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Tower Water-Vapor Mixing Ratio Value-Added Product

April 2013



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1.0 Introduction

The purpose of the Tower Water-Vapor Mixing Ratio (TWRMR) value-added product (VAP) is to calculate water-vapor mixing ratio at the 25-meter and 60-meter levels of the meteorological tower at the Southern Great Plains (SGP) Central Facility.

2.0 General Description

The primary purpose of TWRMR is to calculate water-vapor mixing ratio at the 25-meter and 60-meter levels of the tower at the SGP Central Facility. Because there are no barometric pressure sensors at those levels on the tower, the hypsometric equation is used along with pressure values from the [Surface Meteorological Instrumentation](#) (MET), the [Surface Meteorological Observation System](#) (SMOS) or the [Temperature, Humidity, Wind, and Pressure System](#) (THWAPS) to derive barometric pressures at those altitudes. After this is done, water vapor mixing ratio can be calculated directly.

At the same time, this code serves as a “best-estimate” temperature/relative humidity/pressure product for the surface and the 25-meter and 60-meter levels. The primary input at the surface is the SMOS, while the primary inputs at the 25-meter and 60-meter levels come from the sensors in the southeast (SE) elevator. The alternate observations come from the THWAPS and the west (W) elevator for the surface and 25-meter to 60-meter levels, respectively. This primary and alternates can be switched manually with a command line switch at runtime.

3.0 The Algorithm and Methodology

3.1 Flow Chart

This information is currently unavailable.

3.2 Input Data Sources

Input datastreams for 1-minute time averages:

- sgpmetE13.b1 – Critical input
- sgp1smosE13.b1 – Critical input
- sgpthwapsC1.b1 – Critical input
- sgp1twr10xC1.b1 – not required
- sgp1twr25mC1.b1 – not required
- sgp1twr60mC1.b1 – not required

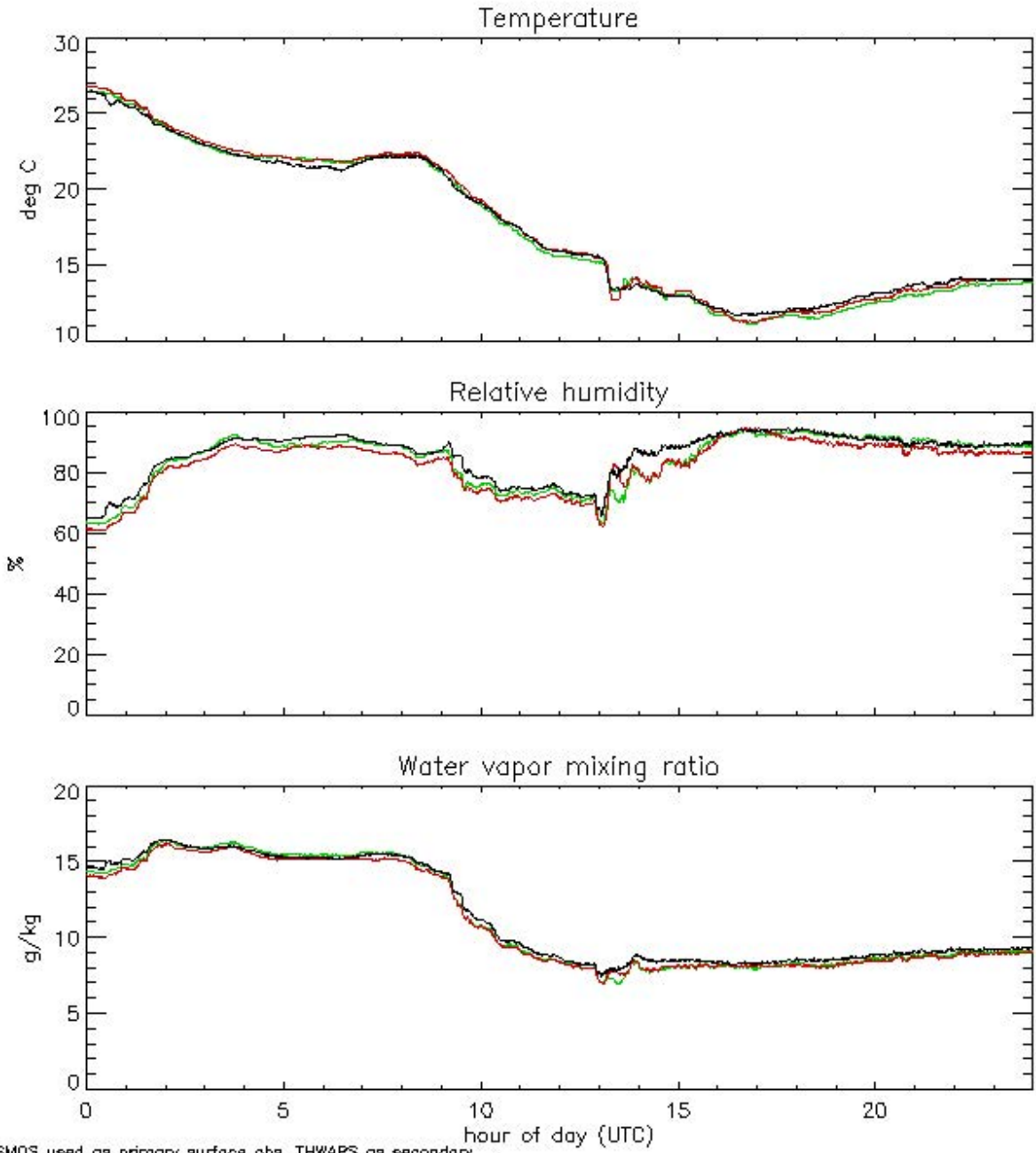
Input datastreams for 30-minute time average:

- sgp30smosE13.b1 – Critical input
- sgp30thwapsC1.b1 – Critical input
- sgp30twr10xC1.b1 – not required
- sgp30twr25mC1.b1 – not required
- sgp30twr60mC1.b1 – not required

The content of input datastreams can be found in Appendix A.

3.3 Output Products

Surface temperature and moisture data
Best estimate time-series
1 Oct 1998



SMOS used as primary surface obs, THWAPS as secondary
SE elevator used as primary tower obs, W elevator as secondary

2mBE

25mBE

60mBE

Version: \$State: Release_1.3 \$

Created on: 9 Jan 2000

Figure 1. Example of best-estimate fields of temperature, relative humidity, and mixing ratio.

Surface temperature and moisture data Quality control time-series 1 Oct 1998

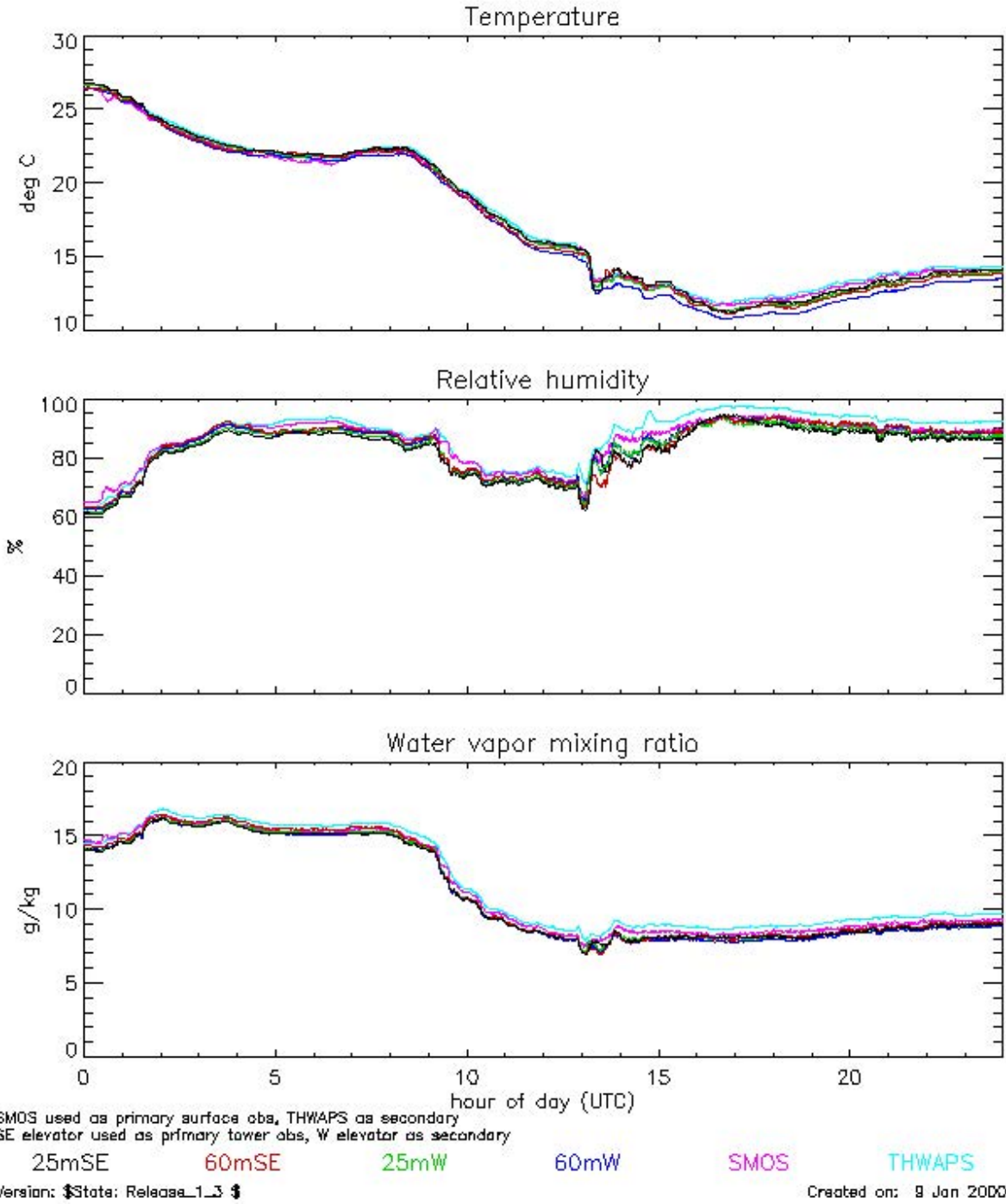


Figure 2. Example of the observations from all input instruments for QC purposes.

3.4 Data Quality Assessment Included

This information is currently unavailable.

3.5 Known Algorithm Caveats

This information is currently unavailable.

3.6 VAP History

3.6.1 Current Version

This information is currently unavailable.

3.6.2 Reprocessing History

This information is currently unavailable.

3.6.3 Compatibility of Results from Different Version

This information is currently unavailable.

3.6.4 Plans for Future Modifications

This information is currently unavailable.

3.6.5 Other

This information is currently unavailable.

4.0 Output Products

4.1 Descriptions of Products

- 1twrmr: sixty-meter tower: mixing ratio at surface, 25-m, and 60-m, 1-min average
- 30twrmr: sixty-meter tower: mixing ratio at surface, 25-m, and 60-m, 30-min average

4.2 Example of Output Data

`sgp*twrmrC1.c1:`

```
netcdf sgp1twrmrC1.c1.19981001.000000 {  
dimensions:
```

```

time = UNLIMITED ; // (1440 currently)
variables:
int base_time ;
    base_time:string = "1-Oct-1998,00:00:00 GMT" ;
    base_time:long_name = "Base time in Epoch" ;
    base_time:units = "seconds since 1970-1-1 0:00:00 0:00" ;
double time_offset(time) ;
    time_offset:long_name = "Time offset from base_time" ;
    time_offset:units = "seconds since 1998-10-1 00:00:00 0:00" ;
float pres_02m(time) ;
    pres_02m:long_name = "Barometric pressure at 2 m" ;
    pres_02m:units = "mb" ;
float pres_25m(time) ;
    pres_25m:long_name = "Barometric pressure at 25 m" ;
    pres_25m:units = "mb" ;
float pres_60m(time) ;
    pres_60m:long_name = "Barometric pressure at 60 m" ;
    pres_60m:units = "mb" ;
float temp_02m(time) ;
    temp_02m:long_name = "Temperature at 2 m" ;
    temp_02m:units = "degC" ;
float temp_25m(time) ;
    temp_25m:long_name = "Temperature at 25 m" ;
    temp_25m:units = "degC" ;
float temp_60m(time) ;
    temp_60m:long_name = "Temperature at 60 m" ;
    temp_60m:units = "degC" ;
float temp_02m_SMOS(time) ;
    temp_02m_SMOS:long_name = "Temperature at surface from SMOS" ;
    temp_02m_SMOS:units = "degC" ;
float temp_02m_THWAPS(time) ;
    temp_02m_THWAPS:long_name = "Temperature at surface from THWAPS" ;
    temp_02m_THWAPS:units = "degC" ;
float temp_25m_SE(time) ;
    temp_25m_SE:long_name = "Temperature at 25 m from SE elevator" ;
    temp_25m_SE:units = "degC" ;
float temp_25m_W(time) ;
    temp_25m_W:long_name = "Temperature at 25 m from W elevator" ;
    temp_25m_W:units = "degC" ;
float temp_60m_SE(time) ;
    temp_60m_SE:long_name = "Temperature at 60 m from SE elevator" ;
    temp_60m_SE:units = "degC" ;
float temp_60m_W(time) ;
    temp_60m_W:long_name = "Temperature at 60 m from W elevator" ;
    temp_60m_W:units = "degC" ;
float rh_02m(time) ;
    rh_02m:long_name = "Relative humidity at 2 m" ;
    rh_02m:units = "%" ;
float rh_25m(time) ;
    rh_25m:long_name = "Relative humidity at 25 m" ;
    rh_25m:units = "%" ;

