



College of Optical Sciences THE UNIVERSITY OF ARIZONA

THE PREFLIGHT AND POST-LAUNCH RADIOMETRIC CALIBRATION OF MSI

Jeffrey Czapla-Myers, Stuart Biggar, and Nikolaus Anderson

Remote Sensing Group
College of Optical Sciences
University of Arizona
Tucson, Arizona, USA

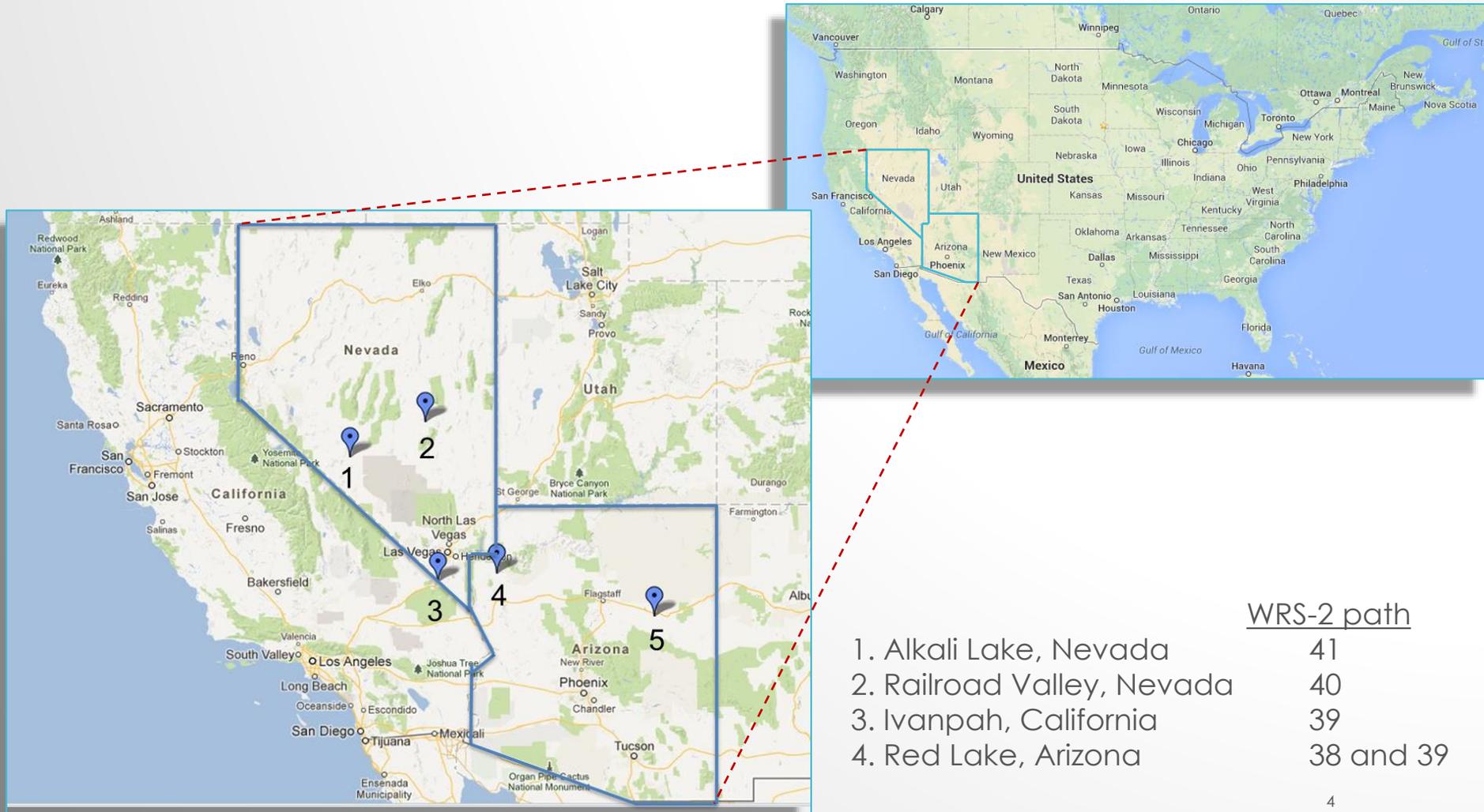
PREFLIGHT CALIBRATION OF MSI

- Stuart Biggar and Nik Anderson travelled to France in 2012 with RSG laboratory equipment
 - Round-robin measurements of two calibration spheres used for MSI preflight calibration
 - Location: Astrium in Toulouse
 - Other parties involved: Astrium, NIST, and GSFC
- MSI onboard diffuser measurements
 - Two 5-cm diameter test diffusers
 - Measured at GSFC (VNIR)
 - Measured at U. Arizona (SWIR with some VNIR)
 - CSL, Belgium (all MSI bands)
 - PTB, Germany (350–1700 nm)

