EddyPro and SMARTFlux Outputs

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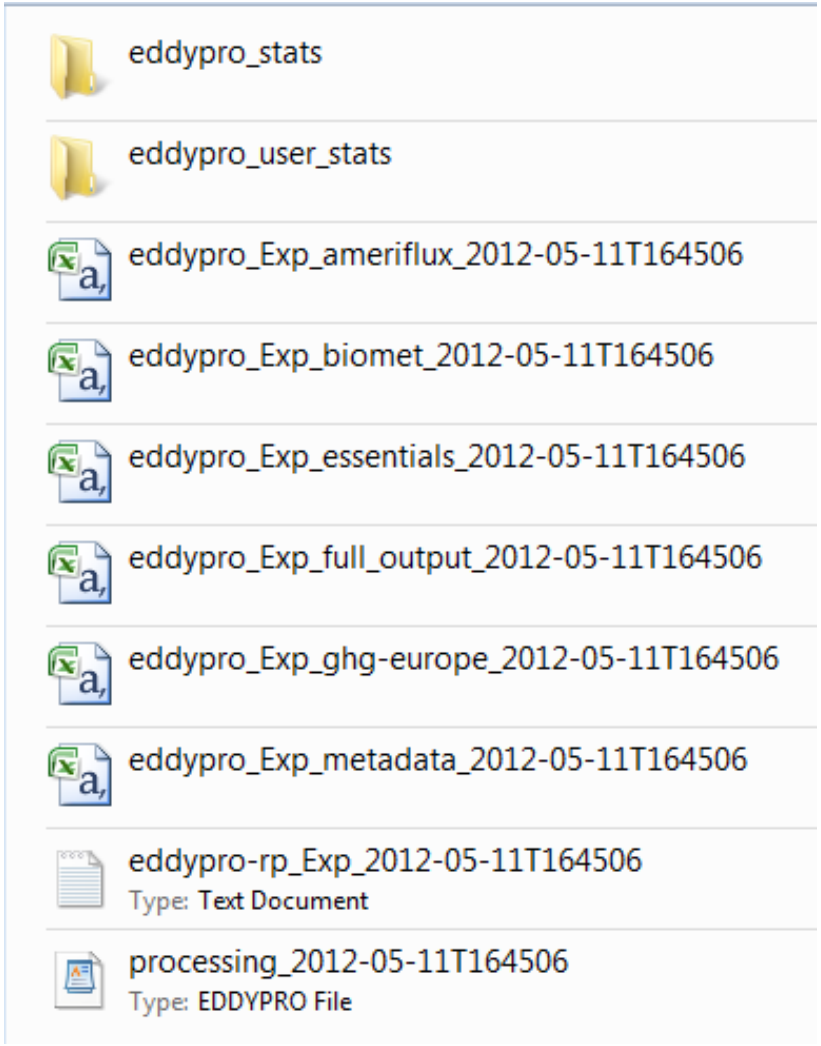
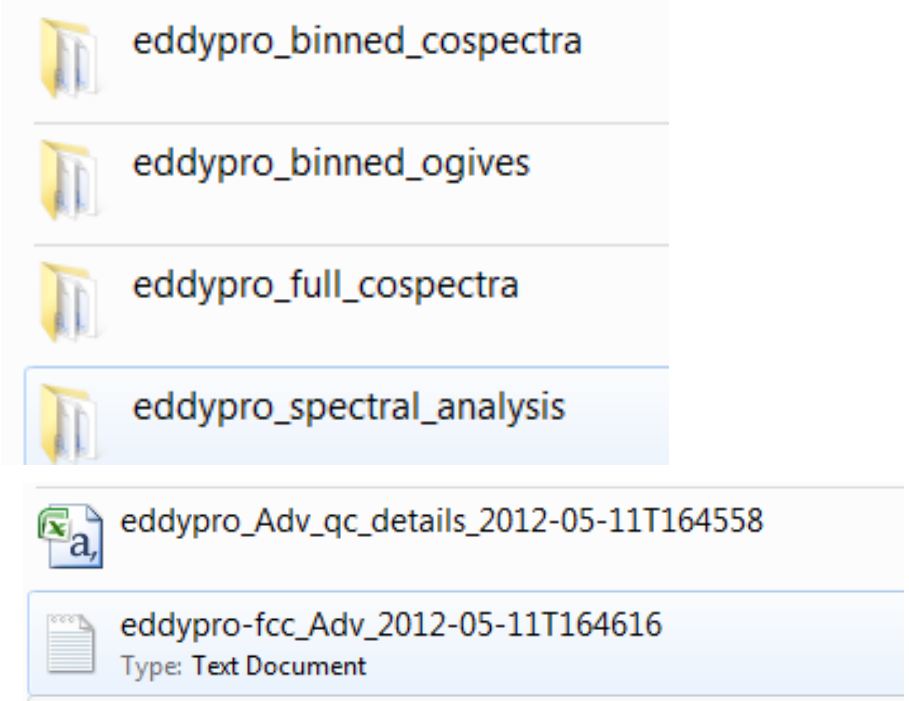
EddyPro Outputs

