

Harvard Forest Data Archive HF103-03

Data File:

Name = hf103-03-flux-2004-2013.csv
Description = eddy flux (2004-2013)
Rows = 167198 Columns = 28
MD5 checksum = 08b7adf222ce52d039beea8d4744e5f7

Variables:

datetime = date and time
year = year
doy = day of the year with hours and minutes converted to a decimal
fraction of a day (nominalDay)
co2 = carbon dioxide concentration of the air drawn into the eddy
covariance system at 28 m above ground or about 5 m above the average tree
canopy top (measured by Licor LI7000 gas analyzer). Height raised to 29
m in November 2006. (dimensionless)
h2o = water vapor concentration of the air drawn into the eddy
covariance system at 28 m above ground or about 5 m above the average tree
canopy top (measured by Licor LI7000 gas analyzer). Height raised to 29
m in November 2006. (dimensionless)
u = wind speed measured by the sonic anemometer at 28 m or 5 m above
the average tree canopy top. Height raised to 29 m in November 2006.
(metersPerSecond)
ustar = friction velocity measured by the sonic anemometer at 28 m.
Friction velocity is the square of momentum flux from the atmosphere above
the sonic to the air layers below the sonic, and is a measure of
atmospheric turbulence (metersPerSecond)
wdir = compass direction in degrees of the average wind vector at 28
m, with 0 and 360 degrees indicating geographic north (degree)
h = sensible heat flux from the forest to the atmosphere, calculated
by the sonic anemometer from the covariance of air temperature and
the vertical component of wind velocity (wattPerMeterSquared)
le = flux of latent heat (heat used in evaporating water) from the
forest to the atmosphere, calculated by multiplying FH2O by the heat of
evaporation of water (wattPerMeterSquared)
fco2 = measured carbon dioxide (CO2) flux from forest to atmosphere.
Includes all data collected, some of which do not represent
hemlock-dominated forest or are invalid (micromolePerMeterSquaredPerSecond)
hem_fco2 = CO2 flux data exclusively for hemlock-dominated forest,
which occurs primarily to the SW of the tower (compass directions of
180 to 270 degrees) (micromolePerMeterSquaredPerSecond)
hem_fco2_filtered = CO2 flux data exclusively for hemlock-dominated
forest, which occurs primarily to the SW of the tower (compass directions
of 180 to 270 degrees), and after removal of data that with friction
velocity (ustar) below 0.4 m/s in which the measured nighttime CO2 flux
appeared to be turbulence-limited and not representative of ecosystem CO2
production (micromolePerMeterSquaredPerSecond)
hemlock_fco2_est = best estimate of CO2 flux, using either valid
measurement from the column to the left, or a model estimate
(micromolePerMeterSquaredPerSecond)

r_est = estimated ecosystem respiration. This is equal to Hemlock.FCO2.ustar.filtered at night, if this is available. Otherwise, it is an estimate of CO2 production by the ecosystem, based on a statistical model that uses soil and air temperatures and valid nighttime FCO2 values to predict FCO2 under other circumstances. By definition, R is greater than zero. (micromolePerMeterSquaredPerSecond)

gee_estimate = estimate of gross carbon fixation by the forest, calculated difference between NEE and R. By definition, GEE is a negative number. (micromolePerMeterSquaredPerSecond)

fh2o = measured water vapor flux from forest to atmosphere. Includes all data collected, some of which do not represent hemlock-dominated forest (millimolePerMeterSquaredPerSecond)

hem_fh2o = water vapor flux data exclusively for hemlock-dominated forest to the SW of the flux tower. Low turbulence (low ustar) data are not removed as the H2O flux is primarily from the canopy, which therefore does not act as a barrier to movement of H2O, as it does for the large amount of CO2 produced by soil and forest-floor litter. (millimolePerMeterSquaredPerSecond)

hem_fh2o_est = best estimate of H2O flux, using either valid measurement from the column to the left, or a model estimate. For most periods nighttime FH2O estimates were not made, because average measured nighttime H2O flux was very close to zero. (millimolePerMeterSquaredPerSecond)