```

```

float rh_60m(time) ;
    rh_60m:long_name = "Relative humidity at 60 m" ;
    rh_60m:units = "%" ;
float rh_02m_SMOS(time) ;
    rh_02m_SMOS:long_name = "Relative humidity at surface from SMOS" ;
    rh_02m_SMOS:units = "%" ;
float rh_02m_THWAPS(time) ;
    rh_02m_THWAPS:long_name = "Relative humidity at surface from THWAPS" ;
    rh_02m_THWAPS:units = "%" ;
float rh_25m_SE(time) ;
    rh_25m_SE:long_name = "Relative humidity at 25 m from SE elevator" ;
    rh_25m_SE:units = "%" ;
float rh_25m_W(time) ;
    rh_25m_W:long_name = "Relative humidity at 25 m from W elevator" ;
    rh_25m_W:units = "%" ;
float rh_60m_SE(time) ;
    rh_60m_SE:long_name = "Relative humidity at 60 m from SE elevator" ;
    rh_60m_SE:units = "%" ;
float rh_60m_W(time) ;
    rh_60m_W:long_name = "Relative humidity at 60 m from W elevator" ;
    rh_60m_W:units = "%" ;
float vap_pres_02m(time) ;
    vap_pres_02m:long_name = "Vapor pressure at 2 m" ;
    vap_pres_02m:units = "mb" ;
float vap_pres_25m(time) ;
    vap_pres_25m:long_name = "Vapor pressure at 25 m" ;
    vap_pres_25m:units = "mb" ;
float vap_pres_60m(time) ;
    vap_pres_60m:long_name = "Vapor pressure at 60 m" ;
    vap_pres_60m:units = "mb" ;
float vap_pres_02m_SMOS(time) ;
    vap_pres_02m_SMOS:long_name = "Vapor pressure at surface from SMOS" ;
    vap_pres_02m_SMOS:units = "mb" ;
float vap_pres_02m_THWAPS(time) ;
    vap_pres_02m_THWAPS:long_name = "Vapor pressure at surface from THWAPS"
;
    vap_pres_02m_THWAPS:units = "mb" ;
float vap_pres_25m_SE(time) ;
    vap_pres_25m_SE:long_name = "Vapor pressure at 25 m from SE elevator" ;
    vap_pres_25m_SE:units = "mb" ;
float vap_pres_25m_W(time) ;
    vap_pres_25m_W:long_name = "Vapor pressure at 25 m from W elevator" ;
    vap_pres_25m_W:units = "mb" ;
float vap_pres_60m_SE(time) ;
    vap_pres_60m_SE:long_name = "Vapor pressure at 60 m from SE elevator" ;
    vap_pres_60m_SE:units = "mb" ;
float vap_pres_60m_W(time) ;
    vap_pres_60m_W:long_name = "Vapor pressure at 60 m from W elevator" ;
    vap_pres_60m_W:units = "mb" ;
float mixing_ratio_02m(time) ;
    mixing_ratio_02m:long_name = "Water vapor mixing ratio at 2 m" ;

```

```

        mixing_ratio_02m:units = "g/kg" ;
float mixing_ratio_25m(time) ;
        mixing_ratio_25m:long_name = "Water vapor mixing ratio at 25 m" ;
        mixing_ratio_25m:units = "g/kg" ;
float mixing_ratio_60m(time) ;
        mixing_ratio_60m:long_name = "Water vapor mixing ratio at 60 m" ;
        mixing_ratio_60m:units = "g/kg" ;
float mixing_ratio_02m_SMOS(time) ;
        mixing_ratio_02m_SMOS:long_name = "Water vapor mixing ratio at surface from
SMOS" ;
        mixing_ratio_02m_SMOS:units = "g/kg" ;
float mixing_ratio_02m_THWAPS(time) ;
        mixing_ratio_02m_THWAPS:long_name = "Water vapor mixing ratio at surface
from THWAPS" ;
        mixing_ratio_02m_THWAPS:units = "g/kg" ;
float mixing_ratio_25m_SE(time) ;
        mixing_ratio_25m_SE:long_name = "Water vapor mixing ratio at 25 m from SE
elevator" ;
        mixing_ratio_25m_SE:units = "g/kg" ;
float mixing_ratio_25m_W(time) ;
        mixing_ratio_25m_W:long_name = "Water vapor mixing ratio at 25 m from W
elevator" ;
        mixing_ratio_25m_W:units = "g/kg" ;
float mixing_ratio_60m_SE(time) ;
        mixing_ratio_60m_SE:long_name = "Water vapor mixing ratio at 60 m from SE
elevator" ;
        mixing_ratio_60m_SE:units = "g/kg" ;
float mixing_ratio_60m_W(time) ;
        mixing_ratio_60m_W:long_name = "Water vapor mixing ratio at 60 m from W
elevator" ;
        mixing_ratio_60m_W:units = "g/kg" ;
float lat ;
        lat:long_name = "north latitude" ;
        lat:units = "degrees" ;
float lon ;
        lon:long_name = "east longitude" ;
        lon:units = "degrees" ;
float alt ;
        alt:long_name = "altitude" ;
        alt:units = "meters above Mean Sea Level" ;

// global attributes:
:Date = "Thu Mar 1 01:52:37 GMT 2001" ;
:Version = "$State: process-vap-twrmr-1.5-1 $" ;
:IDL_Tools_Lib_Version = "$State: process-vap-twrmr-1.5-1 $" ;
:IDL_Version = "VAP coded in IDL (sparc / sunos / unix / 5.4)" ;
:Command_Line = "/home/vlasakova/dev/vap/bin/twrmr -g 1 -d 981001" ;
:Number_Input_Platforms = "5" ;
:Input_Platforms = "sgp1smosE13.a0, Dsgp1thwapsC1.b1, sgp1twr10xC1.b1,
sgp1twr25mC1.a0, sgp1twr60mC1.a0" ;
:Averaging_Int = "1 min" ;

```

```
secondary" ;           :Surface_selection_order = "SMOS used as primary surface obs, THWAPS as  
secondary" ;           :Tower_selection_order = "SE elevator used as primary tower obs, W elevator as  
secondary" ;           :zeb_platform = "sgp1twrmrC1.c1" ;  
                        :missing-data = "-999.0" ;
```

4.3 Examples of Output Filename Structure

- pres_02m
- pres_25m
- pres_60m
- temp_02m
- temp_25m
- temp_60m
- temp_02m_SMOS
- temp_02m_THWAPS
- temp_25m_SE
- temp_25m_W
- temp_60m_SE
- temp_60m_W
- rh_02m
- rh_25m
- rh_60m
- rh_02m_SMOS
- rh_02m_THWAPS
- rh_25m_SE
- rh_25m_W
- rh_60m_SE
- rh_60m_W
- vap_pres_02m
- vap_pres_25m
- vap_pres_60m
- vap_pres_02m_SMOS
- vap_pres_02m_THWAPS

- vap_pres_25m_SE
- vap_pres_25m_W
- vap_pres_60m_SE
- vap_pres_60m_W
- mixing_ratio_02m
- mixing_ratio_25m
- mixing_ratio_60m
- mixing_ratio_02m_SMOS
- mixing_ratio_02m_THWAPS
- mixing_ratio_25m_SE
- mixing_ratio_25m_W
- mixing_ratio_60m_SE
- mixing_ratio_60m_W

4.3.1 Description of Data Quality Fields

This information is currently unavailable.

4.3.2 Status and Location of Results

This information is currently unavailable.

4.3.3 Notes for Data Users

This information is currently unavailable.

5.0 Related Products Data and Links

5.1 Ordering Data

To access data in the ARM Data Archive, visit the [Data Discovery](#) interface. Users can search by measurement category or enter keywords in the search box.

5.2 Links to Notification File

This information is currently unavailable.

5.3 Link to Data Release History

This information is currently unavailable.

5.4 Other

This information is currently unavailable.

6.0 Frequently Asked Questions

This information is currently unavailable.

7.0 Contacts

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8.0 VAP Specific Glossary and Acronyms

For ARM-wide acronyms, see the [ARM Acronyms/Glossary](#).

9.0 Citable References

This information is currently unavailable.

Appendix A

A.1 Input Datastreams

A.1.1 Input Datastreams for 1-Minute Time Averages

sgp1smosE13.b1:

```

netcdf sgp1smosE13.b1.20010217.000000 {
dimensions:
    time = UNLIMITED ; // (1385 currently)
variables:
    int base_time ;
        base_time:string = "17-Feb-2001,0:00:00 GMT" ;
        base_time:long_name = "Base time in Epoch" ;
        base_time:units = "seconds since 1970-1-1 0:00:00 0:00" ;
    double time_offset(time) ;
        time_offset:long_name = "Time offset from base_time" ;
        time_offset:units = "seconds since 2001-02-17 00:00:00 0:00" ;
    float wspd(time) ;
        wspd:long_name = "Wind Speed" ;
        wspd:units = "m/s" ;
        wspd:valid_min = 0.f ;
        wspd:valid_max = 60.f ;
        wspd:resolution = 0.01f ;
        wspd:missing_value = -9999.f ;
        wspd:threshold = "1.00 m/s" ;
        wspd:uncertainty = "+/- 1% for 2.5 to 30 m/s\n",
"- 0.12 to +0.02 m/s at 2.0 m/s\n",
"- 0.22 to +0.00 m/s at 1.5 m/s\n",
"- 0.31 to -0.20 m/s at 1.0 m/s\n",
"- 0.51 to -0.49 m/s at 0.5 m/s\n",
"Error included in uncertainty are calibration accuracy,\n",
"data logger timebase accuracy, and bias by underestimation\n",
"due to threshold. The latter assumes normal distribution\n",
"of winds about the mean with standard deviations ranging\n",
"between 0.25 and 1.00 m/s." ;
    int qc_wspd(time) ;
        qc_wspd:long_name = "Quality check results on field: Wind Speed" ;
        qc_wspd:units = "unitless" ;
    float wspd_va(time) ;
        wspd_va:long_name = "Wind Speed (vector averaged)" ;
        wspd_va:units = "m/s" ;
        wspd_va:valid_min = 0.f ;
        wspd_va:valid_max = 60.f ;
        wspd_va:resolution = 0.01f ;
        wspd_va:missing_value = -9999.f ;
    int qc_wspd_va(time) ;
        qc_wspd_va:long_name = "Quality check results on field: Wind Speed (vector
averaged)" ;
        qc_wspd_va:units = "unitless" ;
    float wdir(time) ;

```

```

wdir:long_name = "Wind Direction" ;
wdir:units = "deg" ;
wdir:valid_min = 0.f ;
wdir:valid_max = 360.f ;
wdir:resolution = 0.1f ;
wdir:missing_value = -9999.f ;
wdir:threshold = "Wind speed </= 1.00 m/s" ;
wdir:uncertainty = "+/- 5.0 deg for wind speed > 1.0 m/s\n",
"+/- 180.0 deg for wind speed </= 1.0 m/s\n",
"Errors included in uncertainty are sensor accuracy,\n",
"alignment accuracy, and A/D conversion accuracy." ;
int qc_wdir(time) ;
qc_wdir:long_name = "Quality check results on field: Wind Direction" ;
qc_wdir:units = "unitless" ;
float sd_deg(time) ;
sd_deg:long_name = "Standard Deviation of wind direction" ;
sd_deg:units = "deg" ;
sd_deg:valid_min = 0.f ;
sd_deg:valid_max = 90.f ;
sd_deg:resolution = 0.1f ;
sd_deg:missing_value = -9999.f ;
int qc_sd_deg(time) ;
qc_sd_deg:long_name = "Quality check results on field: Standard Deviation of wind
direction" ;
qc_sd_deg:units = "unitless" ;
float temp(time) ;
temp:long_name = "Temperature" ;
temp:units = "C" ;
temp:valid_min = -40.f ;
temp:valid_max = 50.f ;
temp:resolution = 0.01f ;
temp:missing_value = -9999.f ;
temp:uncertainty = "+/- 0.45 C for wind speed >/= 6.00 m/s\n",
"+/- 0.89 C for wind speed = 3.00 m/s\n",
"+/- 1.46 C for wind speed = 2.00 m/s\n",
"+/- 3.07 C for wind speed = 1.00 m/s\n",
"Errors included in uncertainty are radiation error, sensor\n",
"interchangeability, bridge resistor precision, and polynomial\n",
"curve fitting. Radiation error is the largest contributor to\n",
"the latter uncertainties. Future algorithm development may\n",
"reduce these uncertainties." ;
int qc_temp(time) ;
qc_temp:long_name = "Quality check results on field: Temperature" ;
qc_temp:units = "unitless" ;
float rh(time) ;
rh:long_name = "Relative Humidity" ;
rh:units = "%" ;
rh:valid_min = -2.f ;
rh:valid_max = 104.f ;
rh:resolution = 0.1f ;
rh:missing_value = -9999.f ;

```

```

        rh:uncertainty = "+/- 2.06 % RH for 0 to 90 % RH\n",
"+/- 3.04 % RH for 90 to 100 % RH\n",
"Errors included in uncertainty are calibration uncertainty,\n",
"repeatability, temperature dependence, long term (1 yr)\n",
"stability, and A/D conversion accuracy. Wind speed dependence\n",
"and radiation dependence have not been considered and may\n",
"increase the uncertainty." ;
    int qc_rh(time) ;
        qc_rh:long_name = "Quality check results on field: Relative Humidity" ;
        qc_rh:units = "unitless" ;
    float vap_pres(time) ;
        vap_pres:long_name = "Vapor Pressure" ;
        vap_pres:units = "kPa" ;
        vap_pres:valid_min = 0.f ;
        vap_pres:valid_max = 10.f ;
        vap_pres:resolution = 0.001f ;
        vap_pres:missing_value = -9999.f ;
    int qc_vap_pres(time) ;
        qc_vap_pres:long_name = "Quality check results on field: Vapor Pressure" ;
        qc_vap_pres:units = "unitless" ;
    float bar_pres(time) ;
        bar_pres:long_name = "Barometric Pressure" ;
        bar_pres:units = "kPa" ;
        bar_pres:valid_min = 80.f ;
        bar_pres:valid_max = 110.f ;
        bar_pres:resolution = 0.01f ;
        bar_pres:missing_value = -9999.f ;
        bar_pres:uncertainty = "+/- 0.035 kPa\n",
"Errors included in uncertainty are linearity, hysteresis,\n",
"repeatability, calibration uncertainty, temperature dependence,\n",
"and long-term (1 yr) stability. Wind speed dependence has not\n",
"been considered and may increase the uncertainty." ;
    int qc_bar_pres(time) ;
        qc_bar_pres:long_name = "Quality check results on field: Barometric Pressure" ;
        qc_bar_pres:units = "unitless" ;
    float precip(time) ;
        precip:long_name = "Precipitation Total" ;
        precip:units = "mm" ;
        precip:valid_min = 0.f ;
        precip:valid_max = 10.f ;
        precip:resolution = 0.001f ;
        precip:missing_value = -9999.f ;
        precip:uncertainty = "Under normal conditions, uncertainty for\n",
"rain is +/- 0.254 mm (one bucket). Uncertainty increases to\n",
"an unknown value during strong winds or very heavy rains (in\n",
"excess of 75 mm per hour). The instrument is not considered\n",
"reliable for snow amounts." ;
    int qc_precip(time) ;
        qc_precip:long_name = "Quality check results on field: Precipitation Total" ;
        qc_precip:units = "unitless" ;
    float lat ;