Express Mode



Advanced Mode

1. More output files



2. Able to choose output files

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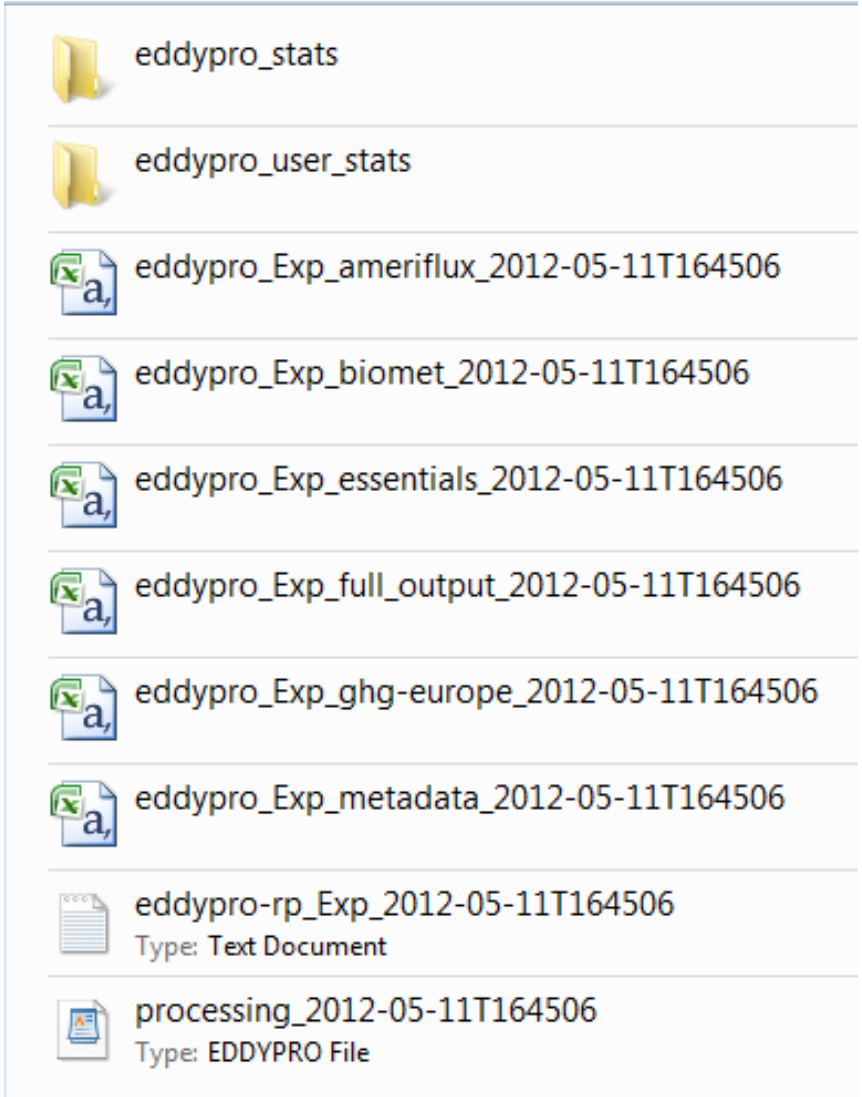
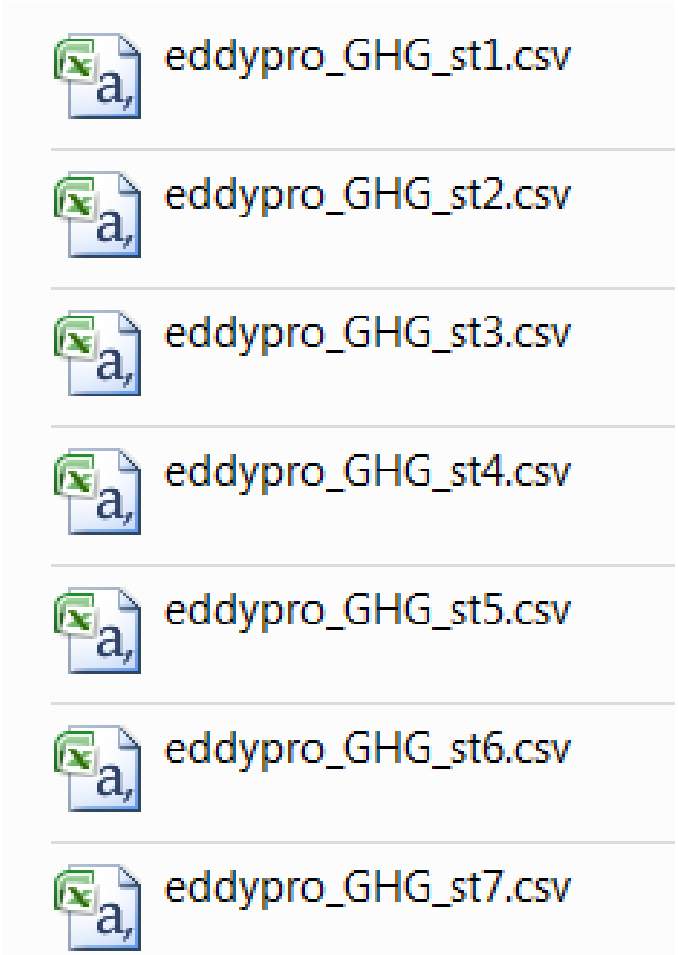
EddyPro Outputs –Express Mode



Similarity I: Eddypro_stats and Eddypro_user_stats



1. Unprocessed (data set as imported from the raw file)
2. After de-spiking
3. After cross-wind correction
4. After angle-of attack correction
5. After double rotation for tilt correction
6. After time lag compensation
7. After de-trending

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Similarity II: Eddypro_stats and Eddypro_user_stats

Label	Description
filename	name of the raw file (or first file of a set) from which the data in the current averaging interval was extracted
date	date of the end of the averaging period
time	time of the end of the averaging period
n_samples	number of valid records found in the raw file (or set of raw files)
mean (*var*)	mean value of variable (*var*)
var (*var*)	variance of variable (*var*)
cov (u/*var*)	covariance between the *u* wind component and *var*
cov(v/*var*)	covariance between the *v* wind component and *var*
cov (w/*var*)	covariance between the *w* wind component and *var*
st_dev(*var*)	standard deviation of variable *var*
skw(*var*)	skewness of variable *var*
kur(*var*)	kurtosis of variable *var*

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Difference: Eddypro_stats and Eddypro_user_stats

Sensitive variables

- used for flux calculation

- Wind components (u, v, w)
- Sonic temperature (Ts) or speed-of-sound (sos)
- Gas concentrations/densities for CO_2, H_2O, CH_4 or N_2O
- Temperatures (Tcell, Tin and Tout) and cell pressure (Pcell)

Non-senstive variables

- not used for flux calculation

- Despiking
- Tilt correction
- Detrending
- Time lag compensation
- Calculation of main statistics

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EddyPro Output File Formats

- Eddypro_output_ID_ameriflux_yyyy_mm_ddTHHMMSS.csv
  (Output file in AmeriFlux format)

- Eddypro_output_ID_biomet_yyyy_mm_ddTHHMMSS.csv
  (Mean biomet values of flux averaging period)

- Eddypro_output_ID_essentials_yyyy_mm_ddTHHMMSS.csv
  (Intermediate results file from raw data processing)

- **Eddypro_output_ID_full_yyyy_mm_ddTHHMMSS.csv**
  (Final results file from raw data processing)

- Eddypro_output_ID_ghg-europe_yyyy_mm_ddTHHMMSS.csv
  (Output file in ghg Europe format)

- Eddypro_output_ID_metadata_yyyy_mm_ddTHHMMSS.csv
  (All the metadata used for flux calculations)

- Eddypro-rp_output_ID_yyyy_mm_ddTHHMMSS.log
  (A log of processing)

- processing_yyyy_mm_ddTHHMMSS.eddypro
  (EddyPro settings for the essentials output file)

