

How to Calculate the Stats for Summary Table

Flags & Data Filtering

Flags will look like this:

“Flag1,Flag2,Flag3,Flag4,Flag5,Flag6”

The flags will be OK, NA or an error message. Here are the possible outputs for each Flag:

Flag1	Output: “OK” / “Out of WFV range” / “NA”
Flag 2	Output: “OK” / “Out of WFV average range” / “NA”
Flag 3	Output: “OK” / “Frozen soil” / warning: “STC averaged using depth 1 & 2” / “NA”
Flag 4	Output: “OK” / “Out of RDC range” / “NA”
Flag 5	Output: “OK” / “DLT >= 1.5” / “NA”
Flag 6	Output: “OK” / “CON >= 0.2” / “NA”

There will also be cases where the data columns have “NoData” reported instead of a number. For those cases the flags usually report “NA”. Note that Flag 5 and 6 report “NA” for all ON data since the ON stations do not record DLT and CON.

These flags are ok and require no filtering (I hope I covered all combinations):

- OK,OK,OK,OK,OK,OK
- OK,OK,STC averaged using depth 1 & 2 - OK,OK,NA,NA
- OK,OK,OK,OK,NA,NA
- OK,Out of WFV average range,OK,OK,OK,OK
- OK,Out of WFV average range,OK,OK,NA,NA
- OK,Out of WFV average range,STC averaged using depth 1 & 2 - OK,OK,NA,NA

Please filter out the data for the following conditions for the purpose of graphing and before doing the daily data averages:

- Filter out any non-numeric from the data columns (generally “NoData”).
- Flag1: when the flag is “Out of WFV range”, filter out all the columns for that sensor with the exception of soil temperature (ie filter out WFV, RDC, CON, DLT). All other flag outputs are ok.
- Flag2: can be ignored. All flag outputs are ok
- Flag3: when the flag is “Frozen soil”, filter out all the columns for that sensor with the exception of soil temperature (ie filter out WFV, RDC, CON, DLT). All other flag outputs are ok. Replace the filtered
- Flag4: when the flag is “Out of RDC range”, filter out all the columns for that sensor with the exception of soil temperature (ie filter out WFV, RDC, CON, DLT). All other flag outputs are ok.
- Flag5: when the flag is “DLT >= 1.5”, filter out all the columns for that sensor with the exception of soil temperature (ie filter out WFV, RDC, CON, DLT). All other flag outputs are ok.
- Flag6: when the flag is “CON >= 0.2”, filter out all the columns for that sensor with the exception of soil temperature (ie filter out WFV, RDC, CON, DLT). All other flag outputs are ok.

One or several of these flags may be reported at the same time

The battery voltage, wind, air temp and RH data do not have flags, but they may have “NoData” in the data columns, which needs to be filtered out

Summary Table

Time zones:

Original Data is in UTC (or Z), which means that:

CST = UTC - 6 hours (SK and MB stations)

EST = UTC - 5 hours (ON stations)

Please leave the “*Note...” on the summary table to clarify the time zones for the user

Current Conditions (past 15 min from given time):

For 15 min data: simply use the time stamp and data value of the last reading (some variables require a unit conversion)

Note: ON stations do not currently have wind, air temperature and relative humidity. They may in the future. When data is missing for ON or the other stations, they will report “NoData” in the data column. Every time there is no data reported or if one of the flags indicates that the data reading should be filtered out, then please report a “No Data” in the summary table.

Average Air Temp: 25.3 °C

Based on data from MB_5_HC2_Air_Temp_Avg . Latest reading, no conversions necessary. Round to one decimal

Average Relative Humidity: 50.2 %

Based on data from MB_5_HC2_RH_Avg . Latest reading, no conversions necessary. Round to one decimal

Average Wind Direction: WSW / 241 °

Based on data from MB_5_RMY_WindDir_3m (SK data header says *_2m). The wind direction in degrees are provided in the data (no conversion needed), you just have to round it to an integer. Use the table below to get the cardinal directions.