```

```

        lat:long_name = "north latitude" ;
        lat:units = "degrees" ;
        lat:valid_min = -90.f ;
        lat:valid_max = 90.f ;
float lon ;
        lon:long_name = "east longitude" ;
        lon:units = "degrees" ;
        lon:valid_min = -180.f ;
        lon:valid_max = 180.f ;
float alt ;
        alt:long_name = "altitude" ;
        alt:units = "meters above Mean Sea Level" ;

// global attributes:
        :qc_method = "Standard Mentor QC" ;
        :Mentor_QC_Field_Information = "For each qc_<field> interpret the values as
follows:\n",
"\n",
"Basic mentor QC checks:\n",
"=====\n",
"A value of 0 means that no mentor QC (missing/min/max/delta) checks failed\n",
"A value of 1 means that the sample contained a \'missing data\' value\n",
"A value of 2 means that the sample failed the \'minimum\' check\n",
"A value of 4 means that the sample failed the \'maximum\' check\n",
"A value of 8 means that the sample failed the \'delta\' check\n",
"\n",
" Note that the delta computation for multi-dimensioned data \n",
" compares the absolute value between points in the same spatial \n",
" location, at the next point in time. \n",
"\n",
"Possible Combinations of mentor QC check results:\n",
"=====\n",
"\n",
"A value of 3 means that the sample failed the \'missing and minimum\' checks\n",
"A value of 5 means that the sample failed the \'missing and maximum\' checks\n",
"A value of 7 means that the sample failed the \'missing, minimum and maximum\' checks\n",
"A value of 9 means that the sample failed the \'missing and delta\' checks\n",
"A value of 10 means that the sample failed the \'minimum and delta\' checks\n",
"A value of 11 means that the sample failed the \'missing, minimum and delta\' checks\n",
"A value of 12 means that the sample failed the \'maximum and delta\' checks\n",
"A value of 14 means that the sample failed the \'minimum, maximum and delta\' checks\n",
"A value of 15 means that the sample failed the \'missing, minimum, maximum and delta\' checks\n",
"\n",
"If the associated non-QC field does not contain any mentor-specified minimum,\n",
maximum or delta information, we do not generate a qc_field.\n",
"" ;

        :mqc_software = "$Id: sgp1smosE13.b1.header.txt,v 1.1 2001/03/01 18:32:16
vlasakova process-vap-twrmr-1.5-1 $" ;
        :proc_level = "b1" ;
        :ingest_software = " smos_ingest.c,v 7.0 2001/02/06 03:45:53 ermold Exp $" ;

```

```

        :input_source = "a1 file generated from:
smos13:/home/ftp/pub/data/collection/sgp/sgpsmosE13.00/smosE13.20010216.225800.icm" ;
        :site_id = "sgp" ;
        :facility_id = "E13 : Lamont_CF1" ;
        :sample_int = "bar press - 1 minute\n",
"all others 1 second" ;
        :averaging_int = "1 minute" ;
        :serial_number = "SMOS8" ;
        :comment = "The time assigned to each data point indicates the end of any\n",
"period of averaging of the geophysical data.\n",
"\n",
"Altitude is in meters above Mean Sea Level." ;
        :resolution_description = "The resolution field attributes refer to the number of
significant\n",
"digits relative to the decimal point that should be used in\n",
"calculations. Using fewer digits might result in greater uncertainty;\n",
"using a larger number of digits should have no effect and thus is\n",
"unnecessary. However, analyses based on differences in values with\n",
"a larger number of significant digits than indicated could lead to\n",
"erroneous results or misleading scientific conclusions.\n",
"\n",
"resolution for lat= 0.001\n",
"resolution for lon = 0.001\n",
"resolution for alt = 1" ;
        :sensor_location = "Sensors heights (above base \"alt\"): \n",
" 10m for winds\n",
" 2m for temp, RH, and vap pres\n",
" 1m for bar pres" ;
        :zeb_platform = "sgp1smosE13.b1" ;
        :history = "created by the Zebra DataStore library, 25-Feb-2001,3:45:43, $RCSfile:
sgp1smosE13.b1.header.txt,v $ $Revision: 1.1 $\n",
"" ;

```

sgpthwapsC1.b1:

```

netcdf sgpthwapsC1.b1.20010217.001000 {
dimensions:
    time = UNLIMITED ; // (281 currently)
variables:
    int base_time ;
        base_time:string = "17-Feb-2001,0:10:00 GMT" ;
        base_time:long_name = "Base time in Epoch" ;
        base_time:units = "seconds since 1970-1-1 0:00:00 0:00" ;
    double time_offset(time) ;
        time_offset:long_name = "Time offset from base_time" ;
        time_offset:units = "seconds since 2001-02-17 00:10:00 0:00" ;
    float pres(time) ;
        pres:long_name = "Pressure" ;
        pres:units = "hPa" ;

```

```

        pres:valid_min = 800.f ;
        pres:valid_max = 1100.f ;
        pres:resolution = 0.1f ;
        pres:missing_value = -9999.f ;
int qc_pres(time) ;
    qc_pres:long_name = "Quality check results on field: Pressure" ;
    qc_pres:units = "unitless" ;
float temp(time) ;
    temp:long_name = "Temperature" ;
    temp:units = "C" ;
    temp:valid_min = -40.f ;
    temp:valid_max = 50.f ;
    temp:resolution = 0.1f ;
    temp:missing_value = -9999.f ;
int qc_temp(time) ;
    qc_temp:long_name = "Quality check results on field: Temperature" ;
    qc_temp:units = "unitless" ;
float rh(time) ;
    rh:long_name = "Relative Humidity" ;
    rh:units = "%" ;
    rh:valid_min = -2.f ;
    rh:valid_max = 104.f ;
    rh:resolution = 1.f ;
    rh:missing_value = -9999.f ;
int qc_rh(time) ;
    qc_rh:long_name = "Quality check results on field: Relative Humidity" ;
    qc_rh:units = "unitless" ;
float vap_pres(time) ;
    vap_pres:long_name = "Vapor Pressure" ;
    vap_pres:units = "kPa" ;
    vap_pres:valid_min = 0.f ;
    vap_pres:valid_max = 10.f ;
    vap_pres:resolution = 0.001f ;
    vap_pres:missing_value = -9999.f ;
int qc_vap_pres(time) ;
    qc_vap_pres:long_name = "Quality check results on field: Vapor Pressure" ;
    qc_vap_pres:units = "unitless" ;
float wspd(time) ;
    wspd:long_name = "Mean Wind Speed" ;
    wspd:units = "m/s" ;
    wspd:valid_min = 0.f ;
    wspd:valid_max = 45.f ;
    wspd:resolution = 0.1f ;
    wspd:missing_value = -9999.f ;
int qc_wspd(time) ;
    qc_wspd:long_name = "Quality check results on field: Mean Wind Speed" ;
    qc_wspd:units = "unitless" ;
float wdir(time) ;
    wdir:long_name = "Unit Vector Wind Direction" ;
    wdir:units = "deg" ;
    wdir:valid_min = 0.f ;

```

```

        wdir:valid_max = 360.f ;
        wdir:resolution = 1.f ;
        wdir:missing_value = -9999.f ;
int qc_wdir(time) ;
    qc_wdir:long_name = "Quality check results on field: Unit Vector Wind Direction" ;
    qc_wdir:units = "unitless" ;
float sd_wdir(time) ;
    sd_wdir:long_name = "Standard Deviation of Wind Direction" ;
    sd_wdir:units = "deg" ;
    sd_wdir:valid_min = 0.f ;
    sd_wdir:valid_max = 90.f ;
    sd_wdir:resolution = 1.f ;
    sd_wdir:missing_value = -9999.f ;
int qc_sd_wdir(time) ;
    qc_sd_wdir:long_name = "Quality check results on field: Standard Deviation of
Wind Direction" ;
    qc_sd_wdir:units = "unitless" ;
float sd_pres(time) ;
    sd_pres:long_name = "Standard Deviation of Pressure" ;
    sd_pres:units = "hPa" ;
    sd_pres:valid_min = 0.f ;
    sd_pres:resolution = 0.1f ;
    sd_pres:missing_value = -9999.f ;
int qc_sd_pres(time) ;
    qc_sd_pres:long_name = "Quality check results on field: Standard Deviation of
Pressure" ;
    qc_sd_pres:units = "unitless" ;
float sd_temp(time) ;
    sd_temp:long_name = "Standard Deviation of Temperature" ;
    sd_temp:units = "C" ;
    sd_temp:valid_min = 0.f ;
    sd_temp:valid_max = 2.f ;
    sd_temp:resolution = 0.1f ;
    sd_temp:missing_value = -9999.f ;
int qc_sd_temp(time) ;
    qc_sd_temp:long_name = "Quality check results on field: Standard Deviation of
Temperature" ;
    qc_sd_temp:units = "unitless" ;
float sd_rh(time) ;
    sd_rh:long_name = "Standard Deviation of Relative Humidity" ;
    sd_rh:units = "%" ;
    sd_rh:valid_min = 0.f ;
    sd_rh:valid_max = 20.f ;
    sd_rh:resolution = 1.f ;
    sd_rh:missing_value = -9999.f ;
int qc_sd_rh(time) ;
    qc_sd_rh:long_name = "Quality check results on field: Standard Deviation of
Relative Humidity" ;
    qc_sd_rh:units = "unitless" ;
float sd_vap_pres(time) ;
    sd_vap_pres:long_name = "Standard Deviation of Vapor Pressure" ;

```

```

        sd_vap_pres:units = "kPa" ;
        sd_vap_pres:valid_min = 0.f ;
        sd_vap_pres:resolution = 0.001f ;
        sd_vap_pres:missing_value = -9999.f ;
    int qc_sd_vap_pres(time) ;
        qc_sd_vap_pres:long_name = "Quality check results on field: Standard Deviation of
Vapor Pressure" ;
        qc_sd_vap_pres:units = "unitless" ;
    float vbat(time) ;
        vbat:long_name = "Battery Voltage" ;
        vbat:units = "V" ;
        vbat:valid_min = 9.6f ;
        vbat:valid_max = 16.f ;
        vbat:resolution = 0.01f ;
        vbat:missing_value = -9999.f ;
    int qc_vbat(time) ;
        qc_vbat:long_name = "Quality check results on field: Battery Voltage" ;
        qc_vbat:units = "unitless" ;
    float lat ;
        lat:long_name = "north latitude" ;
        lat:units = "degrees" ;
        lat:valid_min = -90.f ;
        lat:valid_max = 90.f ;
    float lon ;
        lon:long_name = "east longitude" ;
        lon:units = "degrees" ;
        lon:valid_min = -180.f ;
        lon:valid_max = 180.f ;
    float alt ;
        alt:long_name = "altitude" ;
        alt:units = "meters above Mean Sea Level" ;

// global attributes:
        :qc_method = "Standard Mentor QC" ;
        :Mentor_QC_Field_Information = "For each qc_<field> interpret the values as
follows:\n",
        "\n",
        "Basic mentor QC checks:\n",
        "=====\n",
        "A value of 0 means that no mentor QC (missing/min/max/delta) checks failed\n",
        "A value of 1 means that the sample contained a '\missing data\' value\n",
        "A value of 2 means that the sample failed the '\minimum\' check\n",
        "A value of 4 means that the sample failed the '\maximum\' check\n",
        "A value of 8 means that the sample failed the '\delta\' check\n",
        "\n",
        " Note that the delta computation for multi-dimensioned data \n",
        " compares the absolute value between points in the same spatial \n",
        " location, at the next point in time. \n",
        "\n",
        "Possible Combinations of mentor QC check results:\n",
        "=====\n",

```



```

"\n",
"A value of 3 means that the sample failed the \'missing and minimum\' checks\n",
"A value of 5 means that the sample failed the \'missing and maximum\' checks\n",
"A value of 7 means that the sample failed the \'missing, minimum and maximum\' checks\n",
"A value of 9 means that the sample failed the \'missing and delta\' checks\n",
"A value of 10 means that the sample failed the \'minimum and delta\' checks\n",
"A value of 11 means that the sample failed the \'missing, minimum and delta\' checks\n",
"A value of 12 means that the sample failed the \'maximum and delta\' checks\n",
"A value of 14 means that the sample failed the \'minimum, maximum and delta\' checks\n",
"A value of 15 means that the sample failed the \'missing, minimum, maximum and delta\' checks\n",
"\n",
"If the associated non-QC field does not contain any mentor-specified minimum,\n",
maximum or delta information, we do not generate a qc_field.\n",
"" ;

:mqc_software = "$Id: sgpthwapsC1.b1.header.txt,v 1.1 2001/03/01 18:34:34
vlasakova process-vap-twrmr-1.5-1 $" ;
:proc_level = "b1" ;
:ingest_software = " thwaps_ingest.c,v 7.1 2001/02/06 01:42:20 ermold Exp $" ;
:input_source = "a1 file generated from:
thwaps1:/home/ftp/pub/data/collection/sgp/sgpthwapsC1.00/thwapsC1.20010217.001000.icm" ;
:site_id = "sgp" ;
:facility_id = "C1 : Central_Facility" ;
:sample_int = "3 seconds" ;
:averaging_int = "5 minute" ;
:serial_number = "N/A" ;
:comment = "This is a test THWAPS\n",
"\n",
"The wind speed is the \'mean horizontal wind speed\' which is  $(1/N)*SUM(Si)$ .\n",
"\n",
"The wind direction is the \'unit vector wind direction\' which is defined as \n",
" $ARCTAN(Ux/Uy)$  where  $Ux = SUM(Sin(THETAi))/N$  and  $Uy = SUM(Cos(THETAi))/N$ .\n",
"\n",
"The standard deviation of wind direction is computed using the Yamartino\n",
"algorithm in which  $StdDevTHETA = ARCSIN(epsilon)*[1+0.1547*epsilon**3]$ \n",
"where,  $epsilon = SQRT[1-(Ux**2 + Uy**2)]$ \n",
"\n",
"The time assigned to each data point indicates the end of any period of\n",
"averaging of the geophysical data." ;
:resolution_description = "The resolution field attributes refer to the number of
significant\n",
"digits relative to the decimal point that should be used in\n",
"calculations. Using fewer digits might result in greater uncertainty;\n",
"using a larger number of digits should have no effect and thus is\n",
"unnecessary. However, analyses based on differences in values with\n",
"a larger number of significant digits than indicated could lead to\n",
"erroneous results or misleading scientific conclusions.\n",
"\n",
"resolution for lat= 0.001\n",
"resolution for lon = 0.001\n",
"resolution for alt = 1" ;
:zeb_platform = "sgpthwapsC1.b1" ;

```

```

        :history = "created by the Zebra DataStore library, 25-Feb-2001,5:45:43, $RCSfile:
sgp1twapsC1.b1.header.txt,v $ $Revision: 1.1 $\n",
        "" ;
}

