Questionnaire for information regarding the CEOS WGCV IVOS subgroup Cal/Val test sites for land imager radiometric gain

QA4EO-WGCV-IVO-CSP-001

Name of site: Lspec Frenchman

This page is intentionally blank

Questionnaire for information regarding the CEOS WGCV IVOS subgroup Cal/Val test sites for land imager radiometric gain

Author: Gyanesh Chander

E-mail: gchander@usgs.gov

Issued under Authority of: CEOS

Issue no: Version 1.1

Date of issue: 18 February 2009

Summary of Changes since last issue:

Issue 1.0: Initial version

Issue 1.1: Template section (17 February, 2009)

Table of Contents

1. Abstract 6
2. Scope 6
3. Process 7
Appendix 1: Template for CEOS reference standard test site 9
1. Site location 10
1.1. Identification and characterisation 10
1.1.1. Site Name 10
1.1.2. Location 10
1.1.3. Google Earth Image (1x1 degree around the site center) 10
1.1.4. Altitude 10
1.1.5. Description of the landscape 11
1.1.6. Environment 11
1.1.7. Topography 11
1.2. Site view 11
2. Logistic information 12
2.1. Site proximity from road 12
2.2. Access 12
2.3. Nearest town 12
2.4. Distance from nearest town/port 12
2.5. Logistics (Hotel, Restaurant, etc.) 12
2.6. Access to Communications 13
2.7. Owner 13
3. Site Climatology 13
3.1. General atmospheric conditions: Meteorological conditions 13
3.1.1. Annual pluviometry 13
3.1.2. Wind 13
3.1.3. Clear sky conditions 13
3.2. Atmosphere characterisation 13
3.2.1. Aerosol characteristics 13

3.2.2. Water vapour content characteristics 15
3.3. Surface characterisation 16
3.3.1. Surface albedo characteristics 16
3.3.2. Surface reflectance characteristics 16
3.3.3. BRDF (or specific angles) 17
3.3.4. Surface reflectance – variability across site (uniformity) (%) 17
4. Site instrumentation (Nominal) 17
4.1. Meteorological instrumentation (list) 17
4.1.1. Meteo station (Temperature, pressure, humidity) 17
4.1.2. Pluviometer 18
4.1.3. Anemometer 18
4.2. Atmospheric instrumentation 18
4.2.1. Instrument used for aerosol characterisation 18
4.2.2. Instrument used for surface irradiance characterisation 18
4.2.3. Instrument used for water vapour content characterisation 19
4.3. Surface instrumentation 19
4.3.1. Instrument used for reflectance/radiance characterisation 19
4.3.2. Instrument used for BRDF characterisation 19
5. Current status of the site 20
5.1. Instrumented 20
5.2. Maintained (source and commitment of funding) 20
5.3. Regularly visited (state frequency) 20
6. Site usage 21
6.1. Historical record of comparisons (ground, aircraft and satellite) 21
6.2. Date / sensor / location of results 21
6.3. Regularity of satellite data (if known) 21
6.4. Satellite and sensor ID 21
7. Contact information 21
7.1. Point of Contact (Name and address) 21
7.2. Instrumentation maintenance 21

8. Dataset availability and owner 22
8.1. Dataset 22
8.2. Owner 22
8.3. Availability 22
9. References 22
9.1. Bibliography 22
9.1.1. Characterization of the site 22
9.1.2. Description of the methodology 22
9.1.3. Description of the instrumentation 22
9.1.4. Description of applications for vicarious calibration 22
9.2. Site Web 22