When **Average Wind Speed** is zero, the wind direction should say CALM and nothing else (let me know if this is too tricky)

16 point	Direction/Range
NNE	(012-033)
NE	(034-056)
ENE	(057-078)
E	(079-101)
ESE	(102-123)
SE	(124-146)
SSE	(147-168)
S	(169-191)
SSW	(192-213)
SW	(214-236)
WSW	(237-258)
W	(259-281)
WNW	(282-303)
NW	(304-326)
NNW	(327-348)
N	(349-011)
CALM	When wind speed is 0

Average Wind Speed: 19.5 km/h

Based on data from MB_5_RMY_WindSpeed_3m (SK data header says *_2m). The original data is provided as m/s. Use the latest wind speed reading, convert from m/s to km/h and then round to one decimal:

$$Y \text{ km/h} = X \text{ m/s} \div 1000 \times 60 \times 60$$

Max Wind Speed: 30.6 km/ h

Based on data from MB_5_RMY_WindSpeed_Max_3m (SK data header says *_2m). The original data is provided as m/s. Use the latest max wind speed reading, convert from m/s to km/h and then round to one decimal:

$$Y \text{ km/h} = X \text{ m/s} \div 1000 \times 60 \times 60$$

Min Wind Speed: 12.1 km/ h

Based on data from MB_5_RMY_WindSpeed_Min_3m (SK data header says *_2m). The original data is provided as m/s. Use the latest min wind speed reading, convert from m/s to km/h and then round to one decimal:

$$Y \text{ km/h} = X \text{ m/s} \div 1000 \times 60 \times 60$$

Rain over the past 15 min isn't very useful so we want to give the user total rain over the past hour instead as well as total rain since midnight

Total Precipitation, past hour: 0.0 mm

Based on data from MB_5_TBRG_Precip_15minTotal. Add the precipitation values for the 4 readings representing the past hour. Note that the reading at the top of the hour represents the timeframe between 45min past the hour and top of the hour. The hourly total represents how much rain fell in the previous hour, ie a total of the records at 15 min past the hour, 30 min past the hour, 45 min past the hour and the top of the hour. For example, total hourly precipitation for 02:00 is obtained by adding the precipitation values reported at 01:15, 01:30, 01:45 and 02:00. After adding the values, round the total to one decimal (although the sum should already be one decimal if everything is working properly).

When there are one or more data readings missing (ie "NoData" instead of a data value) within the past hour, the total precipitation the past hour should report "No Data" as well

Total Precipitation, since midnight: 2.2 mm

Based on data from MB_5_TBRG_Precip_15minTotal. Since the value at 00:00 actually represents the last 15 min of the previous day (even if the date on the time stamp has switched to the new day), the total precipitation since midnight is the sum of all the precipitation records starting at 00:15 up to and including the current value (unless the current value is 00:15 because that is midnight of the next day). After adding all the values, round to one decimal (although the sum should already be one decimal if everything is working properly)

10/12/2013 23:15

10/12/2013 23:30

10/12/2013 23:45

11/12/2013 0:00 (this value represents what happened between 23:45 and 00:00 so it should actually be considered December 10. It is a datalogger thing)

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11/12/2013 0:15 (this is where you start adding precip values for the total precipitation since midnight)

11/12/2013 0:30

11/12/2013 0:45

11/12/2013 1:00

**When there are six or more data readings missing (ie “NoData” instead of a data value) since midnight, the total precipitation since midnight should report “No Data” as well.**

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Soil conditions:

|        | Soil Moisture 1 | Soil Moisture 2 | Soil Moisture 3 | Soil Temp 1 | Soil Temp 2 | Soil Temp 3 |
|--------|-----------------|-----------------|-----------------|-------------|-------------|-------------|
| 0-5 cm | 20.1%           | 20.4%           | 20.2%           | 22.8°C      | 22.1°C      | 22.4°C      |
| 5 cm   | 22.1%           | 22.4%           | 22.2%           | 20.3°C      | 20.7°C      | 20.1°C      |
| 20 cm  | 30.2%           | 30.6%           | 30.2%           | 15.8°C      | 15.5°C      | 15.6°C      |
| 50 cm  | 32.5%           | 32.4%           | 32.6%           | 14.1°C      | 14.8°C      | 14.7°C      |
| 100 cm | 30.2%           | 30.2%           | 30.3%           | 12.7°C      | 12.6°C      | 12.3°C      |
| 150 cm | 30.8%           | 30.3%           | 30.7%           | 12.4°C      | 12.7°C      | 12.5°C      |

