WORLD METEOROLOGICAL ORGANIZATION

CIMO/SPICE-IOC-4/Doc. 3(2)
(6.VI.2013)

COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION

ITEM: 3

INTERNATIONAL ORGANIZING COMMITTEE (IOC) FOR THE WMO SOLID PRECIPITATION INTERCOMPARISON EXPERIMENT (SPICE)
Fourth Session

Original: ENGLISH

Davos, Switzerland
17 – 21 June 2013

SITE REPORT FOR CARE (CANADA)

(Submitted by Rodica Nitu)

Summary and purpose of document

This document provides site report of CARE (Canada) for the 2012/2013 winter.

ACTION PROPOSED

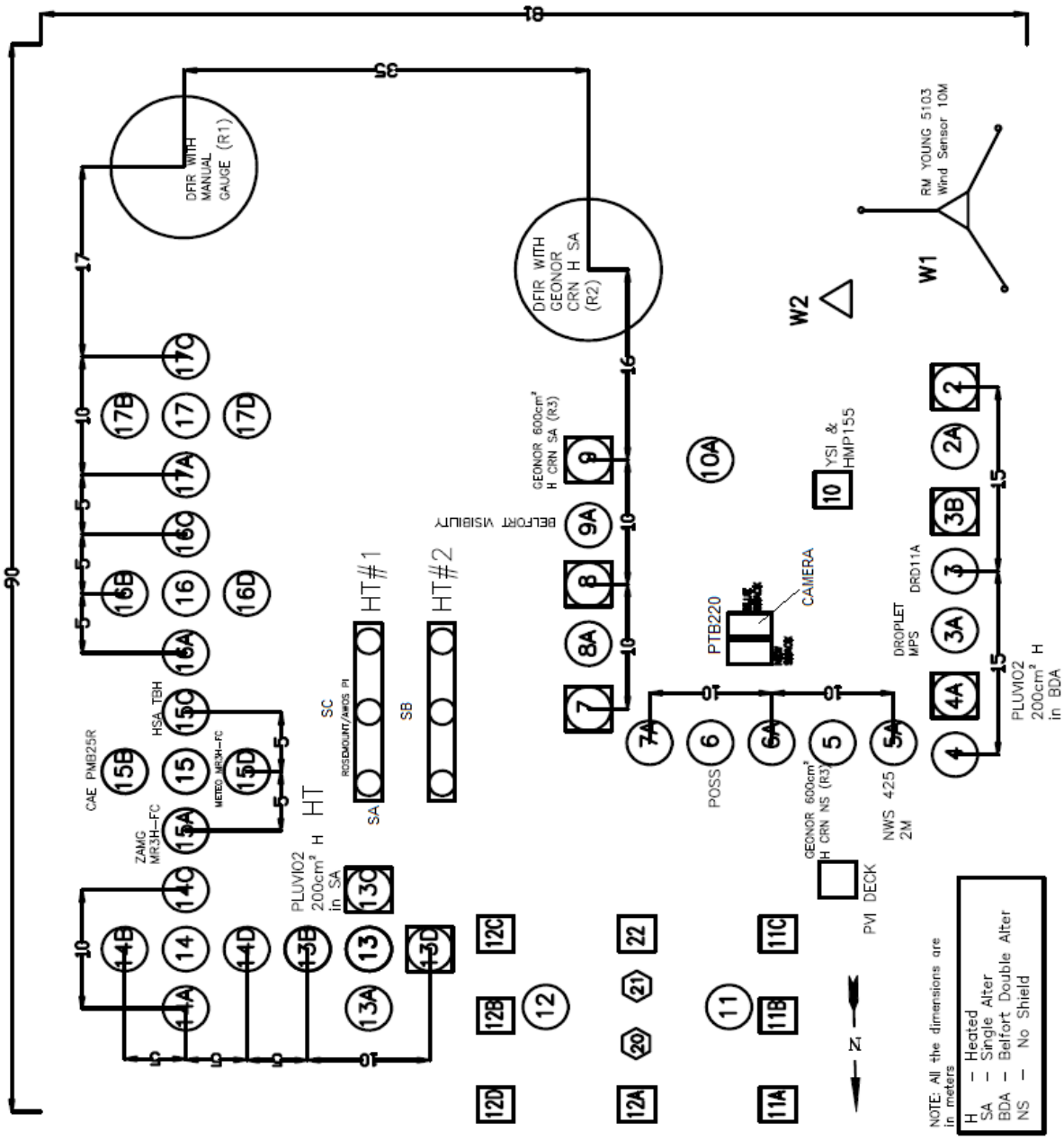
The Meeting is invited to take this information into consideration when deciding on necessary modifications and clarifications on the overall set-up of the experiment and procedures to be followed to ensure best quality observations are collected on all sites and appropriate coordination and data transfer mechanisms are implemented.

