SAFARI 2000 Meteorological Tower Measurements, Kruger National Park, 2000-2002

Abstract

An eddy covariance system mounted on a tower near the Skukuza Camp in Kruger National Park, South Africa has been operating continuously since early 2000. Meteorological measurements started in February 2000, and the first flux measurements were made in April 2000. The site is unique in that the micrometeorological instruments are positioned on a tower located between two distinct savanna types, a broad-leafed *Combretum* savanna and a fine-leafed *Acacia* savanna. These contrasting savanna types are found on soils of differing texture, water holding capacity, and nutrient status, and are characterized by different physical structure, physiology, and phenology. It was expected that the tower placement and prevailing wind directions would allow for the sampling of net ecosystem fluxes from both of these ecosystems.

The data files contain 30-minute averages from meteorological instrumentation mounted on the Skukuza tower from 2000-2002. See table below for included measurements. The data files are stored as ASCII table files, one file per year, in comma-separated-value (.csv) format, with column headers.

Measurements on the main eddy covariance tower include net ecosystem exchange of CO_2, water and energy, and measurements of a range of meteorological variables with 30-minute averaging period. Additional continuous measurements in both adjacent savanna systems include soil heat flux, soil moisture, and soil temperature profiles (from the soil surface to bedrock), and canopy profiles of CO_2 concentration, humidity, and air temperature. Intermittent measurements include soil surface CO_2 flux and spatially distributed soil moisture and soil temperature measurements.

Background Information

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Project: SAFARI 2000/SAVE

Data Set Title: SAFARI 2000 Meteorological Tower Measurements, Kruger National Park, 2000-2002

Site: Skukuza, Kruger National Park, South Africa
Westernmost Longitude: 31° 29.813' E
Easternmost Longitude: 31° 29.813' E
Northernmost Latitude: 25° 01.184' S
Southernmost Latitude: 25° 01.184' S

Data Set Citation:

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Data Set Link: http://www.nrel.colostate.edu/projects/kruger/

Data File Information

The data files contain numeric values that represent 30-minute averages from instrumentation mounted on the Skukuza tower from 2000-2002. The data files are stored as ASCII table files, one file per year, in comma-separated-value (.csv) format, with column headers. The files are:

skukuza_met_tower_2000.csv
skukuza_met_tower_2001.csv
skukuza_met_tower_2002.csv

All variables are 30-minute averages, except for rainfall, which is total for the 30-minute period. Missing data values are represented by a value of -9999. The content of the files are described below.

Column	Column Name	Description	Units/Format
1	Year	year	YYYY
2	Day of year	day of year	DDD
3	Local time	end of time period of measurement	24hhmm
4	Day+Hour	fractional date, midpoint of the time period of measurement	doy.fractional_day
5	Rh	relative humidity	percent
6	Tair	air temperature	degrees Celsius
7	SW_in1	shortwave incoming radiation	W m^{-2}
8	Wspeed	wind speed	m s^{-1}
9	Rain	precipitation	mm
10	VP	vapor pressure	kPa
11	PAR	photosynthetically active radiation	W m^{-2}

Note: Time reported in column 3 indicates the end of the 30 minute measurement period, e.g., the values reported at 1030 are averages for the period from 10:00 am to 10:30 am. The column 4 time, however, is the mean time in days and fractional hours for the reporting period, such that 1.21875 is day 1, at 5.25 am, or 5:15 am, the midpoint of the 5:00 to 5:30 reporting period.

Plots of meteorological and flux measurements from the Skukuza tower in the Kruger National Park can be viewed at: http://www.nrel.colostate.edu/projects/kruger/dataplots/DataPage.htm.

Measurement Site

The study site is located in the southern region of Kruger National Park (KNP) in northeastern South Africa on a gently undulating landscape with granite substrate, drainage lines 2-3 km apart, and ridge tops rising 30-40 meters above the valley floors. The climate is semi-arid subtropical, with hot rainy summers, warm dry winters, and an annual average rainfall of 550-650 mm. The soils of the catena vary between coarse-textured sand near the ridge-tops and finer-textured loamy-

sand on the mid-slope and valley floors. The vegetation also differs along the catena, with broad-leaved tree species and low palatability grasses on the sandy soil, and bipinnate tree species and more palatable grasses on the loam soils. The natural disturbance regime of the site includes fire, at return intervals of 3-8 years, as well as grazing and browsing by numerous species of wild ungulate.