Data based on:

- Soil Moisture 1 for 0-5cm: MB\_3\_Hydra\_0to5cm\_WFV\_1
- Soil Moisture 2 for 0-5cm: MB\_3\_Hydra\_0to5cm\_WFV\_2
- Soil Moisture 3 for 0-5cm: MB\_3\_Hydra\_0to5cm\_WFV\_3
- Soil Temp 1 for 0-5cm: MB\_3\_Hydra\_0to5cm\_Temp\_1
- Soil Temp 2 for 0-5cm: MB\_3\_Hydra\_0to5cm\_Temp\_2
- Soil Temp 3 for 0-5cm: MB\_3\_Hydra\_0to5cm\_Temp\_3
- Etc...

The original soil moisture data is reported as a fraction (m3/m3). Convert these to percent by multiplying by 100, then round to one decimal

$$Y (\%) = X (m^3/m^3) \times 100$$

The original soil temperature data is reported in deg C and no conversion is needed. Round to one decimal

FYI, only SK has soil moisture readings to 150cm.

When the soil data is missing, flagged and filtered out, report "No Data" in the table

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## Conditions, Previous Day

This is daily data, which will be archived and downloaded

Note: the following applies for all daily data calculations

The value at 00:00 actually represents the last 15 min of the previous day (even if the date on the time stamp has switched to the new day)

10/12/2013 23:15

10/12/2013 23:30

10/12/2013 23:45

11/12/2013 0:00 (this value represents what happened between 23:45 and 00:00 so it should actually be considered December 10. It is a datalogger thing)

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11/12/2013 0:15 (this is where you start adding precip values or average the other values to get daily data)

11/12/2013 0:30

11/12/2013 0:45

11/12/2013 1:00

Average Air Temp: 20.2 °C

Based on data from MB_5_HC2_Air_Temp_Avg . Calculate the average of all the air temperature records starting at 0:15 of the previous day up to and including the value at 0:00 of the current day. After averaging the values, round to one decimal

Average Temp: Sum of all air temperature readings during the previous day / total number of air temp readings

If there are more than six missing air temperature data records (ie reported as “NoData”), during the previous day, the Average Air Temp should report “No Data”

Min Air Temp: 13.1 °C

Based on data from MB_5_HC2_Air_Temp_Avg . Find the lowest Air Temp data value between (and including) 0:15 of the previous day and 0:00 of the current day. No conversions necessary. Round to one decimal

If there are more than six missing air temperature data readings (ie “NoData”) during the previous day, the Min Air Temp should report “No Data”

Max Air Temp: 27.3 °C

Based on data from MB_5_HC2_Air_Temp_Avg . Find the highest Air Temp data value between (and including) 0:15 of the previous day and 0:00 of the current day. No conversions necessary. Round to one decimal

If there are more than six missing air temperature data records (ie “NoData”) during the previous day, the Max Air Temp should report “No Data”

Average RH: 60.3 %

Based on data from MB_5_HC2_RH_Avg. Calculate the average of all the Relative Humidity (RH) records starting at 0:15 of the previous day up to and including the value at 0:00 of the current day. After averaging the values, round to one decimal

If there are more than six missing RH data records (ie reported as “NoData”), during the previous day, the Average RH should report “No Data”

Average Wind Direction: WSW / 240 °

Based on data from MB_5_RMY_WindDir_3m (SK data header says *_2m). The wind direction in the original data is provided as degrees (no conversion needed). Calculate the average of all the Average Wind Direction records starting at 0:15 of the previous day up to and including the value at 0:00 of the current day. After averaging the values, round to integer. Thereafter, use the table above (see current values) to get the cardinal directions.