1. Abstract

This document provides the template to collect and present information to describe the characteristics of a Land based test site suitable for calibrating and validating the radiometric gain of an inflight satellite/aircraft imaging optical sensor. The template is structured as a series of questions to describe the sites, accessibility as well as its physical characteristics and their derivation. Test sites with varying characteristics have been used for many years for a variety of applications, however this template has been specifically designed for sites which are regularly instrumented and are or seek to be endorsed by the Committee on Earth Observation Satellites (CEOS) Working Group on Calibration and Validation (WGCV) as "reference standards". At present there are eight such sites but more are required to ensure a robust system to reliably underpin the needs of the Earth Observation (EO) community in the longer term. The template contained in this document should be completed by anyone seeking to have a site endorsed by CEOS to join this group. The current eight **CEOS instrumented reference standard test sites** are:

- **Railroad Valley Playa**, NV, USA, North America
- **Ivanpah**, NV/CA, USA, North America
- **Lspec Frenchman Flat**, NV, USA, North America
- **La Crau**, France, Europe
- **Dunhuang**, Gobi Desert, Gansu Province, China, Asia
- **Negev**, Southern Israel, Asia
- **Tuz Golu**, Central Anatolia, Turkey, Asia
- **Dome C**, Antarctica

2. Scope

The scope of the template is to fully describe the characteristics of a test site so that those referring to its use or those seeking to use it can assess its suitability for their application. Once the template is complete it should be sent to the Infrared and Visible Optical Sensors (IVOS) subgroup chair who will arrange its review against CEOS defined criteria, before it is allocated a formal reference number and published on the Cal/Val portal as an endorsed site. At the time of issue of this template the most critical of these criteria is that it is regularly instrumented. However, these criteria are in the process of review and refinement and are likely to include other characteristics in the future. The template is structured (see table 1) to collate information

under a number of headings and whilst it is desirable to have all questions completed it is recognised that there may be some gaps in knowledge at the time of first submission.

It is also anticipated that as time progresses, data (particularly surface characterisation information) will increase and evolve, and may come from sources other than the nominal Point of Contact (POC). Provision is being made for this new information to be stored and linked to the template to improve the knowledge base. However, the POC should be made aware of such information as part of the submission process.

Table 1: Information content of questionnaires

Questionnaire Content Description
Site location
Logistic information
Site climatology
Site instrumentation
Measurement accuracy
Site usage
Contact information
Data availability
References

3. Process

The attached template (appendix 1) should be completed by an individual willing to serve as POC for a CEOS test site. In this role they are agreeing to ensure that the site is maintained to a level consistent with the data contained in the template or to change the data as appropriate. This confirmation will take place on an annual basis through an email exchange with CEOS WGCV IVOS chair and Quality Assurance Framework for Earth Observation (QA4EO) secretariat. Readers are directed to the view existing completed examples of the template for further guidance.

When the template is completed it should be returned to the CEOS IVOS chair (or other designated individual) to submit for review and to arrange for publication on the Cal/Val portal.

If approved, the template will then be assigned a reference number and placed on the Cal/Val portal (http://calvalportal.ceos.org/CalValPortal/welcome.do) and the information also

incorporated into the test site catalogue currently under development for CEOS WGCV by USGS (http://calval.cr.usgs.gov/sites_catalog_map.php).

Similar templates exist for non-land sites and also for non-instrumented land sites.

Appendix 1: Template for CEOS reference standard test site

CEOS Reference standard test site for Land radiometric gain

CEOS Reference: QA4EO-WGCV-IVO-CSP-xxx[1]

Name of site: Lspec Frenchman

Point of contact:

Address:

Range of applications[1]:

