

WMO SPICE
SITE COMMISSIONING PROTOCOL

V3.1 (JUL, 23 2013)

TABLE OF CONTENTS

| | |
|--|----|
| 1. ORGANIZATION OF THE DOCUMENT..... | 3 |
| 2. PURPOSE AND SCOPE..... | 3 |
| 3. CONFIGURATIONS AND ASSOCIATED COMMISSIONING REQUIREMENTS | 4 |
| 3.1 SPICE Site Components..... | 4 |
| 3.2 Communication Interfaces | 5 |
| 3.3 SPICE Site Project Team | 5 |
| 4. PRE-COMMISSIONING ACTIVITIES..... | 5 |
| 4.1 Station Installation and Scheduling..... | 5 |
| 4.2 Testing of Instruments Included in the Intercomparison | 6 |
| 4.2.1 Site Documentation..... | 6 |
| 4.2.2 Monitoring of Performance | 6 |
| 4.2.3 Site Maintenance | 6 |
| 5. COMMISSIONING ACTIVITIES..... | 6 |
| 5.1 Determination of Site Readiness..... | 6 |
| 5.1.1 Site Readiness Evaluation | 7 |
| 5.1.2 Completion of POP Report | 7 |
| 5.1.3 Invoking Workarounds..... | 7 |
| 5.2 Approval of Site Commissioning..... | 8 |
| 5.3 Implementation of Approved SPICE Site Commissioning..... | 8 |
| 6. Interaction with the Instrument Providers | 8 |
| 6.1 Pre-Commissioning Activities: Engagement of the Instrument Providers | 8 |
| 6.2 Engagement of Instrument Providers during the Experiment..... | 8 |
| 7. SPICE Data Archival..... | 9 |
| APPENDIX A: PROOF OF PERFORMANCE (POP) Forms | 10 |
| SECTION A1: Station Information | 10 |
| SECTION A2: SPICE Field Working Reference System configuration..... | 14 |
| SECTION A3: Instrument Metadata Report..... | 34 |
| SECTION A4: Confirmation of Experiment Configuration..... | 49 |

| | |
|--|-------------------------------------|
| TEST 1: Instrument Calibration and Checks | 49 |
| TEST 2: Instrument Validation | 49 |
| TEST 3: Site-to-archive Transfer Validation..... | Error! Bookmark not defined. |
| SECTION A5: Site Documentation Checklist..... | 53 |
| APPENDIX B: SPICE DATA LEVELS AND DATASETS..... | 54 |
| APPENDIX C: ACRONYMS AND ABBREVIATIONS | 55 |

1. ORGANIZATION OF THE DOCUMENT

The Commissioning Protocol is organized into four parts:

1. **The site components**, data transfer and sharing pathways, and project organizational structure are outlined in Section 3;
2. **The site commissioning procedures**, including pre-commissioning activities and the Interaction with the Instrument Providers, Sections 4 to 6;
3. **SPICE Data Archive**, Section 7.
4. **Appendix A: the template for the Proof of Performance (POP) Report**, in which all site configuration details and commissioning activities are documented.

Appendix B outlines the SPICE Data Levels and Data Sets, and Appendix C includes a list of acronyms used throughout the document.

The first two sections are intended to provide background information on the commissioning process within the scope of the SPICE project, while the Appendix A contains the forms which are required to be filled out as part of the commissioning of the site. Once completed, these forms become the Commissioning Report.

The SPICE data archive section outlines the requirements regarding the SPICE data levels and datasets and the planned strategy for the archival of SPICE data to a central location(s).

2. PURPOSE AND SCOPE

This document is prepared by the WMO SPICE IOC. It outlines the procedures for post-installation testing and commissioning of the sites participating in the WMO SPICE experiment and documents the responsibilities for each aspect of the commissioning process.

Commissioning of a WMO SPICE site refers to the act of “turning it on” and marking the start of the collection of the “official” observations and measurements from the instruments included in the intercomparison (reference, instruments under test, ancillary measurements), and their archival on the designated Site Data Archive.

For this purpose, each site will designate a location for the Site Data Archive, which must protect the integrity of the intercomparison data.

End-to-end data quality and integrity for each instrument on each SPICE site will be verified before the commissioning can take place. It is essential that:

- Only agreed upon instruments are to be installed, in an accepted and standardized configuration;

- Each component be properly tested, and its performance verified, prior to commissioning;
- The transfer of instrument data to the Site Data Archive is validated and the archive secured.

Various individuals and organizations are referred to in this document as having responsibilities.

