CHARACTERIZATION OF BACKGROUND NOISE AND POINTING DIRECTION OF A SKY-IMAGER

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Objective

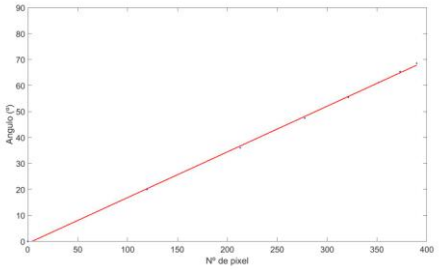
The angular distribution of the radiance of the sky plays an important role in the evaluation of the interaction of this radiation with complex targets. It holds information on the scattering of radiation by molecules, clouds and aerosols, and its measurement can be used to infer and monitor the microphysical properties of aerosols and clouds. An instrument that can make observations of the sky radiance with high angular and temporal resolution is a digital camera, duly calibrated (Roman et al, 2012). In our lab, we developed a low cost model that photographs the sky every 5-min. This project has the objective of first obtaining the pointing direction of each pixel in the image. Later, characterize, as a function of temperature, the background noise of the camera sensor.

Materials and Methods

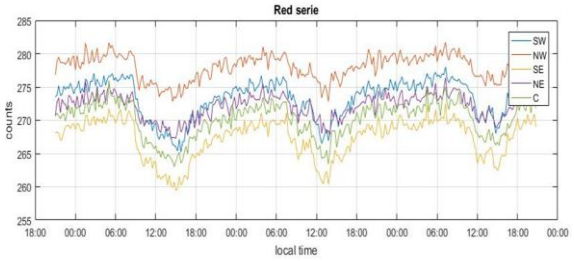
To obtain the lens equation, we used an image of the laboratory ceiling, where a reference system was aligned with the optical center. For measuring the background noise, the camera was operated under environmental conditions without allowing the light thought the aperture.

Results

We obtained the angular response function, which is shown in figure 1. The pixel size varies from 0^o at nadir to 60^o near the edge. However, it is still necessary to compare these with other methods (e.g. python opencv library). The measured variation of the sensor background noise with the time of the day is shown in figure 2. While it clearly shows signal in phase if with the diurnal cycle of temperature, the higher BG values were found for the coldest times of the day.



Picture 1: Linear fit of the experimental measurements of angular aperture.



Picture 2: Example of random background noise presented by our sensor on the red channel.

Conclusions

Good results were found in this first part of the project, but it is necessary to make new adjustments and new measures, such as installing an arduino controlled temperature sensor inside the instrument to monitor the temperature and obtain a parametric equation for background noise.

References

Roman, R., et al.: Calibration of an all-sky camera for obtaining sky radiance at three wavelengths, Atmos. Meas. Tech., 5, 2013–2024, 2012