[1] **to be completed by QA4EO secretariat**

1. Site location

1.1. Identification and characterisation

1.1.1. Site Name

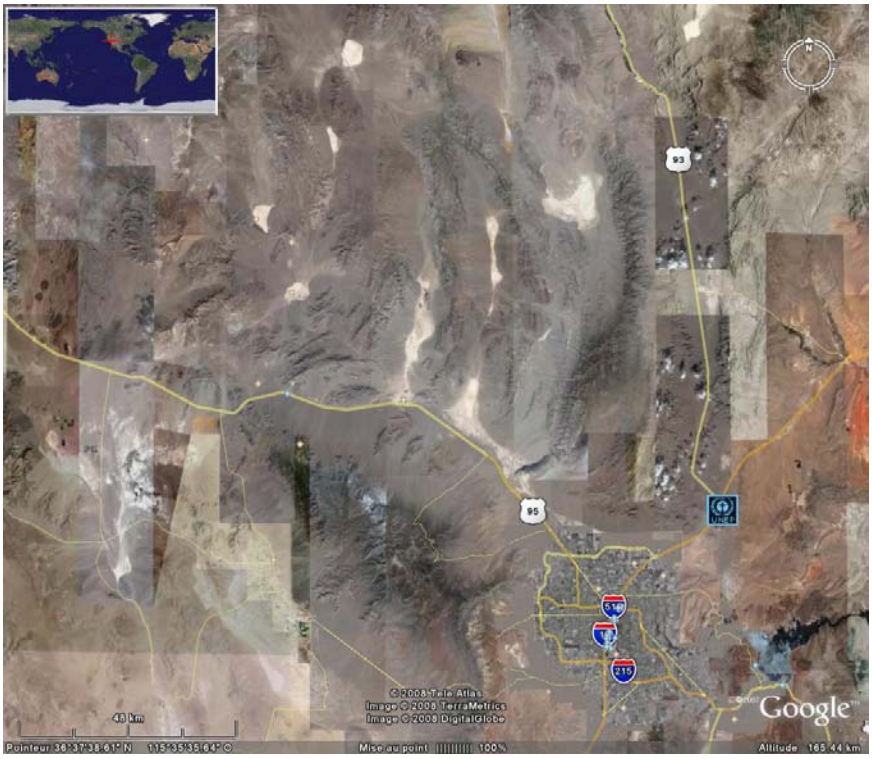
Lspec at Frenchman Flat

1.1.2. Location

Latitude: 36.80928 N

Longitude: -115.93479 W

1.1.3. Google Earth Image (1x1 degree around the site center)



1.1.4. Altitude

940 m

1.1.5. Description of the landscape

The Frenchman Flat vicarious calibration site is situated on a homogeneous section of the Frenchman Flat dry lake-bed found North-North-East of Mercury, Nevada on the Nevada Test Site (NTS) range. This is the site of the LED Spectrometer (LSpec) autonomous calibration facility (http://lspec.jpl.nasa.gov).

Hard clay desert playa surrounded by light creosote and sage scrub

Natural playa extent is roughly 3 x 4 Km but majority of surface is scarred by weapons testing debris such as roads, buildings, bunkers and bridges

