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DERIVING DAYTIME VARIABLES FROM THE AMERIFLUX STANDARD EDDY COVARIANCE DATA SET

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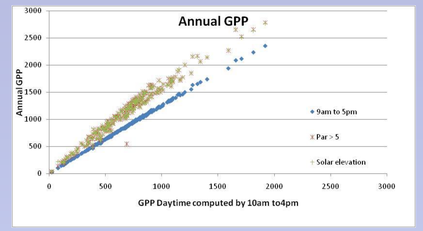
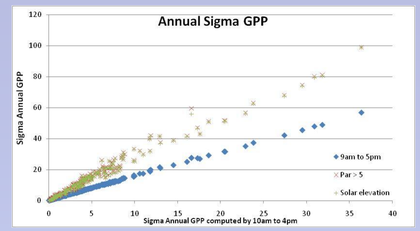
Abstract

A gap-filled, quality assessed eddy covariance dataset has recently become available for the AmeriFlux network. This dataset uses standard processing and produces commonly used science variables. This shared dataset enables robust comparisons across different analyses. Of course, there are many remaining questions. One of those is how to define "during the day" which is an important concept for many analyses. Some studies have used local time – for example 9am to 5pm; others have used thresholds on photosynthetic active radiation (PAR). A related question is how to derive quantities such as the Bowen ratio. Most studies compute the ratio of the averages of the latent heat (LE) and sensible heat (H). In this study, we use different methods of defining "during the day" for GPP, LE, and H. We evaluate the differences between methods in two ways. First, we look at a number of statistics of GPP. Second, we look at differences in the derived Bowen ratio. Our goal is not science per se, but rather informatics in support of the science.

203 site-years of data from 53 AmeriFlux sites were used in this study

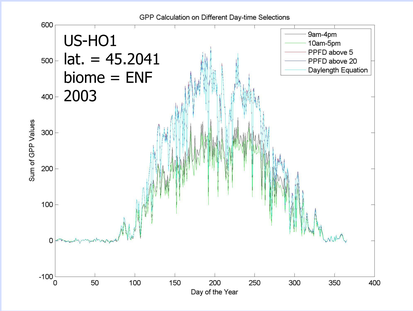




The daytime values computed with local time daytime differ from those computed with PAR > 5 or solar elevation. The computed daytimes always give a higher value of GPP.

Example computations of daytime GPP over a site year.

Local time based daytimes are simple time windows of 9am to 5pm and 10am to 4pm.

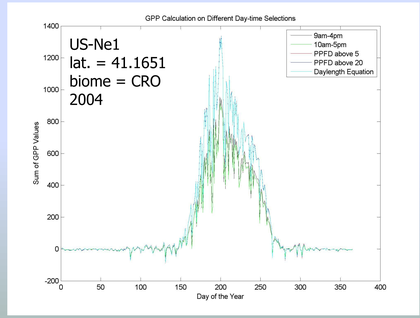


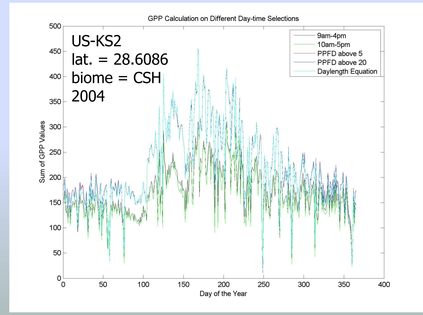
PAR (or PPFD) daytime uses the observed photosynthetic active radiation flux data. "Daytime" is when PAR > is above 5 or above 20.