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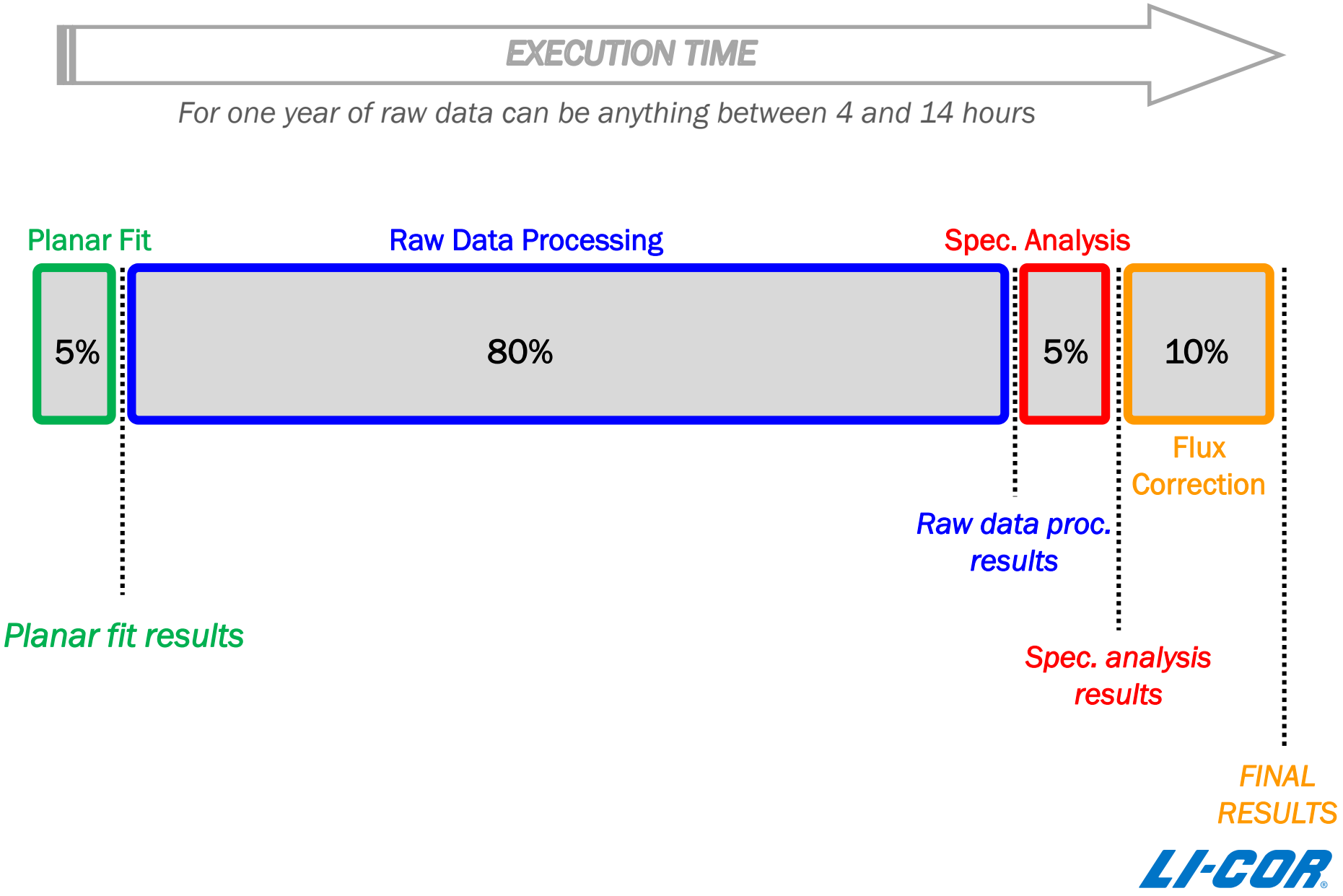
What is an Essentials Output File ?



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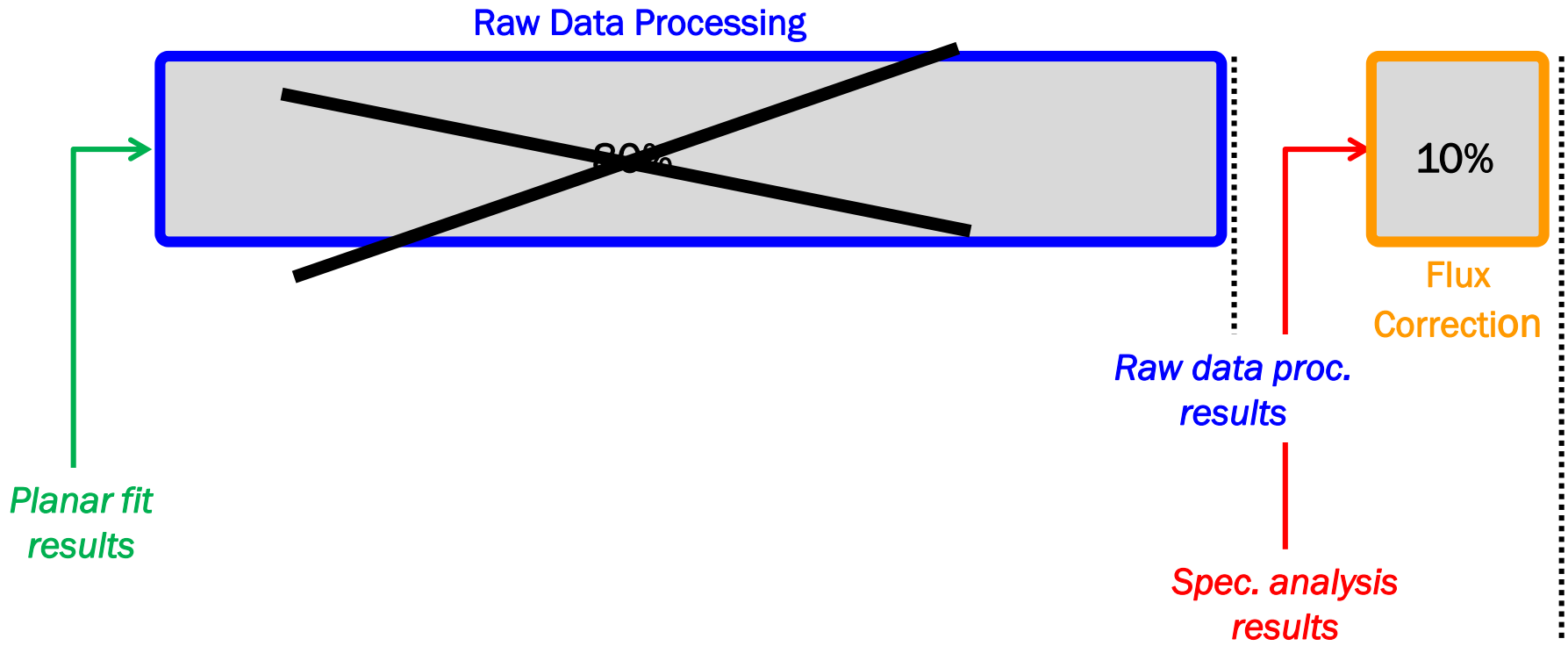
Why do We Need an Essentials Output File ?

For one year of raw data can be anything between 4 and 14 hours



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Full Output File – File Information

filename	-	name of the raw file (or the first of a set) from which the data set for the current averaging interval was extracted
date	yyyy-mm-dd	date of the end of the averaging period
time	HH:MM	time of the end of the averaging period
file_records	#	number of valid records found in the raw file (or set of raw files)
used_records	#	number of valid records used for current the averaging period

Raw data file: Start of the logging period

Output file: End of the averaging period

filename	date	time
	[yyyy-mm	[HH:MM]
2011-04-05T050000_AIU-0205.ghg	4/5/2011	5:30
2011-04-05T053000_AIU-0205.ghg	4/5/2011	6:00
2011-04-05T060000_AIU-0205.ghg	4/5/2011	6:30

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Corrected Fluxes and Quality Flags

Tau	kg m^{-1} s^{-2}	corrected momentum flux
qc_Tau	#	quality flag for momentum flux
H	W m^{-2}	corrected sensible heat flux
qc_H	#	quality flag for sensible heat flux
LE	W m^{-2}	corrected latent heat flux
qc_LE	#	quality flag latent heat flux
*gas*_flux	µmol m^{-2} s^{-1} (†)	corrected *gas* flux
qc_*gas*_flux	#	quality flag for *gas* flux

- Gases: CO_2, H_2O, CH_4, and N_2O
- For gases, equal to Net Ecosystem Exchange (NEE)
- Final flux results.

