SAFARI 2000 PAR Measurements, Kalahari Transect, Botswana, Wet Season 2000

Abstract

Ceptometer data from a Decagon AccuPAR (Model PAR-80) were collected at four sites in Botswana during the SAFARI 2000 Kalahari Transect Wet Season Campaign (March, 2000). These sites are Maun, Pandamentanga, Ghanzi/Okwa River Crossing, and Tshane. The measurements were taken near stake flags placed at 25 m intervals along three parallel 750 m transects located 250 m apart. The ceptometer contains 80 photosynthetically active radiation (PAR) sensors fixed at 1 cm intervals along a wand and connected to a control box. The data can be used to compute fraction of photosynthetically active radiation (FPAR), intercepted PAR, leaf area index (LAI), and gap fraction. These data currently exist in "raw" format, but can be processed using manufacturer-provided software to estimate the derived products.

Background Information

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Project: SAFARI 2000 and Southern Africa Validation of EOS (SAVE)

Data Set Title: SAFARI 2000 PAR Measurements, Kalahari Transect, Botswana, Wet Season 2000

Site: Kalahari Transect
Westernmost Longitude: 21° 42' 47" E
Easternmost Longitude: 25° 30' 01" E
Northernmost Latitude: 18° 39' 19" S
Southernmost Latitude: 24° 09' 51" S

Data Set Citation:

Privette, J. L., Y. Tian, Y. Wang, R. J. Scholes, and R. B. Myneni. 2005. SAFARI 2000 PAR Measurements, Kalahari Transect, Botswana, Wet 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://modarch.gsfc.nasa.gov/MODIS/LAND/VAL/terra/privette/

Data File Information

The data are stored as ASCII files, in csv format, organized by site, with one file per transect. For the Maun and Pandamatenga sites, there is an additional file containing above canopy PAR irradiance. The PAR data units are micromols per meter squared per second (umol m^{-2} $s^{-1)}$, and the time is in Local Time. There is also a readme file, in txt format, for each site.

Sample Data Format:

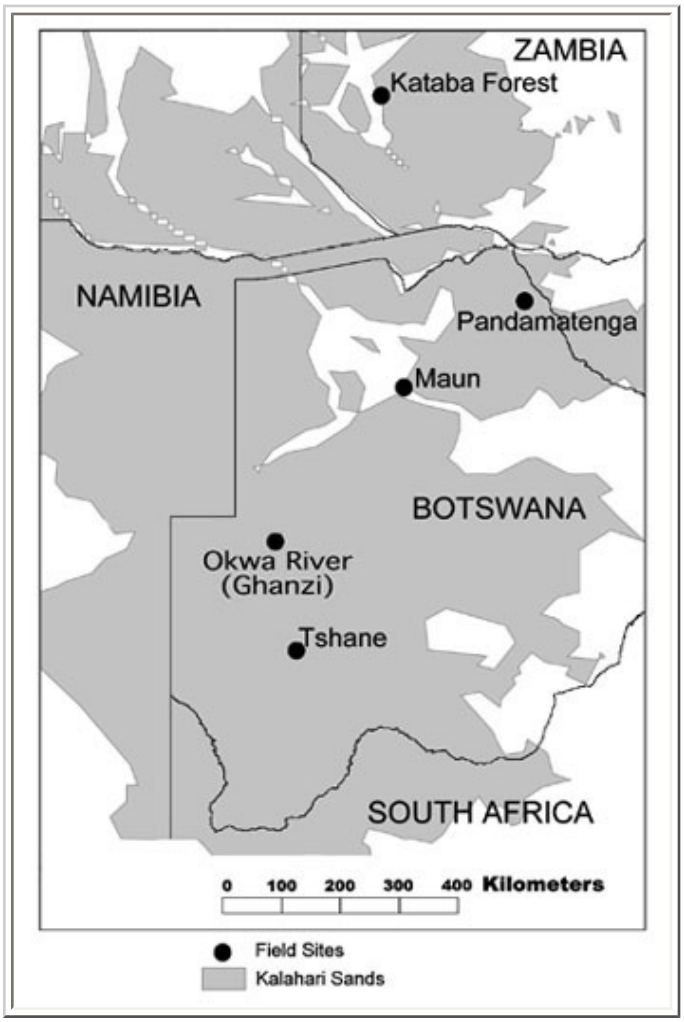
ABOVE CANOPY PAR	1644.8
SEGMENTED PAR	
BELOW PAR SEGMENT [1]	107.3
HOURS:MINUTES:SECONDS	10:55:29
MONTH/DAY/YEAR	3/12/00
COMMENT	W375R
SEGMENTED PAR	
BELOW PAR SEGMENT [1]	290.3
HOURS:MINUTES:SECONDS	10:56:14
MONTH/DAY/YEAR	3/12/00
COMMENT	W375T