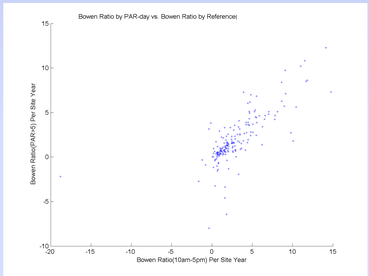
Solar elevation (or daylength equation) daytime is centered at local noon with a length of day (Daylength) computed as:

Declination = 23.5 * cos(2π * (DayOfYear – 172) /365)

Daylength = acos(- tan(π * Latitude /180) * tan(π * Declination/180)) * 2/15 *180/π



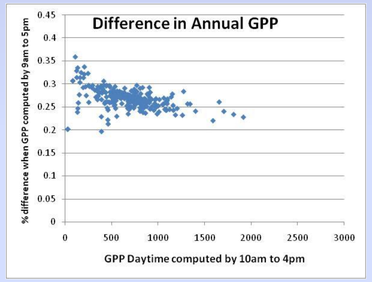




Daytime values of Bowen Ratio computed by solar elevation and PAR>5 differ more than the daily GPP values. We're don't yet know why.

site ID	Name	Tower PI	PI E-Mail
US-ARb	ARM Southern Great Plains burn site-Lamont	Margaret Torn	mstorn@lbl.gov
US-ARc	ARM Southern Great Plains control site- Lamont	Margaret Torn	mstorn@lbl.gov
US-ARM	ARM Southern Great Plains site-Lamont	Margaret Torn	mstorn@lbl.gov
US-Bar	Bartlett Experimental Forest	Andrew Richardson	andrew.richardson@unh.edu
US-Blo	Blodgett Forest	Allen Goldstein	ahg@nature.berkeley.edu
US-Bo2	Bondville (companion site)	Carl Bernacchi	bernacch@uiuc.edu
US-Dk1	Duke Forest-open field	Gaby Katul	gaby@duke.edu
US-Dk2	Duke Forest-hardwoods	Gaby Katul	gaby@duke.edu
US-Dk3	Duke Forest - loblolly pine	Gaby Katul	gaby@duke.edu
US-Fmf	Flagstaff - Managed Forest	Sabina Dore	Sabina.Dore@nau.edu
US-FR2	Freeman Ranch- Mesquite Juniper	Marcy Litvak	mlitvak@unm.edu
US-Fuf	Flagstaff - Unmanaged Forest	Sabina Dore	Sabina.Dore@nau.edu
US-Fwf	Flagstaff - Wildfire	Sabina Dore	Sabina.Dore@nau.edu
US-Ha1	Harvard Forest EMS Tower (HFR1)	Bill Munger	jwmunger@seas.harvard.edu
US-Ha2	Harvard Forest Hemlock Site	Julian Hadley	jhadley@fas.harvard.edu
US-Ho1	Howland Forest (main tower)	Dave Hollinger	davidh@hypatia.unh.edu
US-Ho2	Howland Forest (west tower)	Dave Hollinger	davidh@hypatia.unh.edu
US-IB1	Fermi National Accelerator Laboratory-Batavia (Agricultural site)	Roser Matamala	matamala@anl.gov
US-IB2	Fermi National Accelerator Laboratory-Batavia (Prairie site)	Roser Matamala	matamala@anl.gov
US-KS1	Kennedy Space Center (slash pine)	Bert Drake	drakeb@si.edu
US-KS2	Kennedy Space Center (scrub oak)	Bert Drake	drakeb@si.edu
US-Los	Lost Creek	Ken Davis	davis@essc.psu.edu
US-LPH	Little Prospect Hill	Julian Hadley	jhadley@fas.harvard.edu
US-Me1	Metolius - Eyerly burn	Bev Law	bev.law@oregonstate.edu
US-Me2	Metolius-intermediate aged ponderosa pine	Bev Law	bev.law@oregonstate.edu
US-Me3	Metolius-second young aged pine	Bev Law	bev.law@oregonstate.edu
US-Me4	Metolius-old aged ponderosa pine	Bev Law	bev.law@oregonstate.edu
US-MMS	Morgan Monroe State Forest	Danilo Dragoni	ddragoni@indiana.edu

