**Maryvale Tower Raw Data**

August 2014, Thomas J. Volo

This volume contains data from the West Phoenix/Maryvale urban eddy flux tower from its installation in December 2011 through August 27, 2014. The 23 m (73 ft) tower is located at -112.1426 W, +33.4838 N, in a xeric residential neighborhood in Maryvale, AZ, within the CAP-LTER study area. The tower is instrumented for long-term measurement of the covariance of turbulent eddy and radiative fluxes for the purposes of urban micrometeorological research.

These are raw data and have not been processed at all. Winston Chow, who established the tower as a post-doc at ASU, has processed some data (2011-2012) and has a publication based on it (Chow *et al., International Journal of Climatology*, 2014).Those processed data are stored elsewhere. Darrel Jenerette, a CAP-LTER scientist at UC-Riverside, has a copy of this raw data and has committed to processing it. An ftp has been established for sending more recent data to Dr. Jenerette, and for transferring the processed data back to ASU for publication.

The tower has three data loggers, and this volume has a folder for each. The instruments and data associated with each logger are summarized below.

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| ***Data Logger*** | ***Instruments*** | ***Data*** |
| CR23X | Hukseflux NR01 four-component net radiometer | incoming and outgoing short- and long-wave radiation (W/m2) |
|  | TB4 tipping-bucket rain gauge | rainfall (mm) |
| CR1000\_Soil | CS-616 water content reflectometers (3) | volumetric soil moisture (m3/m3) at 5, 15, and 30 cm |
|  | Hukseflux HFP01-SC heat flux plates (2) | soil heat flux (W/m2) (one HFP currently not operational and uninstalled, data shows “NAN”) |
|  | TCAV soil thermocouples (4) | soil temperature (° C) |
| CR1000\_EC | LI-7500 infrared gas analyzer (IRGA) | CO2 and H2O concentrations (mg/m3, g/m3) |
|  | CSAT 3D sonic anemometer | three-directional wind speed (m/s) |
|  | HMP45C T/RH sensor | air temperature (°C) and relative humidity (-) |

CR23X: Radiometer, Rain Gauge (30 minute averages)

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| ***Data Table Label*** | ***Units*** | ***Description*** |
| TIMESTAMP | YYYY-MM-DD HH:MM:SS | logger timestamp |
| RECORD | - | record number |
| SR01\_up\_1\_AVG | W/m2 | upwelling shortwave radiation |
| SR01\_dn\_2\_AVG | W/m2 | downwelling shortwave radiation |
| IR01\_up\_3\_AVG | W/m2 | upwelling longwave (infrared) radiation |
| IR01\_dn\_4\_AVG | W/m2 | downwelling longwave (infrared) radiation |
| Temp\_c\_AVG | °C | sensor temperature |
| Temp\_k\_AVG | K | sensor temperature |
| Net\_Rs\_AVG | W/m2 | net shortwave radiation |
| Net\_RI\_AVG | W/m2 | net longwave (infrared) radiation |
| Albedo\_AVG | - | shortwave surface albedo |
| Net\_total\_AVG | W/m2 | net total radiation |
| IR01upCor\_AVG | W/m2 | upwelling longwave radiation corrected for Boltzmann radiation from sensor |
| IR-1dnCor\_AVG | W/m2 | downwelling longwave radiation corrected for Boltzmann radiation from sensor |
| Rain\_mm\_TOT | mm | total rainfall for 30 min period |

CR1000\_Soil: 3 soil moisture sensors, 4 soil temperature probes, 2 heat flux plates (30 minute averages)

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| ***Data Table Label*** | ***Units*** | ***Description*** |
| TIMESTAMP | YYYY-MM-DD HH:MM:SS | logger timestamp |
| RECORD | - | record number |
| VW\_AVG | m3/m3 | volumetric water content, 5 cm |
| VW\_2\_AVG | m3/m3 | volumetric water content, 15 cm |
| VW\_3\_AVG | m3/m3 | volumetric water content, 30 cm |
| Temp\_C\_AVG | °C | soil temperature, 2 cm |
| Temp\_C\_2\_AVG | °C | soil temperature, 5 cm |
| Temp\_C\_3\_AVG | °C | soil temperature, 15 cm |
| Temp\_C\_4\_AVG | °C | soil temperature, 30 cm |
| PTemp\_C\_AVG | °C | panel temperature |
| shf\_Avg | W/m2 | soil heat flux, under gravel |
| shf\_2\_Avg | W/m2 | soil heat flux, under bare soil |
| Batt\_Volt\_Avg | V | voltage of battery |
| PA\_uS\_Avg | μs | sensor output period, 5 cm (used to calculate VW) |
| PA\_uS\_2\_Avg | μs | sensor output period, 15 cm |
| PA\_uS\_3\_Avg | μs | sensor output period, 30 cm |

CR1000\_EC: gas analyzer, 3D sonic anemometer, temperature/relative humidity sensor

Data from this sensor is stored in two types of files: 10 Hz data and 30 min averages. Each of these comes in two formats: TOB1 binary format and TOA5 readable format. The TOA5 files were converted from the TOB1 files, so time periods should coincide between the two. Time periods between the 10 Hz and 30 min data will not always coincide, since the data was not always accessed by the same means, especially beginning in the summer of 2014.

