GROUP ON EARTH OBSERVATIONS

CEOS

QA4EO A QUALITY ASSURANCE FRAMEWORK FOR EARTH OBSERVATION

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

QA4EO-WGCV-IVO-CSP-008

Name of site: Tuz Gölü

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

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Issue 1.1: Template section (17 February, 2009)

Issue 2.0: POC Input (20 April, 2009)

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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: Tuz Gölü

Point of contact:

Selime Gürol

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

1. Site location

1.1. Identification and characterisation

1.1.1. Site Name

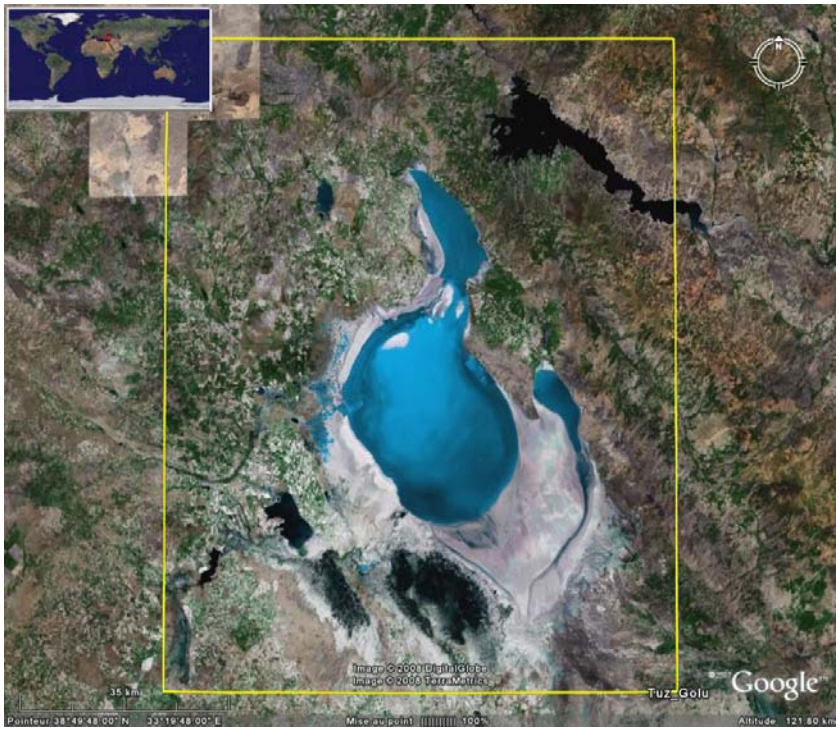
Tuz Gölü (Salt Lake)

1.1.2. Location

Latitude 38°46'21.00"N

Longitude 33°28'23.16"E

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



1.1.4. Altitude

907 meters

1.1.5. Description of the landscape

Tuz Gölü is a permanent endorheic lake in central Anatolia in Turkey situated well away from the influence of the sea (approx. 300km from the Mediterranean Sea, 350 km from

the Black Sea and 580 km from the Aegean Sea). It is extremely saline. During the summer % 95 of water in the lake dries up and exposes an average of 30-80 cm thick salt layer. In July and August this salt layer has a homogeneous area over 500.000 km². This dry salt lake has a large surface which is smooth, uniform, flat (slope less than 1°) and mostly homogeneous. It has a high surface reflectance.

The surface of the dry salt lake is composed of evaporates. They are mainly halite and gypsum, with minor amounts of polyhalite and coelestine. There is no vegetation on the dry salt lake but the lake is surrounded by arable fields and salt-steppes. There are three saltworks operating at the shore of the lake.