VICARIOUS RADIOMETRIC CALIBRATION

- **Remote Sensing Group at University of Arizona traditionally uses reflectance-based approach with on-site personnel**
- **Measurements of surface and atmosphere during sensor overpass**
- **Radiative transfer code to determine at-sensor quantities (e.g. spectral radiance or spectral reflectance)**
- **Dry lake beds typically used as test sites**
 - Railroad Valley, Nevada
 - Ivanpah Playa, California
 - Alkali Lake, Nevada
 - Red Lake, Arizona
- **Motivation: to provide independent measurements for calibration and validation of airborne and satellite sensors**
- **In the past few years, emphasis has moved to establishing automated test site for data collection**

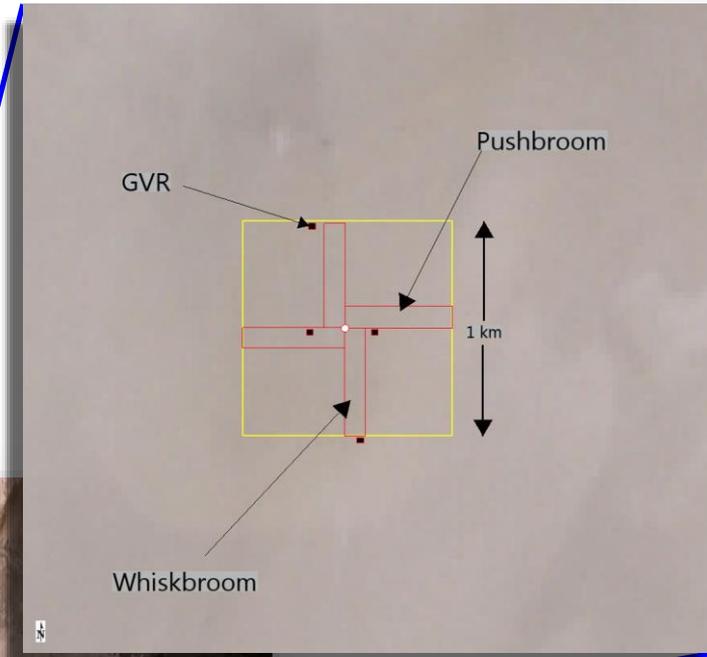
UNIV. OF ARIZONA CALIBRATION SITES



POST-LAUNCH RADIOMETRIC CALIBRATION OF MSI

- **Continuation of MSI preflight calibration**
 - Ground-based measurements
 - Monitor any changes that may have occurred during/after launch
- **Primary data collection will use the Radiometric Calibration Test Site (RadCaTS) in central Nevada**
 - Developed by the Remote Sensing Group, University of Arizona
 - Collects atmospheric and surface reflectance data without ground-based personnel
 - Currently in use with sensors such as ETM+, OLI, MODIS, MISR, ASTER, VIIRS, Hyperion, RapidEye, and WorldView 3
 - Part of CEOS WGCV RadCalNet Working Group
- **Ground instrumentation**
 - 4 multispectral *ground-viewing radiometers* (GVRs)
 - Cimel sun photometer (part of AERONET)
 - Meteorological station for ancillary conditions (e.g. temperature and pressure)
 - GVR data downloaded during routine field trips
- **Processing software**
 - Matlab based
 - MODTRAN radiative transfer code
 - Currently processed on case-by-case basis