Site: CARE (Egbert) Canada

Site Report: IOC-SPICE-4 meeting

Date: June 17, 2013

1. Site layout



2. Configuration of References

R1 Reference: Tretyakov Gauge in a DFIR fence

Gauge: Tretyakov Gauge

Shield type: Tretyakov Shield

Collector Specifications

- **Number of collectors**: 2
- **Inlet area:** 200 cm^2
- **Installation Height**: 3 m

Configuration of DFIR Fence

- **Diameter:** 12 m
- **Height of Outer fence:** 3.5 m
- **Height of Inner fence:** 3 m

Heating: N/A

Heating Algorithm: N/A

Sampling Strategy: The manual gauge is read twice per day and recorded, nominally at 0800 and 1600 local time, 7 days per week.

Output Interval: Once/day

Manual Observation format

Input Date UTC	Site	Obs Time UTC	Inputter	Weight (Cup + Precip) g	Weight (Cup) g	Weight Precip (g)	Precip SWE mm	Weather Conditions	Notes
Jan 18, 2013 16: 05: 00	CAR	13:26:00	Phil	1650.9	1638.3	12.6	0.63	SCT LWR CLD – Scattered Lower Clouds	Some frost on the collector

R2 Reference: Geonor T-200B3 in a DFIR fence

Gauge: Geonor T-200B3

Shield type: Single Alter Shield (Attached to post of the weighing gauge)

Gauge Specifications

- **Capacity:** 600 mm
- **Inlet area:** 200 cm^2
- **Installation Height**: 3 m

Configuration of DFIR Fence

- **Diameter:** 12 m
- **Height of Outer fence:** 3.5 m
- **Height of Inner fence:** 3 m

Heating Hardware & location

Two Minco, Model HR23937 heaters are fixed to the Geonor orifice in the outside of orifice cylinder at top and the Outside of orifice cylinder at bottom (inside housing).
One YSI44212 temperature sensor is mounted near the Geonor gauge. One YSI44003 thermistor is mounted on top of the Geonor orifice to monitor rim temperature. The temperature on the bottom of the rim is also monitored but for information purposes only.

Heating Algorithm

The heating status of the both heaters is controlled using the ambient temperature and upper rim temperature. The heating turns on when the ambient temperature is within -5 °C to +5 °C and the upper rim temperature is below +2 °C.
Heating 'ON': IF {-5 °C <= ambient temperature <= +5 °C} AND {upper rim temperature <= +2 °C}
Heating activation range (ambient temperature): -5 °C to +5 °C
Rim set temperature: +2 °C

Sampling Strategy: 250 pulses/ 6 seconds

Output Interval: 6 sec

Output message format

[Logger time][STIN][Precipitation Cumulative 1] [Frequency Transducer 1][Precipitation Cumulative 2][Frequency Transducer 2] [Precipitation Cumulative 3][Frequency Transducer 3][RimUpperTemp][RimLowerTemp][Air Temp][UpperHeaterOn][LowerHeaterOn] [LoggerBatteryVolt][LoggerTemp]

R3 Reference (1): Geonor T-200B3 in a single alter shield

Gauge: Geonor T-200B3

Shield type: Single Alter Shield (Attached to post of the weighing gauge)

Gauge Specifications

- **Capacity:** 600 mm
- **Inlet area:** 200 cm^2
- **Installation Height**: 2 m

Heating Hardware & location
Two Minco, Model HR23937 heaters are fixed to the Geonor orifice in the outside of orifice cylinder at top and the Outside of orifice cylinder at bottom (inside housing).
One YSI44212 temperature sensor is mounted near the Geonor gauge. One YSI44003 thermistor is mounted on top of the Geonor orifice to monitor rim temperature. The temperature on the bottom of the rim is also monitored but for information purposes only.