If there are more than six missing Average Wind Direction data records (ie reported as “NoData”), during the previous day, the daily Average Wind should report “No Data”

Average Wind Speed: 20.1 km/h

Based on data from MB_5_RMY_WindSpeed_3m (SK data header says *_2m). The original data is provided as m/s. Calculate the average of all the Wind Speed records starting at 0:15 of the previous day up to and including the value at 0:00 of the current day. After averaging the values, convert from m/s to km/h and then round to one decimal:

Y km/h = X m/s ÷ 1000 × 60 × 60

If there are more than six missing Average Wind Direction data records (ie reported as “NoData”), during the previous day, the daily Average Wind should report “No Data”

Min Wind Speed: 15.8 km/h

Based on data from MB_5_RMY_WindSpeed_Min_3m (SK data header says *_2m). The original data is provided as m/s. Find the lowest Min Wind Speed data value between (and including) 0:15 of the previous day and 0:00 of the current day. Convert the value from m/s to km/h and then round to one decimal:

$$Y \text{ km/h} = X \text{ m/s} \div 1000 \times 60 \times 60$$

If there are six or more missing Min Wind Direction data records (ie reported as “NoData”), during the previous day, the daily Min Wind should report “No Data”

Max Wind Speed: 30.2 km/h

Based on data from MB_5_RMY_WindSpeed_Max_3m (SK data header says *_2m). The original data is provided as m/s. Find the highest Max Wind Speed data value between (and including) 0:15 of the previous day and 0:00 of the current day. Convert the value from m/s to km/h and then round to one decimal:

$$Y \text{ km/h} = X \text{ m/s} \div 1000 \times 60 \times 60$$

If there are six or more missing Max Wind Direction data records (ie reported as “NoData”), during the previous day, the daily Max Wind should report “No Data”

Total Precipitation: 1.4 mm

Based on data from MB_5_TBRG_Precip_15minTotal. Add all the precipitation records starting at 0:15 of the previous day up to and including the value at 0:00 of the current day. After adding all the values, round to one decimal (although the sum should already be one decimal if everything is working properly)

When there are six or more data readings missing (ie “NoData” instead of a data value), the total precipitation should report “No Data” as well.

Soil Conditions:

	Average Soil Moisture	Average Soil Temp
0-5 cm	20%	22°C
5 cm	22%	20°C
20 cm	30%	15°C
50 cm	32%	14°C
100 cm	30%	12°C
150 cm	30%	12°C

Data based on:

Average Soil Moisture for 0-5cm: MB_3_Hydra_0to5cm_WFV_1, MB_3_Hydra_0to5cm_WFV_2 & MB_3_Hydra_0to5cm_WFV_3

Average Soil Temp for 0-5cm: MB_3_Hydra_0to5cm_Temp_1, MB_3_Hydra_0to5cm_Temp_2 & MB_3_Hydra_0to5cm_Temp_3

Etc...

Soil Moisture:

For each depth, average all the Soil Moisture records starting at 0:15 of the previous day up to and including the value at 0:00 of the current day data **for all three sensors that have data at the specific depth**. Basically, average the daily average for the three sensors at each depth. The original soil moisture data is reported as a fraction (m3/m3). After averaging the data, convert the value to percent by multiplying by 100, then round to an integer

$$Y (\%) = X (m3/m3) \times 100$$

If there are less than 72 data records in total between sensor 1, 2 and 3 during the previous day, the daily Average Soil Moisture should report “No Data”

Soil Temperature:

For each depth, average all the Soil Temp records starting at 0:15 of the previous day up to and including the value at 0:00 of the current day data for all three sensors that have data at the specific depth. Basically, average the daily average for the three sensors at each depth. The original soil temp data is reported as deg C. No conversion is needed. After averaging, round to an integer

If there are less than 72 data records in total between sensor 1, 2 and 3 during the previous day, the daily Average Soil Temperature should report “No Data”