

## ***Interactive comment on “Improving the Mean and Uncertainty of Ultraviolet Multi-Filter Rotating Shadowband Radiometer In-Situ Calibration Factors: Utilizing Gaussian Process Regression with a New Method to Estimate Dynamic Input Uncertainty” by Maosi Chen et al.***

**Anonymous Referee #2**

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General Comments: The manuscript presents a method that utilizes the Gaussian Process Regression with improved input dynamic uncertainty for calculating in-situ calibration factors for UV-MFRSRs. There are known sources of uncertainties and assumptions to the Langley technique as the author's note in the paper. Reducing the uncertainties in the calibration factors for calculating AOD from these types of instru-

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ments is crucial, as it also helps improve the ability to retrieve other aerosol optical properties.

The manuscript overall is structured and outlined well for ease of reading, the language is fluent and precise, and there is in general proper credit and relevant references. The manuscript does a good job detailing the GP technique, the new improvements incorporating dynamic input uncertainty, and comparing to two other techniques currently in use including their current operational procedure (OPER), and the moving average (MA). Since the improvements are modest across the techniques at HI02, the authors have included three sites (HI01, OK02, IL02) that show the improvements in GP over the two other methods are consistent. I believe this paper has shown the robustness of the GP method, and provides useful descriptive comparisons between techniques that will be helpful for operators of this type of instrument and how to improve the calibration in-situ. The paper addresses relevant questions within the scope of AMT as this paper is an investigation and validation of an improved method for calibrating a remote sensing instrument widely used within the atmospheric community for aerosol optical properties.

Specific Comments: In the abstract, I suggest including a sentence with the improved calibration numbers between the three methods, moving average (MA), the current operational version (OPER), and the Gaussian Process (GP) with improved dynamic input uncertainty for at least one site (HI01, IL02, or OK02).

Pg 8, line 193: Just a note to correct the wording of this sentence (though the sentence refers to irradiance at 369-nm). The Physikalisch-Meteorological Observatorium Davos, World Calibration Center has a Precision Filter Radiometer (PFR) that measures AOD at 368-nm. Using this type of instrument would avoid additional uncertainties in AOD caused by the interpolation between wavelengths when comparing the MFRSR with the AERONET CIMEL. At the sites used for the comparison in this paper, the site HI02 has a PFR but I do not know about the other two sites. This isn't essential for the analysis, nor conclusions of the paper, only suggest the sentence be modified.

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For validation of the technique, the authors compare AOD at 368-nm from the UV-MFRSR indirectly to the AERONET CIMEL using information of AOD at two wavelengths (340 and 380 nm). Different types of measurement techniques have their own source of uncertainties as with the CIMEL and the addition of the few paragraphs on previous literature that highlights these differences is crucial to the understanding the improvements using the GP technique.

Pg. 7, section 2.2 on Moving Average. This doesn't describe the moving window size used in the analysis.

Technical corrections: Pg 18, line 395. AEROENT needs to be AERONET. Pg 420, line 422-423. Incomplete sentence.

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