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# Residual correlations in the solar diffuser measurements of the MODIS Aqua ocean color bands to the sun yaw angle

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## ABSTRACT

The Moderate Resolution Imaging Spectroradiometer (MODIS) on the Earth Observing System (EOS) Aqua platform uses biweekly solar diffuser measurements for the radiometric calibration of the ocean color bands. The solar angle relative to the spacecraft changes throughout the year. This document describes correlations in the solar diffuser measurements of the ocean color bands to the sun yaw angle. The functional form of the correlations depends on the position of the respective band and detector on the focal plane. The proposed corrections often exceed 0.5% (peak-to-peak). The most likely source of the correlations is the radiometric characterization of the solar diffuser screen. These results show the importance of a complete prelaunch characterization for spaceborne sensors regarding the radiometric calibration.

**Keywords:** remote sensing, scanners, on-orbit calibration, solar diffuser, solar diffuser screen

## 1. INTRODUCTION

The Moderate Resolution Imaging Spectroradiometer (MODIS)<sup>1</sup> on the Earth Observing System (EOS) Aqua platform has 36 spectral bands on four different focal planes, see Fig. 1. Bands 8-16 with center wavelengths from 412nm to 870nm are currently used to produce ocean color data products. NASA's Ocean Biology Processing Group (OBPG) is trying to achieve a relative stability of the radiometric calibration on the order of  $\pm 0.2\%$ , which surpasses the official requirements for the MODIS reflective solar bands (RSB, bands 1-19 and 26). The absolute reflectance factor uncertainty varies by band between 1.6% and 2.1%,<sup>2</sup> and the stability is on the order of 0.5%. Thus the ocean color relative stability requirement is very restrictive, whereas an absolute calibration uncertainty of 5% to 10% is acceptable for the ocean color algorithms<sup>3</sup> because most bands are vicariously calibrated.<sup>4</sup>

The primary calibration source for the RSB is the on-board solar diffuser (SD).<sup>1</sup> It is viewed by the ocean color bands using a solar diffuser screen to prevent saturation. The impact of the SD screen as a function of the solar incidence angles was not characterized prelaunch. It was derived by the MODIS Characterization Support Team (MCST) from SD measurements during on-orbit yaw-maneuvers at the beginning of the mission.<sup>1</sup> MCST and the MODIS ocean science team then decided to use these results for the processing of the radiometric calibration coefficients. An analysis by the OBPG of a two-year time series of SD measurements (provided by MCST) has also shown a residual correlation to the solar angle on the order of 0.5%. The most likely cause for this correlation is an imperfect characterization of the impact of the SD screen. In this paper, we present the analysis that shows the solar angle correlation and its removal from the measurements.

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