1.1.6. Environment

Semi - arid

1.1.7. Topography

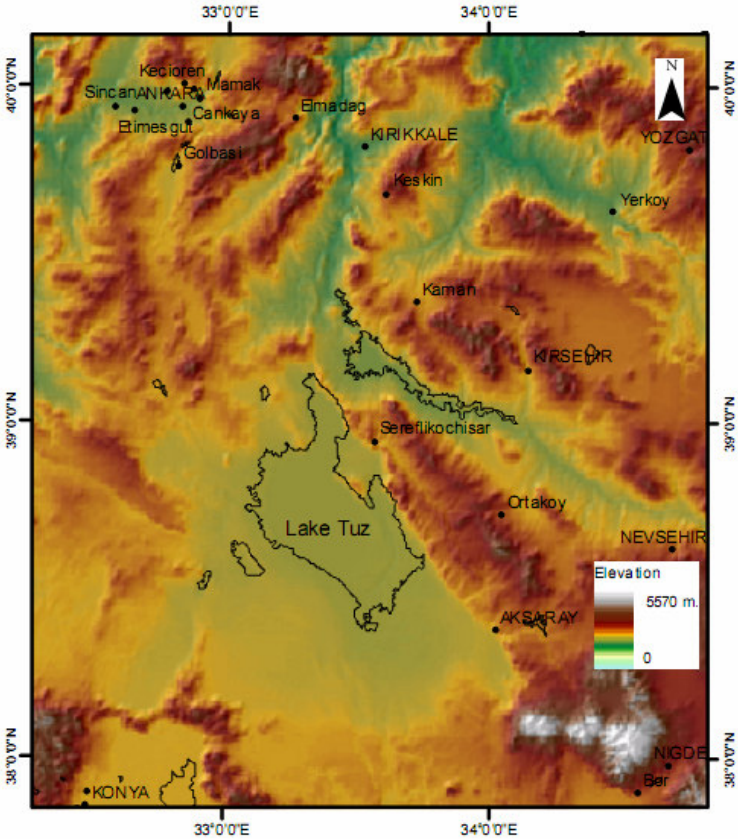


Figure 1: SRTM DEM of the region

1.2.Site view

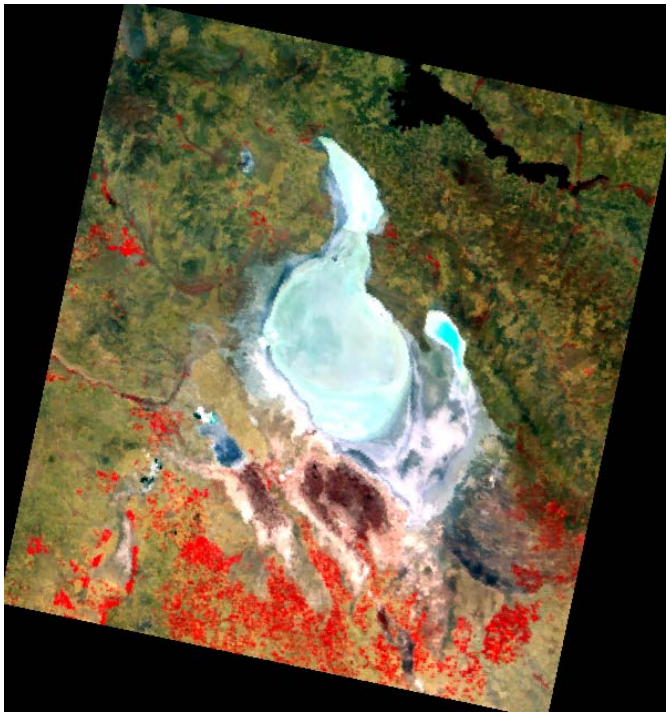


Figure 2: ENVISAT, Meris L1 19.08.2008

2. Logistic information

2.1. Site proximity from road

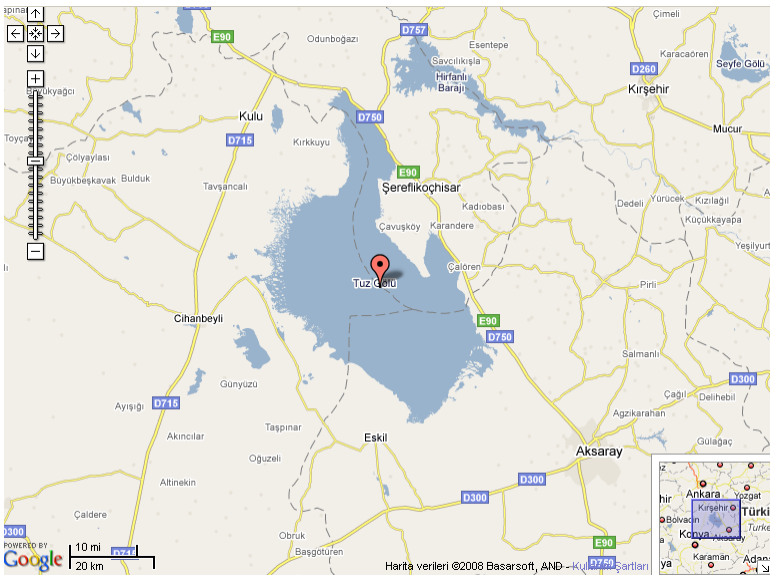


Figure 3: Site map

2.2. Access

Tuz Gölü is located near main highroads and easily accessible. It is located about 150 km southeast of the Turkish capital, Ankara, approximately 2 hours drive. To the site inside the lake it is possible to go by car or bicycle from the Kayacık Saltworks (Figure 4).

2.3. Nearest town

Ankara (capital), Aksaray and Konya

2.4. Distance from nearest town/port

148 km from Ankara, 105 km from Konya

2.5. Logistics (Hotel, Restaurant, etc.)

There is a guesthouse which is limited to 8 guests in Kaldırım Saltworks. It takes approximately 30 minutes to Kayacık Saltworks from Kaldırım Saltworks.

Another possibility is to stay in hotels located in Aksaray (Figure 4). It takes approximately 1.5 hour drive from Aksaray to Kayacık Saltworks. The names of the

hotels in good quality are Grand Eras Hotel, Grand Saatçioğlu Hotel, Ağaçlı Turistik Tesisleri.

For breakfast, lunch and dinner; saltworks facilities can be used. The closest restaurants and markets are in Şereflikoçhisar (Figure 4) which is approximately 20 km to the Kayacık Saltworks.

Figure 4: Accommodation's location map

2.6. Access to Communications

Mobile telephones can be used at the site. There is an internet access and telephones also in Kayacık and Kaldırım Saltworks.

2.7. Owner

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3. Site Climatology

3.1. General atmospheric conditions: Meteorological conditions

3.1.1. Annual pluviometry

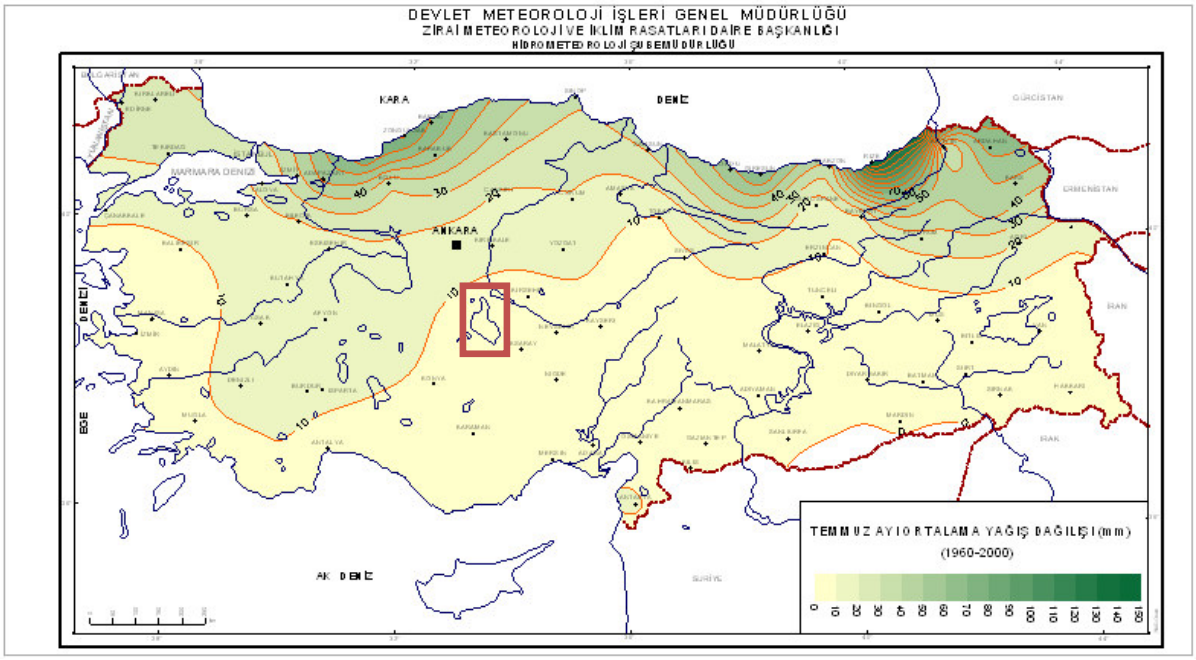

Figure 5: Average Monthly Rainfall (mm) in July in Turkey (1960-2000) (Turkish State Meteorological Service)

