

SEGA Weather Stations

All SEGA stations are based on Campbell CR1000 dataloggers with a Campbell NL115 network interface and 2gigabyte CF card. Each datalogger records its data to both internal memory and the CF card using a ring buffer (new data will eventually overwrite old data). All stations are polled by two server-based systems at a maximum periodicity of 30 minutes and their data stored in separate databases.

Sensor List

BattV – Voltage of 24A-hr battery in enclosure – volts

PTempC – datalogger panel temp thermocouple – degrees C

O5105 – Young Marine Windset – 10 meters AGL

WS_ms_10m – wind speed at 10m above ground level (AGL) – meters/second

WindDir_10m – wind direction at 10m above ground level – deg true heading

CS109 – Campbell CS109 temperature probe

SoilT_5cm – soil temperature at 5 centimeters below ground level – degrees C

SoilT_10cm – soil temperature at 10 cm BGL – degrees C

SoilT_15cm – soil temperature at 15 cm BGL – degrees C

CS616 – Campbell CS6161 Time Domain Reflectometer

VW30 – volumetric water content 0-30 cm below ground level - percent/100 (0.20 = 20%)

PA_uS30 – period average for sensor 0-30 cm – microseconds

VW60 – volumetric water content 30-60 cm below ground level - percent/100

PA_uS60 – period average for sensor 30-60 cm – microseconds

VW90 – not used

PA-uS90 – not used

HMP155 – Campbell (Visala) HMP155 Air Temp and Relative Humidity – 2 meters AGL

AirTC – air temperature at 2 meters AGL – degrees C

RH – relative humidity at 2 meters AGL – percent/100

LI200X – Licor LI200X Pyranometer – total sky plus sun solar radiation – 3 meters AGL

SlrkW – flux density in kilowatts per meter squared

SlrMJ – Total Flux in Megajoules per meter squared

LI190SB – Licor LI190SB Quantum Sensor – Photosynthetic Active Radiation – 3 meters AGL

PAR_DEN – flux density – micromole per second per square meter

PAR_Tot – total flux – millimole per square meter

AM16/32 – Campbell Multiplexer – allows addition of more sensors

TCTemp2m – type T thermocouple at 2 meters AGL – deg C

TCTemp10m – type T thermocouple at 10 meters AGL – deg C

CH200 – Campbell Smart Charge Controller

BattV_2 – battery voltage – volts

BattI - battery current - amps

LoadI – load current – amps

ChgInV – charge input voltage – volts

ChgInI – charge input current – amps

ChgTempC – charge controller temperature – deg C

ChgState - (a code - -1 = regulator fault, 0 = no charge, 1 = current limited charging, 2 = cycle charging, 3 = float charging, 4 = battery test)

ChgSource - (a code - 0 = none, 1 = solar, 2 = continuous)

ChkBatt - (a code - 0 = normal, 1 = Check Battery - indicates battery voltage not increasing after significant charging)

PeriodAvg – Geonor T200B vibrating wire rain can input parameter - measures weight of precipitation in can output is proportional to weight

Geonor_HZ – output from vibrating wire strain gage — hertz

Arboretum ONLY

WindSonic4 – Windsonic 4 doppler wind set – uses microphones to measure wind speed and direction via doppler effect – mounted at 3 meters AGL

WindDir_3m – wind direction at 3 meters above ground level (AGL) – degrees true heading

WS_ms_3m – wind speed at 3 meters AGL – meters per second

WSDiag_3m – diagnostic parameter (see manual for Windsonic 4 sensor)

Diag1F – diagnostic parameter

Diag2F – diagnostic parameter

Diag4F – diagnostic parameter

Diag8F – diagnostic Parameter

Diag9F – diagnostic Parameter

Diag10F – diagnostic parameter

NNDF – diagnostic parameter

Note on evapotranspiration estimates: The CR1000 data logger calculates hourly estimates of evapotranspiration using data from several instruments and information on the stations location. As of September 2016 these settings have not been optimized for individual stations and may not be accurate. This parameter is for informational purposes only.

Note on WindSonic Wind Speed and Direction Sensor: This sensor is only used at the Arboretum Meadow SEGA site placed at 3 meters above ground level. All other sites have only the Young o5106 Wind sensor at 10 meter above ground level.

Output Tables

Each SEGA datalogger is programmed to record data at four periodicities. One minute, thirty minute, one hour and daily. These observations are recorded in four tables called OneMin, Thirty, Hourly and Daily respectively. The data are uploaded to tables in a MySQL database using the same naming convention.

