SAFARI 2000 LAI and FPAR Measurements at Sua Pan, Botswana, Dry Season 2000

Abstract

The Multi-angle Imaging SpectroRadiometer (MISR) Validation team was deployed to the Sua Pan salt playa in the Magkadigkadi region of Botswana during the SAFARI 2000 Dry Season Aircraft Campaign to collect various data sets for validating the MISR LAI/FPAR algorithm. Ground measurements of LAI and FPAR were made using the LAI-2000 plant canopy analyzer and Sunfleck PAR ceptometer, respectively, during focused periods from August 20 to August 28, 2000 at a dry grassland site adjacent to the Sua Pan. Associated reflectance measurements were made with the PARABOLA and ASD instruments (Helmlinger et al., 2004a; 2004b).

The Sua Pan deployment was intended to collect the suite of data necessary for multi-angle top of the atmosphere radiance predictions for the MISR instrument aboard Terra. The pans of the Magkadigkadi region are the remnants of the once great Lake Makgadikgadi. These highly reflective salt pans, such as the vast Sua Pan, serve well as bright calibration targets.

Background Information

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Project: SAFARI 2000

Data Set Title: SAFARI 2000 LAI and FPAR Measurements at Sua Pan, Botswana, Dry Season 2000

Site: Sua Pan Grassland, Botswana
Westernmost Longitude: 26° 01.788' E
Easternmost Longitude: 26° 02.366' E
Northernmost Latitude: -20° 31.010' S
Southernmost Latitude: -20° 31.552' S

Data Set Citation:

Buermann, W. and M. Helmlinger. 2004. SAFARI 2000 LAI and FPAR Measurements at Sua Pan, Botswana, Dry Season 2000. Data set. Available on-line [http://daac.ornl.gov/] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A.

Web Site: http://www-misr.jpl.nasa.gov/mission/valwork/val_reports/000813_safari/safari.html

Data File Information

Data files contain records of leaf area index (LAI) and ceptometer measurements of photosynthetically active radiation (PAR) reflectance and transmission at a dry grassland site adjacent to the Sua Pan. Each file contains summary information in the top portion, providing mean LAI and PAR values, followed by the summary information described below. PAR data were measured only on the transect scale (see sampling section below) and LAI are provided at both pixel and transect scales. The data files are ASCII tables, in comma-separated-value format.

misr_sua_fpar.csv

Column Name	Definition	Units/Format
Date	Date of measurement	DDMMYYYY
Time	Time of measurement	local time (hh:mm)
Location	Sampling location (transect)	character (letter, number)
Incident	Incident PAR	W m^{-2}
Transmission	Transmitted PAR	µmol $m^{-2}s^{-1}$
Reflectance	PAR reflectance	µmol $m^{-2}s^{-1}$
Conditions	Sky conditions	character
Refl. (norm)	normalized reflectance	%
Trans. (norm)	normalized transmittance	%

misr_sua_lai.csv

Column Name	Definition	Units/Format
Location	Sampling location (transect and grid)	character (letter, number)
LAI	Leaf Area Index (one-sided green leaf area per unit ground area)	unitless
SEL	Standard Error of the LAI Determination	unitless
Condition	Sky Conditions	ASCII