IVOS test site questionnaire: QA4EO-WGCV-IVO-CSP-001

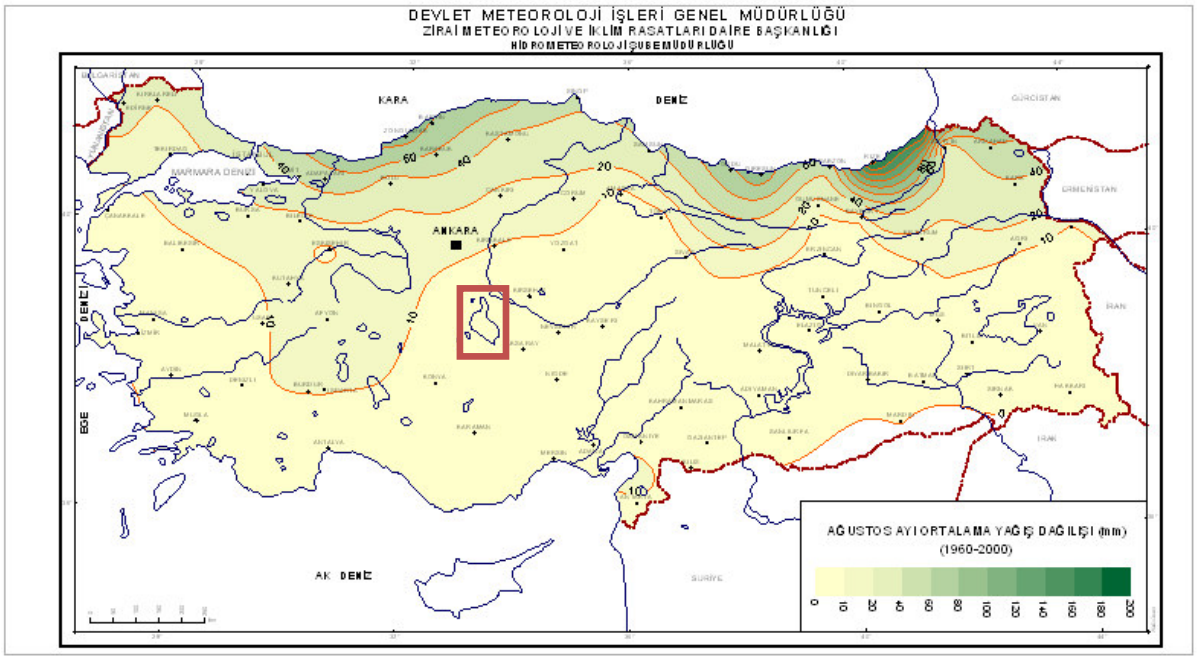

Figure 6: Average Monthly Rainfall (mm) in August in Turkey (1960-2000) (Turkish State Meteorological Service)

Table 2: Average monthly rainfall (mm)

Year/Month	2005	2006	2007	2008
January	13,45	7,225	10,338	8,7813
February	43,2	22,6	32,9	27,75
March	49	26	37,5	31,75
April	55,9	29,95	42,925	36,438
May	30,95	17,975	24,463	21,219
June	23,95	14,975	19,463	17,219
July	12,55	9,775	11,163	10,469
August	5,25	-	5,25	5,25
September	28,7	18,85	23,775	21,313
October	23,65	16,825	20,238	18,531
November	68,85	39,925	54,388	47,156
December	8,55	10,275	9,4125	9,8438

3.1.2. Wind

Table 3: Average monthly wind speed (m/sec)

Year/Month	2005	2006	2007	2008
January	2,45	2,25	2,45	2,17
February	3	2,2	2,01	2,13
March	2,85	2,75	2,88	3,65
April	2,5	2,45	2,58	3,12
May	2,4	2,15	2,81	2,53
June	2,55	2,6	2,76	2,82
July	2,75	2,75	3	2,94
August	2,45	2,4	2,66	2,88
September	2,1	2,1	2,37	2,5
October	2,2	2,2	2	2,31
November	2	1,85	2,59	2,29
December	2	1,55	2,04	1,92

3.1.3. Clear sky conditions

Atmospheric conditions are mostly sunny and cloud-free in the dry season, especially in July and August. There is a high probability of clear weather at the site during summer.

Table 4: Average monthly insolation time per day (hours)

Year/Month	2005	2006	2007	2008
January	3,5113	2,7	3,1056	3,7274
February	4,4232	3,2946	3,8589	5,369
March	5,2516	5,5548	5,4032	5,7677
April	5,9567	7,4017	6,6792	6,3972
May	8,1645	9,9371	9,0508	9,1323
June	10,518	10,69	10,604	10,9
July	11,535	11,584	11,56	12,018
August	11,335	11,331	11,333	11,281
September	8,7833	8,3167	8,55	8,155
October	6,6065	5,4871	6,0468	7,4161
November	3,53	5,5017	4,5158	5,3167
December	3,2629	5,1548	4,2089	2,4255

3.2. Atmosphere characterisation

3.2.1. Aerosol characteristics

3.2.1.1. Seasonal variation of the aerosol

It will be detailed in the following years using data from CIMEL sun-photometer.

3.2.1.2. AOT_550: Historical data

Aerosol climatology over the site was calculated by National Physical Laboratory for 7 years using Terra-MODIS data (October 2001-January 2008) and for the August 2008. Analyses and visualizations used in this part were produced with the Giovanni online data system, developed and maintained by the NASA Goddard Earth Sciences (GES) Data and Information Services Center (DISC).

The 7 years aerosol climatology shows values of AOT550 in the range 0.26-0.34 and Angstrom wavelength exponent in the range of 0.6-0.8. This climatology proves that the selected test site has low anthropogenic influence within an Angstrom wavelength exponent less than 1 along the year.