- SPICE IOC
- SPICE Project Team
- SPICE Data Analysis Team
- Site Manager
- Site (SPICE) Project Team
- ER refers to the Evaluation Representative, an individual named by the SPICE IOC
- IR, the Installation Representative, is identified by the Site Manager, responsible for the site configuration.
- Instrument Providers

3. CONFIGURATIONS AND ASSOCIATED COMMISSIONING REQUIREMENTS

3.1 SPICE SITE COMPONENTS

The SPICE Components include all or some of the following components:

- Field working reference systems (R3, and where applicable R2, and R1: site-specific)
- Reference measurements for snow on the ground (where applicable)
- Instruments under test provided by the host;
- Instruments under test supplied by the Instrument Providers;
- Ancillary measurements (both required and desired measurements listed):
 - Precipitation occurrence/intensity/size/type
 - Station pressure
 - Temperature/dew point
 - Relative humidity
 - Wind speed/direction (2-D and/or 3-D): different heights;
 - Manual observations
 - Vertical particle velocity
 - Net radiation
 - Snow Water Equivalent (SWE)
 - Icing occurrence
 - Visibility
 - Sky condition
- Derived or modeled ancillary parameters: wet bulb temperature, upper air temperature, snow particle density;

- Photography and video equipment for recording and archival of site conditions;

3.2 COMMUNICATION INTERFACES

The SPICE site teams are led by their respective Site Managers and are responsible to setup and manage an effective data communication system collecting, transmitting and archiving the site dataset, continuously, or at predefined intervals (e.g. daily) on the Site Data Archive.

As stated in the report of the SPICE IOC-2 meeting (Boulder), it is recommended that 6 s data be collected for gauges in reference systems and instruments under test, where possible; alternatively, 10 s or 60 s sample intervals can be used.

The frequency of the collection of ancillary measurements will be similar to that of the instruments under test, to the extent possible.

Data communication for SPICE includes the following components:

- Instrument to data logger (site specific);
- Instrument to a site data acquisition system located on site, site specific;
- Transmission of SPICE data from the site to a designated Site Data Archive;
- Transmission of SPICE data from the Site Data Archive to SPICE Archive(s) (See Section 7);
- Transmission of gauge-specific and requisite ancillary SPICE data to Instrument Providers for review.

The communication components and any future changes that may impact the availability of instruments will be documented. Any change to the configuration will be subject to a period of testing to ensure that the availability of instrument data is not affected. The IOC will review and accept the final configuration.

3.3 SPICE SITE PROJECT TEAM

The Site Manager will document the membership of the SPICE Site Project Team, including the names of the individuals who are engaged in the SPICE experiment on the respective site. This information will include reference to the roles relative to the SPICE experiment.

During the project, the participation in the SPICE Site Project Team could change. The Site Manager will update the Site Documentation to reflect the changes (people, roles).

4. PRE-COMMISSIONING ACTIVITIES

The pre-commissioning activities are an integral part of the process of ensuring the quality of the experiment. The following sections detail the pre-commissioning activities ensuring that site infrastructure and procedures are properly managed and documented.

4.1 STATION INSTALLATION AND SCHEDULING

The IOC and the Site Managers will develop target dates for the installation and commissioning of each SPICE Site. An Installation Representative will be identified by the Site Manager to manage the

installation. Site drawings, instrument siting and installation according to national standards, IOC agreed guidelines, or manufacturer recommendations, and exceptions will be documented as part of the POP Report.

4.2 TESTING OF INSTRUMENTS INCLUDED IN THE INTERCOMPARISON

The testing of instruments is conducted by the SPICE Site Project Team. Based on the results, the Site Manager will determine the readiness of instruments and the site for the formal phase of the experiment.

4.2.1 *SITE DOCUMENTATION*

Technical documentation for each SPICE component will include, but not limited to, the site layout, instruments details and configuration, data collection (including the data format), number of similar instruments, installation details, maintenance standards.

Specific information on the Site Documentation is provided in Appendix A.

4.2.2 *MONITORING OF PERFORMANCE*

The Site Manager will establish feasible procedures for monitoring the performance of instruments, identifying problems with the data, and initiating and tracking remedial actions. This may include:

- Review data, diagnostic data, quick view plots, QC reports, etc.
- Establishing Site Journals/Blogs documenting the performance and intervention on the instruments (directly – e.g. snow clearing - or indirectly – e.g. system reset -)

4.2.3 *SITE MAINTENANCE*

The SPICE Site Manager will ensure that site maintenance is available to limit the periods or data outage.