sonic_tair = air temperature estimated from the speed of sound measured by the sonic anemometer. This estimate is based on air density, which is directly related to the speed of sound. The sonic air temperature estimate can differ from actual air temperature by a few degrees due to variation in the concentration of water vapor, which lowers air density. (celsius)

tair_above_canopy = air temperature measured above the canopy at 24 m height by a Campbell Scientific HMP35C sensor. (celsius)

rh_above_canopy = relative humidity measured above the canopy at 24 m height by a Campbell Scientific HMP35C sensor (dimensionless)

tair_above_canopy_tc = air temperature measured by a shaded thermocouple mounted at 24m, just below the top platform of the scaffolding tower to which the mast holding the sonic anemometer and air intake port for CO2 and H2O measurements is mounted at 28 m. This air temperature is used only in making flux estimates only if the HMP35C temperature sensor is not working correctly. (celsius)

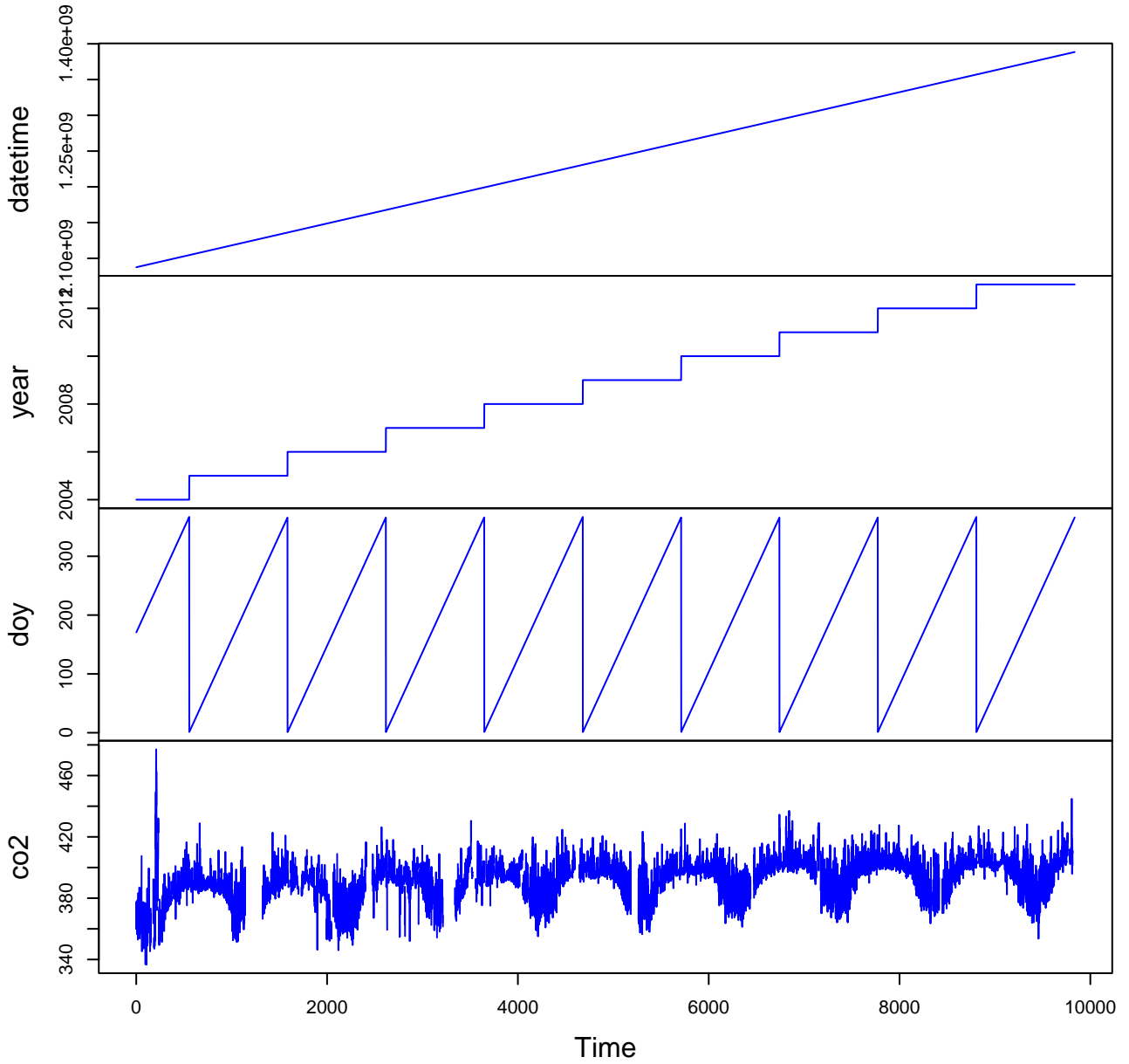
vpd_above_canopy = water vapor pressure deficit (Equals saturation water vapor pressure at Tair.above.canopy, minus actual water vapor pressure calculated as saturation vapor pressure times relative humidity) (kilopascal)