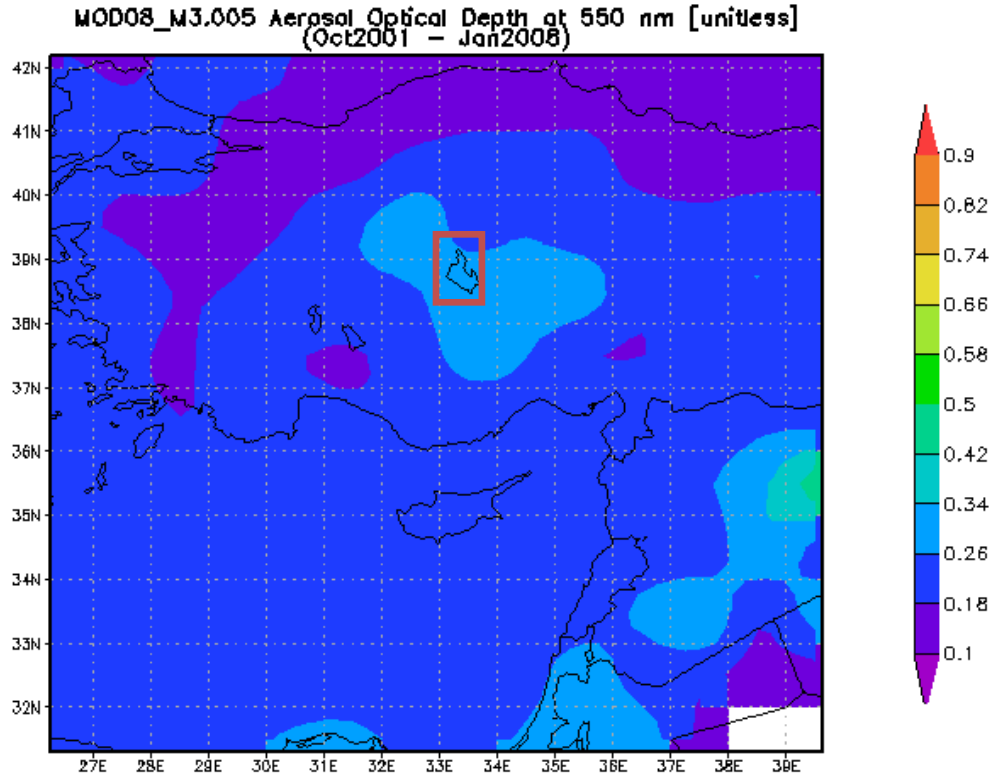

Figure 7: Aerosol optical thickness at 550 nm as calculated from Terra-MODIS data over 2001-2008 period.

3.2.1.3. Data from AERONET CIMEL network

Site will be equipped with CIMEL sun photometer in the following years. Therefore; this data will be available in the following years.

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

Table 5: Average daily mean AOT values of different wavelengths obtained during the 6 days measurement campaign in August 2008 using MICROTOPS II Sun photometer loaned from NERC Field Spectroscopy Facility (N is the number of independent values per day

Day	N	AOT 440	AOT 550	AOT 675	AOT 870
19/08/2008	16	0,196 ± 0,01	0,158 ± 0,004	0,130 ± 0,01	0,109 ± 0,01
20/08/2008	19	0,325 ± 0,01	0,236 ± 0,01	0,176 ± 0,01	0,129 ± 0,01
21/08/2008	20	0,255 ± 0,01	0,185 ± 0,01	0,138 ± 0,01	0,104 ± 0,01
22/08/2008	31	0,235 ± 0,03	0,174 ± 0,02	0,132 ± 0,02	0,101 ± 0,02
23/08/2008	43	0,172 ± 0,004	0,131 ± 0,004	0,102 ± 0,01	0,074 ± 0,004
24/08/2008	30	0,336 ± 0,01	0,271 ± 0,01	0,223 ± 0,01	0,188 ± 0,01

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

A handheld sun-photometer as MICROTOPS has an uncertainty in aerosol optical depth about ±0.01.

3.2.1.6. Model of aerosol used

This part will be detailed by next year.

3.2.1.6.1. Granulometry

3.2.1.6.2. Refraction index used

3.2.1.7. Alpha

Table 6: Angstrom coefficient values obtained from the data taken during August, 2008 measurement campaign using MICROTOPS II Sun Photometer

Day	N	Alpha	Stdv %
19/08/2008	16	0.96	10
20/08/2008	19	1.44	8
21/08/2008	20	1.44	10
22/08/2008	31	1.35	15
23/08/2008	43	1.22	11
24/08/2008	30	0.96	5

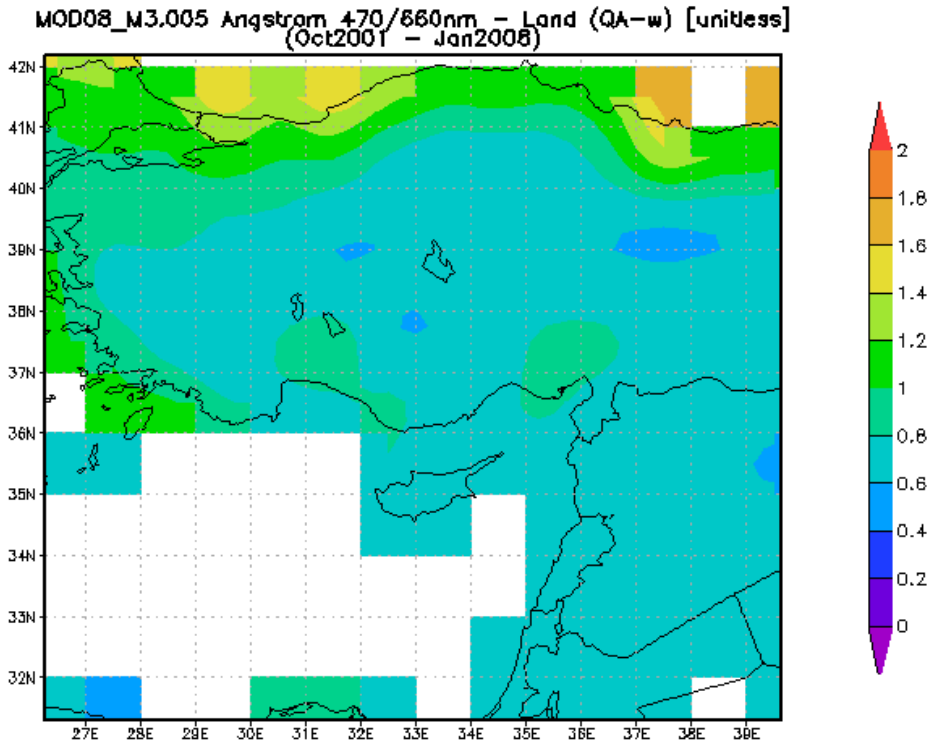

Figure 8: Angstrom wavelength exponent as calculated from Terra-MODIS data over 2001-2008 period