OneHour – hourly observations

| Sensor | Measurement | Processing | Output Label | Description | Units |
|--------------|-------------|------------|---------------------|--|----------------------------|
| Default | BattV | Average | BattV_AVG | battery voltage | volts |
| Default | PTemp_C | Average | PTemp_C_AVG | panel temperature | Deg C |
| 109 | SoilT_5cm | Average | SoilT_5cm_AVG | Soil temp 5cm below ground | Deg C |
| 109 | SoilT_10cm | Average | SoilT_10cm_AVG | Soil temp 10cm below ground | Deg C |
| 109 | SoilT_15cm | Average | SoilT_15cm_AVG | Soil temp 15cm below ground | Deg C |
| CS616 | VW30 | Average | VW30_AVG | soil volumetric water content 0-30cm below ground | Percent/100 |
| CS616 | VW60 | Average | VW60_AVG | soil volumetric water content 30-60cm below ground | Percent/100 |
| CS616 | VW90 | Average | VW90_AVG | NOT USED | Percent/100 |
| PeriodAvg | Geonor_HZ | Sample | Geonor_HZ | Frequency from Geonor Rain Gage | hertz |
| LI190SB | PAR_den | Average | PAR_Den_AVG | PAR density at 3m AGL | Micromole/s/m ² |
| HMP155 | AirTC | Average | AirTC_AVG | Air temperature at 2 meters | Deg C |
| HMP155 | several | ETo | ETOs | Total evapotranspiration | Percent/100 |
| HMP155 | several | ETo | Rso | Total solar radiation (calculated) | MJ/meter ² |
| HMP155 | RH | Maximum | RH_MAX | Relative humidity at 2 m AGL | Percent/100 |
| LI200X | SlrkW | Average | SlrkW_AVG | Total sky + sun solar radiation at 3m AGL | Kilowatts/m ² |
| LI190SB | PAR_Tot | Total | PAR_Tot_TOT | Photosynthetically active radiation | Mmol/m ² |
| 05106 | WindDir_10m | Windvector | WS_ms_10m_S_WVT | Wind speed | m/s |
| 05106 | | Windvector | WindDir_10m_D1_WVT | Wind direction | Deg true north |
| 05106 | | Windvector | WindDir_10m_SD1_WVT | Standard deviation of wind direction | unitless |
| PS200/CH200 | BattV_2 | Average | BattV_2_AVG | Battery voltage | volts |
| PS200/CH200 | BattI | Average | BattI_AVG | Battery current | amps |
| PS200/CH200 | LoadI | Average | LoadI_AVG | Load current | amps |
| PS200/CH200 | ChargInV | Average | ChargInV_AVG | Input voltage | volts |
| PS200/CH200 | ChargInI | Average | ChargInI_AVG | Input amperage | amps |
| PS200/CH200 | ChgTempC | Average | ChgTempC_AVG | Charge controller temp | Deg C |
| PS200/CH200 | ChgState | sample | ChgState | Charge state of battery | code |
| PS200/CH200 | ChgSource | sample | ChgSource | Charging source | code |
| PS200/CH200 | ChkBatt | sample | ChkBatt | Check battery code | code |
| WindSoic4 | WS_ms_3m | sample | WS_ms_3m | Wind speed sample | Meters / second |
| WindSoic4 | WindDir_3m | WindVector | WS_ms_3m_S_WVT | Wind speed average | Meters / second |
| WindSoic4 | | | WindDir_3m_D1_WVT | Wind direction average | degrees |
| WindSoic4 | | | WindDir_3m_SD1_WVT | Wind direction standard deviation | unitless |
| Geonor T200B | sample | | Geonor_precip_mm | Total precipitation since last reset | millimeters |
| Geonor T200B | total | total | Precip_1hour_mm | Total precipitation in the past hour | millimeters |