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Storage Fluxes

H_strg	W m^{-2}	estimate of storage sensible heat flux
LE_strg	W m^{-2}	estimate of storage latent heat flux
*gas*_strg	µmol m^{-2} s^{-1} (†)	estimate of storage *gas* flux

$$S = \int_0^z \frac{\partial CO_2}{\partial t} dz$$

- Storage terms are estimated from concentrations based on a 1-point profile
- Corrected fluxes do not include storage fluxes

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Gas and Air Properties

*gas*_molar_density	mmol m^{-3}	measured or estimated molar density of *gas*
*gas*_mole_fraction	µmol m^{-3} (†)	measured or estimated mole fraction of *gas*
*gas*_mixing_ratio	µmol m^{-3} (†)	measured or estimated mixing ratio of *gas*
air_temperature	K	mean temperature of ambient air, either calculated from high frequency air temperature readings, or estimated from sonic temperature
air_pressure	Pa	mean pressure of ambient air, either calculated from high frequency air pressure readings, or estimated based on site altitude (barometric pressure)
air_density	kg m^{-3}	density of ambient air

If no air temperature and pressure data available

- Air temperature is estimated from sonic temperature and water vapor density
- Air pressure is estimated based on site altitude (barometric pressure).

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Wind and Turbulence

Unrotated and rotated three wind components: u, v, and w

u_rot	m s^{-1}	rotated *u* wind component (mean wind speed)
v_rot	m s^{-1}	rotated *v* wind component (should be zero)
w_rot	m s^{-1}	rotated *w* wind component (should be zero)

Wind speed and direction

wind_speed	m s^{-1}	mean wind speed
max_wind_speed	m s^{-1}	maximum instantaneous wind speed
wind_dir	° (degrees)	direction from which the wind blows, with respect to Geographic or Magnetic north

Turbulence parameters

u*	m s^{-1}	friction velocity
TKE	$m^2 s^{-2}$	turbulent kinetic energy
L	M	Monin-Obukov length
(z-d)/L	#	Monin-Obukhov stability parameter

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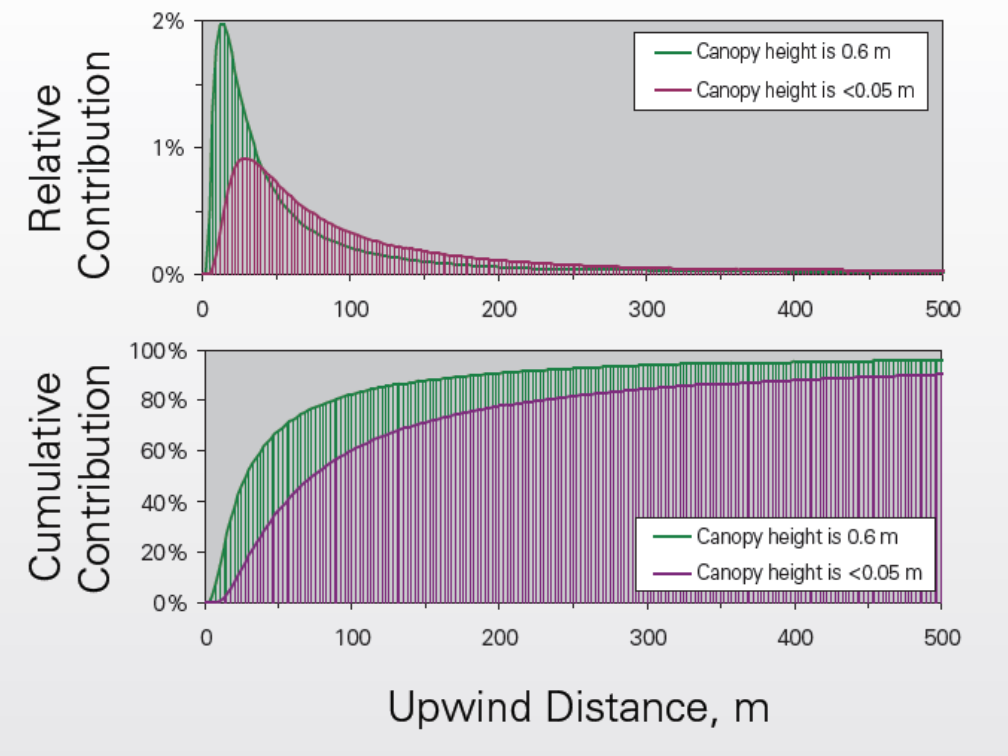
Footprint

x_peak	m	along-wind distance providing the highest (peak) contribution to turbulent fluxes
x_10%	m	along-wind distance providing 10% (cumulative) contribution to turbulent fluxes

x_30%, x-50%, x_70%, x_90%



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Spectral Correction Factors

un_Tau	kg m^{-1} s^{-2}	uncorrected momentum flux
Tau_scf	#	spectral correction factor for momentum flux
un_H	W m^{-2}	uncorrected sensible heat flux
H_scf	#	spectral correction factor for sensible heat flux
un_LE	W m^{-2}	uncorrected latent heat flux
LE_scf	#	spectral correction factor for latent heat flux
un_*gas*_flux	µmol m^{-2} s^{-1} (†)	uncorrected *gas* flux
gas_scf	#	spectral correction factor for gas flux

- scf = F_{true} / $F_{measured}$
- scf > 1

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Hard Flags and Diagnostics

spikes	HFu/v/w/ts/co2 /h2o/ch4/n2	hard flags for individual variables for spike test
amp_res	HFu/v/w/ts/co2 /h2o/ch4/n2	hard flags for individual variables for amplitude resolution
drop_out	HFu/v/w/ts/co2 /h2o/ch4/n2	hard flags for individual variables for drop-out test

- Flagged for quality issues based on various criteria
- Flags 0 for good quality,1 for bad quality, and 9 for values not calculated

HFu/v/w/ts/co2/h2o/ch4/n2

HF00000099

DP	DQ	DR	DS	DT	DU
diagnostic_flags_LI-7500A				diagnostic_flags_LI-7700	
chopper_LI-7500	detector_LI-7500	pll_LI-7500	sync_LI-7500	not_ready_LI-7700	no_signal_LI-7700
[#_flagged_recs]	[#_flagged_recs]	[#_flagged_recs]	[#_flagged_recs]	[#_flagged_recs]	[#_flagged_recs]
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

Custom Variables

EV	EW	EX	EY
custom_variables			
air_t_mean	air_p_mean	co2_mean	h2o_mean
--	--	--	--
287.6563945	97529.49232	378.9224766	13.67288579
287.5615905	97536.26254	378.8656877	13.40743966
286.6554498	97529.12577	379.7712094	13.64764479
286.3570617	97535.46518	380.8968833	13.9376531
285.7731864	97559.73668	382.3884786	13.95274986
285.5737962	97570.94328	380.9291808	13.63473591
285.3251548	97582.13416	381.6878291	13.15995196
284.7614498	97593.73383	384.0084412	12.6089211

- Variables not used for flux computation
- No unit output

Outputs from Advanced Mode

Express Mode

- eddypro_stats
- eddypro_user_stats
- eddypro_Exp_ameriflux_2012-05-11T164506
- eddypro_Exp_biomet_2012-05-11T164506
- eddypro_Exp_essentials_2012-05-11T164506
- eddypro_Exp_full_output_2012-05-11T164506
- eddypro_Exp_ghg-europe_2012-05-11T164506
- eddypro_Exp_metadata_2012-05-11T164506
- eddypro-rp_Exp_2012-05-11T164506
  Type: Text Document
- processing_2012-05-11T164506
  Type: EDDYPRO File

