

Name of research institute or organization:

EKO Instruments Europe B.V.

Title of project:

Langley calibration of EKO spectroradiometers at the high-altitude research station Jungfrauoch

Project leader and team:

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Project description:

To study the Earth's climate the knowledge of the radiation budget is essential. Such an assessment relies on the measurement quality of the radiometers, which either orbit around the Earth or sit on the surface. Unfortunately, the two groups of instruments are rarely compared side-by-side in order to guarantee the consistency of the radiation measurements. In space, radiometers may use the sun as a calibration source. However, ground-based radiometers can also be calibrated with the extra-terrestrial solar radiance by using the Langley-plot calibration method. The requirements for a successful Langley calibration include, a) stable measurement conditions, b) an accurate solar tracker, and c) stable instruments with a narrow field-of-view collimator tube. When all three conditions are met it can be assumed that nearly only unscattered direct solar radiation is measured. This Langley calibration was used at the Sphinx observatory for 3 different spectral radiometers, covering the spectral region between 350nm and 1700nm with an average spectral resolution of 5nm. The 6 most stable and clear days out of the measurements taken in September and October 2009 were selected for the Langley calibration. Especially on 23rd of September the Langley-plots show an excellent agreement between the field data and the linear fit: The residuals were less than 5ppm for an airmass up to 12 (see Figure 1). The primary purpose of the experiment on the Jungfrauoch is to establish a set of reference instruments which will serve to validate the indoor calibration methods currently under development at EKO Instruments. However, we will use the reference instruments permanently under outdoor measurement conditions at our experimental sites in order to keep an eye on the calibration values. Moreover one of the reference spectral radiometers will be used with a rotating shadowband for global and diffuse hemispheric spectral measurements at Leiden (The Netherlands). Together with a set of well-calibrated broad-band radiometers we will be able to perform detailed radiative closure studies.

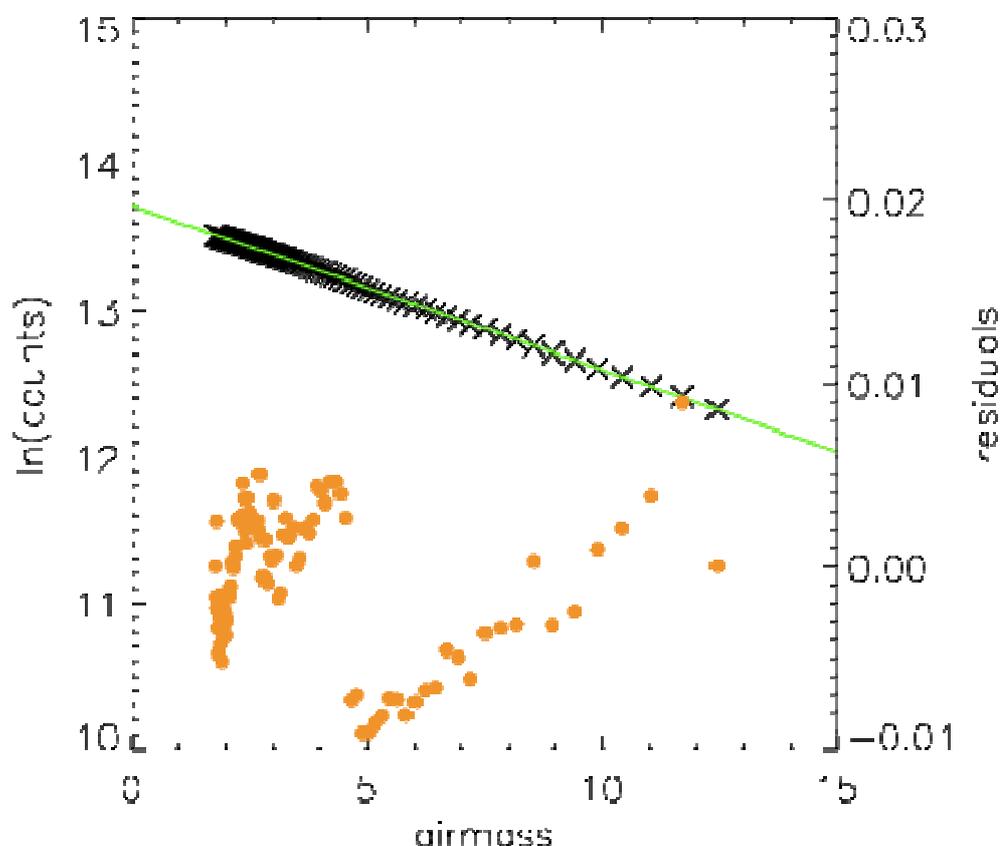


Figure 1: The Langley-plot for the 23rd of September 2009 (MS-700) at 550nm. The residuals shown as red dots (y-axis on the right-hand side) are smaller than 5ppm. It shows that the quality of this Langley-plot is excellent. From such plots, we derive the calibration value per wavelength region.

Key words:

spectral solar radiation, spectroradiometer, Langley-plot, calibration, photo-voltaic, radiation budget

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