RADCATS LAYOUT

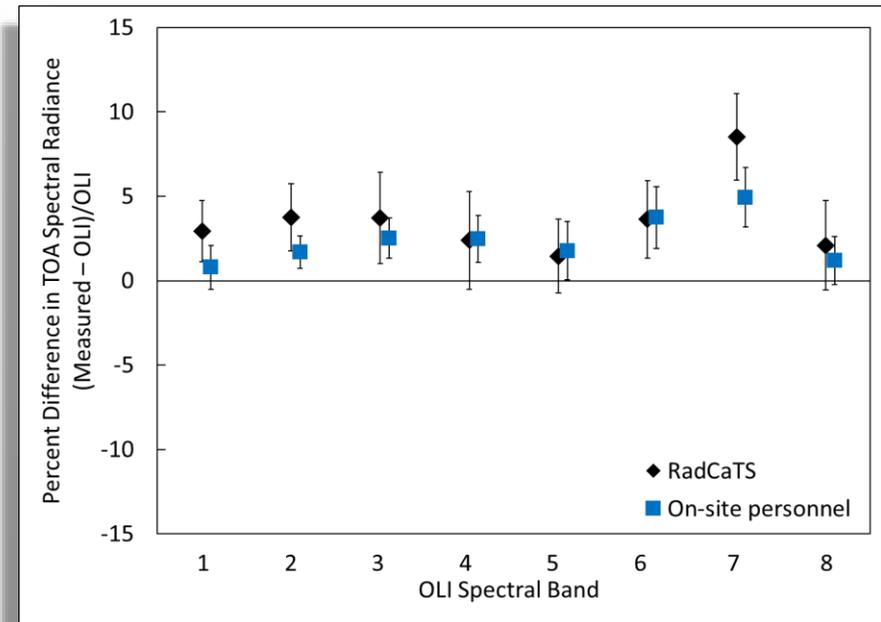


RADCATS INSTRUMENTATION



SAMPLE OF RADCATS RESULTS: LANDSAT 8

- **~27 overpasses at RadCaTS from launch – May 2014**
- **9 successful data collects**
 - Two were considered outliers due to salt on surface in Mar 2013
 - Two dates with snow on site
- **On-site personnel site size:**
 - 90×500 m (Railroad Valley)
 - 120×300 m (Ivanpah, Red Lake, Alkali)
- **RadCaTS size**
 - 1-km²

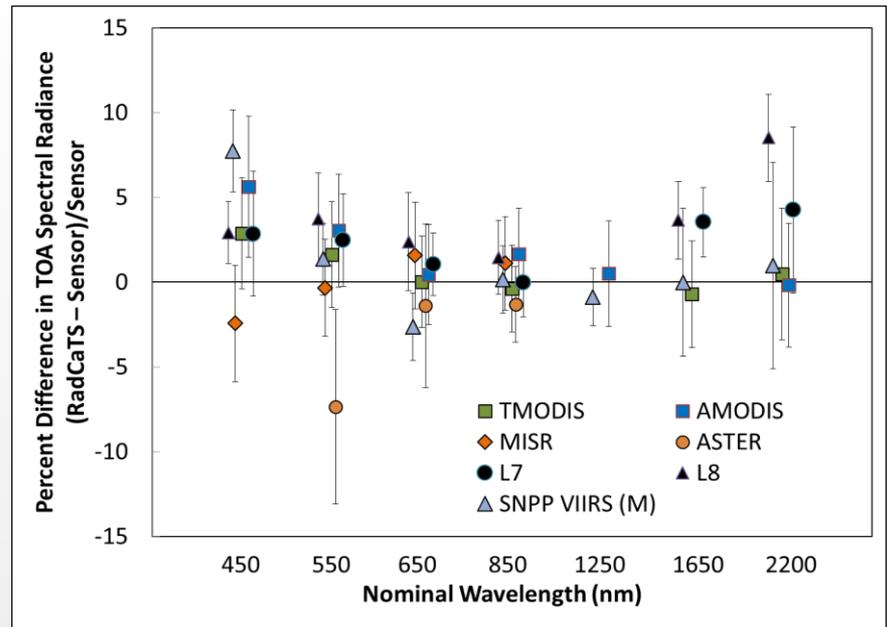


RADCATS AND OTHER EARTH-OBSERVATION SENSORS (2012–2013)

- Sensors compared to 1-km² area at RadCaTS
- Uncertainty bars are 1 σ standard deviation of measurements