3.2.2. Water vapour content characteristics

3.2.2.1. Water vapour content origin

MICROTOPS II sun photometer loaned from NERC Field Spectroscopy Facility. CIMEL Sun photometer will be used

3.2.2.2. Seasonal variation of the water vapour content

There is not enough historical data now. In the following years, data will be collected by CIMEL Sun photometer.

3.2.2.3. Mean and accuracy

Table 7: Water vapour (PW) content obtained from the data taken during August, 2008 measurement campaign using MICROTOPS II Sun Photometer (N=number of independent values per day, PW Stdv % = standard deviation of the daily mean of PW)

Day	N	PW cm daily mean	PW Stdv %
19/08/2008	16	1.00	2.5
20/08/2008	19	1.56	5
21/08/2008	20	1.26	5.9
22/08/2008	31	1.17	6.4
23/08/2008	43	1.15	10
24/08/2008	30	1.59	2.5

3.3.Surface characterisation

3.3.1. Surface albedo characteristics

It will be detailed later.

3.3.2. Surface reflectance characteristics

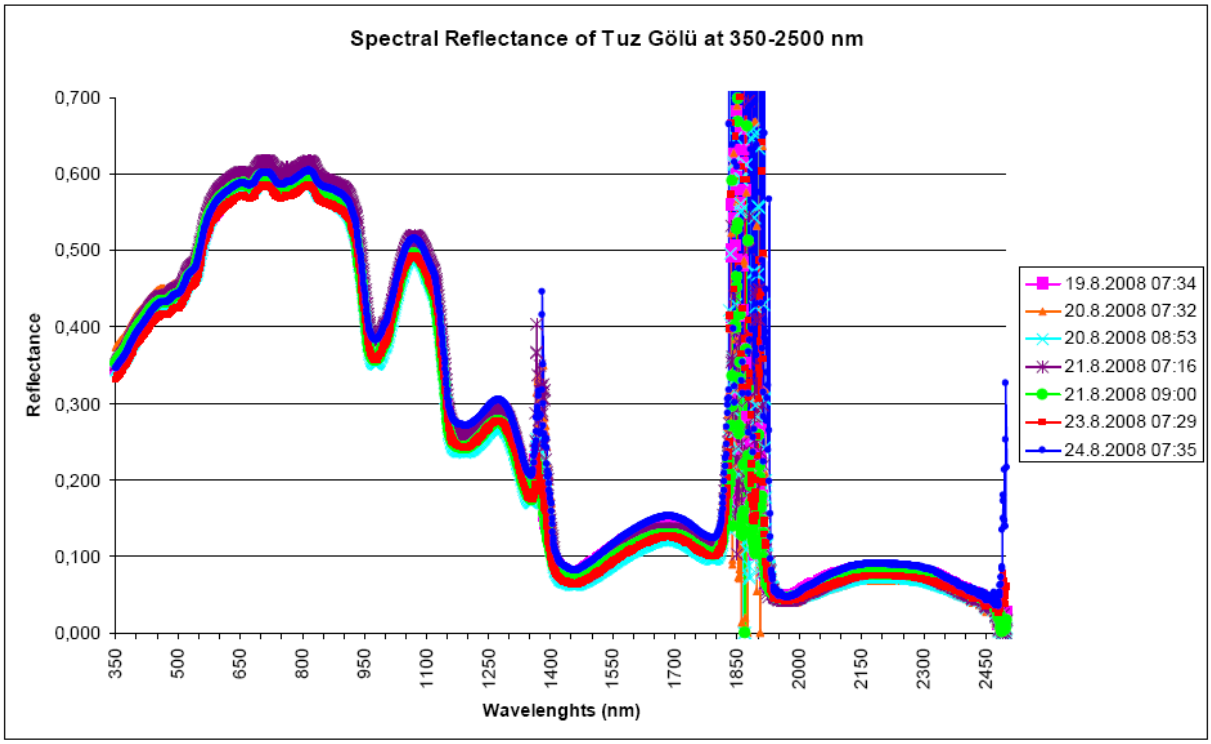

Figure 9: 19-24 August 2008 reflectance data from ground measurements

3.3.2.1. Instrumentation used for characterisation

ASD Fieldspec 3 (350-2500nm) was used for the spectral measurements. Some specific information of the instrument is given in the following table.

Table 8: ASD Fieldspec3 Characteristics

Spectral range	350 - 2500 nm
Sampling interval	1.4 nm for 350 - 1000 nm and 2 nm for 1000 - 2500 nm
Spectral resolution	3 nm at 700 nm and 10 nm at 1400 nm and 2100 nm
Data collection speed	0.1 seconds single spectrum acquisition, about 1.5 seconds for 10 spectra averaging
Set-up optimization speed	about 8.5 to 14 seconds initial optimization depending upon illumination
Dispersion element & detector	fixed reflective holographic diffraction grating, 512 element silicon photo-diode array with high order blocking filter, 2 X fast scanning reflective holographic diffraction grating and a TE cooled "graded index" InGaAs photo-diode with high order blocking filter, internal shutters, and ASD's proprietary DriftLock® automatic offset correction
Noise equivalent delta radiance (nedl) for standard 1.5 m fiberoptic cable	1.4 x 10^-9 W/cm^2/nm/sr @ 700 nm 2.4 x10^-9 W/cm^2/nm/sr @ 1400 nm 8.8 x 10^-9 W/cm^2/nm/sr @ 2100 nm

3.3.2.2. Route of traceability

Traceable to ASD's standard. ASD facilities include NIST traceable wavelength and radiometric calibration equipment.