```

sgp1twr10xC1.b1:

```

netcdf sgp1twr10xC1.b1.20010217.000000 {
dimensions:
    time = UNLIMITED ; // (1440 currently)
variables:
    int base_time ;
        base_time:string = "17-Feb-2001,0:00:00 GMT" ;
        base_time:long_name = "Base time in Epoch" ;
        base_time:units = "seconds since 1970-1-1 0:00:00 0:00" ;
    double time_offset(time) ;
        time_offset:long_name = "Time offset from base_time" ;
        time_offset:units = "seconds since 2001-02-17 00:00:00 0:00" ;
    float temp_60m(time) ;
        temp_60m:long_name = "60 m Air Temperature" ;
        temp_60m:units = "C" ;
        temp_60m:valid_min = -50.f ;
        temp_60m:valid_max = 50.f ;
        temp_60m:resolution = 0.01f ;
        temp_60m:missing_value = -9999.f ;
    int qc_temp_60m(time) ;
        qc_temp_60m:long_name = "Quality check results on field: 60 m Air Temperature" ;
        qc_temp_60m:units = "unitless" ;
    float temp_25m(time) ;
        temp_25m:long_name = "25 m Air Temperature" ;
        temp_25m:units = "C" ;
        temp_25m:valid_min = -50.f ;
        temp_25m:valid_max = 50.f ;
        temp_25m:resolution = 0.01f ;
        temp_25m:missing_value = -9999.f ;
    int qc_temp_25m(time) ;
        qc_temp_25m:long_name = "Quality check results on field: 25 m Air Temperature" ;
        qc_temp_25m:units = "unitless" ;
    float rh_60m(time) ;
        rh_60m:long_name = "60 m Relative Humidity" ;
        rh_60m:units = "%" ;
        rh_60m:valid_min = 0.f ;
        rh_60m:valid_max = 102.f ;
        rh_60m:resolution = 0.1f ;
        rh_60m:missing_value = -9999.f ;
    int qc_rh_60m(time) ;
        qc_rh_60m:long_name = "Quality check results on field: 60 m Relative Humidity" ;
        qc_rh_60m:units = "unitless" ;
    float rh_25m(time) ;

```

```

    rh_25m:long_name = "25 m Relative Humidity" ;
    rh_25m:units = "%" ;
    rh_25m:valid_min = 0.f ;
    rh_25m:valid_max = 102.f ;
    rh_25m:resolution = 0.1f ;
    rh_25m:missing_value = -9999.f ;
int qc_rh_25m(time) ;
    qc_rh_25m:long_name = "Quality check results on field: 25 m Relative Humidity" ;
    qc_rh_25m:units = "unitless" ;
float vap_pres_60m(time) ;
    vap_pres_60m:long_name = "60 m Vapor Pressure" ;
    vap_pres_60m:units = "kPa" ;
    vap_pres_60m:valid_min = 0.f ;
    vap_pres_60m:valid_max = 10.f ;
    vap_pres_60m:resolution = 0.001f ;
    vap_pres_60m:missing_value = -9999.f ;
int qc_vap_pres_60m(time) ;
    qc_vap_pres_60m:long_name = "Quality check results on field: 60 m Vapor
Pressure" ;
    qc_vap_pres_60m:units = "unitless" ;
float vap_pres_25m(time) ;
    vap_pres_25m:long_name = "25 m Vapor Pressure" ;
    vap_pres_25m:units = "kPa" ;
    vap_pres_25m:valid_min = 0.f ;
    vap_pres_25m:valid_max = 10.f ;
    vap_pres_25m:resolution = 0.001f ;
    vap_pres_25m:missing_value = -9999.f ;
int qc_vap_pres_25m(time) ;
    qc_vap_pres_25m:long_name = "Quality check results on field: 25 m Vapor
Pressure" ;
    qc_vap_pres_25m:units = "unitless" ;
float vbat(time) ;
    vbat:long_name = "Battery Voltage" ;
    vbat:units = "V" ;
    vbat:valid_min = 10.4f ;
    vbat:valid_max = 15.f ;
    vbat:resolution = 0.01f ;
    vbat:missing_value = -9999.f ;
    vbat:comment = "This is the voltage of the CR10X battery for QA/QC purposes,\n",
"prior to 19:30 GMT on 10/30/2000 this was a CR21X logger" ;
int qc_vbat(time) ;
    qc_vbat:long_name = "Quality check results on field: Battery Voltage" ;
    qc_vbat:units = "unitless" ;
float lat ;
    lat:long_name = "north latitude" ;
    lat:units = "degrees" ;
    lat:valid_min = -90.f ;
    lat:valid_max = 90.f ;
float lon ;
    lon:long_name = "east longitude" ;
    lon:units = "degrees" ;

```

```

lon:valid_min = -180.f ;
lon:valid_max = 180.f ;
float alt ;
alt:long_name = "altitude" ;
alt:units = "meters above Mean Sea Level" ;

// global attributes:
:qc_method = "Standard Mentor QC" ;
:Mentor_QC_Field_Information = "For each qc_<field> interpret the values as
follows:\n",
"\n",
"Basic mentor QC checks:\n",
"=====\n",
"A value of 0 means that no mentor QC (missing/min/max/delta) checks failed\n",
"A value of 1 means that the sample contained a '\missing data\' value\n",
"A value of 2 means that the sample failed the '\minimum\' check\n",
"A value of 4 means that the sample failed the '\maximum\' check\n",
"A value of 8 means that the sample failed the '\delta\' check\n",
"\n",
" Note that the delta computation for multi-dimensioned data \n",
" compares the absolute value between points in the same spatial \n",
" location, at the next point in time. \n",
"\n",
"Possible Combinations of mentor QC check results:\n",
"=====\n",
"\n",
"A value of 3 means that the sample failed the '\missing and minimum\' checks\n",
"A value of 5 means that the sample failed the '\missing and maximum\' checks\n",
"A value of 7 means that the sample failed the '\missing, minimum and maximum\' checks\n",
"A value of 9 means that the sample failed the '\missing and delta\' checks\n",
"A value of 10 means that the sample failed the '\minimum and delta\' checks\n",
"A value of 11 means that the sample failed the '\missing, minimum and delta\' checks\n",
"A value of 12 means that the sample failed the '\maximum and delta\' checks\n",
"A value of 14 means that the sample failed the '\minimum, maximum and delta\' checks\n",
"A value of 15 means that the sample failed the '\missing, minimum, maximum and delta\' checks\n",
"\n",
"If the associated non-QC field does not contain any mentor-specified minimum,\n",
"maximum or delta information, we do not generate a qc_field.\n",
"" ;

:mqc_software = "$Id: sgp1twr10xC1.b1.header.txt,v 1.1 2001/03/01 18:32:41
vlasakova process-vap-twrmr-1.5-1 $" ;
:proc_level = "b1" ;
:ingest_software = " twr_ingest.c,v 7.1 2001/02/06 02:15:58 ermold Exp $" ;
:input_source = "a1 file generated from:
twr10x1:/home/ftp/pub/data/collection/sgp/sgptwr10xC1.00/twr10xC1.20010216.230000.icm" ;
:site_id = "sgp" ;
:facility_id = "C1 : Central_Facility" ;
:sample_int = "1 second" ;
:averaging_int = "1 minute" ;
:serial_number = "N/A" ;

```

```

        :comment = "The time assigned to each data point indicates the end of any period
of\n",
    "averaging of the geophysical data." ;
        :resolution_description = "The resolution field attributes refer to the number of
significant\n",
    "digits relative to the decimal point that should be used in\n",
    "calculations. Using fewer digits might result in greater uncertainty;\n",
    "using a larger number of digits should have no effect and thus is\n",
    "unnecessary. However, analyses based on differences in values with\n",
    "a larger number of significant digits than indicated could lead to\n",
    "erroneous results or misleading scientific conclusions.\n",
    "\n",
    "resolution for lat= 0.001\n",
    "resolution for lon = 0.001\n",
    "resolution for alt = 1" ;
        :zeb_platform = "sgp1twr10xC1.b1" ;
        :history = "created by the Zebra DataStore library, 25-Feb-2001,3:45:31, $RCSfile:
sgp1twr10xC1.b1.header.txt,v $ $Revision: 1.1 $" ;
    "" ;
}

```

sgp1twr25mC1.b1:

```

netcdf sgp1twr25mC1.b1.20010217.000000 {
dimensions:
    time = UNLIMITED ; // (1440 currently)
variables:
    int base_time ;
        base_time:string = "17-Feb-2001,0:00:00 GMT" ;
        base_time:long_name = "Base time in Epoch" ;
        base_time:units = "seconds since 1970-1-1 0:00:00 0:00" ;
    double time_offset(time) ;
        time_offset:long_name = "Time offset from base_time" ;
        time_offset:units = "seconds since 2001-02-17 00:00:00 0:00" ;
    float temp(time) ;
        temp:long_name = "Temperature (degrees C)" ;
        temp:units = "C" ;
        temp:valid_min = -50.f ;
        temp:valid_max = 50.f ;
        temp:resolution = 0.01f ;
        temp:missing_value = -9999.f ;
    int qc_temp(time) ;
        qc_temp:long_name = "Quality check results on field: Temperature (degrees C)" ;
        qc_temp:units = "unitless" ;
    float rh(time) ;
        rh:long_name = "Relative Humidity" ;
        rh:units = "%" ;
        rh:valid_min = 0.f ;
        rh:valid_max = 102.f ;
}

```

```

        rh:resolution = 0.1f ;
        rh:missing_value = -9999.f ;
int qc_rh(time) ;
        qc_rh:long_name = "Quality check results on field: Relative Humidity" ;
        qc_rh:units = "unitless" ;
float vap_pres(time) ;
        vap_pres:long_name = "Vapor Pressure (kiloPascals)" ;
        vap_pres:units = "kPa" ;
        vap_pres:valid_min = 0.f ;
        vap_pres:valid_max = 10.f ;
        vap_pres:resolution = 0.001f ;
        vap_pres:missing_value = -9999.f ;
int qc_vap_pres(time) ;
        qc_vap_pres:long_name = "Quality check results on field: Vapor Pressure
(kiloPascals)" ;
        qc_vap_pres:units = "unitless" ;
float aspirator(time) ;
        aspirator:long_name = "Aspirator Flow Status (% of time with proper flow)" ;
        aspirator:units = "%" ;
        aspirator:valid_min = 90.f ;
        aspirator:valid_max = 100.f ;
        aspirator:resolution = 0.1f ;
        aspirator:missing_value = -9999.f ;
int qc_aspirator(time) ;
        qc_aspirator:long_name = "Quality check results on field: Aspirator Flow Status (%
of time with proper flow)" ;
        qc_aspirator:units = "unitless" ;
float vbat(time) ;
        vbat:long_name = "Battery Voltage" ;
        vbat:units = "V" ;
        vbat:valid_min = 10.4f ;
        vbat:valid_max = 15.f ;
        vbat:resolution = 0.01f ;
        vbat:missing_value = -9999.f ;
        vbat:comment = "This is the voltage of the CR10X battery for QA/QC purposes,\n",
"prior to 19:30 GMT on 10/30/2000 this was a CR21X logger" ;
int qc_vbat(time) ;
        qc_vbat:long_name = "Quality check results on field: Battery Voltage" ;
        qc_vbat:units = "unitless" ;
float lat ;
        lat:long_name = "north latitude" ;
        lat:units = "degrees" ;
        lat:valid_min = -90.f ;
        lat:valid_max = 90.f ;
float lon ;
        lon:long_name = "east longitude" ;
        lon:units = "degrees" ;
        lon:valid_min = -180.f ;
        lon:valid_max = 180.f ;
float alt ;
        alt:long_name = "altitude" ;

```

```

alt:units = "meters above Mean Sea Level" ;

// global attributes:
:qc_method = "Standard Mentor QC" ;
:Mentor_QC_Field_Information = "For each qc_<field> interpret the values as
follows:\n",
"\n",
"Basic mentor QC checks:\n",
"=====\n",
"A value of 0 means that no mentor QC (missing/min/max/delta) checks failed\n",
"A value of 1 means that the sample contained a \missing data\ value\n",
"A value of 2 means that the sample failed the \minimum\ check\n",
"A value of 4 means that the sample failed the \maximum\ check\n",
"A value of 8 means that the sample failed the \delta\ check\n",
"\n",
" Note that the delta computation for multi-dimensioned data \n",
" compares the absolute value between points in the same spatial \n",
" location, at the next point in time. \n",
"\n",
"Possible Combinations of mentor QC check results:\n",
"=====\n",
"\n",
"A value of 3 means that the sample failed the \missing and minimum\ checks\n",
"A value of 5 means that the sample failed the \missing and maximum\ checks\n",
"A value of 7 means that the sample failed the \missing, minimum and maximum\ checks\n",
"A value of 9 means that the sample failed the \missing and delta\ checks\n",
"A value of 10 means that the sample failed the \minimum and delta\ checks\n",
"A value of 11 means that the sample failed the \missing, minimum and delta\ checks\n",
"A value of 12 means that the sample failed the \maximum and delta\ checks\n",
"A value of 14 means that the sample failed the \minimum, maximum and delta\ checks\n",
"A value of 15 means that the sample failed the \missing, minimum, maximum and delta\ checks\n",
"\n",
"If the associated non-QC field does not contain any mentor-specified minimum,\n",
"maximum or delta information, we do not generate a qc_field.\n",
"" ;

:mqc_software = "$Id: sgp1twr25mC1.b1.header.txt,v 1.1 2001/03/01 18:32:57
vlasakova process-vap-twrmr-1.5-1 $" ;
:proc_level = "b1" ;
:ingest_software = " twr_ingest.c,v 7.1 2001/02/06 02:15:58 ermold Exp $" ;
:input_source = "a1 file generated from:
twr25m1:/home/ftp/pub/data/collection/sgp/sgptwr25mC1.00/twr25mC1.20010216.230100.icm" ;
:site_id = "sgp" ;
:facility_id = "C1 : Central_Facility" ;
:sample_int = "1 second" ;
:averaging_int = "1 minute" ;
:serial_number = "N/A" ;
:comment = "The time assigned to each data point indicates the end of any period
of\n",
"averaging of the geophysical data." ;
:resolution_description = "The resolution field attributes refer to the number of
significant\n",

```

```

"digits relative to the decimal point that should be used in\n",
"calculations. Using fewer digits might result in greater uncertainty;\n",
"using a larger number of digits should have no effect and thus is\n",
"unnecessary. However, analyses based on differences in values with\n",
"a larger number of significant digits than indicated could lead to\n",
"erroneous results or misleading scientific conclusions.\n",
"\n",
"resolution for lat= 0.001\n",
"resolution for lon = 0.001\n",
"resolution for alt = 1" ;
:sensor_location = "Sensors heights (above base \alt\): 25m for temp, rh, vap_pres
and aspirator." ;
:zeb_platform = "sgp1twr25mC1.b1" ;
:history = "created by the Zebra DataStore library, 25-Feb-2001,3:45:26, $RCSfile:
sgp1twr25mC1.b1.header.txt,v $ $Revision: 1.1 $\n",
"" ;
}