CR1000\_EC 10 Hz data (“.ts” files)

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| ***Data Table Label*** | ***Units*** | ***Description*** |
| TIMESTAMP | YYYY-MM-DD HH:MM:SS.S | logger timestamp |
| RECORD | - | record number |
| Ux | m/s | E 🡪 W wind speed |
| Uy | m/s | N 🡪 S wind speed |
| Uz | m/s | upward wind speed |
| Ts | °C | virtual temperature from anemometer |
| co2 | mg/m3 | CO2 concentration of air |
| h2o | g/m3 | water vapor concentration of air |
| press | kPa | air pressure |
| diag\_csat | - | value for diagnosing CSAT problems |
| t\_hmp | °C | air temperature from T/RH sensor |
| e\_hmp | kPa | vapor pressure from T/RH sensor |

CR1000\_EC 30 min data (“.flux” files)

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| ***Data Table Label*** | ***Units*** | ***Description*** |
| TIMESTAMP | YYYY-MM-DD HH:MM:SS | logger timestamp |
| RECORD | - | record number |
| Hs | W/m2 | Sensible heat flux using sonic temperature |
| Fc\_wpl | mg/m2s | CO2 flux with Webb correction term |
| LE\_wpl | W/m2 | Latent heat flux with Webb correction term |
| Hc | W/m2 | Sensible heat flux computed from Hs and LE\_wpl |
| tau | kg/ms2 | momentum flux |
| u\_star | m/s | friction velocity |
| Ts\_mean | °C | average virtual temperature from anemometer |
| stdev\_Ts | °C | standard deviation of Ts |
| cov\_Ts\_Ux | m°C/s | covariance: Ts and Ux |
| cov\_Ts\_Uy | m °C/s | covariance: Ts and Uy |
| cov\_Ts\_Uz | m °C/s | covariance: Ts and Uz |
| co2\_mean | mg/m3 | average CO2 concentration |
| stdev\_co2 | mg/m3 | standard deviation of CO2 concentration |
| cov\_co2\_Ux | mg/m2s | covariance: co2 and Ux |
| cov\_co2\_Uy | mg/m2s | covariance: co2 and Uy |
| cov\_co2\_Uz | mg/m2s | covariance: co2 and Uz |
| h2o\_Avg | g/m3 | average H2O concentration (IRGA) |
| stdev\_h2o | g/m3 | standard deviation of H2O concentration |
| cov\_h2o\_Ux | g/m2s | covariance: h2o and Ux |
| cov\_h2o\_Uy | g/m2s | covariance: h2o and Uy |
| cov\_h2o\_Uz | g/m2s | covariance: h2o and Uz |
| Ux\_Avg | m/s | average E 🡪 W wind speed |
| stdev\_Ux | m/s | standard deviation of E 🡪 W wind speed |
| cov\_Ux\_Uy | (m/s)2 | covariance: Ux and Uy |
| cov\_Ux\_Uz | (m/s)2 | covariance: Ux and Uz |
| Uy\_Avg | m/s | average N 🡪 S wind speed |
| stdev\_Uy | m/s | standard deviation of N 🡪 S wind speed |
| cov\_Uy\_Uz | (m/s)2 | covariance: Uy and Uz |
| Uz\_Avg | m/s | average upward wind speed |
| stdev\_Uz | m/s | standard deviation of upward wind speed |
| press\_mean | kPa | mean air pressure |
| t\_hmp\_mean | °C | mean air temperature from T/RH sensor |
| h2o\_hmp\_mean | g/m3 | mean vapor density from T/RH sensor |
| rho\_a\_mean | kg/m3 | mean air density |
| wnd\_dir\_compass | degrees | wind direction (compass) corrected for azimuth |
| wnd\_dir\_csat3 | degrees | wind direction with reference to CSAT field of view |
| wnd\_spd | m/s | mean wind speed |
| rslt\_wnd\_spd | m/s | average wind speed in compass coordinate system |
| std\_wnd\_dir | degrees | standard deviation of wind direction in compass coordinate system |
| Fc\_irga | mg/m2s | CO2 flux without Webb correction term |
| LE\_irga | W/m2 | latent heat flux without Webb correction term |
| co2\_wpl\_LE | mg/m2s | Webb correction term for CO2 flux due to latent heat flux |
| co2\_wpl\_H | mg/m2s | Webb correction term for CO2 flux due to sensible heat flux |
| h2o\_wpl\_LE | W/m2 | Webb correction term for H2O flux due to latent heat flux |
| h2o\_wpl\_H | W/m2 | Webb correction term for H2O flux due to sensible heat flux |
| n\_Tot | samples | number of samples in averaging period |
| csat\_warnings | samples | number of samples with CSAT flags |
| irga\_warnings | samples | number of samples with IRGA flags |
| del\_T\_f\_Tot | samples | number of samples with delta temperature flags |
| sig\_lck\_f\_Tot | samples | number of samples with poor signal lock flags |
| amp\_h\_f\_Tot | samples | number of samples with amplitude high flags |
| amp\_l\_f\_Tot | samples | number of samples with amplitude low flags |
| chopper\_f\_Tot | samples | number of samples with chopper warning flags |
| detector\_f\_Tot | samples | number of samples with detector warning flags |
| pll\_f\_Tot | samples | number of samples with PLL warning flags |
| sync\_f\_Tot | samples | number of samples with synchronization flags |
| agc\_Avg | - | automatic gain control |
| panel\_temp\_Avg | °C | datalogger panel temperature |
| batt\_volt\_Avg | V | battery voltage |