tsoil_10cm = soil temperature measured at 10 cm depth. The average of 3 to 4 values at randomly located points within 15 m of the flux tower base. (celsius)

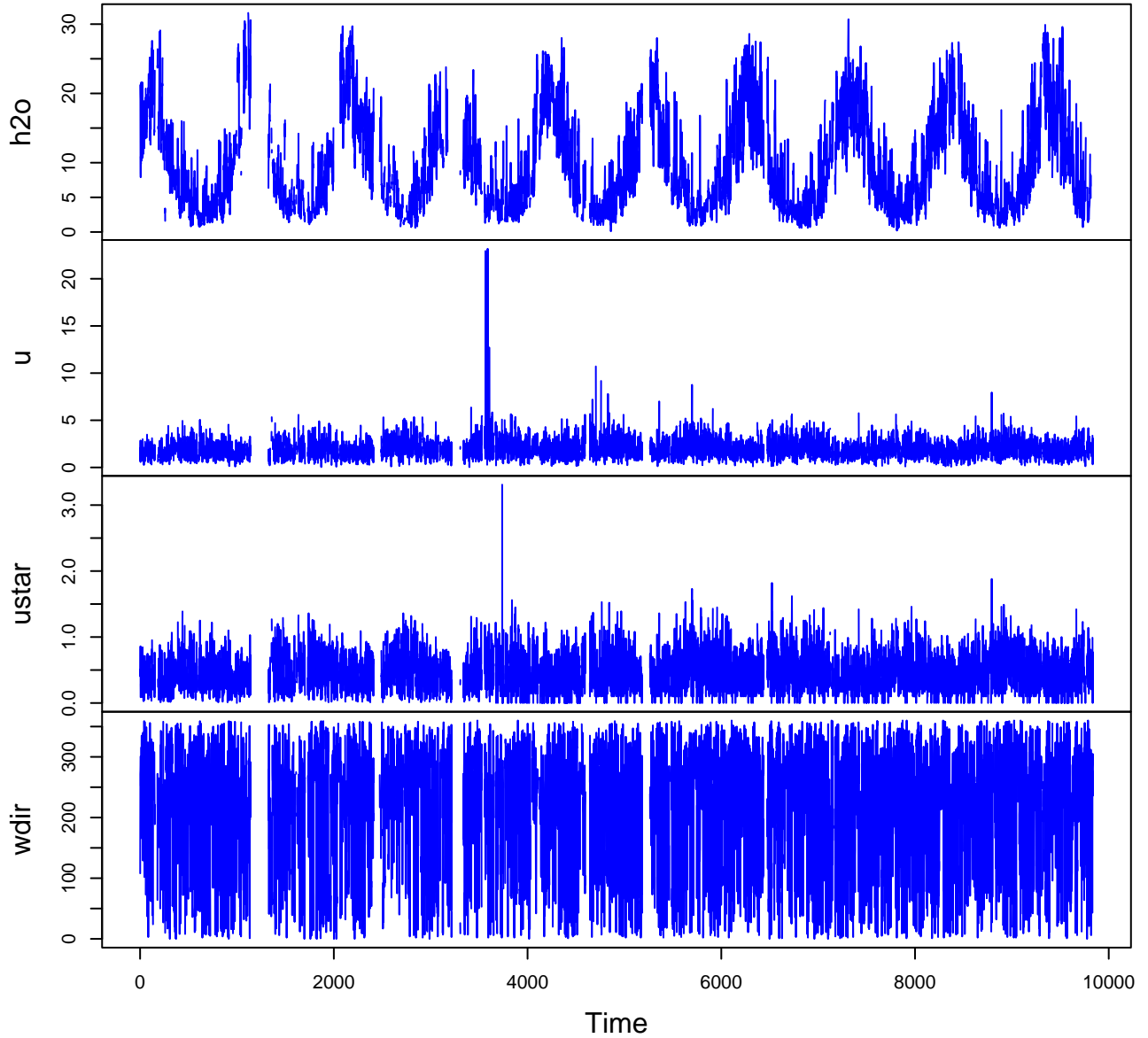
par = photosynthetically active radiation measured above the canopy at 24 m height by a Licor 190S quantum sensor (micromolePerMeterSquaredPerSecond)