5. COMMISSIONING ACTIVITIES

The commissioning of a SPICE site is led by the Site Manager. The SPICE POP Report will document the status of the site operation at the start of the intercomparison.

The site commissioning process consists of the following steps:

- Determine the instrument readiness, including;
 - ⇒ Installation and configuration of the instruments participating in the experiment;
 - ⇒ Data integrity confirmation at the Site Data Archive;
- Review and approval of the POP Report by the IOC;
- Agreement on the official start of the experiment on the site.

5.1 DETERMINATION OF SITE READINESS

This sub-section details the activities to be conducted following the installation of instruments, and which are completed prior to the official start of the SPICE experiment on the site.

5.1.1 SITE READINESS EVALUATION

The Site Manager will initiate the evaluation of the SPICE Site and will provide to the IOC adequate notice of the SPICE site commissioning.

The IOC will name a representative (the ER) to conduct the evaluation of the Site Documentation prepared by the Site Manager. The ER will work with the Site Manager on the evaluation of the POP Report.

The site readiness evaluation should be sufficient to ensure proper operation of all instruments and interfaces. The assessments will include:

- Satisfactory performance of the field reference system(s).
- Satisfactory performance of each instrument under test.
- Satisfactory performance of instruments providing ancillary measurements.
- Satisfactory performance of site communication components and interfaces.
- Satisfactory performance of the data transmission to the Site Data Archive;
- Proper functioning of service backup capabilities for that particular site, if available.
- Maintenance capacity.

5.1.2 COMPLETION OF POP REPORT

The SPICE Site POP Report documents the readiness of the site and is approved by the IOC.

The POP Report includes:

- A form for recording station information and configuration, including the site layout;
- A form for documenting the configuration of SPICE field working reference configurations, including both manual and automatic measurements;
- Forms for recording the specifications of instruments under test and instruments used to provide ancillary measurements ;
- Details of tests conducted for instrument data validation;
- Details of tests conducted for end-to-end data validation;
- A checklist for all additional documentation to be recorded and submitted ;
- A table for recording commissioning milestones.

The Site Manager will provide the POP Report to the IOC, for final review.

5.1.3 INVOKING WORKAROUNDS

A workaround is a temporary solution to a system limitation that requires special attention and will be removed eventually. Any workarounds will be documented and included as part of the POP Report. Each work-around will be tracked as an open item until resolved.

5.2 APPROVAL OF SITE COMMISSIONING

The Site Manager will notify and update the IOC on the organization and completion of the tests outlined in Appendix A. Once all tests results are verified, the IOC and the Site Manager will agree on the start date of the formal experiment on the site.

In case some of the instruments under test are not ready for the start of the experiment as planned (currently Nov. 15, 2012), the experiment could commence in steps, provided that all field references and key ancillary parameters (wind speed and direction, temperature) have been commissioned.

Commissioning of additional instruments would follow as their configurations are finalized; this will allow for their inclusion in the experiment as early as feasible, with no compromise to the data quality. The Data Analysis Team will take into consideration the commissioning data for each instrument.

5.3 IMPLEMENTATION OF APPROVED SPICE SITE COMMISSIONING

Upon commissioning, the site will commence the official collection of the SPICE project dataset and ancillary measurements/observations.

6. INTERACTION WITH THE INSTRUMENT PROVIDERS

Instrument Providers are responsible for the delivery of their instruments to the SPICE Sites and for supporting the Site Managers in verifying their proper functioning before and during SPICE.

6.1 PRE-COMMISSIONING ACTIVITIES: ENGAGEMENT OF THE INSTRUMENT PROVIDERS

During the installation, the Site Manager or a representative will engage the Instrument Provider regarding the preparation of their instruments, to ensure the operation within recommended standards.

The Site Manager would confirm with the Instrument Provider the functioning of the instrument prior to the commissioning of the site. This could be done by the sharing of instrument and/or ancillary data and pictures, coordinated site visits, or any other method agreed upon by the two parties.

The Site Manager should be able to indicate in the Commissioning Report the confirmation from the Instrument Provider that the instrument operates as expected.

6.2 ENGAGEMENT OF INSTRUMENT PROVIDERS DURING THE EXPERIMENT

During the experiment, each Instrument Provider will be given access to the unprocessed output from its own instrument(s), and a minimum set of corresponding ancillary data consisting of air temperature, relative humidity, and wind speed. These data are provided only for ensuring the proper functioning of the instruments, and will neither be reported nor published prior to publication of the SPICE Final Report.