OneMin – one minute observations

| Sensor | Measurement | Processing | Output Label | Description | Units |
|--------------|-------------|------------|---------------------|--|----------------------------|
| Default | BattV | Average | BattV_AVG | battery voltage | volts |
| Default | PTemp_C | Average | PTemp_C_AVG | panel temperature | Deg C |
| 109 | SoilT_5cm | Average | SoilT_5cm_AVG | Soil temp 5cm below ground | Deg C |
| 109 | SoilT_10cm | Average | SoilT_10cm_AVG | Soil temp 10cm below ground | Deg C |
| 109 | SoilT_15cm | Average | SoilT_15cm_AVG | Soil temp 15cm below ground | Deg C |
| CS616 | VW30 | Average | VW30_AVG | soil volumetric water content 0-30cm below ground | Percent/100 |
| CS616 | PA_uS30 | Average | PA_uS30 | Period average 0-30 sensor | microseconds |
| CS616 | VW60 | Average | VW60_AVG | soil volumetric water content 30-60cm below ground | Percent/100 |
| CS616 | PA_uS60 | average | PA_uS60 | Period average 30-60cm sensor | microseconds |
| CS616 | VW90 | Average | VW90_AVG_AVG | NOT USED | Not used |
| CS616 | PA_uS90 | average | PA_uS90 | NOT USED | Not used |
| PeriodAvg | Geonor_HZ | Sample | Geonor_HZ | Frequency from Geonor Rain Gage | hertz |
| LI190SB | PAR_den | Average | PAR_Den_AVG | PAR density at 3m AGL | Micromole/s/m ² |
| HMP155 | AirTC | Average | AirTC_AVG | Air temperature at 2 meters | Deg C |
| HMP155 | RH | Maximum | RH_MAX | Relative humidity at 2 m AGL | Percent/100 |
| LI200X | SlrkW | Average | SlrkW_AVG | Total sky + sun solar radiation at 3m AGL | Kilowatts/m ² |
| LI190SB | PAR_Tot | Total | PAR_Tot_TOT | Photosynthetically active radiation | Mmol/m ² |
| 05106 | WindDir_10m | Windvector | WS_ms_10m_S_WVT | Wind speed | m/s |
| 05106 | | Windvector | WindDir_10m_D1_WVT | Wind direction | Deg true north |
| 05106 | | Windvector | WindDir_10m_SD1_WVT | Standard deviation of wind direction | unitless |
| WindSoiic4 | WS_ms_3m | average | WS_ms_3m | Wind speed sample | Meters / second |
| WindSoiic4 | WindDir_3m | sample | WS_Dir_3m | Wind direction | degrees |
| Geonor T200B | sample | | Geonor_precip_mm | Total precipitation since last reset | millimeters |
| Geonor T200B | total | total | Precip_1min_mm | Total precipitation in the past minute | millimeters |

Thirty – thirty minute observations

| Sensor | Measurement | Processing | Output Label | Description | Units |
|--------------|-------------|------------|---------------------|--|--------------------------|
| Default | BattV | Average | BattV_AVG | battery voltage | volts |
| Default | PTemp_C | Average | PTemp_C_AVG | panel temperature | Deg C |
| 109 | SoilT_5cm | Average | SoilT_5cm_AVG | Soil temp 5cm below ground | Deg C |
| 109 | SoilT_10cm | Average | SoilT_10cm_AVG | Soil temp 10cm below ground | Deg C |
| 109 | SoilT_15cm | Average | SoilT_15cm_AVG | Soil temp 15cm below ground | Deg C |
| CS616 | VW30 | Average | VW30_AVG | soil volumetric water content 0-30cm below ground | Percent/100 |
| CS616 | PA_uS30 | Average | PA_uS30 | Period average 0-30 sensor | microseconds |
| CS616 | VW60 | Average | VW60_AVG | soil volumetric water content 30-60cm below ground | Percent/100 |
| CS616 | PA_uS60 | average | PA_uS60 | Period average 30-60cm sensor | microseconds |
| CS616 | VW90 | Average | VW90_AVG_AVG | NOT USED | Not used |
| CS616 | PA_uS90 | average | PA_uS90 | NOT USED | Not used |
| PeriodAvg | Geonor_HZ | Sample | Geonor_HZ | Frequency from Geonor Rain Gage | hertz |
| LI190SB | PAR_den | Average | PAR_Den_AVG | PAR density at 3m AGL | mmole/s/m ² |
| LI190SB | PAR_Tot | Total | PAR_Tot_TOT | PAR total at 3m AGL | Mmole/m ² |
| HMP155 | AirTC | Average | AirTC_AVG | Air temperature at 2 meters | Deg C |
| HMP155 | RH | Maximum | RH_MAX | Relative humidity at 2 m AGL | Percent/100 |
| LI200X | SlrkW | Average | SlrkW_AVG | Total sky + sun solar radiation at 3m AGL | Kilowatts/m ² |
| 05106 | WS_ms_10m | Average | WS_ms_10m_AGV | Wind speed | m/s |
| 05106 | WindDir_10m | Windvector | WS_ms_10m_S_WVT | Wind speed | m/s |
| 05106 | | Windvector | WindDir_10m_D1_WVT | Wind direction | Deg true north |
| 05106 | | Windvector | WindDir_10m_SD1_WVT | Standard deviation of wind direction | unitless |
| WindSoiic4 | WS_ms_3m | average | WS_ms_3m_AVG | Wind speed | Meters / second |
| WindSoiic4 | WindDir_3m | sample | WS_ms_3m_S_WVT | Wind speed | m/s |
| WindSoiic4 | | | WindDir_3m_D1_WVT | Wind direction average | Degrees true north |
| WindSoiic4 | | | WindDir_3m_SD1_WVT | Wind direction standard deviation | unitless |
| Geonor T200B | sample | | Geonor_precip_mm | Total precipitation since last reset | millimeters |
| Geonor T200B | total | total | Precip_30min_mm | Total precipitation in the past thirty minutes | millimeters |