| Variable | Min | Median | Mean | Max | NAs |
|--------------|------------------|----------|------------------|----------|--------|
| datetime | 2004-06-18T17:00 | | 2013-12-31T23:30 | | 0 |
| year | 2004.000 | 2009.000 | 2008.719 | 2013.000 | 0 |
| doy | 1.021 | 192.146 | 188.424 | 367.000 | 0 |
| co2 | 331.100 | 394.000 | 392.268 | 504.600 | 20767 |
| h2o | 0.100 | 7.700 | 9.556 | 43.700 | 25176 |
| u | 0.020 | 1.840 | 2.008 | 38.160 | 27676 |
| ustar | 0.000 | 0.450 | 0.483 | 9.860 | 27966 |
| wdir | 0.000 | 234.000 | 212.453 | 360.000 | 18001 |
| h | -479.900 | -6.900 | 30.496 | 876.800 | 30957 |
| le | -879.200 | 3.500 | 29.366 | 940.300 | 73546 |
| fco2 | -94.200 | 0.100 | -1.884 | 68.000 | 32326 |
| hem_fco2 | -61.500 | 0.200 | -1.441 | 153.200 | 115659 |
| hem_fco2_fil | -32.100 | 0.000 | -2.292 | 33.100 | 135915 |
| hemlock_fco2 | -32.100 | 0.200 | -1.600 | 33.100 | 95009 |
| r_est | 0.000 | 1.300 | 2.303 | 23.000 | 111901 |
| gee_estimate | -39.200 | 0.000 | -3.632 | 18.300 | 114548 |
| fh2o | -19.620 | 0.070 | 0.619 | 20.980 | 33305 |
| hem_fh2o | -9.380 | 0.060 | 0.665 | 12.640 | 115266 |
| hem_fh20_est | -9.380 | 0.100 | 0.736 | 12.640 | 104096 |
| sonic_tair | -23.400 | 10.600 | 10.282 | 38.300 | 31029 |
| tair_above_c | -24.800 | 8.740 | 8.162 | 34.200 | 8461 |
| rh_above_can | 6.080 | 75.800 | 73.777 | 100.000 | 15681 |
| tair_above_c | -23.900 | 8.995 | 8.481 | 36.700 | 24658 |
| vpd_above_ca | -0.193 | 0.200 | 0.371 | 4.300 | 19557 |
| tsoil_10cm | -4.900 | 8.100 | 8.557 | 26.000 | 8263 |
| par | 0.000 | 7.000 | 282.181 | 2271.000 | 3928 |