1.1.6. Environment

1.1.7. Topography

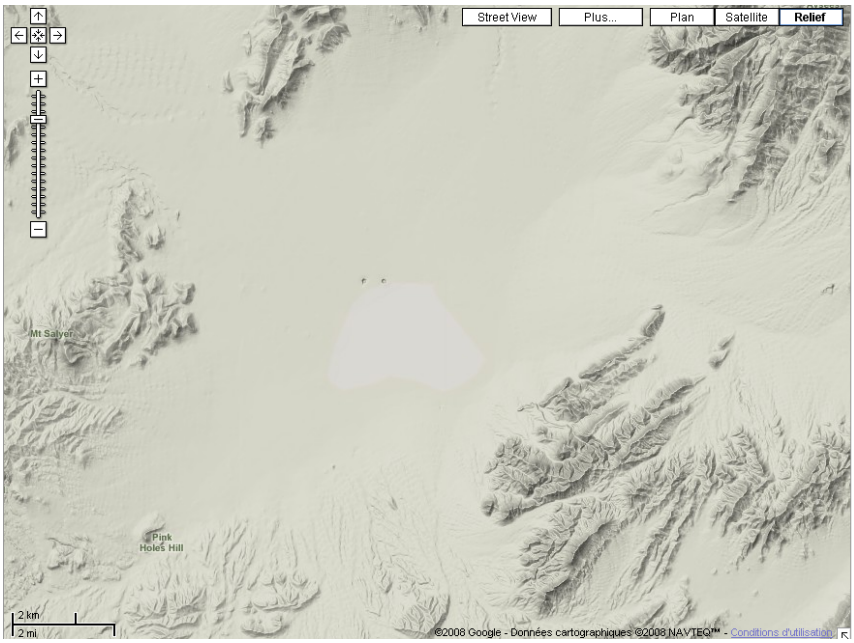


Figure 1: Site topography

1.2.Site view

Site photos are available at http://lspec.jpl.nasa.gov

Figure 2: Site overview

2. Logistic information

2.1. Site proximity from road

I-95

2.2. Access

Road

2.3. Nearest town

Las Vegas

2.4. Distance from nearest town/port

100km Northwest of Las Vegas, Nevada, USA

2.5. Logistics (Hotel, Restaurant, etc.)

2.6. Access to Communications

2.7. Owner

3. Site Climatology

3.1. General atmospheric conditions: Meteorological conditions

3.1.1. Annual pluviometry

DESERT ROCK WSMO, NEVADA (262251)

Period of Record Monthly Climate Summary

Period of Record : 4/ 1/1984 to 6/30/2007

Average Total Precipitation (in.)	0.45	1.31	0.50	0.51	0.10	0.22	0.36	0.26	0.52	0.49	0.27	0.34	5.34
Average Total SnowFall (in.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0

3.1.2. Wind

3.1.3. Clear sky conditions

Average number of days with clear skies >300

3.2. Atmosphere characterisation

3.2.1. Aerosol characteristics

3.2.1.1. Seasonal variation of the aerosol

3.2.1.2. AOT_550: Historical data

3.2.1.3.Data from AERONET CIMEL network

Historical record of site from mid-November, 2006

Operational Time at 'Frenchman_Flat' Site

484 Days [1.326 Years] : Start Date: 11-DEC-2006; Latest Date: 13-MAY-2008

Total Processed Data [Years represent total data equivalent]

- Level 1.0 AOD: 453 Days [1.241 Years]
- Level 1.5 AOD: 434 Days [1.189 Years]
- Level 2.0 AOD: 0 Days [0.000 Years]

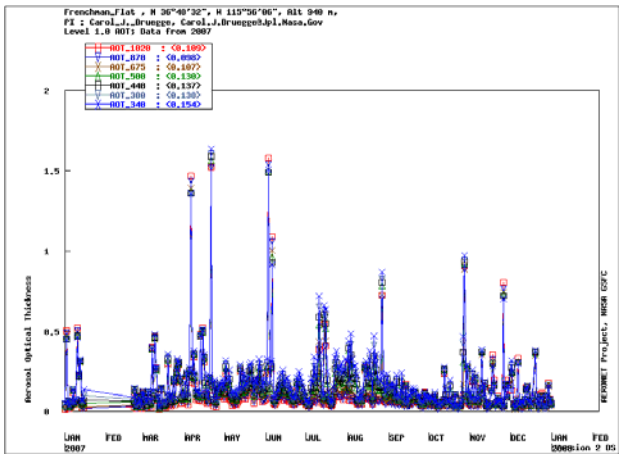


Figure 3: Monthly variability of AOT (2007)

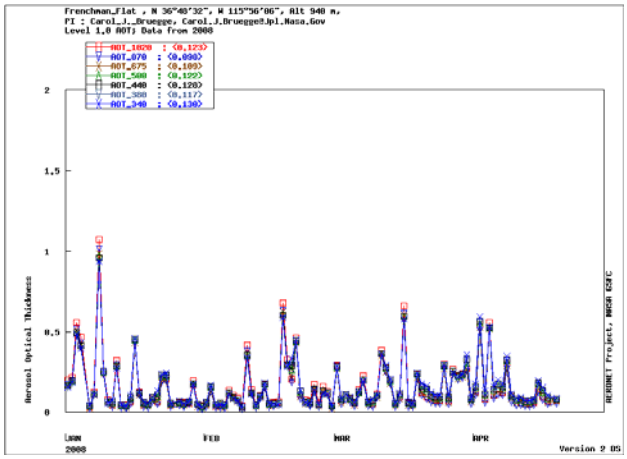


Figure 4: Monthly variability of AOT (2008)