3.3.2.3. Mean reflectance at Nadir (full spectrum)

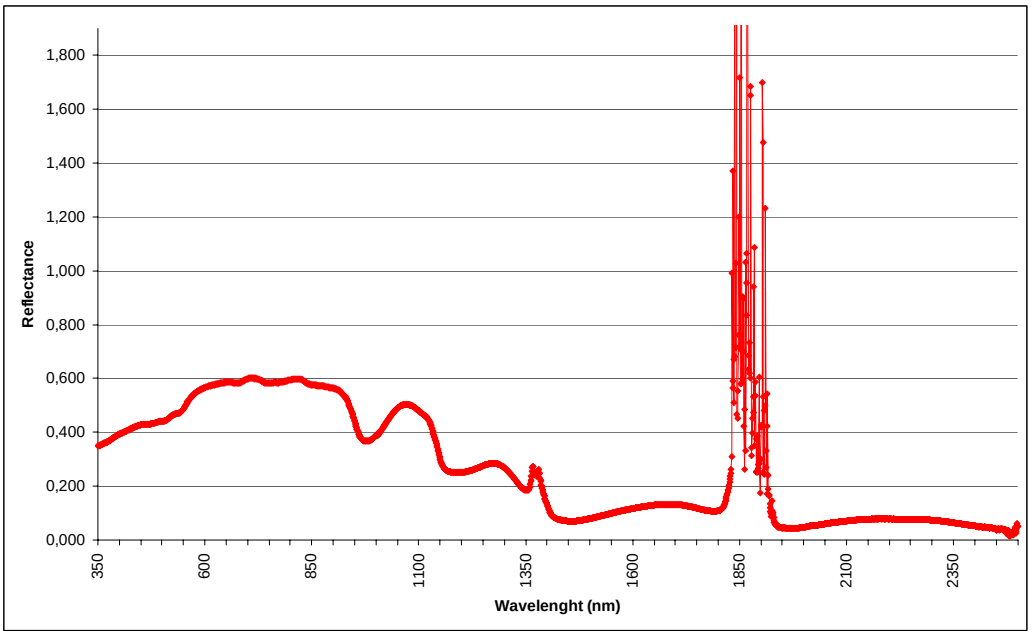

Figure 10: Mean reflectance taken over 18 – 24th August 2008 measurement campaign

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

The sources of uncertainties can be listed from the literature as:

- the panel reference which is not characterized in terms of its non-uniformity and bi-directional effects
- the field spectrometer. The instrument has not always a calibration with traceability to SI standards. The instrument should be warmed up and come in equilibrium before data collection begins. The fiber optic should be stabilised before the start of the measurements.
- the reflectance measurements are not corrected from the diffuse light that add the contribution of the environment
- the sampling method is not always followed in a consistent way by one operator. The operator should keep the same height of the foreoptic above the surface, pointing of the foreoptic, walking with the same speed over the selected areas.

The contribution of these items will be investigated in future studies.

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

Table 9: Mean reflectance values obtained from measurement campaign 2008.

Date	450 nm	550 nm	650 nm	850 nm
19.08.2008	0,42	0,48	0,58	0,57
20.08.2008	0,44	0,49	0,59	0,58
21.08.2008	0,43	0,49	0,59	0,58
22.08.2008	0,43	0,49	0,59	0,58
23.08.2008	0,43	0,49	0,59	0,58
24.08.2008	0,42	0,48	0,58	0,57

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

Table 10: $\Delta\rho$ at 450 nm, 550, 650, 850 nm

Wavelength (nm)	Mean Reflectance	$\Delta\rho$
450	0,431	
550	0,491	
650	0,588	
850	0,577	

3.3.3. BRDF (or specific angles)

GRASS (Gonio Radiometric Spectrometer System) was used to conduct a series of multi angular measurements of the light reflected from the surface. GRASS was located at the edge of the area used for the spatial sampling.

An example of the relative reflectance of the surface is shown in Figure 11 and Figure 12 where 0° is the solar principal plane. Measurements were taken at 08:20UTC, with a solar zenith angle of 32°.

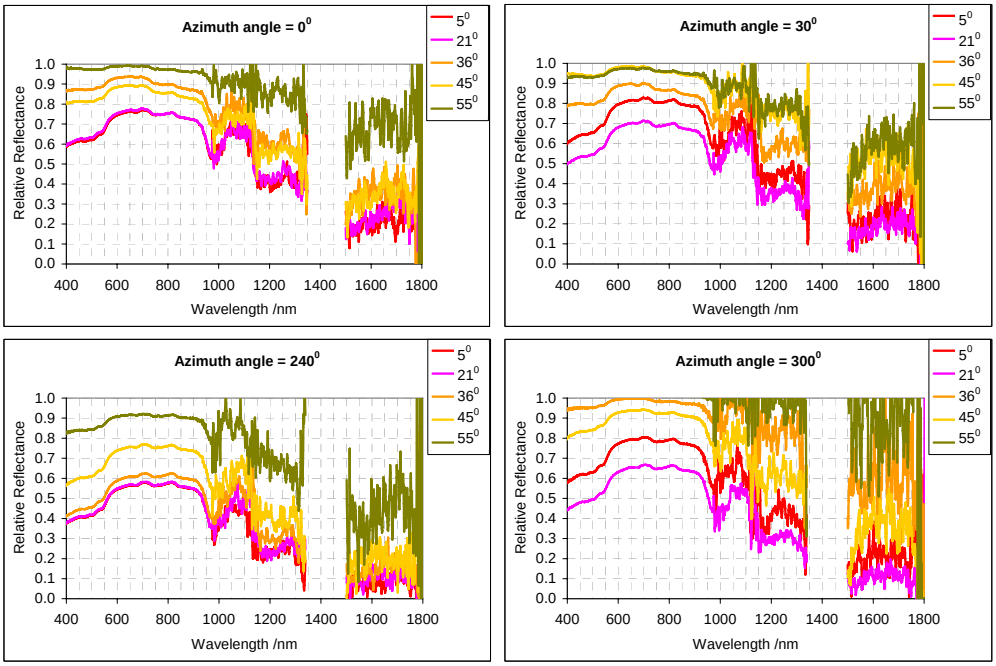

Figure 11: Variation in the relative reflectance with zenith at azimuth angles of 0°, 30°, 240° and 300°, where 0° is the solar principal plane. Measurements were taken at 08:20UTC, with a solar zenith angle of 32°.

