College of Optical Sciences The University of Arizona®

GOES-R Field Campaign Support

Final Report

PI: Jeffrey Czapla-Myers
College of Optical Sciences, University of Arizona
1630 E University Blvd
Tucson, Arizona, 85721–0094

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1. Project Summary

This serves as the final report for field work performed by the Remote Sensing Group (RSG) of the College of Optical Sciences at the University of Arizona in support of the GOES-R (GOES-16) field campaign in March 2017. The main goal of this work is to provide an independent validation of the AVIRIS-NG airborne instrument calibration during the Sonoran Desert collection campaign. AVIRIS-NG is a primary validation asset for ABI and GLM validation activities, and this work seeks to provide an independent assessment of the AVIRIS-NG calibration by comparing the at-sensor spectral radiance determined using ground-based measurements to those reported by AVIRIS-NG.

2. Field collection

The field campaign results are obtained using the reflectance-based approach, where measurements of the atmosphere and surface reflectance collected during each overpass are used in a radiative transfer code to determine the at-sensor spectral radiance. Ivanpah Playa, California was the test site used for this work. The region of interest (ROI) was on the west side of Interstate 15. Normally, RSG uses the east side of Ivanpah, but it was unavailable due to a large land-sailing regatta that was taking place during the same day. The ROI was an 80×300-m area, shown as the yellow square in Fig. 1.

Fig. 1. The 80×300-m region of interest at Ivanpah Playa is shown in yellow. The dark line running SW-NE is Interstate 15. This image was collected by AVIRIS-NG on 23 Mar 2017 starting at ~22:16 UTC. Clouds and shadows are also visible in this image.

The atmospheric measurements were made using a combination of an automated solar radiometer (ASR), which tracks the sun throughout the day. Surface reflectance measurements were made using an ASD portable spectroradiometer and Spectralon reference panel. The surface reflectance is determined using a ratio method with the panel, which is calibrated is RSG's goniometric facility prior to the field campaign.

On 23 Mar 2017, there were nine ER-2 overpasses that occurred between approximately 20:58 and 22:16 UTC. In two of the nine overpasses there were clouds directly shadowing the ROI, so these images were not included in the final analysis. There was significant cloud cover near the

site, and clouds were often near the sun during the collection period. The all-sky images from the ROI for each of the overpasses are shown in Fig. 2.

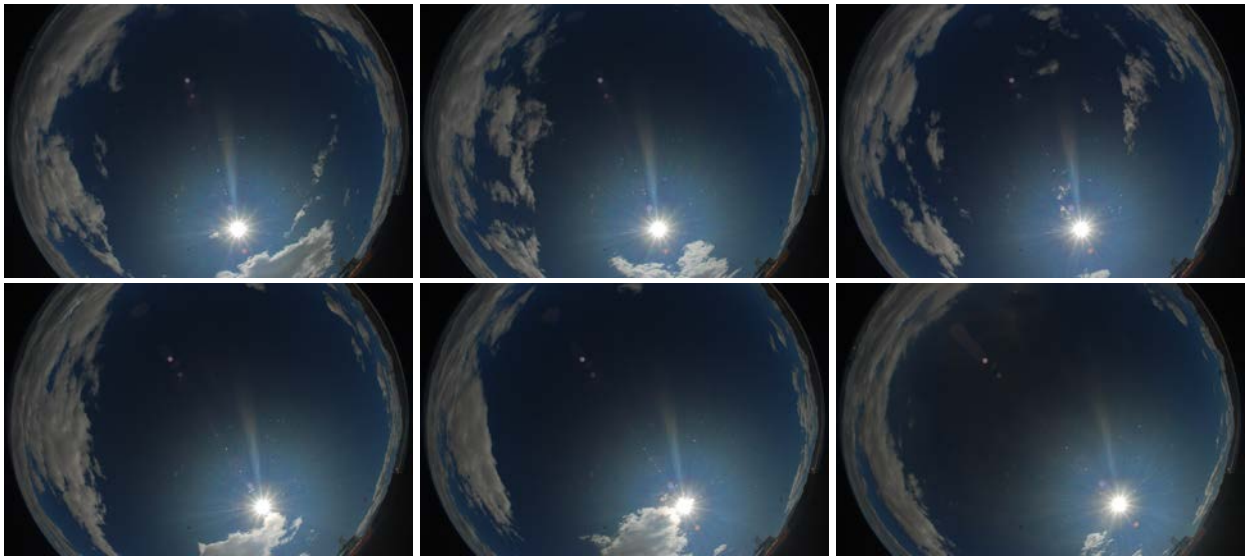

Fig. 2. The all-sky images near the six clear overpasses. The times are approximately (top row, l to r): 21:00, 21:08, and 21:18 UTC, (bottom row, l to r): 21:39, 21:48, and 22:19 UTC. Dust near the line-of-sight to the sun is not visible in these images. It should be noted that these images are taken every ~2 minutes, so they are not exactly at the time of overpass.

The surface reflectance of the 80×300-m ROI was measured twice in the timeframe of the nine overpasses. There were high winds from the west during both collections, which created sustained airborne dust over the site. During both collects, the ASD operator had to stop while clouds passed in front of the sun. The results of the first surface reflectance collection are shown in Fig. 3. The values of the second surface reflectance collect are within 1% of the first.

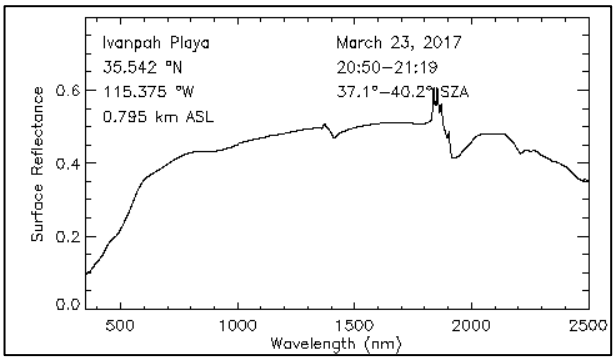

Fig. 3. Surface reflectance of Ivanpah Playa. The features at 1370 and 1800 nm are created by low SNR due to atmospheric absorption features.