```

sgp1twr60mC1.b1:

```

netcdf sgp1twr60mC1.b1.20010217.000000 {
dimensions:
    time = UNLIMITED ; // (1440 currently)
variables:
    int base_time ;
        base_time:string = "17-Feb-2001,0:00:00 GMT" ;
        base_time:long_name = "Base time in Epoch" ;
        base_time:units = "seconds since 1970-1-1 0:00:00 0:00" ;
    double time_offset(time) ;
        time_offset:long_name = "Time offset from base_time" ;
        time_offset:units = "seconds since 2001-02-17 00:00:00 0:00" ;
    float temp(time) ;
        temp:long_name = "Temperature (degrees C)" ;
        temp:units = "C" ;
        temp:valid_min = -50.f ;
        temp:valid_max = 50.f ;
        temp:resolution = 0.01f ;
        temp:missing_value = -9999.f ;
    int qc_temp(time) ;
        qc_temp:long_name = "Quality check results on field: Temperature (degrees C)" ;
        qc_temp:units = "unitless" ;
    float rh(time) ;
        rh:long_name = "Relative Humidity" ;
        rh:units = "%" ;
        rh:valid_min = 0.f ;
        rh:valid_max = 102.f ;
        rh:resolution = 0.1f ;
        rh:missing_value = -9999.f ;
    int qc_rh(time) ;

```



```

        qc_rh:long_name = "Quality check results on field: Relative Humidity" ;
        qc_rh:units = "unitless" ;
float vap_pres(time) ;
        vap_pres:long_name = "Vapor Pressure (kiloPascals)" ;
        vap_pres:units = "kPa" ;
        vap_pres:valid_min = 0.f ;
        vap_pres:valid_max = 10.f ;
        vap_pres:resolution = 0.001f ;
        vap_pres:missing_value = -9999.f ;
int qc_vap_pres(time) ;
        qc_vap_pres:long_name = "Quality check results on field: Vapor Pressure
(kiloPascals)" ;
        qc_vap_pres:units = "unitless" ;
float aspirator(time) ;
        aspirator:long_name = "Aspirator Flow Status (% of time with proper flow)" ;
        aspirator:units = "%" ;
        aspirator:valid_min = 90.f ;
        aspirator:valid_max = 100.f ;
        aspirator:resolution = 0.1f ;
        aspirator:missing_value = -9999.f ;
int qc_aspirator(time) ;
        qc_aspirator:long_name = "Quality check results on field: Aspirator Flow Status (%
of time with proper flow)" ;
        qc_aspirator:units = "unitless" ;
float vbat(time) ;
        vbat:long_name = "Battery Voltage" ;
        vbat:units = "V" ;
        vbat:valid_min = 10.4f ;
        vbat:valid_max = 15.f ;
        vbat:resolution = 0.01f ;
        vbat:missing_value = -9999.f ;
        vbat:comment = "This is the voltage of the CR10X battery for QA/QC purposes,\n",
"prior to 19:30 GMT on 10/30/2000 this was a CR21X logger" ;
int qc_vbat(time) ;
        qc_vbat:long_name = "Quality check results on field: Battery Voltage" ;
        qc_vbat:units = "unitless" ;
float lat ;
        lat:long_name = "north latitude" ;
        lat:units = "degrees" ;
        lat:valid_min = -90.f ;
        lat:valid_max = 90.f ;
float lon ;
        lon:long_name = "east longitude" ;
        lon:units = "degrees" ;
        lon:valid_min = -180.f ;
        lon:valid_max = 180.f ;
float alt ;
        alt:long_name = "altitude" ;
        alt:units = "meters above Mean Sea Level" ;

```

```
// global attributes:
      :qc_method = "Standard Mentor QC" ;
      :Mentor_QC_Field_Information = "For each qc_<field> interpret the values as
follows:\n",
      "\n",
      "Basic mentor QC checks:\n",
      "=====\n",
      "A value of 0 means that no mentor QC (missing/min/max/delta) checks failed\n",
      "A value of 1 means that the sample contained a '\missing data\' value\n",
      "A value of 2 means that the sample failed the '\minimum\' check\n",
      "A value of 4 means that the sample failed the '\maximum\' check\n",
      "A value of 8 means that the sample failed the '\delta\' check\n",
      "\n",
      " Note that the delta computation for multi-dimensional data \n",
      " compares the absolute value between points in the same spatial \n",
      " location, at the next point in time. \n",
      "\n",
      "Possible Combinations of mentor QC check results:\n",
      "=====\n",
      "\n",
      "A value of 3 means that the sample failed the '\missing and minimum\' checks\n",
      "A value of 5 means that the sample failed the '\missing and maximum\' checks\n",
      "A value of 7 means that the sample failed the '\missing, minimum and maximum\' checks\n",
      "A value of 9 means that the sample failed the '\missing and delta\' checks\n",
      "A value of 10 means that the sample failed the '\minimum and delta\' checks\n",
      "A value of 11 means that the sample failed the '\missing, minimum and delta\' checks\n",
      "A value of 12 means that the sample failed the '\maximum and delta\' checks\n",
      "A value of 14 means that the sample failed the '\minimum, maximum and delta\' checks\n",
      "A value of 15 means that the sample failed the '\missing, minimum, maximum and delta\' checks\n",
      "\n",
      "If the associated non-QC field does not contain any mentor-specified minimum,\n",
      "maximum or delta information, we do not generate a qc_field.\n",
      "" ;
      :mqc_software = "$Id: sgp1twr60mC1.b1.header.txt,v 1.1 2001/03/01 18:33:05
vlasakova process-vap-twr60mC1.1.5-1 $" ;
      :proc_level = "b1" ;
      :ingest_software = " twr_ingest.c,v 7.1 2001/02/06 02:15:58 ermold Exp $" ;
      :input_source = "a1 file generated from:
twr60m1:/home/ftp/pub/data/collection/sgp/sgptwr60mC1.00/twr60mC1.20010216.230200.icm" ;
      :site_id = "sgp" ;
      :facility_id = "C1 : Central_Facility" ;
      :sample_int = "1 second" ;
      :averaging_int = "1 minute" ;
      :serial_number = "N/A" ;
      :comment = "The time assigned to each data point indicates the end of any period
of\n",
      "averaging of the geophysical data." ;
      :resolution_description = "The resolution field attributes refer to the number of
significant\n",
      "digits relative to the decimal point that should be used in\n",
      "calculations. Using fewer digits might result in greater uncertainty;\n",
```

```

"using a larger number of digits should have no effect and thus is\n",
"unnecessary. However, analyses based on differences in values with\n",
"a larger number of significant digits than indicated could lead to\n",
"erroneous results or misleading scientific conclusions.\n",
"\n",
"resolution for lat= 0.001\n",
"resolution for lon = 0.001\n",
"resolution for alt = 1" ;
:sensor_location = "Sensors heights (above base \alt\): 60m for temp, rh, vap_pres
and aspirator." ;
:zeb_platform = "sgp1twr60mC1.b1" ;
:history = "created by the Zebra DataStore library, 25-Feb-2001,3:45:26, $RCSfile:
sgp1twr60mC1.b1.header.txt,v $ $Revision: 1.1 $\n",
"" ;
}

```

A.1.2 Input Datastreams for 30-Minute Time Average

sgp30smosE13.b1:

```

netcdf sgp30smosE13.b1.20010217.000000 {
dimensions:
    time = UNLIMITED ; // (47 currently)
variables:
    int base_time ;
        base_time:string = "17-Feb-2001,0:00:00 GMT" ;
        base_time:long_name = "Base time in Epoch" ;
        base_time:units = "seconds since 1970-1-1 0:00:00 0:00" ;
    double time_offset(time) ;
        time_offset:long_name = "Time offset from base_time" ;
        time_offset:units = "seconds since 2001-02-17 00:00:00 0:00" ;
    float wspd(time) ;
        wspd:long_name = "Wind Speed" ;
        wspd:units = "m/s" ;
        wspd:valid_min = 0.f ;
        wspd:valid_max = 45.f ;
        wspd:resolution = 0.01f ;
        wspd:missing_value = -9999.f ;
        wspd:threshold = "1.00 m/s" ;
        wspd:uncertainty = "+/- 1% for 2.5 to 30 m/s\n",
"- 0.12 to +0.02 m/s at 2.0 m/s\n",
"- 0.22 to +0.00 m/s at 1.5 m/s\n",
"- 0.31 to -0.20 m/s at 1.0 m/s\n",
"- 0.51 to -0.49 m/s at 0.5 m/s\n",
"Error included in uncertainty are calibration accuracy,\n",
"data logger timebase accuracy, and bias by underestimation\n",
"due to threshold. The latter assumes normal distribution\n",
"of winds about the mean with standard deviations ranging\n",
"between 0.25 and 1.00 m/s." ;
    int qc_wspd(time) ;

```

```

        qc_wspd:long_name = "Quality check results on field: Wind Speed" ;
        qc_wspd:units = "unitless" ;
float wspd_va(time) ;
        wspd_va:long_name = "Wind Speed (vector averaged)" ;
        wspd_va:units = "m/s" ;
        wspd_va:valid_min = 0.f ;
        wspd_va:valid_max = 45.f ;
        wspd_va:resolution = 0.01f ;
        wspd_va:missing_value = -9999.f ;
int qc_wspd_va(time) ;
        qc_wspd_va:long_name = "Quality check results on field: Wind Speed (vector
averaged)" ;
        qc_wspd_va:units = "unitless" ;
float wdir(time) ;
        wdir:long_name = "Wind Direction" ;
        wdir:units = "deg" ;
        wdir:valid_min = 0.f ;
        wdir:valid_max = 360.f ;
        wdir:resolution = 0.1f ;
        wdir:missing_value = -9999.f ;
        wdir:threshold = "Wind speed <= 1.00 m/s" ;
        wdir:uncertainty = "+/- 5.0 deg for wind speed > 1.0 m/s\n",
"+/- 180.0 deg for wind speed <= 1.0 m/s\n",
"Errors included in uncertainty are sensor accuracy,\n",
"alignment accuracy, and A/D conversion accuracy." ;
int qc_wdir(time) ;
        qc_wdir:long_name = "Quality check results on field: Wind Direction" ;
        qc_wdir:units = "unitless" ;
float sd_deg(time) ;
        sd_deg:long_name = "Standard Deviation of wind direction" ;
        sd_deg:units = "deg" ;
        sd_deg:valid_min = 0.f ;
        sd_deg:valid_max = 90.f ;
        sd_deg:resolution = 0.1f ;
        sd_deg:missing_value = -9999.f ;
int qc_sd_deg(time) ;
        qc_sd_deg:long_name = "Quality check results on field: Standard Deviation of wind
direction" ;
        qc_sd_deg:units = "unitless" ;
float temp(time) ;
        temp:long_name = "Temperature" ;
        temp:units = "C" ;
        temp:valid_min = -40.f ;
        temp:valid_max = 50.f ;
        temp:resolution = 0.01f ;
        temp:missing_value = -9999.f ;
        temp:uncertainty = "+/- 0.45 C for wind speed >= 6.00 m/s\n",
"+/- 0.89 C for wind speed = 3.00 m/s\n",
"+/- 1.46 C for wind speed = 2.00 m/s\n",
"+/- 3.07 C for wind speed = 1.00 m/s\n",
"Errors included in uncertainty are radiation error, sensor\n",

```

```

"interchangeability, bridge resistor precision, and polynomial\n",
"curve fitting. Radiation error is the largest contributor to\n",
"the latter uncertainties. Future algorithm development may\n",
"reduce these uncertainties." ;
    int qc_temp(time) ;
        qc_temp:long_name = "Quality check results on field: Temperature" ;
        qc_temp:units = "unitless" ;
    float rh(time) ;
        rh:long_name = "Relative Humidity" ;
        rh:units = "%" ;
        rh:valid_min = -2.f ;
        rh:valid_max = 104.f ;
        rh:resolution = 0.1f ;
        rh:missing_value = -9999.f ;
        rh:uncertainty = "+/- 2.06 % RH for 0 to 90 % RH\n",
"+/- 3.04 % RH for 90 to 100 % RH\n",
"Errors included in uncertainty are calibration uncertainty,\n",
"repeatability, temperature dependence, long term (1 yr)\n",
"stability, and A/D conversion accuracy. Wind speed dependence\n",
"and radiation dependence have not been considered and may\n",
"increase the uncertainty." ;
    int qc_rh(time) ;
        qc_rh:long_name = "Quality check results on field: Relative Humidity" ;
        qc_rh:units = "unitless" ;
    float vap_pres(time) ;
        vap_pres:long_name = "Vapor Pressure" ;
        vap_pres:units = "kPa" ;
        vap_pres:valid_min = 0.f ;
        vap_pres:valid_max = 10.f ;
        vap_pres:resolution = 0.001f ;
        vap_pres:missing_value = -9999.f ;
    int qc_vap_pres(time) ;
        qc_vap_pres:long_name = "Quality check results on field: Vapor Pressure" ;
        qc_vap_pres:units = "unitless" ;
    float bar_pres(time) ;
        bar_pres:long_name = "Barometric Pressure" ;
        bar_pres:units = "kPa" ;
        bar_pres:valid_min = 80.f ;
        bar_pres:valid_max = 110.f ;
        bar_pres:resolution = 0.01f ;
        bar_pres:missing_value = -9999.f ;
        bar_pres:uncertainty = "+/- 0.035 kPa\n",
"Errors included in uncertainty are linearity, hysteresis,\n",
"repeatability, calibration uncertainty, temperature dependence,\n",
"and long-term (1 yr) stability. Wind speed dependence has not\n",
"been considered and may increase the uncertainty." ;
    int qc_bar_pres(time) ;
        qc_bar_pres:long_name = "Quality check results on field: Barometric Pressure" ;
        qc_bar_pres:units = "unitless" ;
    float snow(time) ;
        snow:long_name = "Snow Depth" ;