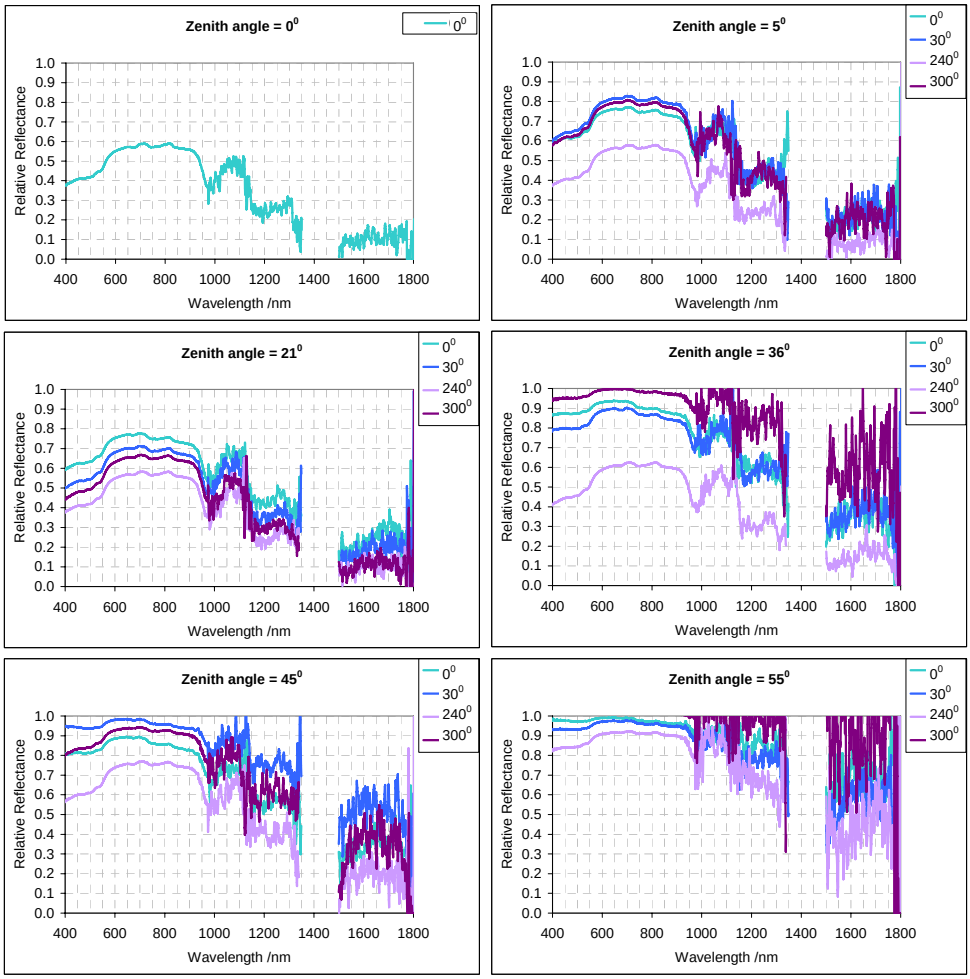

Figure 12: Variation in the relative reflectance with azimuth at zenith angles of 0°, 5°, 21°, 36°, 45° and 55°. Measurements were taken at 08:20UTC, with a solar zenith angle of 32°.

3.3.3.1.Instrument used

GRASS (Gonio Radiometric Spectrometer System) was used to conduct a series of multi angular measurements of the light reflected from the surface. It was designed by NPL (National Physical Laboratory). The instrument has been designed to be easily and quickly assembled in remote situations, be robust and able to be transported by "estate car". GRASS has been designed to measure the Earth's reflected sunlight over half a hemisphere, at 30-degree intervals i.e. 0°, 30°, 60°, 90°, 120°, 150°, 180°, on a series of seven arms. Six of these arms have five collecting optics (referred to as a "camera"), and the seventh will have six, to be able to capture the nadir measurement, as well. This results in 36 cameras /

measurement angles, within the half of the hemisphere, which measure an area approximately 25 cm in diameter.

Figure 13: NPL *Gonio Radiometric Spectrometer System (GRASS)*

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

This part will be detailed later.

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

100 * 100 m = < 5 % (Standard Deviation/Mean value using ground measurements taken on 18-24 August 2008)

500 * 500 m = After field campaign on 2009, this value will be obtained from ground measurements. Looking at MERIS image with 300 m resolution taken on 22nd August 2008, the variability is less than % 0.5 over selected 500 * 500 m areas.

1000 * 1000 m = After field campaign on 2009, this value will be obtained from ground measurements. Looking at MERIS image with 300 m resolution taken on 22nd August 2008, the variability is less than % 1 over selected 1000 * 1000 m areas.

4. Site instrumentation (Nominal)

4.1. Meteorological instrumentation (list)

4.1.1. Meteo station (Temperature, pressure, humidity)

Wireless Vantage Pro2 Plus Weather Station (Figure 14) includes display console/receiver, Integrated Sensor Suite (ISS), and mounting hardware. ISS includes automatic emptying rain collector, temperature and humidity sensors, anemometer, solar radiation sensor, UV sensor, sensor mounting shelf, and solar panel. Temperature and humidity sensors are enclosed in the standard radiation shield.

Figure 14: Automatic Weather Station

4.1.2. Pluviometer

It is included in the weather station (Figure 14).

4.1.3. Anemometer

It is included in the weather station (Figure 14).

4.2. Atmospheric instrumentation

4.2.1. Instrument used for aerosol characterisation

4.2.1.1. Instrument used

The Microtops II sunphotometer (Figure 15) was loaned to NPL for the duration of the measurements from the Natural Environmental Research Council Field Spectroscopy Facility (NERC FSF).

Figure 15: Microtops II Sunphotometer

The Microtops II sun photometer is a 5 channel (440nm, 675nm, 870nm, 936nm, 1020nm), hand-held instrument for measuring the direct solar radiance using a 2.5° viewing angle.