The "COMMENT" line contains the flag sampled (i.e., location on transect) and measurement type (i.e., R = reflectance and T = transmittance). See Sampling Scheme section below for details.

Study Sites

The Kalahari Transect is marked by fairly constant arenosol soils, typically tens of meters deep (the Kalahari sands). The Transect's vegetation includes near-continuous Kalahari woodlands (Miombo woodland on sand) to the north and increasingly sparser woodlands and savannas southward. All field sites were on the southern African plateau with elevations of about 1000 meters. All sites in Botswana exhibited signs of light grazing. The region experiences a hot continental climate with a pronounced wet and dry seasonality. Nearly all of the rain occurs from November to April, while typically no rainfall occurs from June to September. The vegetation is generally semi-deciduous, responding to the seasonal variation in rainfall. Summary information is available in Otter et al. (2002), Dowty et al. (2000) and Scholes et al. (2002).

Location of Kalahari Sands and Study Sites:



Coordinants for the Kalahari Transect Sites in Botswana:

Sites	Latitude	Longitude
Maun	19° 55' 22" S	23° 35' 40" E
Pandamentanga	18° 39' 19" S	25° 30' 01" E
Ghanzi/Okwa River Crossing	22° 24' 33" S	21° 42' 47" E
Tshane	24° 09' 51" S	21° 53' 34" E

PAR Radiation Measurements

The ceptometer data have not been reduced and remain in raw form. Thus, the incident, transmitted and reflected PAR radiation values for a transect and site remain within one file. The type of measurement for each data point is known due to comments in the data files.