```

```

snow:units = "mm" ;
snow:valid_min = -25.f ;
snow:valid_max = 1500.f ;
snow:resolution = 0.1f ;
snow:missing_value = -9999.f ;
snow:uncertainty = "+/- 10.0 mm plus any offset error\n",
"(Specified accuracy)" ;
int qc_snow(time) ;
qc_snow:long_name = "Quality check results on field: Snow Depth" ;
qc_snow:units = "unitless" ;
float snow_sen(time) ;
snow_sen:long_name = "Snow Depth Sensor" ;
snow_sen:units = "on/off" ;
snow_sen:valid_min = 0.f ;
snow_sen:valid_max = 1.f ;
snow_sen:missing_value = -9999.f ;
int qc_snow_sen(time) ;
qc_snow_sen:long_name = "Quality check results on field: Snow Depth Sensor" ;
qc_snow_sen:units = "unitless" ;
float precip(time) ;
precip:long_name = "Precipitation Total" ;
precip:units = "mm" ;
precip:valid_min = 0.f ;
precip:valid_max = 150.f ;
precip:resolution = 0.001f ;
precip:missing_value = -9999.f ;
precip:uncertainty = "Under normal conditions, uncertainty for\n",
"rain is +/- 0.254 mm (one bucket). Uncertainty increases to\n",
"an unknown value during strong winds or very heavy rains (in\n",
"excess of 75 mm per hour). The instrument is not considered\n",
"reliable for snow amounts." ;
int qc_precip(time) ;
qc_precip:long_name = "Quality check results on field: Precipitation Total" ;
qc_precip:units = "unitless" ;
float vbat(time) ;
vbat:long_name = "Battery Voltage" ;
vbat:units = "V" ;
vbat:valid_min = 9.6f ;
vbat:valid_max = 16.f ;
vbat:resolution = 0.01f ;
vbat:missing_value = -9999.f ;
vbat:comment = "This is the voltage of the CR10X battery for QA/QC purposes" ;
int qc_vbat(time) ;
qc_vbat:long_name = "Quality check results on field: Battery Voltage" ;
qc_vbat:units = "unitless" ;
float sd_wspd(time) ;
sd_wspd:long_name = "Standard Deviation of Wind Speed" ;
sd_wspd:units = "m/s" ;
sd_wspd:valid_min = 0.f ;
sd_wspd:valid_max = 9.f ;
sd_wspd:resolution = 0.01f ;

```

```

        sd_wspd:missing_value = -9999.f ;
int qc_sd_wspd(time) ;
        qc_sd_wspd:long_name = "Quality check results on field: Standard Deviation of
Wind Speed" ;
        qc_sd_wspd:units = "unitless" ;
float sd_temp(time) ;
        sd_temp:long_name = "Standard Deviation of Temperature" ;
        sd_temp:units = "C" ;
        sd_temp:valid_min = 0.f ;
        sd_temp:valid_max = 2.f ;
        sd_temp:resolution = 0.01f ;
        sd_temp:missing_value = -9999.f ;
int qc_sd_temp(time) ;
        qc_sd_temp:long_name = "Quality check results on field: Standard Deviation of
Temperature" ;
        qc_sd_temp:units = "unitless" ;
float sd_rh(time) ;
        sd_rh:long_name = "Standard Deviation of Relative Humidity" ;
        sd_rh:units = "%" ;
        sd_rh:valid_min = 0.f ;
        sd_rh:valid_max = 20.f ;
        sd_rh:resolution = 0.1f ;
        sd_rh:missing_value = -9999.f ;
int qc_sd_rh(time) ;
        qc_sd_rh:long_name = "Quality check results on field: Standard Deviation of
Relative Humidity" ;
        qc_sd_rh:units = "unitless" ;
float sd_vap_pres(time) ;
        sd_vap_pres:long_name = "Standard Deviation of Vapor Pressure" ;
        sd_vap_pres:units = "kPa" ;
        sd_vap_pres:valid_min = 0.f ;
        sd_vap_pres:resolution = 0.001f ;
        sd_vap_pres:missing_value = -9999.f ;
int qc_sd_vap_pres(time) ;
        qc_sd_vap_pres:long_name = "Quality check results on field: Standard Deviation of
Vapor Pressure" ;
        qc_sd_vap_pres:units = "unitless" ;
float sd_bar_pres(time) ;
        sd_bar_pres:long_name = "Standard Deviation of Barometric Pressure" ;
        sd_bar_pres:units = "kPa" ;
        sd_bar_pres:valid_min = 0.f ;
        sd_bar_pres:resolution = 0.01f ;
        sd_bar_pres:missing_value = -9999.f ;
int qc_sd_bar_pres(time) ;
        qc_sd_bar_pres:long_name = "Quality check results on field: Standard Deviation of
Barometric Pressure" ;
        qc_sd_bar_pres:units = "unitless" ;
float lat ;
        lat:long_name = "north latitude" ;
        lat:units = "degrees" ;
        lat:valid_min = -90.f ;

```

```

        lat:valid_max = 90.f ;
float lon ;
        lon:long_name = "east longitude" ;
        lon:units = "degrees" ;
        lon:valid_min = -180.f ;
        lon:valid_max = 180.f ;
float alt ;
        alt:long_name = "altitude" ;
        alt:units = "meters above Mean Sea Level" ;

// global attributes:
        :qc_method = "Standard Mentor QC" ;
        :Mentor_QC_Field_Information = "For each qc_<field> interpret the values as
follows:\n",
        "\n",
        "Basic mentor QC checks:\n",
        "=====\n",
        "A value of 0 means that no mentor QC (missing/min/max/delta) checks failed\n",
        "A value of 1 means that the sample contained a '\missing data\' value\n",
        "A value of 2 means that the sample failed the '\minimum\' check\n",
        "A value of 4 means that the sample failed the '\maximum\' check\n",
        "A value of 8 means that the sample failed the '\delta\' check\n",
        "\n",
        " Note that the delta computation for multi-dimensioned data \n",
        " compares the absolute value between points in the same spatial \n",
        " location, at the next point in time. \n",
        "\n",
        "Possible Combinations of mentor QC check results:\n",
        "=====\n",
        "\n",
        "A value of 3 means that the sample failed the '\missing and minimum\' checks\n",
        "A value of 5 means that the sample failed the '\missing and maximum\' checks\n",
        "A value of 7 means that the sample failed the '\missing, minimum and maximum\' checks\n",
        "A value of 9 means that the sample failed the '\missing and delta\' checks\n",
        "A value of 10 means that the sample failed the '\minimum and delta\' checks\n",
        "A value of 11 means that the sample failed the '\missing, minimum and delta\' checks\n",
        "A value of 12 means that the sample failed the '\maximum and delta\' checks\n",
        "A value of 14 means that the sample failed the '\minimum, maximum and delta\' checks\n",
        "A value of 15 means that the sample failed the '\missing, minimum, maximum and delta\' checks\n",
        "\n",
        "If the associated non-QC field does not contain any mentor-specified minimum,\n",
        "maximum or delta information, we do not generate a qc_field.\n",
        "" ;

        :mqc_software = "$Id: sgp30smosE13.b1.header.txt,v 1.1 2001/03/01 18:33:42
vlasakova process-vap-twrnr-1.5-1 $" ;
        :proc_level = "b1" ;
        :ingest_software = " smos_ingest.c,v 7.0 2001/02/06 03:45:53 ermold Exp $" ;
        :input_source = "a1 file generated from:
smos13:/home/ftp/pub/data/collection/sgp/sgpsmosE13.00/smosE13.20010216.225800.icm" ;
        :site_id = "sgp" ;
        :facility_id = "E13 : Lamont_CF1" ;

```



```

        :sample_int = "snow - every 3 minutes when temp < 10.01 deg C.\n",
"bar press - 1 minute\n",
"all others 1 second" ;
        :averaging_int = "30 minutes" ;
        :serial_number = "SMOS8" ;
        :comment = "The time assigned to each data point indicates the end of any\n",
"period of averaging of the geophysical data.\n",
"\n",
"Altitude is in meters above Mean Sea Level." ;
        :resolution_description = "The resolution field attributes refer to the number of
significant\n",
"digits relative to the decimal point that should be used in\n",
"calculations. Using fewer digits might result in greater uncertainty;\n",
"using a larger number of digits should have no effect and thus is\n",
"unnecessary. However, analyses based on differences in values with\n",
"a larger number of significant digits than indicated could lead to\n",
"erroneous results or misleading scientific conclusions.\n",
"\n",
"resolution for lat= 0.001\n",
"resolution for lon = 0.001\n",
"resolution for alt = 1" ;
        :sensor_location = "Sensors heights (above base \"alt\"):\n",
" 10m for winds\n",
" 2m for temp, RH, and vap pres\n",
" 1m for bar pres" ;
        :zeb_platform = "sgp30smosE13.b1" ;
        :history = "created by the Zebra DataStore library, 25-Feb-2001,3:46:01, $RCSfile:
sgp30smosE13.b1.header.txt,v $ $Revision: 1.1 $\n",
"" ;
}

```

sgpthwapsC1.b1:

```

netcdf sgpthwapsC1.b1.20010217.001000 {
dimensions:
    time = UNLIMITED ; // (281 currently)
variables:
    int base_time ;
        base_time:string = "17-Feb-2001,0:10:00 GMT" ;
        base_time:long_name = "Base time in Epoch" ;
        base_time:units = "seconds since 1970-1-1 0:00:00 0:00" ;
    double time_offset(time) ;
        time_offset:long_name = "Time offset from base_time" ;
        time_offset:units = "seconds since 2001-02-17 00:10:00 0:00" ;
    float pres(time) ;
        pres:long_name = "Pressure" ;
        pres:units = "hPa" ;
        pres:valid_min = 800.f ;
        pres:valid_max = 1100.f ;
}

```

```

        pres:resolution = 0.1f ;
        pres:missing_value = -9999.f ;
int qc_pres(time) ;
    qc_pres:long_name = "Quality check results on field: Pressure" ;
    qc_pres:units = "unitless" ;
float temp(time) ;
    temp:long_name = "Temperature" ;
    temp:units = "C" ;
    temp:valid_min = -40.f ;
    temp:valid_max = 50.f ;
    temp:resolution = 0.1f ;
    temp:missing_value = -9999.f ;
int qc_temp(time) ;
    qc_temp:long_name = "Quality check results on field: Temperature" ;
    qc_temp:units = "unitless" ;
float rh(time) ;
    rh:long_name = "Relative Humidity" ;
    rh:units = "%" ;
    rh:valid_min = -2.f ;
    rh:valid_max = 104.f ;
    rh:resolution = 1.f ;
    rh:missing_value = -9999.f ;
int qc_rh(time) ;
    qc_rh:long_name = "Quality check results on field: Relative Humidity" ;
    qc_rh:units = "unitless" ;
float vap_pres(time) ;
    vap_pres:long_name = "Vapor Pressure" ;
    vap_pres:units = "kPa" ;
    vap_pres:valid_min = 0.f ;
    vap_pres:valid_max = 10.f ;
    vap_pres:resolution = 0.001f ;
    vap_pres:missing_value = -9999.f ;
int qc_vap_pres(time) ;
    qc_vap_pres:long_name = "Quality check results on field: Vapor Pressure" ;
    qc_vap_pres:units = "unitless" ;
float wspd(time) ;
    wspd:long_name = "Mean Wind Speed" ;
    wspd:units = "m/s" ;
    wspd:valid_min = 0.f ;
    wspd:valid_max = 45.f ;
    wspd:resolution = 0.1f ;
    wspd:missing_value = -9999.f ;
int qc_wspd(time) ;
    qc_wspd:long_name = "Quality check results on field: Mean Wind Speed" ;
    qc_wspd:units = "unitless" ;
float wdir(time) ;
    wdir:long_name = "Unit Vector Wind Direction" ;
    wdir:units = "deg" ;
    wdir:valid_min = 0.f ;
    wdir:valid_max = 360.f ;
    wdir:resolution = 1.f ;

```

```

        wdir:missing_value = -9999.f ;
int qc_wdir(time) ;
        qc_wdir:long_name = "Quality check results on field: Unit Vector Wind Direction" ;
        qc_wdir:units = "unitless" ;
float sd_wdir(time) ;
        sd_wdir:long_name = "Standard Deviation of Wind Direction" ;
        sd_wdir:units = "deg" ;
        sd_wdir:valid_min = 0.f ;
        sd_wdir:valid_max = 90.f ;
        sd_wdir:resolution = 1.f ;
        sd_wdir:missing_value = -9999.f ;
int qc_sd_wdir(time) ;
        qc_sd_wdir:long_name = "Quality check results on field: Standard Deviation of
Wind Direction" ;
        qc_sd_wdir:units = "unitless" ;
float sd_pres(time) ;
        sd_pres:long_name = "Standard Deviation of Pressure" ;
        sd_pres:units = "hPa" ;
        sd_pres:valid_min = 0.f ;
        sd_pres:resolution = 0.1f ;
        sd_pres:missing_value = -9999.f ;
int qc_sd_pres(time) ;
        qc_sd_pres:long_name = "Quality check results on field: Standard Deviation of
Pressure" ;
        qc_sd_pres:units = "unitless" ;
float sd_temp(time) ;
        sd_temp:long_name = "Standard Deviation of Temperature" ;
        sd_temp:units = "C" ;
        sd_temp:valid_min = 0.f ;
        sd_temp:valid_max = 2.f ;
        sd_temp:resolution = 0.1f ;
        sd_temp:missing_value = -9999.f ;
int qc_sd_temp(time) ;
        qc_sd_temp:long_name = "Quality check results on field: Standard Deviation of
Temperature" ;
        qc_sd_temp:units = "unitless" ;
float sd_rh(time) ;
        sd_rh:long_name = "Standard Deviation of Relative Humidity" ;
        sd_rh:units = "%" ;
        sd_rh:valid_min = 0.f ;
        sd_rh:valid_max = 20.f ;
        sd_rh:resolution = 1.f ;
        sd_rh:missing_value = -9999.f ;
int qc_sd_rh(time) ;
        qc_sd_rh:long_name = "Quality check results on field: Standard Deviation of
Relative Humidity" ;
        qc_sd_rh:units = "unitless" ;
float sd_vap_pres(time) ;
        sd_vap_pres:long_name = "Standard Deviation of Vapor Pressure" ;
        sd_vap_pres:units = "kPa" ;
        sd_vap_pres:valid_min = 0.f ;

```

```

        sd_vap_pres:resolution = 0.001f ;
        sd_vap_pres:missing_value = -9999.f ;
    int qc_sd_vap_pres(time) ;
        qc_sd_vap_pres:long_name = "Quality check results on field: Standard Deviation of
Vapor Pressure" ;
        qc_sd_vap_pres:units = "unitless" ;
    float vbat(time) ;
        vbat:long_name = "Battery Voltage" ;
        vbat:units = "V" ;
        vbat:valid_min = 9.6f ;
        vbat:valid_max = 16.f ;
        vbat:resolution = 0.01f ;
        vbat:missing_value = -9999.f ;
    int qc_vbat(time) ;
        qc_vbat:long_name = "Quality check results on field: Battery Voltage" ;
        qc_vbat:units = "unitless" ;
    float lat ;
        lat:long_name = "north latitude" ;
        lat:units = "degrees" ;
        lat:valid_min = -90.f ;
        lat:valid_max = 90.f ;
    float lon ;
        lon:long_name = "east longitude" ;
        lon:units = "degrees" ;
        lon:valid_min = -180.f ;
        lon:valid_max = 180.f ;
    float alt ;
        alt:long_name = "altitude" ;
        alt:units = "meters above Mean Sea Level" ;

// global attributes:
        :qc_method = "Standard Mentor QC" ;
        :Mentor_QC_Field_Information = "For each qc_<field> interpret the values as
follows:\n",
        "\n",
        "Basic mentor QC checks:\n",
        "=====\n",
        "A value of 0 means that no mentor QC (missing/min/max/delta) checks failed\n",
        "A value of 1 means that the sample contained a '\missing data\' value\n",
        "A value of 2 means that the sample failed the '\minimum\' check\n",
        "A value of 4 means that the sample failed the '\maximum\' check\n",
        "A value of 8 means that the sample failed the '\delta\' check\n",
        "\n",
        " Note that the delta computation for multi-dimensioned data \n",
        " compares the absolute value between points in the same spatial \n",
        " location, at the next point in time. \n",
        "\n",
        "Possible Combinations of mentor QC check results:\n",
        "=====\n",
        "\n",
        "A value of 3 means that the sample failed the '\missing and minimum\' checks\n",