The at-sensor spectral radiance is determined by using the atmospheric and surface reflectance measurements as input into MODTRAN 5. The exoatmospheric irradiance model used for AVIRIS-NG is a combination of two solar models, which was provided by JPL. The at-sensor spectral radiance for each of the six overpasses not affected by clouds over the site are shown in Fig. 4. The average of the six individual collects is shown in Fig. 5.

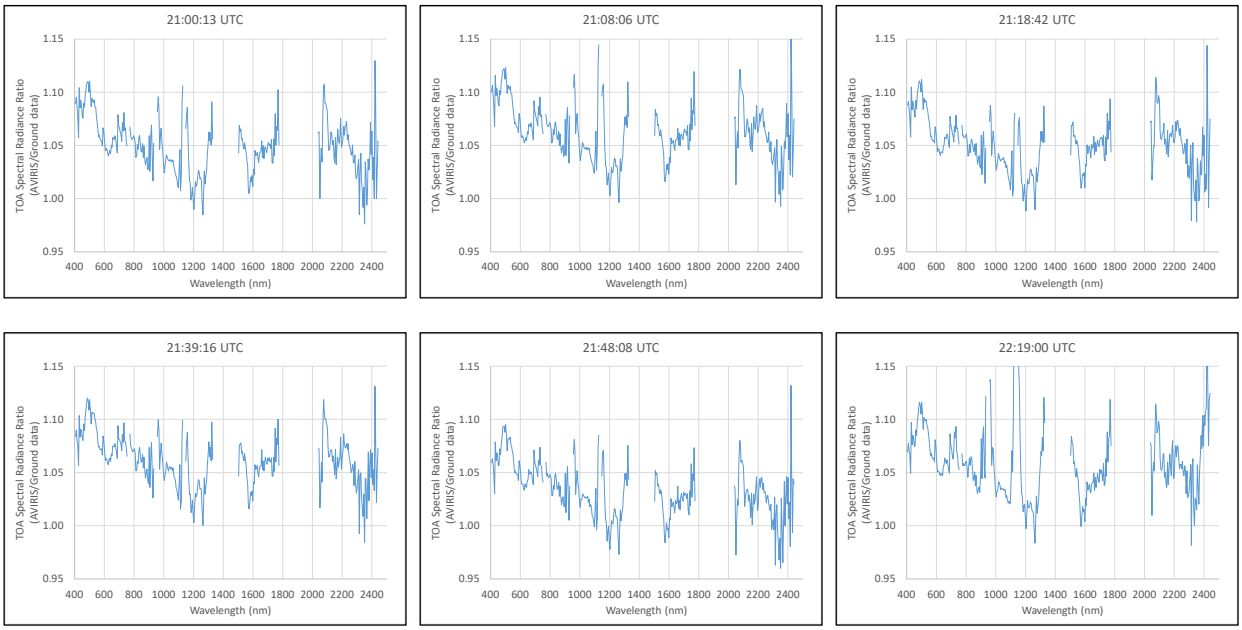

Fig. 4. The results of the six clearest overpasses of AVIRIS-NG at Ivanpah Playa on 23 Mar 2017. The results are the at-sensor spectral radiance for the bands not affected by atmospheric absorption, shown as the ratio of AVIRIS-NG to the ground-based measurements.

3. Results and conclusion

The results of the field collection vary from overpass to overpass, although the shape of the at-sensor radiance ratio between the AVIRIS-NG and ground measurements generally remains the same. The conditions at Ivanpah were far from ideal, with blowing dust, cumulus, and cirrus clouds present throughout the entire collection. It is therefore suggested that the results obtained by RSG during the Ivanpah field campaign on 23 Mar 2017 be ignored for the purpose of validating the calibration of AVIRIS-NG. The excessive amount of cirrus and cumulus clouds create highly varying and temporally changing diffuse sky conditions, which lead to the large variability of the results.

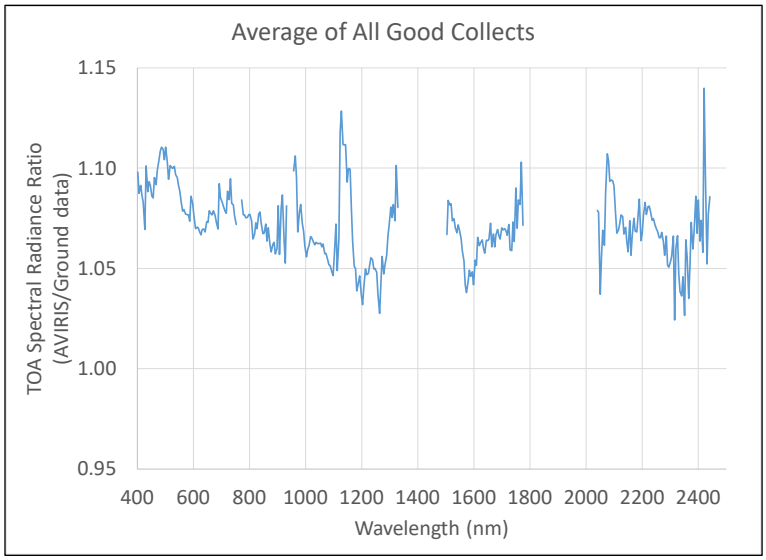

Fig. 5. An average of the six results shown in Fig. 4.