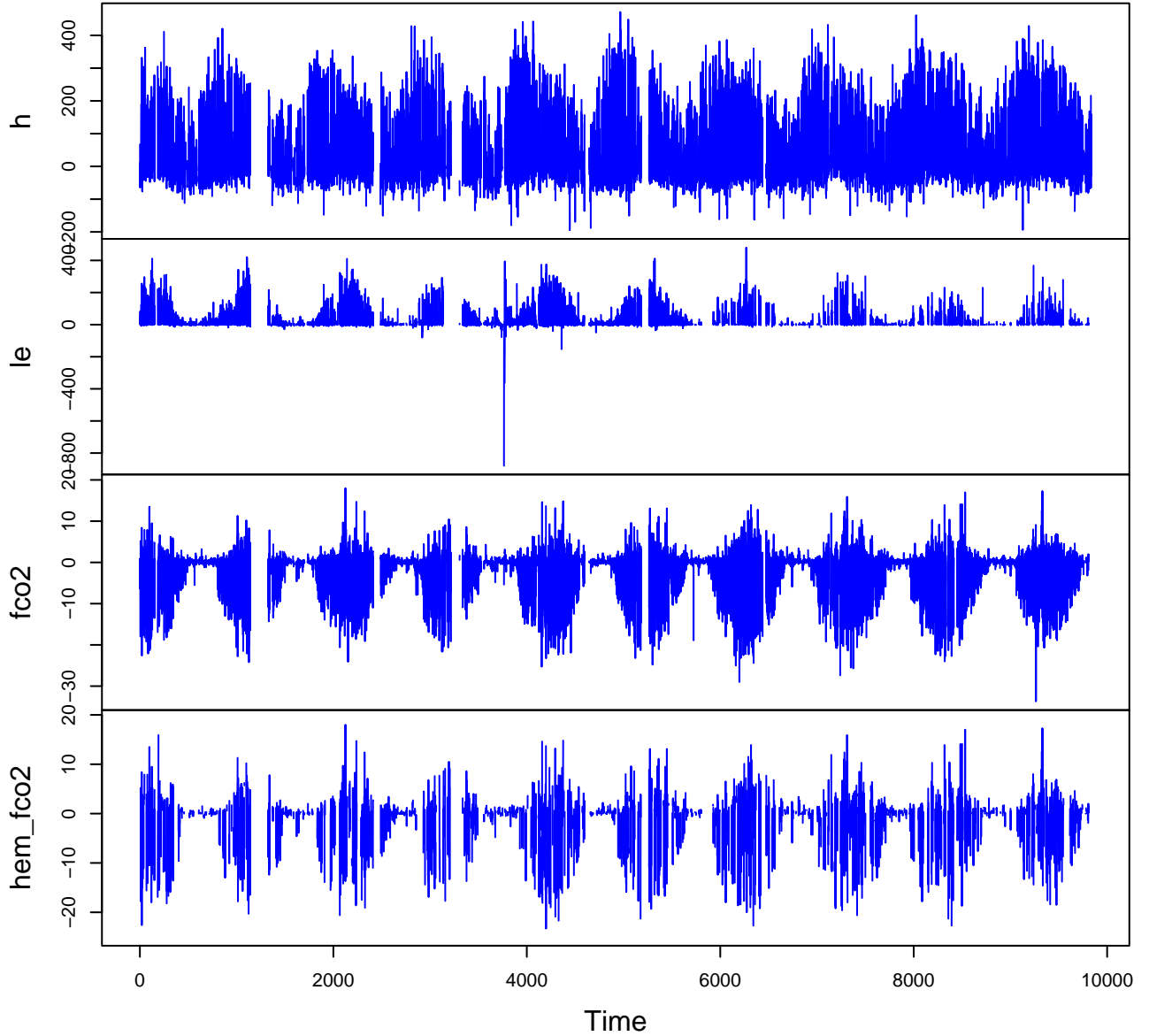
HF103-03 Plot 1