Advanced Mode

More output files

- eddypro_binned_cospectra
- eddypro_binned_ogives
- eddypro_full_cospectra
- eddypro_spectral_analysis
- eddypro_Adv_qc_details_2012-05-11T164558
- eddypro-fcc_Adv_2012-05-11T164616
  Type: Text Document

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Full and Binned Spectra or Co-spectra

- Full spectra or co-spectra

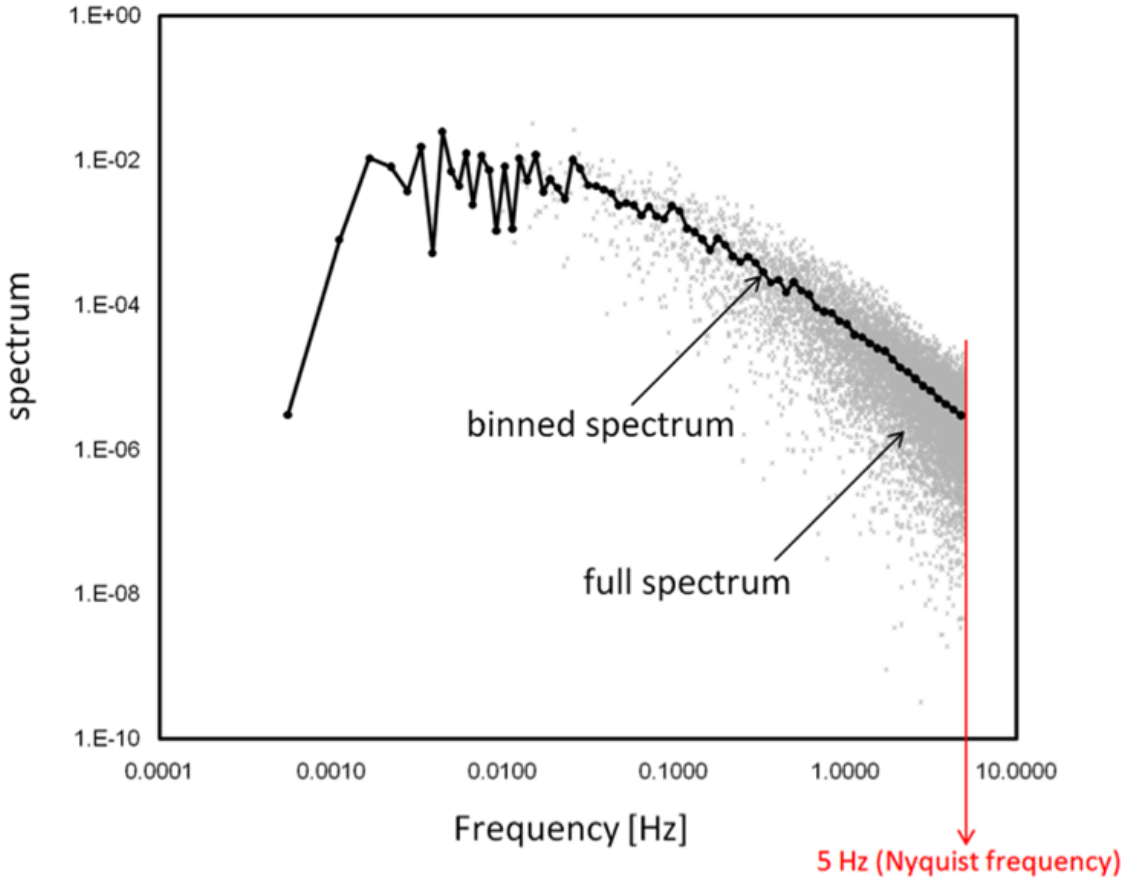
0.00056 (=1/(30*60)) – 5 (=10/2) s

9000 frequencies

- Binned spectra or co-spectra

0.00056 (=1/(30*60)) – 5 (=10/2) s

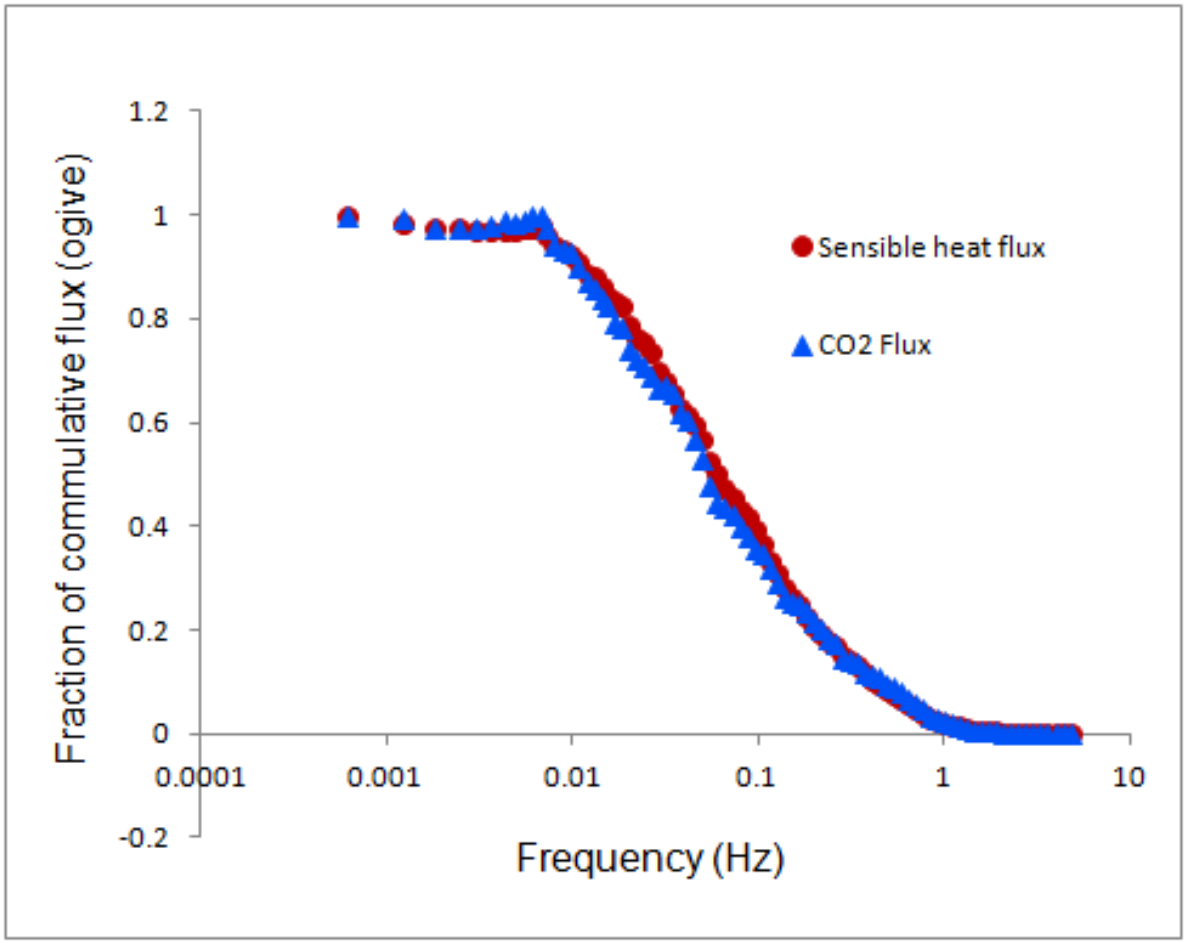
User-specified number of exponentiall spaced frequency bins (100 as default)