Description of Sua Pan Grassland Site

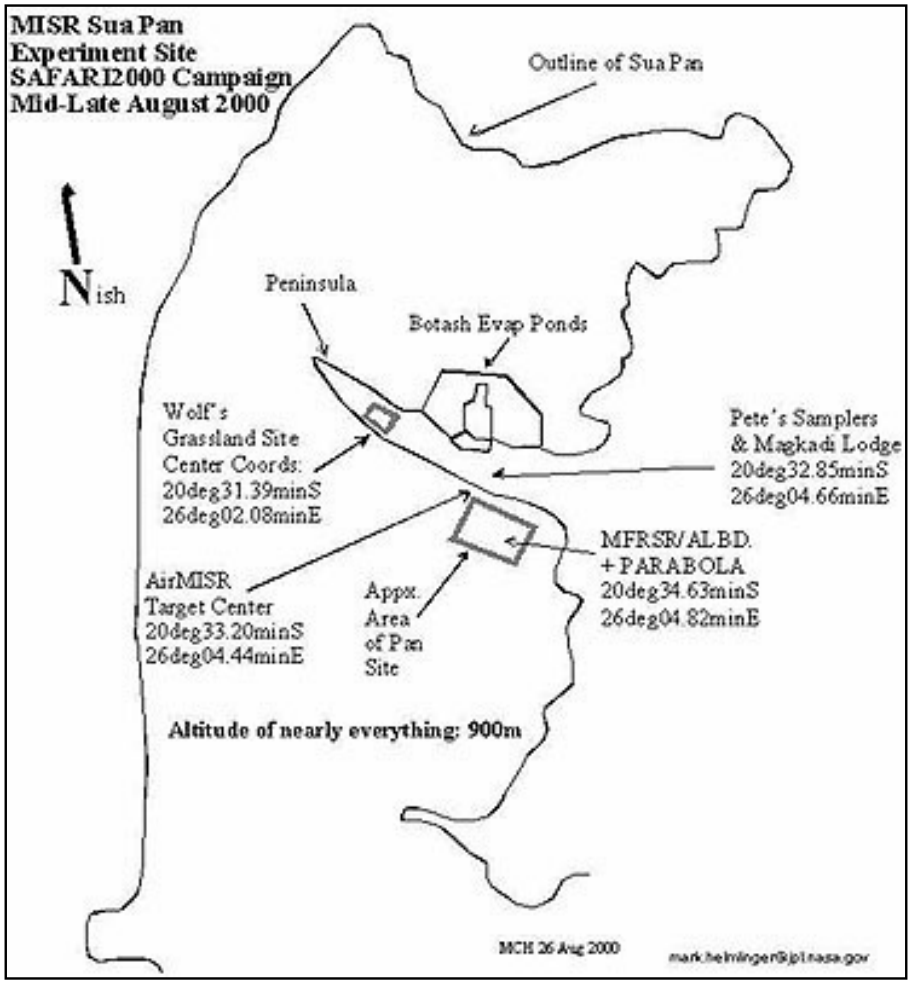
The pans of the Magkadigkadi region are the remnants of the once great Lake Makgadikgadi. These highly reflective salt pans, such as the vast Sua Pan, serve as excellent bright calibration targets. This vast area of salt pans are interspersed with low-lying grass islands. The winter season begins in May and ends in August. This is also the dry season when virtually no rainfall occurs. The pans flood between January and March, if it rains enough. This causes grasses to burst into life.

The conditions at the time of the measurements were dry, as it was the end of the dry season, and the grasses were completely senescent. The 1 km by 1 km sampling grid was a homogeneous, relatively dense grassland, with a height of 20-100 cm. Two different grass types were prevalent, *Odyssea paucinervis* and *Sporobolus spicatus.* At the southwest corner of the grid, at a distance of about 200 m, the shoreline of the pan appears. To the east, at about

1.5 km distance from the grid, is the Botash plant (see the map below).

The GPS corner values of the grid are:

Corner	Latitude	Longitude
SE	-20°31.552 S	26°02.366 E
SW	-20°31.551 S	26°01.795 E
NW	-20°31.010 S	26°01.788 E
NE	-20°31.015 S	26°02.365 E



Instrument Descriptions

LAI Instrument Description

The LAI-2000 plant canopy analyzer is composed of an LAI-2070 control unit and an LAI-

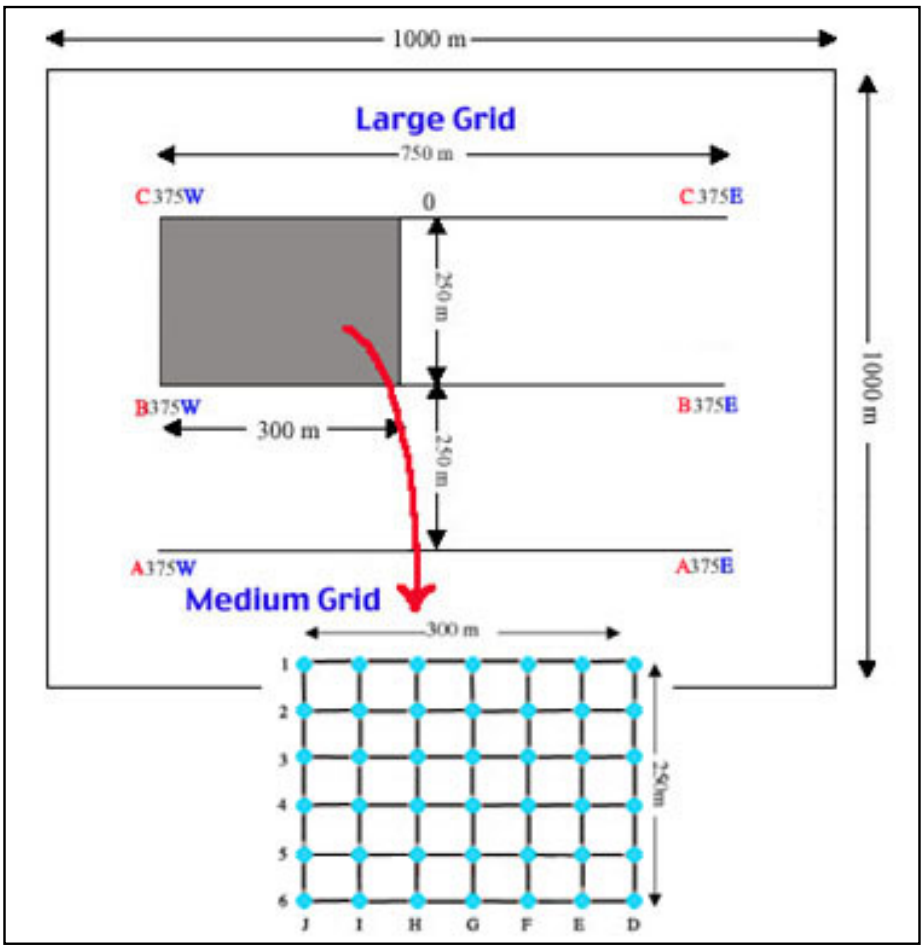
2050 sensor head. The control unit has connectors for two sensor heads, two connectors for other LI-COR sensors, and an RS-232 communication connector. The sensor head projects the image of its nearly-hemispheric view onto five detectors arranged in concentric rings (each view ranges approximately 0-13, 16-28, 32-43, 47-58, and 61-74 degrees). Radiation above 490 nm is rejected.