```

```

"A value of 5 means that the sample failed the \'missing and maximum\' checks\n",
"A value of 7 means that the sample failed the \'missing, minimum and maximum\' checks\n",
"A value of 9 means that the sample failed the \'missing and delta\' checks\n",
"A value of 10 means that the sample failed the \'minimum and delta\' checks\n",
"A value of 11 means that the sample failed the \'missing, minimum and delta\' checks\n",
"A value of 12 means that the sample failed the \'maximum and delta\' checks\n",
"A value of 14 means that the sample failed the \'minimum, maximum and delta\' checks\n",
"A value of 15 means that the sample failed the \'missing, minimum, maximum and delta\' checks\n",
"\n",
"If the associated non-QC field does not contain any mentor-specified minimum,\n",
"maximum or delta information, we do not generate a qc_field.\n",
"" ;

        :mqc_software = "$Id: sgpthwapsC1.b1.header.txt,v 1.1 2001/03/01 18:34:34
vlasakova process-vap-twrmr-1.5-1 $" ;
        :proc_level = "b1" ;
        :ingest_software = " thwaps_ingest.c,v 7.1 2001/02/06 01:42:20 ermold Exp $" ;
        :input_source = "a1 file generated from:
thwaps1:/home/ftp/pub/data/collection/sgp/sgpthwapsC1.00/thwapsC1.20010217.001000.icm" ;
        :site_id = "sgp" ;
        :facility_id = "C1 : Central_Facility" ;
        :sample_int = "3 seconds" ;
        :averaging_int = "5 minute" ;
        :serial_number = "N/A" ;
        :comment = "This is a test THWAPS\n",
"\n",
"The wind speed is the \'mean horizontal wind speed\' which is (1/N)*SUM(Si).\n",
"\n",
"The wind direction is the \'unit vector wind direction\' which is defined as \n",
"ARCTAN(Ux/Uy) where Ux = SUM(Sin(THETAi))/N and Uy = SUM(Cos(THETAi))/N.\n",
"\n",
"The standard deviation of wind direction is computed using the Yamartino\n",
"algorithm in which StdDevTHETA = ARCSIN(epsilon)*[1+0.1547*epsilon**3]\n",
"where, epsilon = SQRT[1-(Ux**2 + Uy**2)]\n",
"\n",
"The time assigned to each data point indicates the end of any period of\n",
"averaging of the geophysical data." ;
        :resolution_description = "The resolution field attributes refer to the number of
significant\n",
"digits relative to the decimal point that should be used in\n",
"calculations. Using fewer digits might result in greater uncertainty;\n",
"using a larger number of digits should have no effect and thus is\n",
"unnecessary. However, analyses based on differences in values with\n",
"a larger number of significant digits than indicated could lead to\n",
"erroneous results or misleading scientific conclusions.\n",
"\n",
"resolution for lat= 0.001\n",
"resolution for lon = 0.001\n",
"resolution for alt = 1" ;
        :zeb_platform = "sgpthwapsC1.b1" ;
        :history = "created by the Zebra DataStore library, 25-Feb-2001,5:45:43, $RCSfile:
sgpthwapsC1.b1.header.txt,v $ $Revision: 1.1 $\n",

```

```

    "" ;
}

```

sgp30twr10xC1.b1:

```

netcdf sgp30twr10xC1.b1.20010217.000000 {
dimensions:
    time = UNLIMITED ; // (48 currently)
variables:
    int base_time ;
        base_time:string = "17-Feb-2001,0:00:00 GMT" ;
        base_time:long_name = "Base time in Epoch" ;
        base_time:units = "seconds since 1970-1-1 0:00:00 0:00" ;
    double time_offset(time) ;
        time_offset:long_name = "Time offset from base_time" ;
        time_offset:units = "seconds since 2001-02-17 00:00:00 0:00" ;
    float temp_60m(time) ;
        temp_60m:long_name = "60 m Air Temperature" ;
        temp_60m:units = "C" ;
        temp_60m:valid_min = -50.f ;
        temp_60m:valid_max = 50.f ;
        temp_60m:resolution = 0.01f ;
        temp_60m:missing_value = -9999.f ;
    int qc_temp_60m(time) ;
        qc_temp_60m:long_name = "Quality check results on field: 60 m Air Temperature" ;
        qc_temp_60m:units = "unitless" ;
    float temp_25m(time) ;
        temp_25m:long_name = "25 m Air Temperature" ;
        temp_25m:units = "C" ;
        temp_25m:valid_min = -50.f ;
        temp_25m:valid_max = 50.f ;
        temp_25m:resolution = 0.01f ;
        temp_25m:missing_value = -9999.f ;
    int qc_temp_25m(time) ;
        qc_temp_25m:long_name = "Quality check results on field: 25 m Air Temperature" ;
        qc_temp_25m:units = "unitless" ;
    float rh_60m(time) ;
        rh_60m:long_name = "60 m Relative Humidity" ;
        rh_60m:units = "%" ;
        rh_60m:valid_min = 0.f ;
        rh_60m:valid_max = 102.f ;
        rh_60m:resolution = 0.1f ;
        rh_60m:missing_value = -9999.f ;
    int qc_rh_60m(time) ;
        qc_rh_60m:long_name = "Quality check results on field: 60 m Relative Humidity" ;
        qc_rh_60m:units = "unitless" ;
    float rh_25m(time) ;
        rh_25m:long_name = "25 m Relative Humidity" ;
        rh_25m:units = "%" ;

```

```

        rh_25m:valid_min = 0.f ;
        rh_25m:valid_max = 102.f ;
        rh_25m:resolution = 0.1f ;
        rh_25m:missing_value = -9999.f ;
int qc_rh_25m(time) ;
    qc_rh_25m:long_name = "Quality check results on field: 25 m Relative Humidity" ;
    qc_rh_25m:units = "unitless" ;
float vap_pres_60m(time) ;
    vap_pres_60m:long_name = "60 m Vapor Pressure" ;
    vap_pres_60m:units = "kPa" ;
    vap_pres_60m:valid_min = 0.f ;
    vap_pres_60m:valid_max = 10.f ;
    vap_pres_60m:resolution = 0.001f ;
    vap_pres_60m:missing_value = -9999.f ;
int qc_vap_pres_60m(time) ;
    qc_vap_pres_60m:long_name = "Quality check results on field: 60 m Vapor
Pressure" ;
    qc_vap_pres_60m:units = "unitless" ;
float vap_pres_25m(time) ;
    vap_pres_25m:long_name = "25 m Vapor Pressure" ;
    vap_pres_25m:units = "kPa" ;
    vap_pres_25m:valid_min = 0.f ;
    vap_pres_25m:valid_max = 10.f ;
    vap_pres_25m:resolution = 0.001f ;
    vap_pres_25m:missing_value = -9999.f ;
int qc_vap_pres_25m(time) ;
    qc_vap_pres_25m:long_name = "Quality check results on field: 25 m Vapor
Pressure" ;
    qc_vap_pres_25m:units = "unitless" ;
float sd_temp_60m(time) ;
    sd_temp_60m:long_name = "Standard Deviation of 60 m Temperature" ;
    sd_temp_60m:units = "C" ;
    sd_temp_60m:valid_min = 0.f ;
    sd_temp_60m:valid_max = 2.f ;
    sd_temp_60m:resolution = 0.01f ;
    sd_temp_60m:missing_value = -9999.f ;
int qc_sd_temp_60m(time) ;
    qc_sd_temp_60m:long_name = "Quality check results on field: Standard Deviation
of 60 m Temperature" ;
    qc_sd_temp_60m:units = "unitless" ;
float sd_temp_25m(time) ;
    sd_temp_25m:long_name = "Standard Deviation of 25 m Temperature" ;
    sd_temp_25m:units = "C" ;
    sd_temp_25m:valid_min = 0.f ;
    sd_temp_25m:valid_max = 2.f ;
    sd_temp_25m:resolution = 0.01f ;
    sd_temp_25m:missing_value = -9999.f ;
int qc_sd_temp_25m(time) ;
    qc_sd_temp_25m:long_name = "Quality check results on field: Standard Deviation
of 25 m Temperature" ;
    qc_sd_temp_25m:units = "unitless" ;

```

```

float sd_rh_60m(time) ;
    sd_rh_60m:long_name = "Standard Deviation of 60 m Relative Humidity" ;
    sd_rh_60m:units = "%" ;
    sd_rh_60m:valid_min = 0.f ;
    sd_rh_60m:valid_max = 20.f ;
    sd_rh_60m:resolution = 0.1f ;
    sd_rh_60m:missing_value = -9999.f ;
int qc_sd_rh_60m(time) ;
    qc_sd_rh_60m:long_name = "Quality check results on field: Standard Deviation of
60 m Relative Humidity" ;
    qc_sd_rh_60m:units = "unitless" ;
float sd_rh_25m(time) ;
    sd_rh_25m:long_name = "Standard Deviation of 25 m Relative Humidity" ;
    sd_rh_25m:units = "%" ;
    sd_rh_25m:valid_min = 0.f ;
    sd_rh_25m:valid_max = 20.f ;
    sd_rh_25m:resolution = 0.1f ;
    sd_rh_25m:missing_value = -9999.f ;
int qc_sd_rh_25m(time) ;
    qc_sd_rh_25m:long_name = "Quality check results on field: Standard Deviation of
25 m Relative Humidity" ;
    qc_sd_rh_25m:units = "unitless" ;
float sd_vap_pres_60m(time) ;
    sd_vap_pres_60m:long_name = "Standard Deviation of 60 m Vapor Pressure" ;
    sd_vap_pres_60m:units = "kPa" ;
    sd_vap_pres_60m:valid_min = 0.f ;
    sd_vap_pres_60m:valid_max = 1.f ;
    sd_vap_pres_60m:resolution = 0.001f ;
    sd_vap_pres_60m:missing_value = -9999.f ;
int qc_sd_vap_pres_60m(time) ;
    qc_sd_vap_pres_60m:long_name = "Quality check results on field: Standard
Deviation of 60 m Vapor Pressure" ;
    qc_sd_vap_pres_60m:units = "unitless" ;
float sd_vap_pres_25m(time) ;
    sd_vap_pres_25m:long_name = "Standard Deviation of 25 m Vapor Pressure" ;
    sd_vap_pres_25m:units = "kPa" ;
    sd_vap_pres_25m:valid_min = 0.f ;
    sd_vap_pres_25m:valid_max = 1.f ;
    sd_vap_pres_25m:resolution = 0.001f ;
    sd_vap_pres_25m:missing_value = -9999.f ;
int qc_sd_vap_pres_25m(time) ;
    qc_sd_vap_pres_25m:long_name = "Quality check results on field: Standard
Deviation of 25 m Vapor Pressure" ;
    qc_sd_vap_pres_25m:units = "unitless" ;
float lat ;
    lat:long_name = "north latitude" ;
    lat:units = "degrees" ;
    lat:valid_min = -90.f ;
    lat:valid_max = 90.f ;
float lon ;
    lon:long_name = "east longitude" ;

```



```

lon:units = "degrees" ;
lon:valid_min = -180.f ;
lon:valid_max = 180.f ;
float alt ;
alt:long_name = "altitude" ;
alt:units = "meters above Mean Sea Level" ;

// global attributes:
:qc_method = "Standard Mentor QC" ;
:Mentor_QC_Field_Information = "For each qc_<field> interpret the values as
follows:\n",
"\n",
"Basic mentor QC checks:\n",
"=====\n",
"A value of 0 means that no mentor QC (missing/min/max/delta) checks failed\n",
"A value of 1 means that the sample contained a '\missing data\' value\n",
"A value of 2 means that the sample failed the '\minimum\' check\n",
"A value of 4 means that the sample failed the '\maximum\' check\n",
"A value of 8 means that the sample failed the '\delta\' check\n",
"\n",
" Note that the delta computation for multi-dimensional data \n",
" compares the absolute value between points in the same spatial \n",
" location, at the next point in time. \n",
"\n",
"Possible Combinations of mentor QC check results:\n",
"=====\n",
"\n",
"A value of 3 means that the sample failed the '\missing and minimum\' checks\n",
"A value of 5 means that the sample failed the '\missing and maximum\' checks\n",
"A value of 7 means that the sample failed the '\missing, minimum and maximum\' checks\n",
"A value of 9 means that the sample failed the '\missing and delta\' checks\n",
"A value of 10 means that the sample failed the '\minimum and delta\' checks\n",
"A value of 11 means that the sample failed the '\missing, minimum and delta\' checks\n",
"A value of 12 means that the sample failed the '\maximum and delta\' checks\n",
"A value of 14 means that the sample failed the '\minimum, maximum and delta\' checks\n",
"A value of 15 means that the sample failed the '\missing, minimum, maximum and delta\' checks\n",
"\n",
"If the associated non-QC field does not contain any mentor-specified minimum,\n",
"maximum or delta information, we do not generate a qc_field.\n",
"" ;

:mqc_software = "$Id: sgp30twr10xC1.b1.header.txt,v 1.1 2001/03/01 18:33:58
vlasakova process-vap-twrmr-1.5-1 $" ;
:proc_level = "b1" ;
:ingest_software = " twr_ingest.c,v 7.1 2001/02/06 02:15:58 ermold Exp $" ;
:input_source = "a1 file generated from:
twr10x1:/home/ftp/pub/data/collection/sgp/sgptwr10xC1.00/twr10xC1.20010216.230000.icm" ;
:site_id = "sgp" ;
:facility_id = "C1 : Central_Facility" ;
:sample_int = "1 second" ;
:averaging_int = "30 minutes" ;
:serial_number = "N/A" ;

```

```

        :comment = "The time assigned to each data point indicates the end of any period
of\n",
    "averaging of the geophysical data." ;
        :resolution_description = "The resolution field attributes refer to the number of
significant\n",
    "digits relative to the decimal point that should be used in\n",
    "calculations. Using fewer digits might result in greater uncertainty;\n",
    "using a larger number of digits should have no effect and thus is\n",
    "unnecessary. However, analyses based on differences in values with\n",
    "a larger number of significant digits than indicated could lead to\n",
    "erroneous results or misleading scientific conclusions.\n",
    "\n",
    "resolution for lat= 0.001\n",
    "resolution for lon = 0.001\n",
    "resolution for alt = 1" ;
        :zeb_platform = "sgp30twr10xC1.b1" ;
        :history = "created by the Zebra DataStore library, 25-Feb-2001,3:45:41, $RCSfile:
sgp30twr10xC1.b1.header.txt,v $ $Revision: 1.1 $\n",
    "" ;
}