Spectral or Co-spectral Ogives

$$\mathrm{Og}_{\mathrm{wc}}(f) = \int_{f_{\mathrm{high}}}^{f} \mathrm{Co}_{\mathrm{wc}}(f)\,\mathrm{d}f$$

Integration of co-spectra from the current frequency to the Nyquist frequency



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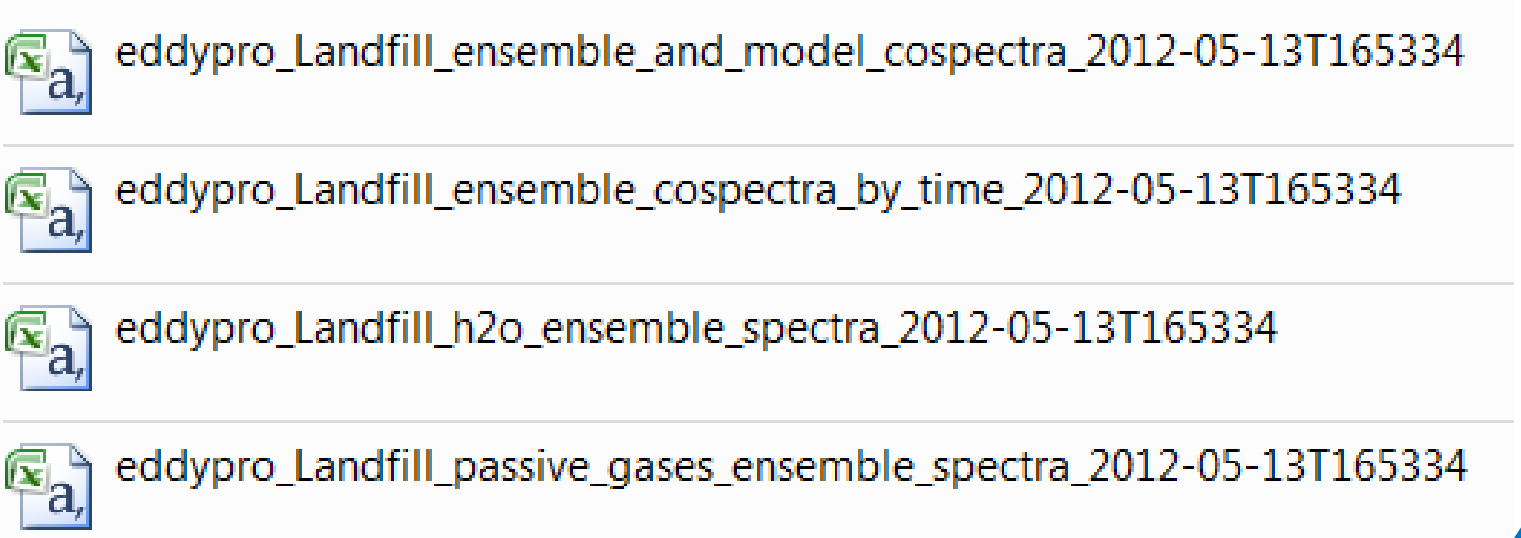
Spectral Analysis

1. Ensemble and modeled cospectra
   – average, Massman fitted, and Kaimal model
   1) Stable (-650 < L< 0)
   2) Unstable (0 < L< 1000)

2. Binned average cospectra every three hours sorted by time of day

3. Binned average and predicted H_2O spectra sorted by RH-class

4. Binned average and predicted spectra for CO_2 and CH_4



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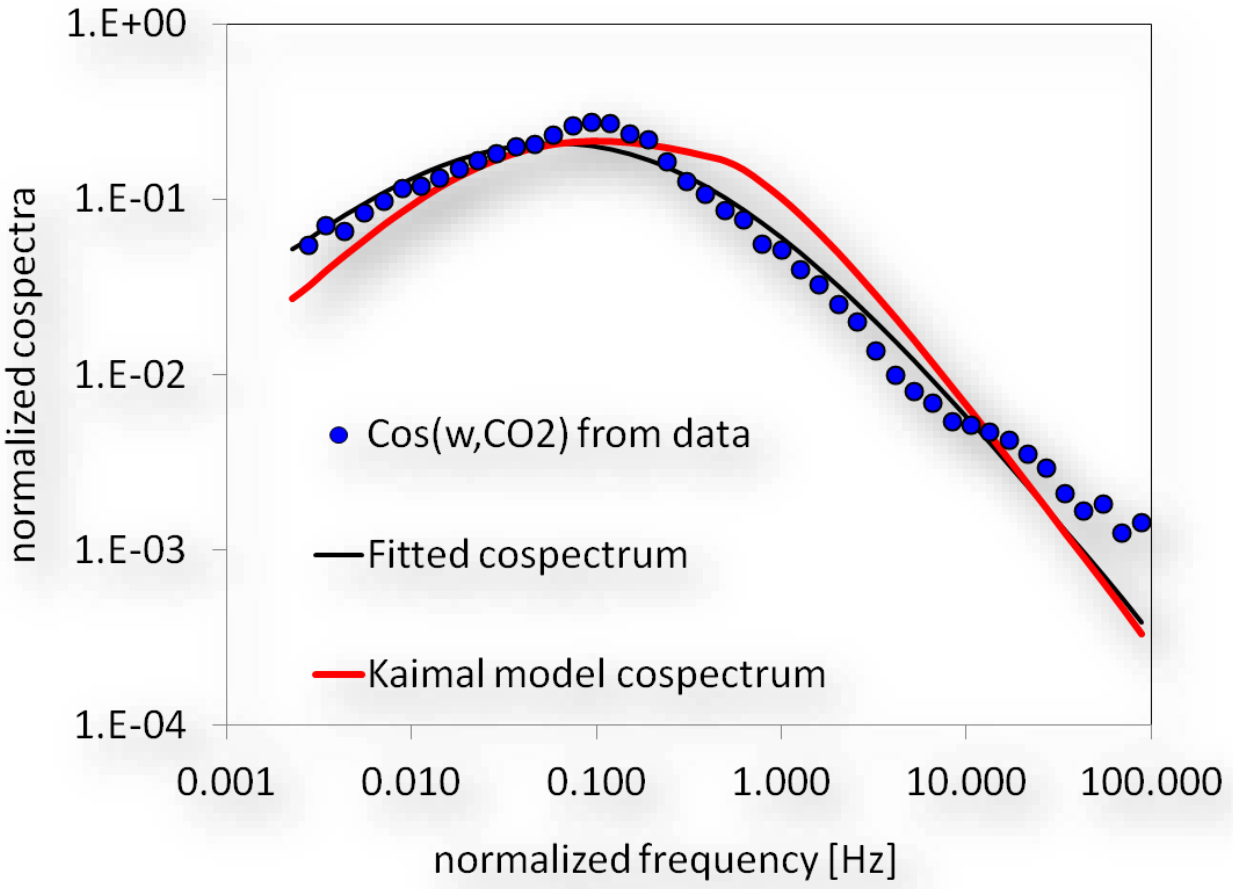
Ensemble Cospectra Sorted by Stability Regimes