Sampling Methods

At the grassland site, LAI was measured over two scales: a 1 km by1 km transect scale; and a 300 m by 250 m pixel scale (large and medium grid below). PAR data were measured only on the transect scale. At the transect scale, there were three straight transect lines parallel to one another from south to north, spaced by 250 m. The first line is A line, which is 250 m north of the southern margin of the square kilometer. The second line is B line, which is 250 m north of A line. The last line is C line, which is 250 m north of B line. The length of each line is 750 m, centered in the square kilometer. LAI measurements were taken at 25 m intervals from west to east. Therefore, there are 31 measurements (sample points) on each of the 750 m lines. The transect points are counted from East to West (C1 to C31) for transect C, from West to East for transect B (B1 to B31) and again from East to West for transect A (A1 to A31).

The subgrid (medium grid below) is 300 m x 250 m with 50 m grid point intervals. The subgrid is located between transects C and B at the most eastern edge. The grid points are counted from East to West (D to J) and from North to South (1 to 6). Consequently, transect point C1 is identical to subgrid point D1 and transect point B31 is identical to subgrid point D6.

In summary, LAI readings were performed at 135 (93 transect and 42 subgrid) sample points, and PAR readings were performed at 93 transect sample points.



Data Acquisition Methods

The LAI-2000 measures the attenuation of diffuse sky radiation at five zenith angles, simultaneously. LAI measurements were made at times of low sun elevation, at the hour shortly before and after sunrise and sunset. LAI measurements during sunrise commenced about 10 minutes before sunrise and continued until 30 minutes after (sun angle approx. 10 degrees). During sunset, LAI measurements started about 25 minutes before sunset and continued until 15 minutes after. All measurements were made under clear sky conditions. On August 20, LAI was measured in the morning under uniform cloud conditions.

Measurements were made by placing the sensor in a horizontal position while facing the opposite direction from the sun. A 180-degree mask was used to prevent interference caused by the sun presence. A 90-degree mask was used during uniform cloud cover conditions to prevent interference from the operator. The LAI-2000 instrument was held in a horizontal position below the vegetation to obtain LAI readings. Whenever possible, a uniform distance of about 30 cm was maintained between the sensor and the grasses.

Measurements of FPAR were made with the Sunfleck PAR ceptometer. The sampling and data acquisition methods were identical to those used for the acquisition of LAI data at all 135 Sua Pan grass sample points (transect and grid). PAR readings of incidence, transmittance, and reflectance were obtained. All measurements were made under clear sky conditions.

Related Data Sets

Helmlinger, M., W. Buermann, and F. Eckardt. 2004a. SAFARI 2000 BRDF Measurements at Sua Pan and Skukuza, Dry Season 2000. Data set. Available on-line [http://daac.ornl.gov/] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A.

Helmlinger, M., W. Buermann, and F. Eckardt. 2004b. SAFARI 2000 Surface Spectral Reflectance at Sua Pan, Botswana, Dry Season 2000. Data set. Available on-line [http://daac.ornl.gov/] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A.

Additional Sources of Information

Tian, Y., C. E. Woodcock, Y. Wang, J. L. Privette, N. V. Shabanov, L. Zhou, Y. Zhang, W. Buermann, J. Dong, B. Veikkanen, T. Hame, K. Andersson, M. Ozdogan, Y. Knyazikhin, and R. B. Myneni. 2002. Multiscale analysis and validation of MODIS LAI product. I. Uncertainty assessment. Remote Sens. Environ. 83: 414-430.

Tian, Y., C. E. Woodcock, Y. Wang, J. L. Privette, N. V. Shabanov, L. Zhou, Y. Zhang, W. Buermann, J. Dong, B. Veikkanen, T. Hame, K. Andersson, M. Ozdogan, Y. Knyazikhin, and R. B. Myneni. 2002. Multiscale analysis and validation of the MODIS LAI product over Maun, Botswana. II. Sampling strategy. Remote Sens. Environ. 83: 431-441.

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