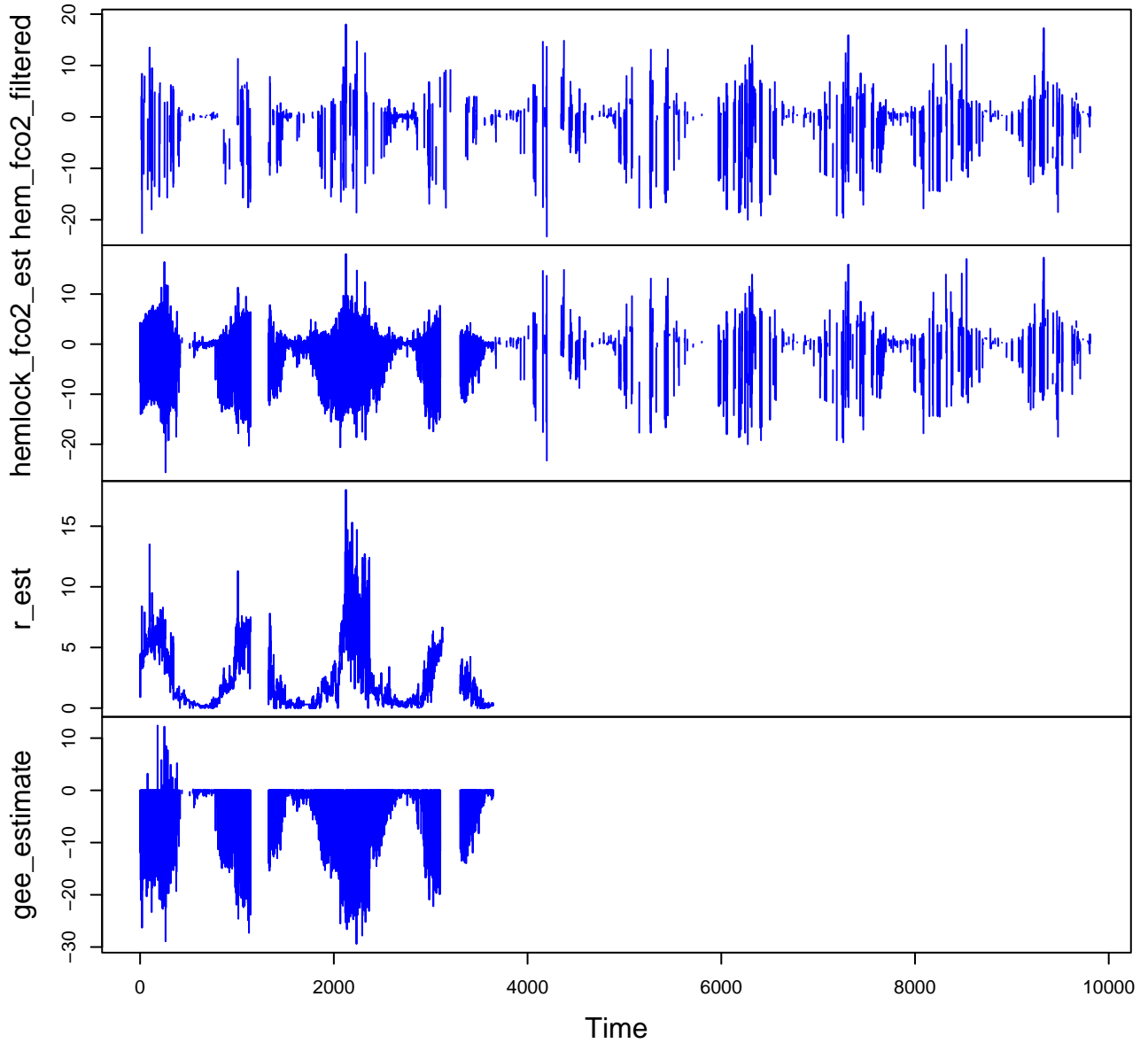
HF103-03 Plot 2



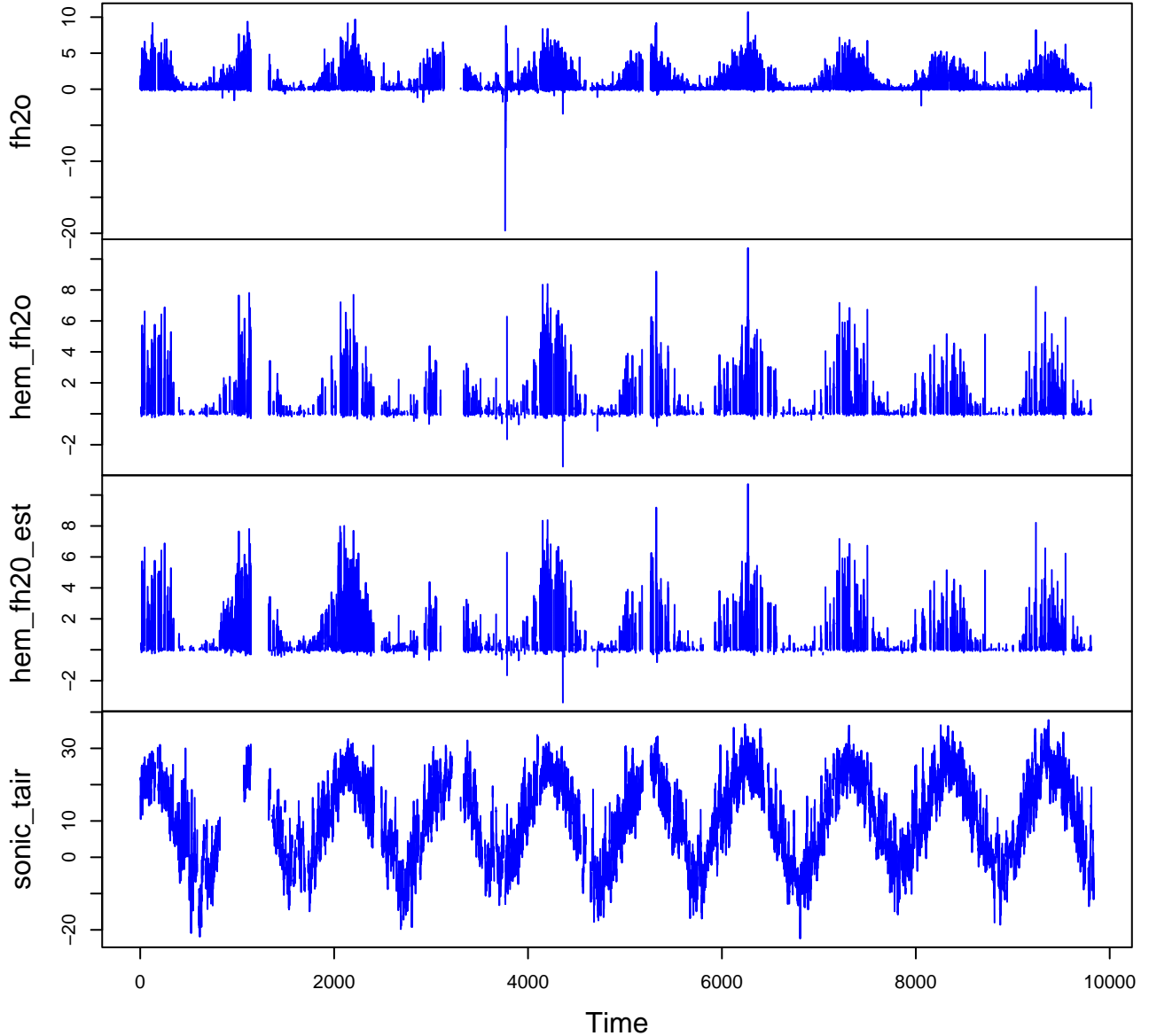