The Site Manager will coordinate the data transfer to the Instrument Provider(s), including such aspects as the frequency, methodology, etc. It is desired that this data transfer is in place prior to the start of the experiment. The Instrument Provider is expected to alert the Site Manager in the event that a malfunction of an instrument is noted, and provide support to the Site Project team (including site visits), if needed, to address the failure.

The Instrument Providers could visit the intercomparison sites, after prior arrangements are made with the Site Manager.

7. SPICE DATA ARCHIVAL

The SPICE Project Team will establish and maintain a SPICE Archive on at least one SPICE designated Server where the Site Intercomparison Datasets and the Input Documentation will be stored. This will facilitate the preparation of data for the individual and comparative data analysis and the preparation of the Final Report. A description of the data levels and datasets for SPICE, as currently defined, is provided in Appendix B.

The National Centre for Atmospheric Research (NCAR), USA, will host the SPICE Archive and provide quick view capabilities of (near) real time data. Options for a second SPICE Archive are being explored by Environment Canada, Canada.

Each Site Manager will work towards preparing the transfer of Level 1 and Level 2a datasets to the SPICE Archive(s). The IOC will provide to the Site Managers the requirements regarding the data transfer to enable the preparation of datasets (format change, setup of data uploads/availability, etc...)

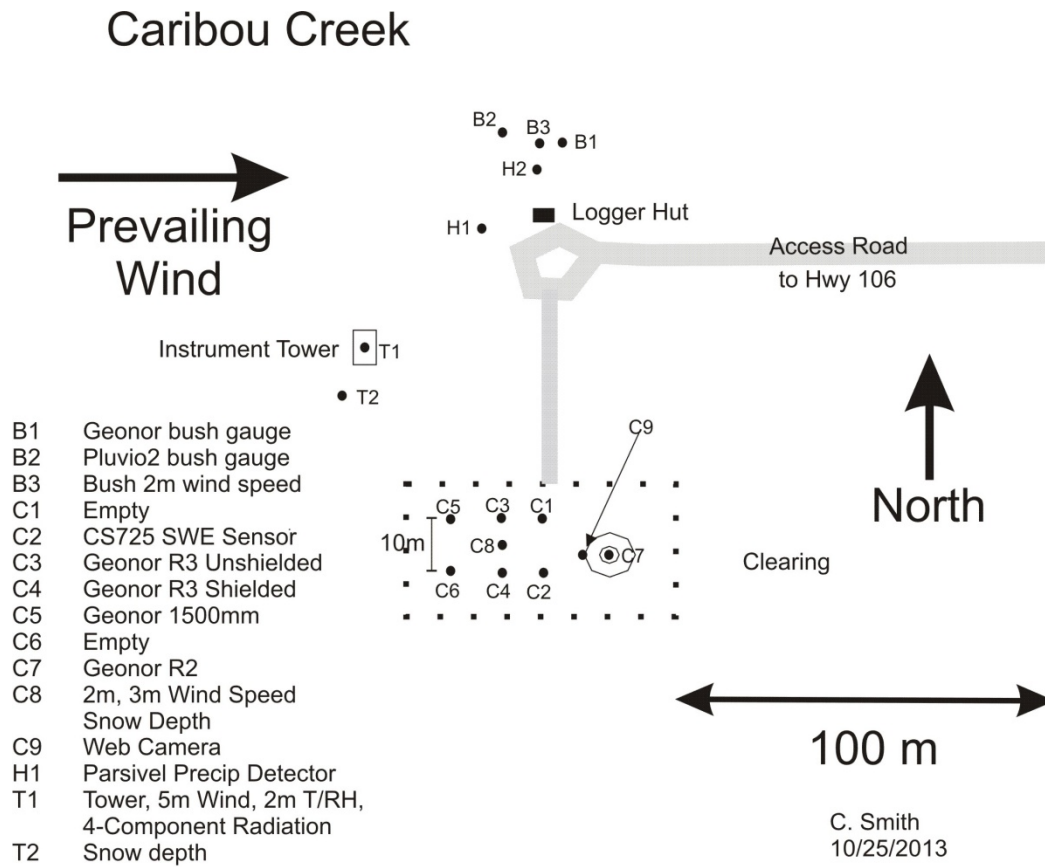
The data transfer between the Site Data Archive and the SPICE Archive is expected to be established and validated within 3 months of the official start of the experiment, and implemented based on site specific conditions and limitations.

