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Changing the Integration Time has a Minimal Effect on the Accuracy of the Apogee / StellarNet Spectroradiometer

Nick Knighton
Utah State University

Bruce Bugbee
Utah State University, bruce.bugbee@usu.edu

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Nick Knighton and Bruce Bugbee
Crop Physiology Laboratory / Utah State University

INTRODUCTION

Changing the integration time has the potential to change the accuracy of the Apogee/StellarNet spectroradiometer. All Apogee/StellarNet spectroradiometers are calibrated to an NIST traceable calibration lamp. This lamp (LI-COR Inc., model 1800-02; Lincoln, NE) has an output of 206.2 µmol m^{-2} s^{-1}, which requires a relatively long integration time (about 500 ms) to obtain a full scale response. Sunlight and high-wattage electric light sources often have a much higher intensity, which require much shorter integration times (10 to100 ms) to prevent light saturation of the detectors. The accuracy might be affected differently by increasing or decreasing integration times from the initial calibration time.

MATERIAL AND METHODS

A VIS/NIR spectroradiometer was calibrated with the Apogee cosine-corrected head at an integration time of 500 ms in the LI-COR 1800-02 optical radiation calibrator. The head was kept in the calibrator and the integration time was then incrementally decreased to 50 ms. A new dark reference scan was made between each integration time change.

RESULTS

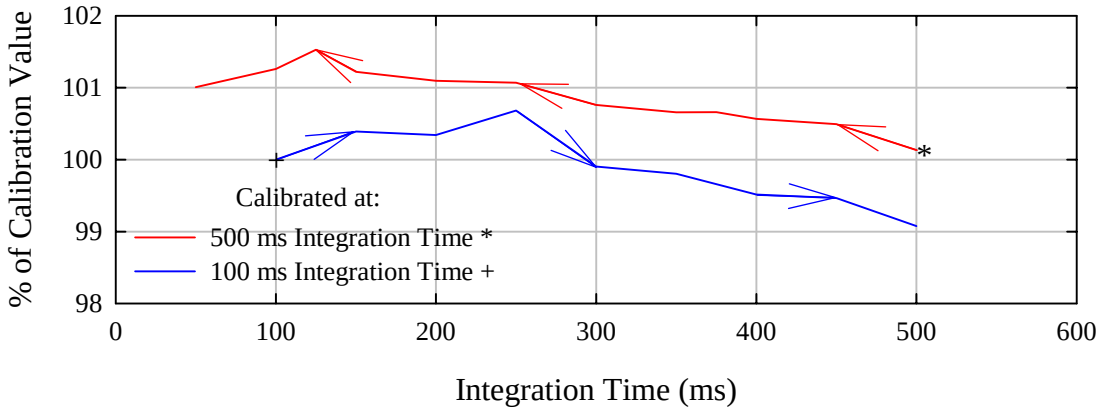

FIGURE 1 Effect of changing integration time on measurement accuracy. The red line shows the effect of **decreasing** integration time. The blue line shows the effect of **increasing** integration time. Changes are less than 1.5% in both cases.

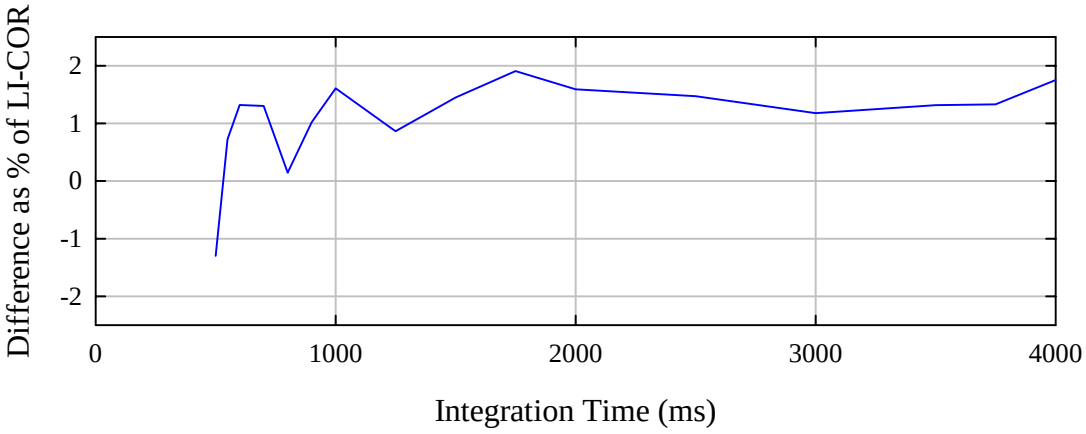

FIGURE 2 The effect of changing integration time from 500 ms to 4000 ms. Measurements were made under an incandescent lamp. The calibration time was 100 ms. The radiation varied from 30 to 300 umol per m2 per s. Changes were less than 2% in all cases.

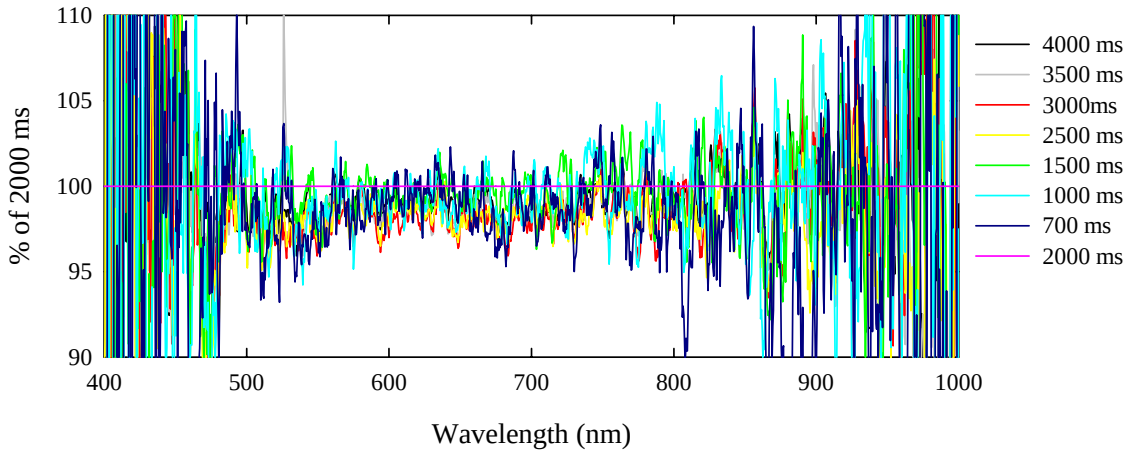

FIGURE 3 Irradiance spectra of incandescent light as a percentage of the spectra at 2000 ms. Changing the integration time did not cause any detectable spectral shift.

DISCUSSION

Decreasing integration time from 500 to 50 ms had a minimal effect on accuracy. Increasing the integration time from 100 ms to 500 ms also had minimal effect on accuracy. Increasing the integration time to a value more than 500 ms saturated the detectors in the spectroradiometer. In lower light levels, increasing the integration time from 500 ms to 4000 ms also had minimal effect on accuracy. Future studies will also examine the effect of decreasing the integration time to 4 ms, which can be necessary outside in full sunlight.