3.2.1.4. Nominal values of AOT at 450, 550, 650, 850 nm

3.2.1.5. Absolute error of AOT at 450, 550, 650, 850 nm

3.2.1.6. Model of aerosol used

3.2.1.6.1. Granulometry

3.2.1.6.2. Refraction index used

3.2.1.7. Alpha

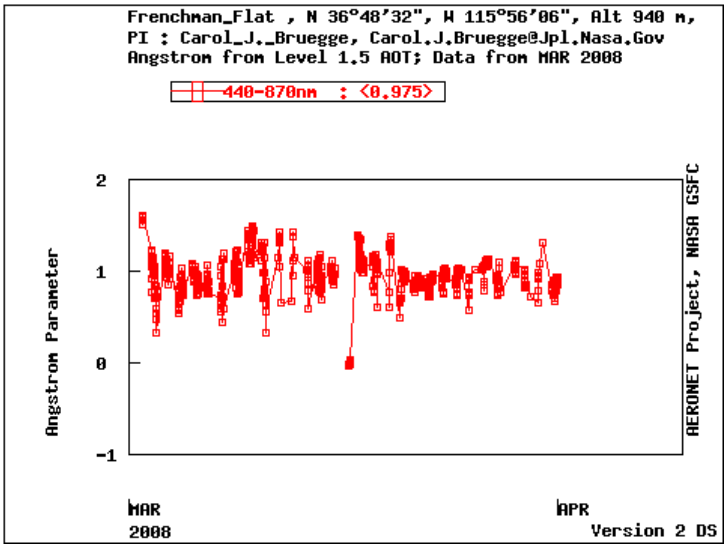


Figure 5: Monthly variability of Angstrom coefficient (2008)

3.2.2. Water vapour content characteristics

3.2.2.1. Water vapour content origin

3.2.2.2. Seasonal variation of the water vapour content

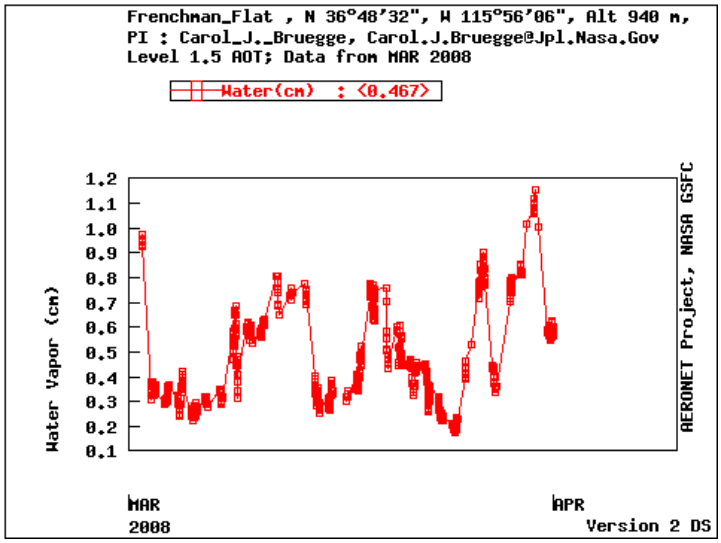


Figure 6: Monthly variability of water vapour content (2008)

3.2.2.3. Mean and accuracy

3.3. Surface characterisation

3.3.1. Surface albedo characteristics

3.3.2. Surface reflectance characteristics

3.3.2.1. Instrumentation used for characterisation

Hyperspectral surface reflectance is measured about twice a year via ASD FR Field spectrometer. For further information, see: http://lspec.jpl.nasa.gov