HF103-03 Plot 3



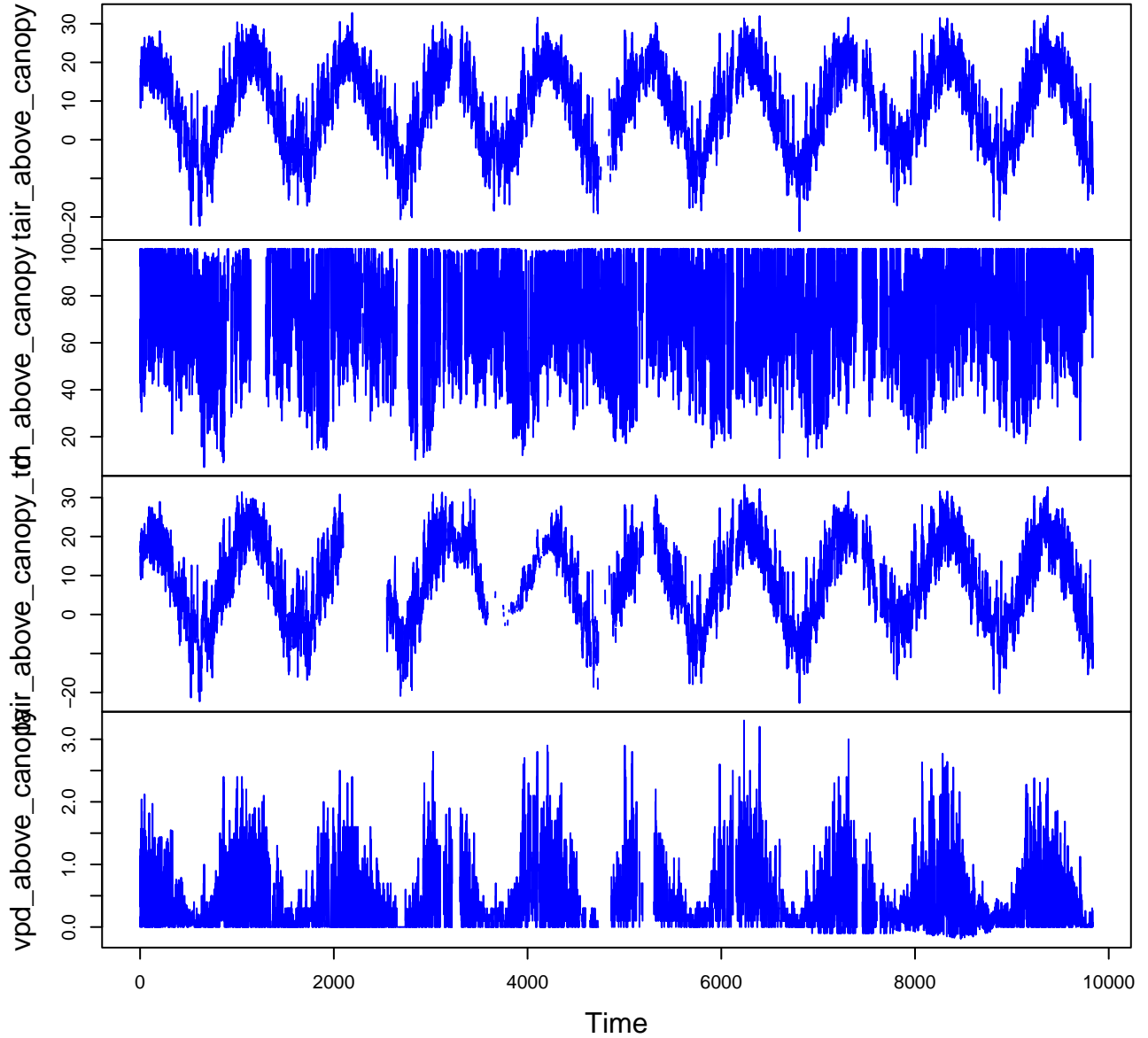
HF103-03 Plot 4



HF103-03 Plot 5



HF103-03 Plot 6



HF103-03 Plot 7