Daily – daily averages and totals

| Sensor | Measurement | Processing | Output Label | Description | Units |
|--------------|-------------|------------|---------------------|--|----------------------------|
| Default | PTemp_C | Average | PTemp_C_AVG | panel temperature | Deg C |
| 109 | SoilT_5cm | Average | SoilT_5cm_AVG | Soil temp 5cm below ground | Deg C |
| 109 | SoilT_10cm | Average | SoilT_10cm_AVG | Soil temp 10cm below ground | Deg C |
| 109 | SoilT_15cm | Average | SoilT_15cm_AVG | Soil temp 15cm below ground | Deg C |
| CS616 | VW30 | Average | VW30_AVG | soil volumetric water content 0-30cm below ground | Percent/100 |
| CS616 | PA_uS30 | Average | PA_uS30 | Period average 0-30 sensor | microseconds |
| CS616 | VW60 | Average | VW60_AVG | soil volumetric water content 30-60cm below ground | Percent/100 |
| CS616 | PA_uS60 | average | PA_uS60 | Period average 30-60cm sensor | microseconds |
| CS616 | VW90 | Average | VW90_AVG_AVG | NOT USED | Not used |
| CS616 | PA_uS90 | average | PA_uS90 | NOT USED | Not used |
| PeriodAvg | Geonor_HZ | Sample | Geonor_HZ | Frequency from Geonor Rain Gage | hertz |
| LI190SB | PAR_den | Average | PAR_Den_AVG | PAR density at 3m AGL | Micromole/s/m ² |
| HMP155 | AirTC | Average | AirTC_AVG | Air temperature at 2 meters | Deg C |
| HMP155 | RH | Maximum | RH_MAX | Relative humidity at 2 m AGL | Percent/100 |
| LI200X | SlrkW | Average | SlrkW_AVG | average sky + sun solar radiation at 3m AGL | Kilowatts/m ² |
| LI200X | SlrMJ | Total | SlrMJ_TOT | Total sky + sun solar radiation at 3m AGL | MJ/m ² |
| LI190SB | PAR_Tot | Total | PAR_Tot_TOT | Photosynthetically active radiation | Mmol/m ² |
| 05106 | WindDir_10m | Windvector | WS_ms_10m_S_WVT | Wind speed | m/s |
| 05106 | | Windvector | WindDir_10m_D1_WVT | Wind direction | Deg true north |
| 05106 | | Windvector | WindDir_10m_SD1_WVT | Standard deviation of wind direction | unitless |
| PS200/CH200 | BattV_2 | Average | BattV_2_AVG | Battery voltage | volts |
| PS200/CH200 | BattI | Average | BattI_AVG | Battery current | amps |
| PS200/CH200 | LoadI | Average | LoadI_AVG | Load current | amps |
| PS200/CH200 | ChrgInV | Average | ChrgInV_AVG | Input voltage | volts |
| PS200/CH200 | ChrgInI | Average | ChrgInI_AVG | Input amperage | amps |
| PS200/CH200 | ChgTempC | Average | ChgTempC_AVG | Charge controller temp | Deg C |
| PS200/CH200 | ChgState | sample | ChgState | Charge state of battery | code |
| PS200/CH200 | ChgSource | sample | ChgSource | Charging source | code |
| PS200/CH200 | ChkBatt | sample | ChkBatt | Check battery code | code |
| WindSoiic4 | WS_ms_3m | sample | WS_ms_3m | Wind speed sample | Meters / second |
| WindSoiic4 | WindDir_3m | WindVector | WS_ms_3m_S_WVT | Wind speed average | Meters / second |
| WindSoiic4 | | | WindDir_3m_D1_WVT | Wind direction average | degrees |
| WindSoiic4 | | | WindDir_3m_SD1_WVT | Wind direction standard deviation | unitless |
| Geonor T200B | sample | | Geonor_precip_mm | Total precipitation since last reset | millimeters |
| Geonor T200B | total | total | Precip_1day_mm | Total precipitation in the past day | millimeters |