Months ensemble cospectra for all unstable periods



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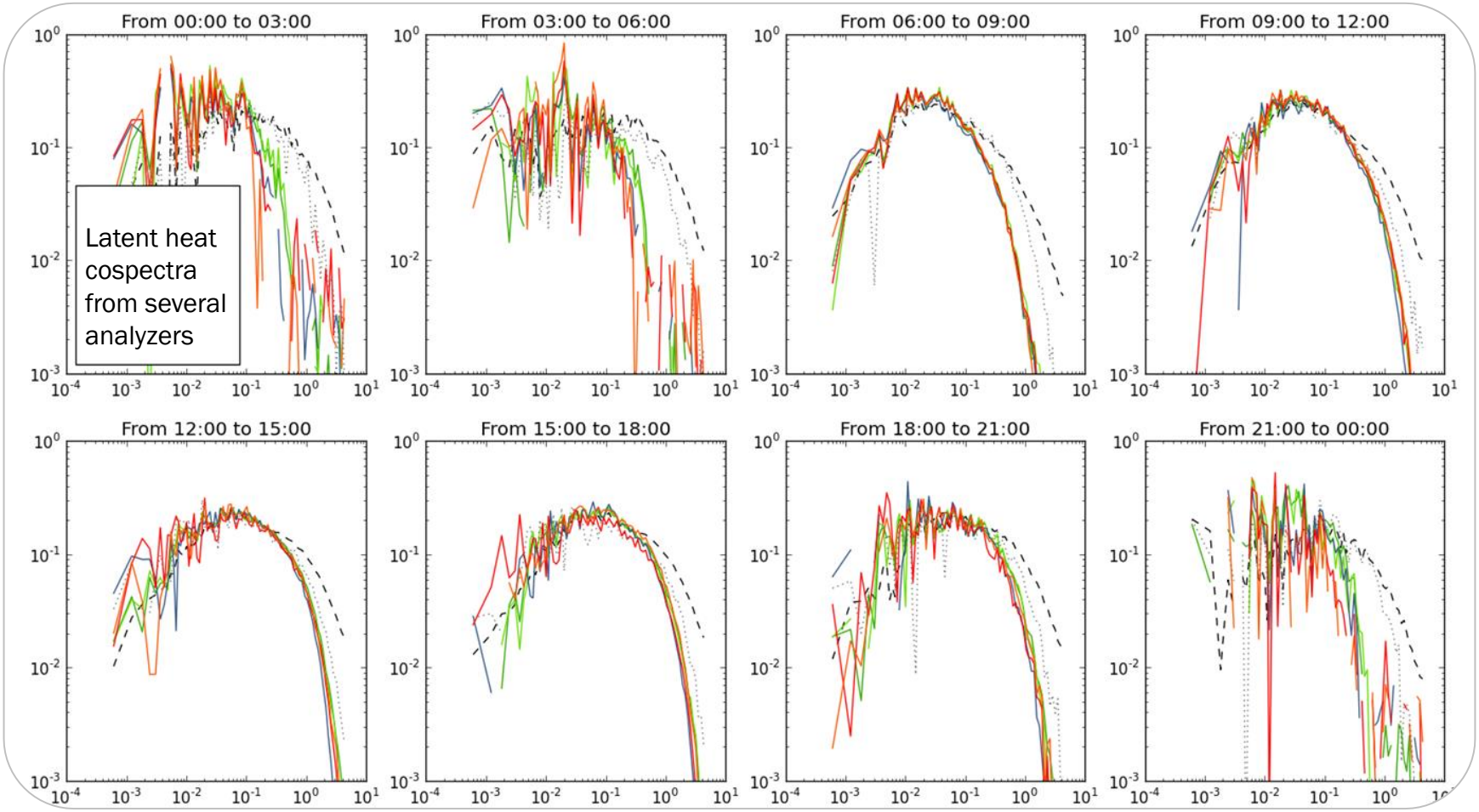
Ensemble Cospectra Sorted by Time-of-day



Biomet Data Output File

Mean Biomet values of flux averaging period

Eddypro_output ID_biomet_yyyy_mm_ddTHHMMSS.csv

File Type:	2				
Software Version:	5.9.7				
Timestamp:	0:01:15				
Timezone:	US/Central				
DATE	TIME	AIRTEMP(C)	BATTERY(V)	BATTERYTEMP(C)	GLOBRAD(W/m^2)
5/7/2012	00:02:00:000	14.8513	11.8387	16.6	-0.576236
5/7/2012	00:03:00:000	14.8266	12.1226	16.6	-0.615977
5/7/2012	00:04:00:000	14.7846	12.1157	16.6	-0.576236
5/7/2012	00:05:00:000	14.7611	12.2766	16.4	-0.655717
5/7/2012	00:06:00:000	14.7299	12.3153	16.4	-0.357664
5/7/2012	00:07:00:000	14.7439	12.3158	16.4	-0.87429
5/7/2012	00:08:00:000	14.7229	12.3185	16.4	-0.834549
5/7/2012	00:09:00:000	14.6905	12.3215	16.4	-0.476885
5/7/2012	00:10:00:000	14.7102	12.3197	16.4	-0.834549

EddyPro Output – More Information

EddyPro help: 1) EddyPro Help → Online help
2) Instruction Manual (PDF)

Shorthand for variables in output files from EddyPro.

Label	Units, Format, or Range	Description
filename	-	Name of the raw file (or the first of a set) from which the dataset for the current averaging interval was extracted
date	yyyy-mm-dd	Date of the end of the averaging period
time	HH:MM	Time of the end of the averaging period
file_records	#	Number of valid records found in the raw file (or set of raw files)

Biomet variables supported by EddyPro.

Variable	EddyPro Label	EddyPro Units	How to Write Units	Other Supported Units
Air Temperature	Ta	K	K	C, cC, F, cF, cK
Atmospheric pressure	Pa	Pa	Pa	hPa, kPa, PSI, Torr, mmHg, Atm, Bar
Relative humidity	RH	%	%	#

SMARTFlux Outputs

Archived Data

GHG Files

Zipped result output
for each EddyPro run

Flux and diagnostics
daily summary files

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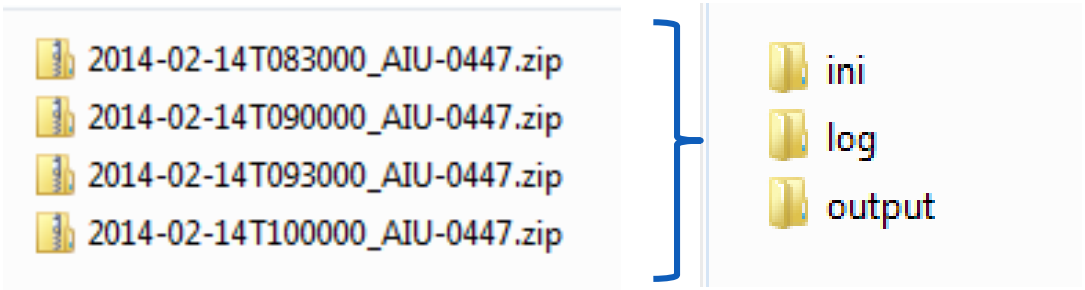
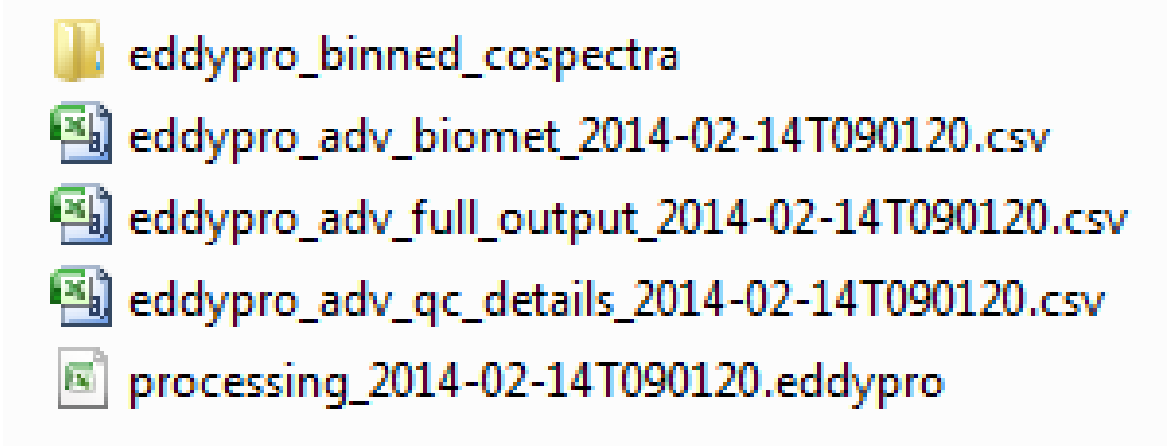
SMARTFlux Results Files