3.3.2.2. Route of traceability

Met: manufacturer's initial calibration (RM Young & Campbell)

3.3.2.3. Mean reflectance at Nadir (full spectrum)

3.3.2.4. Uncertainty of reflectance (please give breakdown of uncertainty contributions)

3.3.2.5. Mean reflectance at Nadir at 450, 550, 650, 850 nm

3.3.2.6. $\Delta\rho$ at 450 nm, 550, 650, 850 nm

3.3.3. BRDF (or specific angles)

3.3.3.1. Instrument used

3.3.3.2. Relative error on BRDF correction at θs=45 degrees, θv=30 degrees

3.3.4. Surface reflectance – variability across site (uniformity) (%)

- Fairly clear area: 1000 m square clocked corners N-S & E-W
- Homogenious area: 300 m square clocked sides N-S & E-W
- Monitored area: 50m square clocked sides N-S & E-W

4. Site instrumentation (Nominal)

4.1. Meteorological instrumentation (list)

4.1.1. Meteo station (Temperature, pressure, humidity)

4.1.2. Pluviometer

4.1.3. Anemometer

4.2. Atmospheric instrumentation

4.2.1. Instrument used for aerosol characterisation

4.2.1.1. Instrument used

4.2.1.2. Route of traceability

4.2.1.3. Measurement protocol

4.2.1.3.1. Scanning mode

4.2.1.3.2. Spectral characteristics

4.2.1.3.3. Frequency of measurements

4.2.2. Instrument used for surface irradiance characterisation

4.2.2.1. Instrument used

4.2.2.2. Route of traceability

4.2.2.3. Measurement protocol

4.2.3. Instrument used for water vapour content characterisation

4.2.3.1. Instrument used

4.2.3.2. Route of traceability

4.2.3.3. Measurement protocol

4.3. Surface instrumentation

4.3.1. Instrument used for reflectance/radiance characterisation

4.3.1.1. Instrument used

4.3.1.2. Route of traceability

4.3.1.3. Measurement protocol

4.3.1.3.1. Scanning mode

4.3.1.3.2. Spectral characteristics

4.3.1.3.3. Frequency of measurements

4.3.2. Instrument used for BRDF characterisation

4.3.2.1. Instrument used

4.3.2.2. Route of traceability

4.3.2.3. Measurement protocol

4.3.2.3.1. Scanning mode

4.3.2.3.2. Spectral characteristics

4.3.2.3.3. Frequency of measurements

5. Current status of the site

5.1. Instrumented

Instrumented, Automated

5.2. Maintained (source and commitment of funding)

- Visited and maintained quarterly
- Source of funding for maintenance: US Government
- Restricted access

5.3. Regularly visited (state frequency)

- Human ☐
- Satellite ☐
- Aircraft ☐
- Automated ☐

6. Site usage

6.1. Historical record of comparisons (ground, aircraft and satellite)

6.2. Date / sensor / location of results

6.3. Regularity of satellite data (if known)

6.4. Satellite and sensor ID

7. Contact information

7.1. Point of Contact (Name and address)

Carol J. Bruegge, Ph.D.

