obtain cloud masks for each image, where a cloudy/cloud-free probability flag is associated with each pixel. These algorithms normally use several spectral bands that are not always available in non-meteorological sensors. For this reason a different approach is presented in this paper. It only relies on the grey level values of the image pixel, and it can be applied on thermal infra-red as well as visible images acquired from both space and the ground. To test the method on real cloudy scenes, images from polar satellite and all-sky data archives are considered, and the results are compared to the corresponding cloudiness masks provided by the same data repositories.

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