The Microtops II has been configured with five filters for the determination of aerosol optical thickness (AOT), including filters at 936nm and 1020nm for the measurement of the precipitable water vapour content. Additionally it contains a non-volatile memory allowing associating date, time, coordinates, solar angle, altitude, pressure and temperature to each data point.

Further information on the specification and user guides can be found at: http://fsf.nerc.ac.uk/instruments/sunphotometer.shtml

For the next measurement campaigns, CIMEL Sun Photometer CE 318 will be used.

4.2.1.2. Route of traceability

The handheld Microtops II sun photometers are returned to the manufacturer for annual calibration as part of the FSF quality assurance schedule.

4.2.1.3. Measurement protocol

4.2.1.3.1. Scanning mode[2]

A sun target and pointing assembly is permanently attached to the optical block and laser-aligned to ensure accurate alignment with the optical channels. When the image of the sun is centered in the bull's-eye of the sun target, all optical channels are oriented directly at the solar disk. To take the measurements the

[2] This part was written from the instrument's manual document.

operator should keep the instrument's window towards the sun and adjust its position so that the image of the sun appears in the "Sun target". While keeping the sun's image centered, the operator should press the Scan/Escape button to initiate the scan.

Each scan can consist of up to 64 samples from each of the 5 channels. The samples are taken in a rapid succession at a rate of over 3 samples/second (one sample contains readings from all 5 channels). Consequently, the maximum time for a single scan is about 20 seconds. The number of samples in a scan (scan length) can be set by the user to a number from 1 to 64. The default value is 32 and it is suitable for virtually all conditions. Lowering the number of samples per scan may be necessary if only a short time is available for taking the measurement.

4.2.1.3.2. Spectral characteristics

There are five channels as 440nm, 675nm, 870nm, 936nm, 1020nm.

4.2.1.3.3. Frequency of measurements

Each 10 minutes during taking spectral measurements from ASD Spectrometer.

4.2.2. Instrument used for surface irradiance characterisation

4.2.2.1. Instrument used

ASD Fieldspec 3 (350-2500 nm) was used for irradiance characterisation. Please refer to 3.3.2.1 for the characteristics of the instrument.

4.2.2.2. Route of traceability

Traceable to ASD's standard. ASD facilities include NIST traceable wavelength and radiometric calibration equipment.

4.2.2.3. Measurement protocol

Irradiance measurements are performed before and after the spectral measurements using cosine receptor.

4.2.3. Instrument used for water vapour content characterisation

4.2.3.1. Instrument used

The Microtops II sun photometer (Figure 15) was used. Please refer to 4.2.1.1 for the detailed information. CIMEL sun photometer will be used for the following years.

4.2.3.2. Route of traceability

The handheld Microtops II sun photometers are returned to the manufacturer for annual calibration as part of the FSF quality assurance schedule.

4.2.3.3. Measurement protocol

Please refer to 4.2.1.3.

4.3. Surface instrumentation

4.3.1. Instrument used for reflectance/radiance characterisation

4.3.1.1. Instrument used

ASD Fieldspec 3 (350-2500nm) was used for reflectance/radiance characterisation. Please refer to 3.3.2.1 for the characteristics of the instrument.

4.3.1.2. Route of traceability

Traceable to ASD's standard. ASD facilities include NIST traceable wavelength and radiometric calibration equipment.

4.3.1.3. Measurement protocol

4.3.1.3.1. Scanning mode

ASD FieldSpec 3 can collect 10 spectra per second data for the entire 350-2500 nm range. The 0.1 second scanning time provides an accurate average every second.

A photo diode array spectrometer is used to cover the 350 to 1000 nm spectral range (UV/VNIR), while two fast scanning spectrometers provide coverage for the wavelength range from 1000 to 2500 nm (SWIR 1 and 2):

- SWIR1 for the wavelength range of 1000 nm to 1830 nm
- SWIR2 for the wavelength range of 1830 nm to 2500 nm

4.3.1.3.2. Spectral characteristics

Table 11: Spectral Characteristics of ASD FieldSpec 3

Spectral range	350 - 2500 nm
Sampling interval	1.4 nm for 350 - 1000 nm and 2 nm for 1000 - 2500 nm.
Spectral resolution	3 nm at 700 nm and 10 nm at 1400 nm and 2100 nm

4.3.1.3.3. Frequency of measurements

Measurements were taken in two different ways as discrete and continuous. Every 10 minutes, reference panel measurements were performed for reflectance calculations.

4.3.2. Instrument used for BRDF characterisation

4.3.2.1. Instrument used

Please refer to 3.3.3.1.

4.3.2.2. Route of traceability

Traceable to NPL's primary standard.

4.3.2.3. Measurement protocol

This part will be detailed later.

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

The site is instrumented with ASD Spectrometer, meteorological station and DGPS. BRDF measurements were performed with GRASS designed by NPL. CIMEL Sun photometer CE 318 will be purchased in 2009.

5.2. Maintained (source and commitment of funding)

TUBITAK UZAY national resources

5.3. Regularly visited (state frequency)

- Human : A week in a year
- Satellite □
- Aircraft □

- Automated ☐

6. Site usage

Tuz Gölü is a new radiometric calibration site. The results of the comparisons will be reported later.

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)

Selime Gürol

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7.2. Instrumentation maintenance

The same contact information in the previous part can be used for the detailed instrumentation maintenance information.

8. Dataset availability and owner

8.1. Dataset

Ground measurements and satellite images

8.2. Owner

TÜBİTAK UZAY for ground measurements; USGS, ESA and DMC Imaging for satellite images

8.3. Availability

Ground measurements dataset can be available for the interested researchers.

9. References

9.1. Bibliography

9.1.1. Characterization of the site

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9.1.2. Description of the methodology

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9.1.3. Description of the instrumentation

- Sunman: Microtops II Sun Photometer Version 5.5 User's Guide, Solar Light Company, Inc. www.solarlight.com/faqs/documents/sunman.pdf

- Wireless Vantage Pro2™ & Vantage Pro2™ Plus Stations Product Information Document, http://www.davisnet.com/weather/products/weather_product.asp?pnum=06152

- ASD FieldSpec 3 Product Information available on http://www.asdi.com/products-fs3.asp

- GRASS information was obtained from National Physical Laboratory

9.1.4. Description of applications for vicarious calibration

9.2. Site Web

The website will be available later.