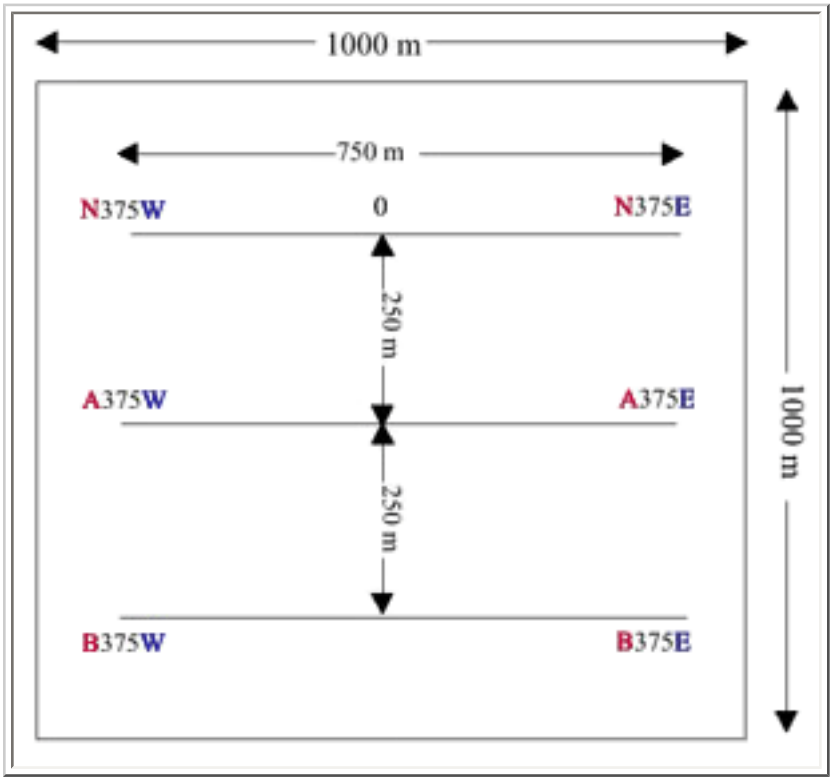
Instrument Description

The AccuPAR instrument is a battery-operated linear PAR ceptometer, used to measure light interception in plant canopies, and to calculate LAI. It consists of an integrated microprocessor-driven datalogger and probe. The probe contains 80 independent photodiodes, spaced 1 cm apart. The photodiodes measure PAR in the 400-700 nm waveband. AccuPAR displays PAR in units of micromols per meter squared per second (µmol m^{-2} s^{-1}). PAR represents the portion of the electromagnetic spectrum that plants use for photosynthesis.

Sampling Scheme

Ceptometer measurements were collected at stake flags located on the three transects of the Large Grid shown in the figure below. The 750 m (east-west) transects were flagged at 25 m intervals. The northernmost transect was labeled N, the middle transect A, and the southernmost transect was named B. The transects were separated by 250 m. The flag positions were labeled according to their direction and distance relative to the center of the given transect, specifically: 375W, 350W, 325W, 300W, 275W, 250W, 225W, 200W, 175W, 150W, 125W, 100W, 75W, 50W, 25W, 0, 25E, 50E, 75E, 100E, 125E, 150E, 175E, 200E, 225E, 250E, 275E, 300E, 325E, 350E, 375E.

In this scheme, 0 = center, "W" indicates west of the center, and "E" indicates east of the center. For example, a flag at 250W was 250 m west of the transect center. The length and spacing of the transects were chosen to sample an area large enough to be representative of a 1 km MODIS pixel.



The sampling protocol followed in general was to first measure above canopy incident PAR, then canopy reflected PAR, then above canopy incident PAR again, and finally, canopy transmitted PAR. The "COMMENT" line contains the flag sampled and measurement type, for example, "W375R" or "W375T", as described above. The East and West indicators may preceed or follow the number of meters along the transect. The other letter indicator in the "COMMENT" line indicates the type of measurement, where R = reflectance and T = transmittance.

Data Notes

The above canopy PAR in the transect data files cannot be used for Maun and Pandamatenga. Please read data from file "maun_above_par.csv" and "pandamentanga_above_par.csv" to get the correct above canopy PAR values for these sites. Please note that FPAR is dependent upon the solar angle, and the three transects were measured at different times of day. Also, cloudiness varied and conditions are noted in the readme files and in COMMENTS of the data files.

Instrument Calibration

The data are cross-calibrated by comparison to AERONET CIMEL data collected on February 22, 2000 in Greenbelt, MD. The data were reduced using a procedure develop by C. Pietras for the NASA SIMBIOS group.

Quality Assessment

Error Sources

Errors are possible from partial clouds (e.g., thin cirrus). High grade filters are embedded in a solid cast aluminum housing which assures accurate, stable optical alignment. Low noise electronics and a 20 bit A/D converter ensure high linearity, resolution and dynamic range.

Known Problems with the Data

There are a few cases where NaN (Not a Number) and Inf (Infinite number) are reported in the columns. Those cases obviously should be ignored.

Additional Sources of Information

Manufacturer manuals on the AccuPAR are available at:

http://www.decagon.com/manuals/APman34.pdf
http://www.decagon.com/info/AccuPAR.pdf

Acknowlegments

The data were collected by Jeff Privette of NASA's Goddard Space Flight Center, Yuhong Tian of Georgia Tech. University, Yujie Wang of Univ. of Maryland Baltimore County, and Bob Scholes of CSIR Enviromentek.

Related Data Sets

Holben, B. N. and T. F. Eck. 2004. SAFARI 2000 AERONET Ground-based Aerosol Data, Dry Season 2000. Data set. Available on-line [http://www.daac.ornl.

gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A.

Additional related data sets collected during the Kalahari Transect Wet Season Field Campaign are archived by ORNL DAAC. A list of these data sets is available at: http://www.daac.ornl.gov/S2K/safari.html.

References

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Revision Date: Friday, March 11, 2005