ini folder: Project file used to process the data
log folder: The EddyPro® engine log for the run
output folder: Selected output files



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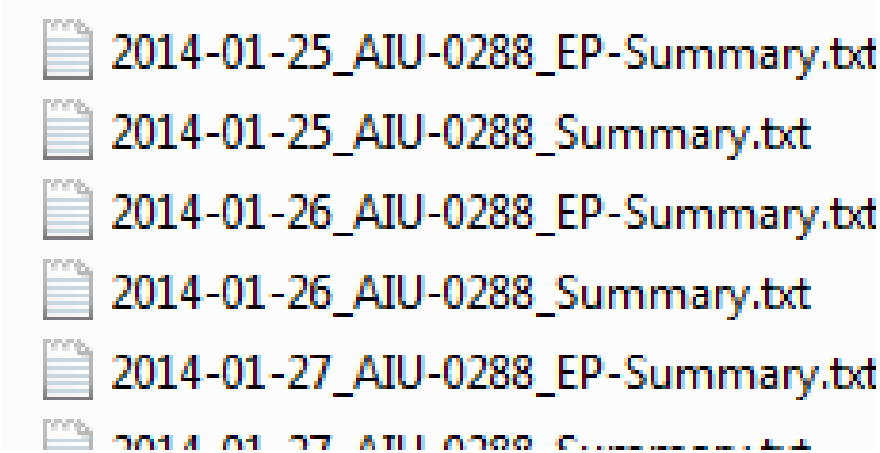
SMARTFlux Daily Summary Files

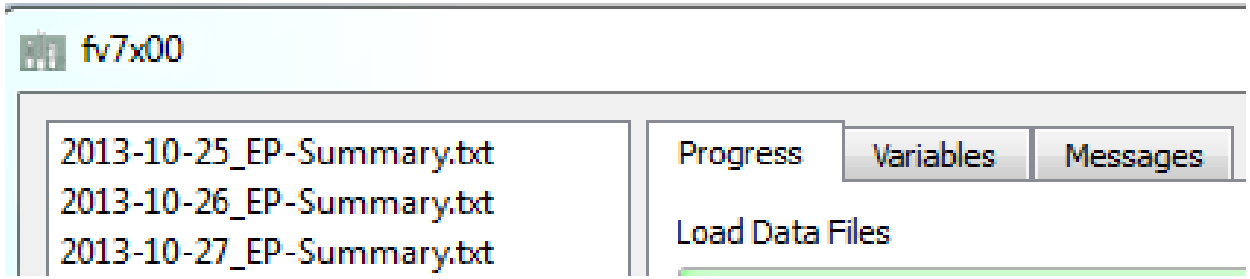
1. Flux Summary
   - Final fluxes for each half hour of the day

2. Diagnostic Summary
   - Means for each half hour of the day for the measured variables

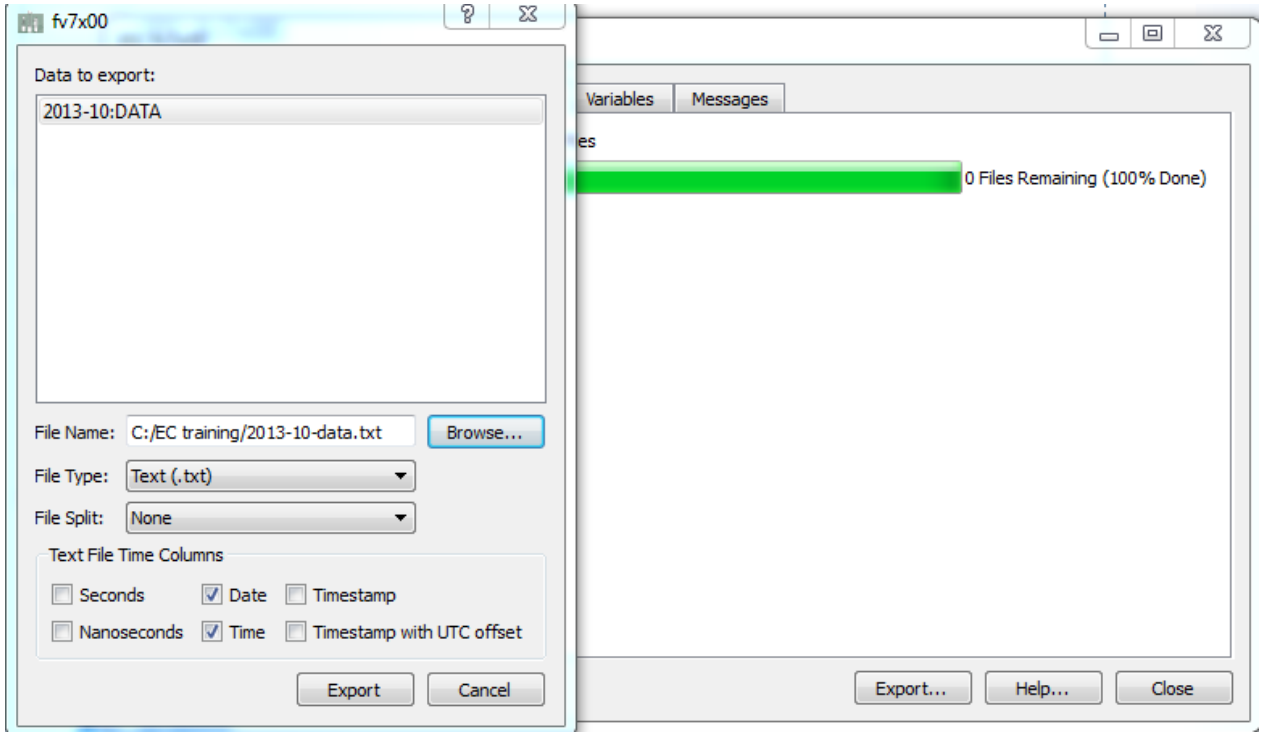


How to Combine Daily Summary Files

1. Add all the daily summary files to File Viewer



2. Export the files to a single text file



Thank You

Questions?

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