The flux site in the KNP near Skukuza Camp has operated continuously since early 2000. The site is unique in that the micrometeorological instruments are positioned on a tower located between two distinct savanna types, a broad-leafed *Combretum* savanna and a fine-leafed *Acacia* savanna. These contrasting savanna types are found on soils of differing texture, water holding capacity, and nutrient status, and are characterized by different physical structure, physiology, and phenology. Wind directions are such that observation of net ecosystem fluxes from both ecosystems were expected. Data from the first 3 years of measurements are provided in this data set. The 1999-2000 wet season was unusually wet. It was followed by a dry-season fire and a growing season with more average rainfall (2000-2001).

Skukuza Eddy Covariance Tower

Measurements on the main eddy covariance tower include net ecosystem exchange of CO_2, water, and energy, and a range of meteorological variables, with a 30-minute averaging period. Additional continuous measurements in both adjacent savanna systems include soil heat flux, soil moisture, and soil temperature profiles (from the soil surface to bedrock), as well as canopy profiles of CO_2 concentration, humidity, and air temperature. Intermittent measurements of soil surface CO_2 flux and spatially distributed soil moisture and soil temperature measurements.

Skukuza Eddy Covariance Tower

The Skukuza research site is the focus of several complementary studies by colleagues from South Africa and elsewhere relating to savanna biophysics, radiative transfer, and biogeochemistry. Among others, these include the EOS validation activities of the SAVE (Southern Africa Validation of EOS) project, which includes measurement of canopy radiative transfer, bidirectional reflectance, leaf area index, and primary production. Other studies include measurements of nitrogen oxide and methane sources and sinks and measurements of volatile organic compound emissions at both leaf and canopy scale.

Acacia Profile Tower

Instrumentation on the Skukuza Eddy Covariance Tower

(instrument data in BLUE are NOT included in this data set)

Measurement	Instrument Type	Make & Model	Output Units	Instrument Height (m)
Turbulence (u,v,w)	3-D Sonic anemometer	Gill Wind Master Pro	m s^{-1}	16
CO_2 mixing ratio	Infrared gas analyzer	LiCor 6262	mmol mol^{-1}	16
H_2O mixing ratio	Infrared gas analyzer	LiCor 6262	mmol mol^{-1}	16
Air pressure	Barometric pressure sensor	Vaisala Barocap	mb	16
Air temperature	PT1000	Vaisala HMP45C	°C	16

Relative humidity	Capacitive RH sensor	Vaisala HMP45C	%	16
Incoming/ reflected shortwave radiation	Pyranometer	Kipp & Zonen CM14	W m^{-2}	20
Incoming/emitted longwave radiation	Pyrgeometer	Kipp & Zonen CG2 1	W m^{-2}	20
Precipitation	Tipping bucket rain gauge	Texas Instruments TE525	mm	21
Wind speed	Cup anemometer	Climatronics F460	m s^{-1}	22
Wind direction	Wind vane	Climatronics F460	Degrees North	22

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Additional Sources of Information

Related Data Sets

The Skukuza research site is the focus of several complementary studies by colleagues from South Africa and elsewhere relating to savanna biophysics, radiative transfer and biogeochemistry. Among others, these include the EOS validation activities of the SAVE project, which includes measurement of canopy radiative transfer, bidirectional reflectance, leaf area index, and primary production (Privette and Mukelabai, 2004; Pinheiro and Privette, 2004; Scholes, 2004). Other studies include measurements of nitrogen oxide and methane sources and sinks (Otter, 2004), and measurements of volatile organic compound emissions at both leaf and canopy scale (James et al., 2004; Guenther et al., 2004).

Additional data collected from the Skukuza tower not included in this data set (see

instrument table above) can be requested directly from the PI. See the contact information provided below.

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Scholes, R. J. 2004. SAFARI 2000 Woody Vegetation Characteristics of Kalahari and Skukuza Sites. Data set. Available on-line [http://daac.ornl.gov/] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A.

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