Earth Remote Sensing Science

NASA/ Jet Propulsion Laboratory Mail Stop 183-601

4800 Oak Grove Dr.

Pasadena, CA 91109-8099

Tel: + 818-354-4956

Fax: + 818-354-5148

E-mail: Carol.J.Bruegge@Jpl.Nasa.Gov

7.2. Instrumentation maintenance

8. Dataset availability and owner

8.1. Dataset

8.2. Owner

8.3. Availability

9. References

9.1. Bibliography

9.1.1. Characterization of the site

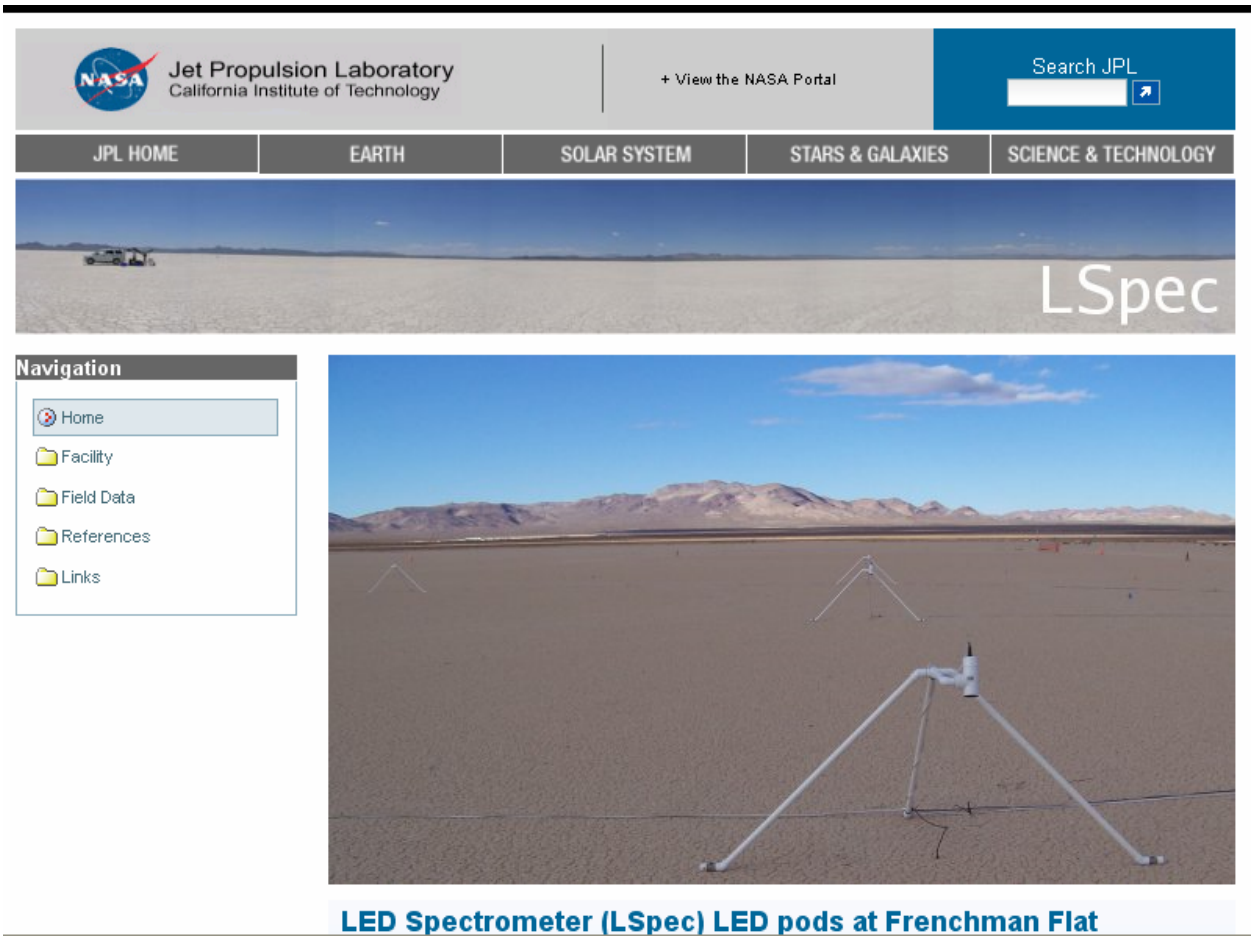
9.1.2. Description of the methodology

9.1.3. Description of the instrumentation

9.1.4. Description of applications for vicarious calibration

9.2. Site Web

https://lspec.jpl.nasa.gov/



9.3. General acknowledgement

For AERONET data : We thank Carrol Bruegge and her staff for establishing and maintaining the site used in this investigation.