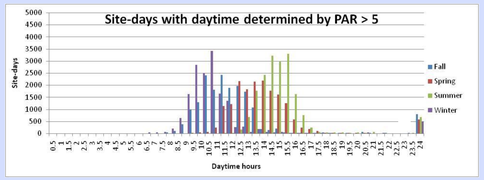
site ID	Name	Tower PI	PI E-Mail
US-Me1	Metolius - Eyerly burn	Bev Law	bev.law@oregonstate.edu
US-Me2	Metolius-intermediate aged ponderosa pine	Bev Law	bev.law@oregonstate.edu
US-Me3	Metolius-second young aged pine	Bev Law	bev.law@oregonstate.edu
US-Me4	Metolius-old aged ponderosa pine	Bev Law	bev.law@oregonstate.edu
US-MMS	Morgan Monroe State Forest	Danilo Dragoni	ddragoni@indiana.edu
US-MOz	Missouri Ozark Site	Lianhong Gu	lianhong-gu@ornl.gov
US-NC1	NC_Clearcut	Jiquan Chen	Jiquan.Chen@utoledo.edu
US-NC2	NC_Loblolly Plantation	Jiquan Chen	Jiquan.Chen@utoledo.edu
US-Ne1	Mead - irrigated continuous maize site	Shashi Verma	sverma@unlinotes.unl.edu
US-Ne2	Mead - irrigated maize-soybean rotation site	Shashi Verma	sverma@unlinotes.unl.edu
US-Ne3	Mead - rainfed maize-soybean rotation site	Shashi Verma	sverma@unlinotes.unl.edu
US-NR1	Niwot Ridge Forest (LTER NWT1)	Russ Monson	Russell.Monson@colorado.edu
US-Oho	Oak Openings	Jiquan Chen	Jiquan.Chen@utoledo.edu
US-PFa	Park Falls/WLEF	Ken Davis	davis@essc.psu.edu
US-SRM	Santa Rita Mesquite	Russ Scott	rscott@tucson.ars.ag.gov
US-Syv	Sylvania Wilderness Area	Ken Davis	davis@essc.psu.edu
US-Ton	Tonzi Ranch	Dennis Baldocchi	baldocchi@nature.berkeley.edu
US-UMB	Univ. of Mich. Biological Station	Peter Curtis	curtis.7@osu.edu
US-Var	Vaira Ranch- Ione	Dennis Baldocchi	baldocchi@nature.berkeley.edu
US-WCr	Willow Creek	Ken Davis	davis@essc.psu.edu
US-Wi0	Young red pine (YRP)	Jiquan Chen	Jiquan.Chen@utoledo.edu
US-Wi1	Intermediate hardwood (IHW)	Jiquan Chen	Jiquan.Chen@utoledo.edu
US-Wi2	Intermediate red pine (IRP)	Jiquan Chen	Jiquan.Chen@utoledo.edu
US-Wi4	Mature red pine (MRP)	Jiquan Chen	Jiquan.Chen@utoledo.edu
US-Wi5	Mixed young jack pine (MYJP)	Jiquan Chen	Jiquan.Chen@utoledo.edu
US-Wi6	Pine barrens #1 (PB1)	Jiquan Chen	Jiquan.Chen@utoledo.edu
US-Wi7	Red pine clearcut (RPCC)	Jiquan Chen	Jiquan.Chen@utoledo.edu
US-Wi8	Young hardwood clearcut (YHW)	Jiquan Chen	Jiquan.Chen@utoledo.edu
US-Wi9	Young jack pine (YJP)	Jiquan Chen	Jiquan.Chen@utoledo.edu
US-Wkg	Walnut Gulch Kendall Grasslands	Russ Scott	rscott@tucson.ars.ag.gov

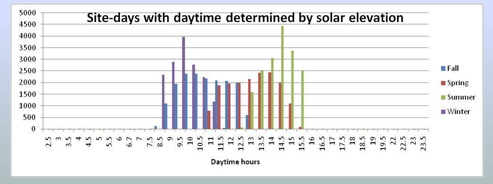


Annual values of GPP computed with local time daytime tend to be consistent. The 9am to 5pm daytime values tend to be 25% larger – a bit less than simple linear scaling of the time window. The differences are larger with smaller annual GPP values.

While the annual values of GPP computed with the PAR > 5 and solar elevation tend to be the same, the actual duration of the "daytime" are different.

The plots at left show the number of site-days with a given length of daytime. Season are defined with 3 month duration; winter begins in December.





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URL: http://www.fluxdata.org/