APPENDIX A: PROOF OF PERFORMANCE (POP) FORMS

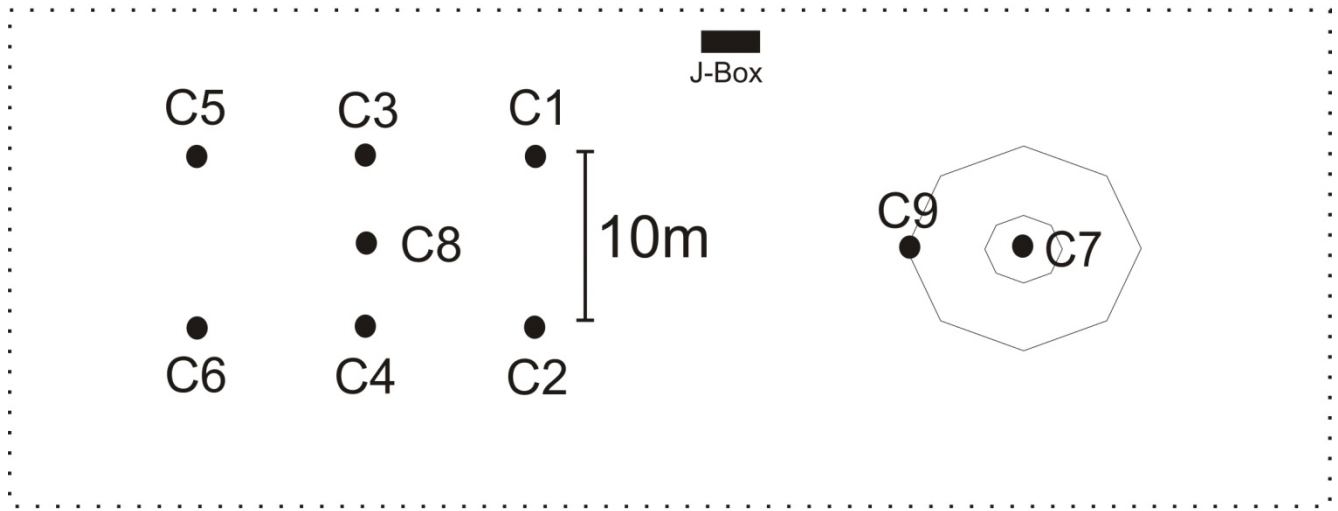
SECTION A1: STATION INFORMATION

| | |
|-----------------------------|-----------------------|
| Station name | Caribou Creek |
| Reference town | Smeaton, Saskatchewan |
| Station latitude | 53.944737N |
| Station longitude | 104.649339W |
| Station elevation in metres | 519 m |

Insert here a Site Layout indicating the location of SPICE references and all instruments, including distances and the direction of the prevailing winter winds.



Caribou Creek Clearing Layout



..... Approximate clearing boundaries

Insert here a set of pictures documenting the overall site installation (views from N, E, S, W).

It is suggested to submit here also a horizon / sky view diagram taken with a camera., if available



Clearing site at Caribou Creek looking East (left) and West (right)



Clearing site at Caribou Creek looking North (left) and South (right)



Bush shielded gauges. Pluvio2 (left) and Geonor T-200B (right)

SECTION A2: SPICE FIELD WORKING REFERENCE SYSTEM CONFIGURATION

Field Reference Type R0

Pluvio2 (Single Alter) in bush on B2

| | |
|---|---|
| R0 type | MANUAL <input type="checkbox"/> AUTOMATIC <input checked="" type="checkbox"/> |
| Measurement frequency, planned | 1 minute |
| Measurement methodology planned (volume, weight, etc) | by weight |

Additional information required: Provide details of the planned measurement procedure.

Configuration of the bush

| | |
|--|--|
| Description of surrounding obstacles (including distance/direction from, height, and type) | The ROP is located north of the logger hut in a thick bushy area of regenerating jack pine (harvested in 2002). The trees around the gauge have been trimmed to the height of the gauge. |
| Bush area | > 100m in all directions |
| Average height of the bush | About 2.5m |
| Bush vegetation type | regenerating jack pine |
| Maintenance details | prune in the fall and summer if necessary |

Collector and shield specifications (manual configuration)

| | |
|--|--|
| Model | |
| Inlet area | |
| Installation height (measured at the top of the collector) | |
| Number of collectors available for the experiment | |
| Shield type | |