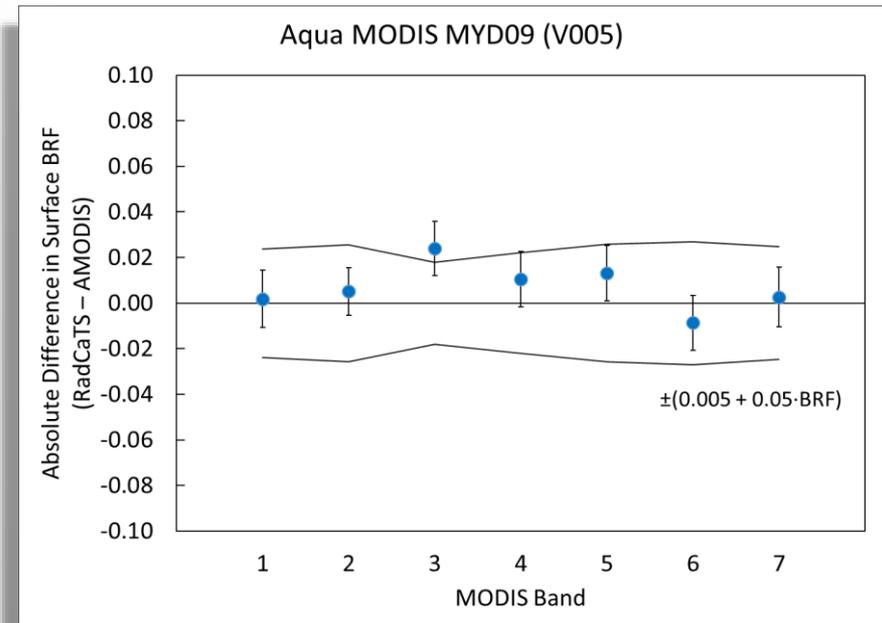
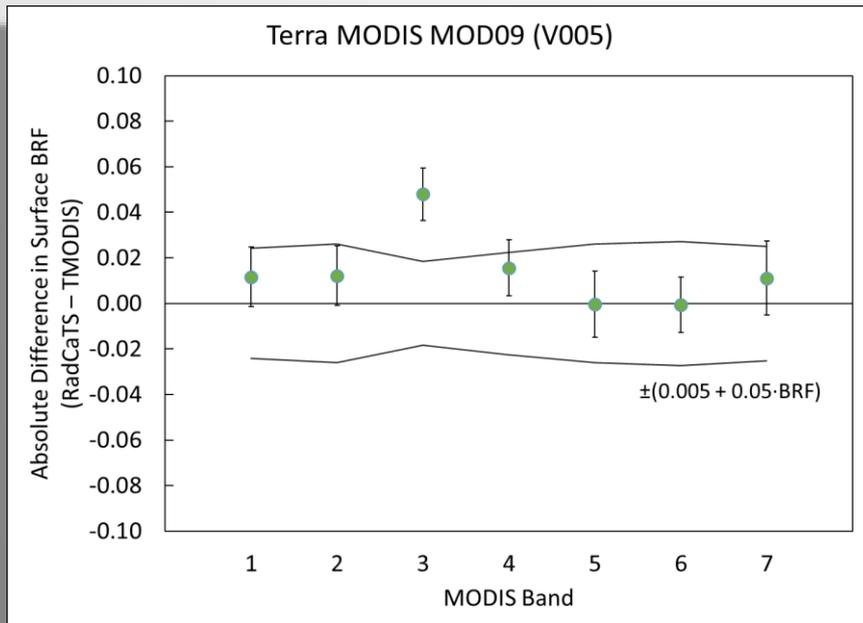
Near-Nadir Overpasses

- Terra (3 view angles) : 36
- Aqua (2 view angles) : 22
- Landsat 7 (nadir) : 10
- Landsat 8 (nadir) (2013): 7
- SNPP VIIRS (nadir): 13



SURFACE REFLECTANCE VALIDATION WITH MODIS

- 42 Terra and 25 Aqua collects at RadCaTS from Mar 2012 – Oct 2014
- MODIS Collection 5 data, MODIS land bands (1–7)
- RadCaTS area: 1-km²



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- www.optics.arizona.edu/rsg

EXTRA SLIDES

Railroad
Valley



Ivanpah



Alkali
Lake



Red Lake