Heating Algorithm
The heating status of the both heaters is controlled using the ambient temperature and upper rim temperature. The heating turns on when the ambient temperature is within -5 °C to +5 °C and the upper rim temperature is below +2 °C.
Heating 'ON': IF {-5 °C <= ambient temperature <= +5 °C} AND {upper rim temperature <= +2 °C}
Heating activation range (ambient temperature): -5 °C to +5 °C
Rim set temperature: +2 °C

Sampling Strategy: 250 pulses/ 6 seconds

Output Interval: 6 sec

Output message format
[Logger time][STIN][Precipitation Cumulative 1] [Frequency Transducer 1][Precipitation Cumulative 2][Frequency Transducer 2] [Precipitation Cumulative 3][Frequency Transducer 3][RimUpperTemp][RimLowerTemp][Air Temp][UpperHeaterOn][LowerHeaterOn] [LoggerBatteryVolt][LoggerTemp]

R3 Reference (2): Geonor T-200B3 (No Shield)

Gauge: Geonor T-200B3

Shield type: N/A

Gauge Specifications

- **Capacity:** 600 mm
- **Inlet area:** 200 cm^2
- **Installation Height**: 2 m

Heating Hardware & location

Two Minco, Model HR23937 heaters are fixed to the Geonor orifice in the outside of orifice cylinder at top and the Outside of orifice cylinder at bottom (inside housing).
One YSI44212 temperature sensor is mounted near the Geonor gauge. One YSI44003 thermistor is mounted on top of the Geonor orifice to monitor rim temperature. The temperature on the bottom of the rim is also monitored but for information purposes only.

Heating Algorithm

The heating status of the both heaters is controlled using the ambient temperature and upper rim temperature. The heating turns on when the ambient temperature is within -5 °C to +5 °C and the upper rim temperature is below +2 °C.
Heating 'ON': IF {-5 °C <= ambient temperature <= +5 °C} AND {upper rim temperature <= +2 °C}
Heating activation range (ambient temperature): -5 °C to +5 °C
Rim set temperature: +2 °C

Sampling Strategy: 250 pulses/ 6 seconds

Output Interval: 6 sec

Output message format

[Logger time][STIN][Precipitation Cumulative 1] [Frequency Transducer 1][Precipitation Cumulative 2][Frequency Transducer 2] [Precipitation Cumulative 3][Frequency Transducer 3][RimUpperTemp][RimLowerTemp][Air Temp][UpperHeaterOn][LowerHeaterOn] [LoggerBatteryVolt][LoggerTemp]

3. Changes made during the season 12/13

No changes made to the reference configuration from Dec 01, 2012 to April 30, 2013.

4. Issues

Issues noted during the operating of the site related to:

Heating - No heating issues observed.

Capping – No capping issues observed.

Vibrations of the mast – The Geonor pedestal is 30 kg, made of cast iron and it's mounted on a concrete base which significantly minimizes vibration effects due to wind speed.

Vibrating of the gauge – None.

Orientation – The three Geonor transducers are oriented in a way that each transducer is facing North, South East or South West. Measured precipitation co-varies with changes in temperature due to solar heating, as the sun rises and sets, its position changes in the horizon which may affect the vibrating wires independently due to their difference in orientation. Significant variations can be observed in non-precipitating conditions on a cloudless clear day.

Grounding – No grounding issues observed.

Length and type of cables and connections used – No issues.

Materials - : Coefficients of thermal expansion of the gauge components may influence precipitation values. Further study is being done on this topic.