```

sgp30twr25mC1.b1:

```

netcdf sgp30twr25mC1.b1.20010217.000000 {
dimensions:
    time = UNLIMITED ; // (48 currently)
variables:
    int base_time ;
        base_time:string = "17-Feb-2001,0:00:00 GMT" ;
        base_time:long_name = "Base time in Epoch" ;
        base_time:units = "seconds since 1970-1-1 0:00:00 0:00" ;
    double time_offset(time) ;
        time_offset:long_name = "Time offset from base_time" ;
        time_offset:units = "seconds since 2001-02-17 00:00:00 0:00" ;
    float temp(time) ;
        temp:long_name = "Temperature (degrees C)" ;
        temp:units = "C" ;
        temp:valid_min = -50.f ;
        temp:valid_max = 50.f ;
        temp:resolution = 0.01f ;
        temp:missing_value = -9999.f ;
    int qc_temp(time) ;
        qc_temp:long_name = "Quality check results on field: Temperature (degrees C)" ;
        qc_temp:units = "unitless" ;
    float rh(time) ;
        rh:long_name = "Relative Humidity" ;
        rh:units = "%" ;
        rh:valid_min = 0.f ;
        rh:valid_max = 102.f ;
        rh:resolution = 0.1f ;
}

```

```

        rh:missing_value = -9999.f ;
int qc_rh(time) ;
    qc_rh:long_name = "Quality check results on field: Relative Humidity" ;
    qc_rh:units = "unitless" ;
float vap_pres(time) ;
    vap_pres:long_name = "Vapor Pressure (kiloPascals)" ;
    vap_pres:units = "kPa" ;
    vap_pres:valid_min = 0.f ;
    vap_pres:valid_max = 10.f ;
    vap_pres:resolution = 0.001f ;
    vap_pres:missing_value = -9999.f ;
int qc_vap_pres(time) ;
    qc_vap_pres:long_name = "Quality check results on field: Vapor Pressure
(kiloPascals)" ;
    qc_vap_pres:units = "unitless" ;
float aspirator(time) ;
    aspirator:long_name = "Aspirator Flow Status (% of time with proper flow)" ;
    aspirator:units = "%" ;
    aspirator:valid_min = 90.f ;
    aspirator:valid_max = 100.f ;
    aspirator:resolution = 0.1f ;
    aspirator:missing_value = -9999.f ;
int qc_aspirator(time) ;
    qc_aspirator:long_name = "Quality check results on field: Aspirator Flow Status (%
of time with proper flow)" ;
    qc_aspirator:units = "unitless" ;
float sd_temp(time) ;
    sd_temp:long_name = "Standard Deviation of Temperature" ;
    sd_temp:units = "C" ;
    sd_temp:resolution = 0.01f ;
    sd_temp:missing_value = -9999.f ;
float sd_rh(time) ;
    sd_rh:long_name = "Standard Deviation of Relative Humidity" ;
    sd_rh:units = "%" ;
    sd_rh:resolution = 0.1f ;
    sd_rh:missing_value = -9999.f ;
float sd_vap_pres(time) ;
    sd_vap_pres:long_name = "Standard Deviation of Vapor Pressure" ;
    sd_vap_pres:units = "kPa" ;
    sd_vap_pres:resolution = 0.001f ;
    sd_vap_pres:missing_value = -9999.f ;
float lat ;
    lat:long_name = "north latitude" ;
    lat:units = "degrees" ;
    lat:valid_min = -90.f ;
    lat:valid_max = 90.f ;
float lon ;
    lon:long_name = "east longitude" ;
    lon:units = "degrees" ;
    lon:valid_min = -180.f ;
    lon:valid_max = 180.f ;

```

```

float alt ;
    alt:long_name = "altitude" ;
    alt:units = "meters above Mean Sea Level" ;

// global attributes:
    :qc_method = "Standard Mentor QC" ;
    :Mentor_QC_Field_Information = "For each qc_<field> interpret the values as
follows:\n",
    "\n",
    "Basic mentor QC checks:\n",
    "=====\n",
    "A value of 0 means that no mentor QC (missing/min/max/delta) checks failed\n",
    "A value of 1 means that the sample contained a '\missing data\' value\n",
    "A value of 2 means that the sample failed the '\minimum\' check\n",
    "A value of 4 means that the sample failed the '\maximum\' check\n",
    "A value of 8 means that the sample failed the '\delta\' check\n",
    "\n",
    " Note that the delta computation for multi-dimensioned data \n",
    " compares the absolute value between points in the same spatial \n",
    " location, at the next point in time. \n",
    "\n",
    "Possible Combinations of mentor QC check results:\n",
    "=====\n",
    "\n",
    "A value of 3 means that the sample failed the '\missing and minimum\' checks\n",
    "A value of 5 means that the sample failed the '\missing and maximum\' checks\n",
    "A value of 7 means that the sample failed the '\missing, minimum and maximum\' checks\n",
    "A value of 9 means that the sample failed the '\missing and delta\' checks\n",
    "A value of 10 means that the sample failed the '\minimum and delta\' checks\n",
    "A value of 11 means that the sample failed the '\missing, minimum and delta\' checks\n",
    "A value of 12 means that the sample failed the '\maximum and delta\' checks\n",
    "A value of 14 means that the sample failed the '\minimum, maximum and delta\' checks\n",
    "A value of 15 means that the sample failed the '\missing, minimum, maximum and delta\' checks\n",
    "\n",
    "If the associated non-QC field does not contain any mentor-specified minimum,\n",
    "maximum or delta information, we do not generate a qc_field.\n",
    "" ;
        :mqc_software = "$Id: sgp30twr25mC1.b1.header.txt,v 1.1 2001/03/01 18:34:09
vlasakova process-vap-twrmr-1.5-1 $" ;
        :proc_level = "b1" ;
        :ingest_software = " twr_ingest.c,v 7.1 2001/02/06 02:15:58 ermold Exp $" ;
        :input_source = "a1 file generated from:
twr25m1:/home/ftp/pub/data/collection/sgp/sgptwr25mC1.00/twr25mC1.20010216.230100.icm" ;
        :site_id = "sgp" ;
        :facility_id = "C1 : Central_Facility" ;
        :sample_int = "1 second" ;
        :averaging_int = "30 minutes" ;
        :serial_number = "N/A" ;
        :comment = "The time assigned to each data point indicates the end of any period
of\n",
    "averaging of the geophysical data." ;

```

```

        :resolution_description = "The resolution field attributes refer to the number of
significant\n",
    "digits relative to the decimal point that should be used in\n",
    "calculations. Using fewer digits might result in greater uncertainty;\n",
    "using a larger number of digits should have no effect and thus is\n",
    "unnecessary. However, analyses based on differences in values with\n",
    "a larger number of significant digits than indicated could lead to\n",
    "erroneous results or misleading scientific conclusions.\n",
    "\n",
    "resolution for lat= 0.001\n",
    "resolution for lon = 0.001\n",
    "resolution for alt = 1" ;
        :sensor_location = "Sensors heights (above base \alt\): 25m for temp, rh, vap_pres
and aspirator." ;
        :zeb_platform = "sgp30twr25mC1.b1" ;
        :history = "created by the Zebra DataStore library, 25-Feb-2001,3:45:27, $RCSfile:
sgp30twr25mC1.b1.header.txt,v $ $Revision: 1.1 $" ,
        "" ;
    }

```

sgp30twr60mC1.b1:

```

netcdf sgp30twr60mC1.b1.20010217.000000 {
dimensions:
    time = UNLIMITED ; // (48 currently)
variables:
    int base_time ;
        base_time:string = "17-Feb-2001,0:00:00 GMT" ;
        base_time:long_name = "Base time in Epoch" ;
        base_time:units = "seconds since 1970-1-1 0:00:00 0:00" ;
    double time_offset(time) ;
        time_offset:long_name = "Time offset from base_time" ;
        time_offset:units = "seconds since 2001-02-17 00:00:00 0:00" ;
    float temp(time) ;
        temp:long_name = "Temperature (degrees C)" ;
        temp:units = "C" ;
        temp:valid_min = -50.f ;
        temp:valid_max = 50.f ;
        temp:resolution = 0.01f ;
        temp:missing_value = -9999.f ;
    int qc_temp(time) ;
        qc_temp:long_name = "Quality check results on field: Temperature (degrees C)" ;
        qc_temp:units = "unitless" ;
    float rh(time) ;
        rh:long_name = "Relative Humidity" ;
        rh:units = "%" ;
        rh:valid_min = 0.f ;
        rh:valid_max = 102.f ;
        rh:resolution = 0.1f ;

```

```

        rh:missing_value = -9999.f ;
int qc_rh(time) ;
    qc_rh:long_name = "Quality check results on field: Relative Humidity" ;
    qc_rh:units = "unitless" ;
float vap_pres(time) ;
    vap_pres:long_name = "Vapor Pressure (kiloPascals)" ;
    vap_pres:units = "kPa" ;
    vap_pres:valid_min = 0.f ;
    vap_pres:valid_max = 10.f ;
    vap_pres:resolution = 0.001f ;
    vap_pres:missing_value = -9999.f ;
int qc_vap_pres(time) ;
    qc_vap_pres:long_name = "Quality check results on field: Vapor Pressure
(kiloPascals)" ;
    qc_vap_pres:units = "unitless" ;
float aspirator(time) ;
    aspirator:long_name = "Aspirator Flow Status (% of time with proper flow)" ;
    aspirator:units = "%" ;
    aspirator:valid_min = 90.f ;
    aspirator:valid_max = 100.f ;
    aspirator:resolution = 0.1f ;
    aspirator:missing_value = -9999.f ;
int qc_aspirator(time) ;
    qc_aspirator:long_name = "Quality check results on field: Aspirator Flow Status (%
of time with proper flow)" ;
    qc_aspirator:units = "unitless" ;
float sd_temp(time) ;
    sd_temp:long_name = "Standard Deviation of Temperature" ;
    sd_temp:units = "C" ;
    sd_temp:resolution = 0.01f ;
    sd_temp:missing_value = -9999.f ;
float sd_rh(time) ;
    sd_rh:long_name = "Standard Deviation of Relative Humidity" ;
    sd_rh:units = "%" ;
    sd_rh:resolution = 0.1f ;
    sd_rh:missing_value = -9999.f ;
float sd_vap_pres(time) ;
    sd_vap_pres:long_name = "Standard Deviation of Vapor Pressure" ;
    sd_vap_pres:units = "kPa" ;
    sd_vap_pres:resolution = 0.001f ;
    sd_vap_pres:missing_value = -9999.f ;
float lat ;
    lat:long_name = "north latitude" ;
    lat:units = "degrees" ;
    lat:valid_min = -90.f ;
    lat:valid_max = 90.f ;
float lon ;
    lon:long_name = "east longitude" ;
    lon:units = "degrees" ;
    lon:valid_min = -180.f ;
    lon:valid_max = 180.f ;

```

```

float alt ;
    alt:long_name = "altitude" ;
    alt:units = "meters above Mean Sea Level" ;

// global attributes:
    :qc_method = "Standard Mentor QC" ;
    :Mentor_QC_Field_Information = "For each qc_<field> interpret the values as
follows:\n",
    "\n",
    "Basic mentor QC checks:\n",
    "=====\n",
    "A value of 0 means that no mentor QC (missing/min/max/delta) checks failed\n",
    "A value of 1 means that the sample contained a '\missing data\' value\n",
    "A value of 2 means that the sample failed the '\minimum\' check\n",
    "A value of 4 means that the sample failed the '\maximum\' check\n",
    "A value of 8 means that the sample failed the '\delta\' check\n",
    "\n",
    " Note that the delta computation for multi-dimensioned data \n",
    " compares the absolute value between points in the same spatial \n",
    " location, at the next point in time. \n",
    "\n",
    "Possible Combinations of mentor QC check results:\n",
    "=====\n",
    "\n",
    "A value of 3 means that the sample failed the '\missing and minimum\' checks\n",
    "A value of 5 means that the sample failed the '\missing and maximum\' checks\n",
    "A value of 7 means that the sample failed the '\missing, minimum and maximum\' checks\n",
    "A value of 9 means that the sample failed the '\missing and delta\' checks\n",
    "A value of 10 means that the sample failed the '\minimum and delta\' checks\n",
    "A value of 11 means that the sample failed the '\missing, minimum and delta\' checks\n",
    "A value of 12 means that the sample failed the '\maximum and delta\' checks\n",
    "A value of 14 means that the sample failed the '\minimum, maximum and delta\' checks\n",
    "A value of 15 means that the sample failed the '\missing, minimum, maximum and delta\' checks\n",
    "\n",
    "If the associated non-QC field does not contain any mentor-specified minimum,\n",
    "maximum or delta information, we do not generate a qc_field.\n",
    "" ;

    :mqc_software = "$Id: sgp30twr60mC1.b1.header.txt,v 1.1 2001/03/01 18:34:23
vlasakova process-vap-twr60mC1.5-1 $" ;
    :proc_level = "b1" ;
    :ingest_software = " twr_ingest.c,v 7.1 2001/02/06 02:15:58 ermold Exp $" ;
    :input_source = "a1 file generated from:
twr60m1:/home/ftp/pub/data/collection/sgp/sgptwr60mC1.00/twr60mC1.20010216.230200.icm" ;
    :site_id = "sgp" ;
    :facility_id = "C1 : Central_Facility" ;
    :sample_int = "1 second" ;
    :averaging_int = "30 minutes" ;
    :serial_number = "N/A" ;
    :comment = "The time assigned to each data point indicates the end of any period
of\n",
    "averaging of the geophysical data." ;

```

```
        :resolution_description = "The resolution field attributes refer to the number of
significant\n",
        "digits relative to the decimal point that should be used in\n",
        "calculations. Using fewer digits might result in greater uncertainty;\n",
        "using a larger number of digits should have no effect and thus is\n",
        "unnecessary. However, analyses based on differences in values with\n",
        "a larger number of significant digits than indicated could lead to\n",
        "erroneous results or misleading scientific conclusions.\n",
        "\n",
        "resolution for lat= 0.001\n",
        "resolution for lon = 0.001\n",
        "resolution for alt = 1" ;
        :sensor_location = "Sensors heights (above base \alt\): 60m for temp, rh, vap_pres
and aspirator." ;
        :zeb_platform = "sgp30twr60mC1.b1" ;
        :history = "created by the Zebra DataStore library, 25-Feb-2001,3:45:27, $RCSfile:
sgp30twr60mC1.b1.header.txt,v $ $Revision: 1.1 $\n",
        "" ;
}
```




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