Data sampling- No issues observed.

Data Output:

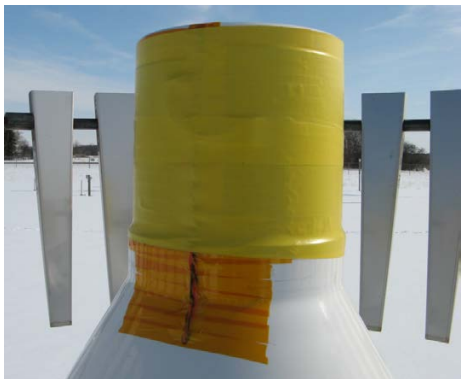
- Data logger failing to send the expected message, resulting in no data <ND> due to data corruption, and is corrected after a few messages.
- Wireless connection Interference, no connection with the computer, data stored in a buffer and dumped all at once)

Data quality - No issues observed.

5. Heating report:

Summary of configurations throughout the winter of 12/13:

Hardware



I. How was it implemented

Two Minco, Model HR23937 heaters are fixed to the Geonor orifice in the outside of orifice cylinder at top and the Outside of orifice cylinder at bottom (inside housing) see figure 2.

One YSI44212 temperature sensor is mounted near the Geonor gauge. One YSI44003 thermistor is mounted on top of the Geonor orifice to monitor rim temperature. The temperature on the bottom of the rim is also monitored but for information purposes only.

II. Power applied

Both heaters are powered in parallel using a DC power supply.

- Power supply: 12VDC
- Heater resistance: ~5.1 Ω (each heater)
- Heater power: ~28.2 W (each heater)

Software

The data logger is programmed to control the status of both heaters by monitoring the ambient temperature and upper rim temperature. The heating turns on when the ambient temperature is within -5 °C to +5 °C and the upper rim temperature is below +2 °C.

Heating 'ON':

IF {-5 °C <= ambient temperature <= +5 °C} AND {upper rim temperature <= +2 °C}

Heating activation range (ambient temperature): -5 °C to +5 °C

Rim set temperature: +2 °C

Heating - Topics to study

1) Comparison between heated and non-heated gauges with the same shield configuration over a specific events or extended periods to study evaporation loss.
2) The effect heaters have on gauge performance (Noise).
3) The need to extend heating to additional surfaces.

6. What has worked well?

- Having Phil Raczynski and Jeff Anderson available at the CARE site reduced the instances of missing data.
- The CARE site team consists of 12 members, who contribute to the running of the experiment in addition to their regular responsibilities. Their dedication and efforts have increased our efficiency.
- The close proximity of the site to the office.

7. What has not worked well; Lesson Learned

- The competing priorities of the team led to delays in configuration of the instruments;

8. Data Available

i. 150 days of data were collected for each sensor site.
ii. No data files were transmitted to NCAR as of May 27, 2013; the person assigned to prepare the files for transfer is testing the routines
iii. All data was QC'd using OSE applications.
iv. Issues in data:
    - Missing records.
    - Missing fields.
    - Correct/Incorrect file sizes reported.
    - Missing time stamp.
    - Fields containing unexpected characters. (Data logger fails to send the expected message; result is "No Data". The next message will have the previous and present message).
    - Duplicate records

9. Instruments under test

List of instruments under test:

I. OTT Pluvio2 weighing gauge, Single Alter, Heated.
II. OTT Pluvio2 weighing gauge, Belfort Double Alter, Heated.
III. CAE S.P A PMB25R Tipping Bucket.
IV. Hydrological Services America TBH/TBH-LP Tipping Bucket.
V. Meteoservis MR3H-FC Tipping Bucket.
VI. ZAMG MR3H-FC Tipping Bucket.

Have you had any problems with instruments under test?
Pluvio2 built up snow on the shoulders in BDA, even for moderate snowfall

Have all instruments allocated to your site from Instrument Providers, been installed?
No, the Meteorological Particle Sensor from Droplet Measurement Technologies was not installed in CARE. It is scheduled to be installed in Boulder this summer.

Has the data been shared with the Instrument Providers?
Yes.

The following files were shared with each Instrument Provider:

I. The file for the instrument proposed by the manufacturer.
II. Temperature data – YSI 44212
III. Humidity data – Vaisala HMP155
IV. 2 meter wind data - Vaisala NWS425
V. 10 meter wind data – RM YOUNG 5103

Did an Instrument Provider visit the site? No.

10. Information on the Precipitation Detector(s) used

The DRD11A is the precipitation detector used in CARE.

11. Commissioning

I. **Date:** December 1, 2012
II. **Configuration at commissioning:** See CARE Commissioning Protocol report.

12. Results to date:

- Comparison of shield performance;
- Evaluation of the Pluvio 2 data fields
- Assessment of Geonor 600 mm vs 1000 mm;
- Filtering methodologies.

13. Interaction Site manager and the IOC and Project team

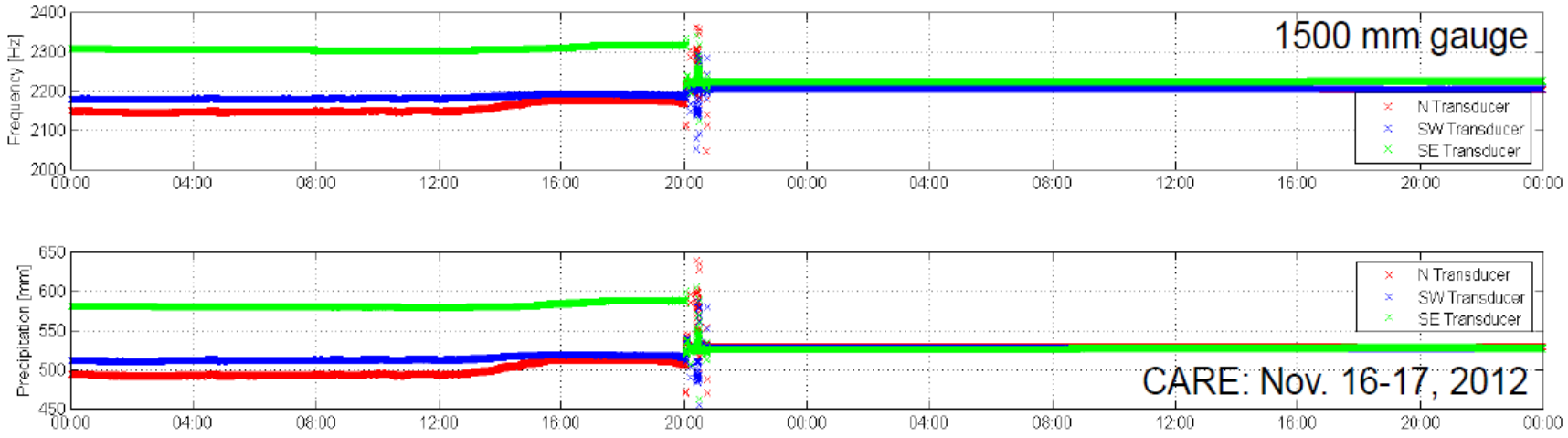
Current methods of interaction between Site manager, IOC and project team are:

- Weekly/Bi-weekly teleconference meetings.
- Emails.
- Blog on the Cspice website.

14. Small things, Big impacts.

Positioning of transducers, wires, within housing can impact gauge performance:

- In the example below, see marked change in output from 1500 mm gauge after wires were fixed to avoid contact with housing interior.
- Of particular concern for higher capacity gauges (1000 mm, 1500 mm), for which available space within housing is limited.
- Heated gauges present an additional challenge – even more wires to fit inside housing.


1500 mm gauge
Frequency [Hz]
2400
2300
2200
2100
2000
00:00
04:00
08:00
12:00
16:00
20:00
00:00
04:00
08:00
12:00
16:00
20:00
00:00
N Transducer
SW Transducer
SE Transducer
Precipitation [mm]
650
600
550
500
450
CARE: Nov. 16-17, 2012