Weighing gauge specifications (automatic configuration)

| | |
|----------------------------------|-------------|
| Make and model | OTT Pluvio2 |
| Serial number | 300595 |
| Firmware version (if applicable) | 1.30.0 |
| Number of transducers (if | |

| | |
|---|---|
| applicable) | |
| Height of installation (measured from the top of the gauge) | 2m |
| Heater configuration and algorithm | Manufacturer Default (to be updated prior to 2013/2014 season) |
| Output data message format | "TIMESTAMP","RECORD","Pluvio_Bush_PrecipIntensity", "Pluvio_Bush_AccuPrecipUnfilt","Pluvio_Bush_AccuPrecipFilt", "Pluvio_Bush_AccuTotalPrecip","Pluvio_Bush_BucketUnfilt", "Pluvio_Bush_BucketFilt","Pluvio_Bush_PrecipTemp","Pluvio_Bush_HStatus", "Pluvio_Bush_PStatus" |
| Frequency of data sampling | 1 min |

Single Alter shield

| | |
|---|---|
| According to the SPICE instructions? | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Attached to the post of the weighing gauge? | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| If different, provide details: | |

Picture. Field Reference Type R0

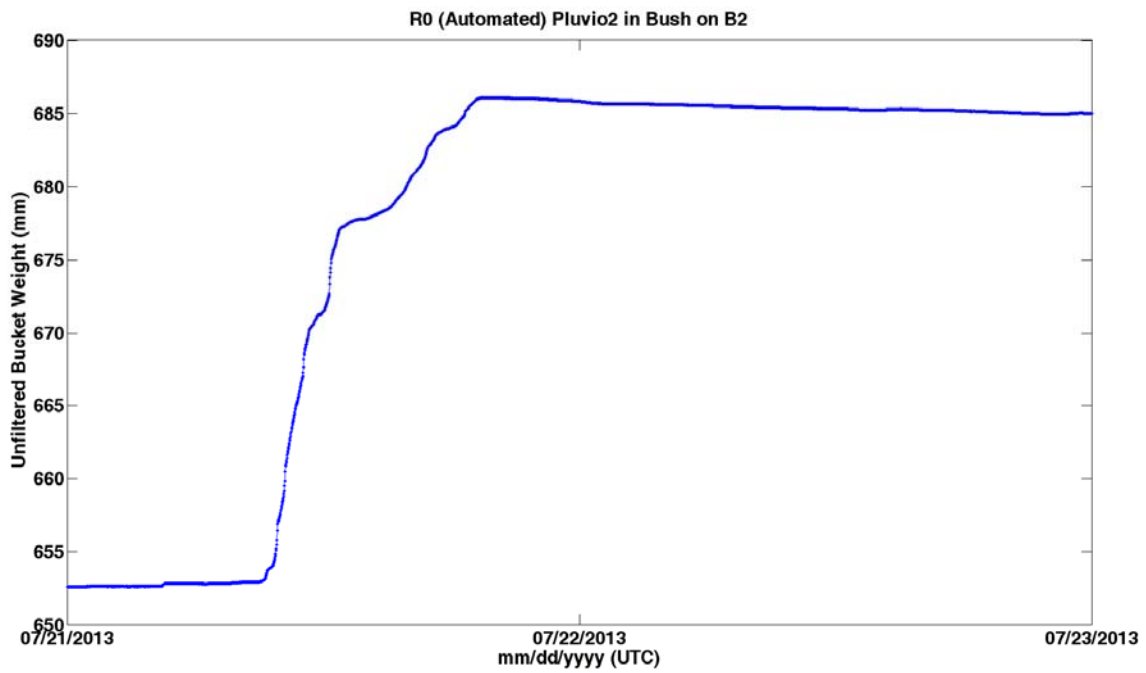


R0P in bush looking west (left) and south (right)

Table. Field Calibration of Reference Type R0 (if applicable)

[In progress](#)

48h Observation Table for Reference Type R0 (Manual) or Plots (Automatic)



Field Reference Type R0

Geonor T-200B (Single Alter) in bush on B1

| | |
|---|---|
| R0 type | MANUAL <input type="checkbox"/> AUTOMATIC <input checked="" type="checkbox"/> |
| Measurement frequency, planned | 1 minute |
| Measurement methodology planned (volume, weight, etc) | by weight |

Additional information required: Provide details of the planned measurement procedure.

Configuration of the bush

| | |
|--|--|
| Description of surrounding obstacles (including distance/direction from, height, and type) | The ROP is located north of the logger hut in a thick bushy area of regenerating jack pine (harvested in 2002). The trees around the gauge have been trimmed to the height of the gauge. |
| Bush area | > 100m in all directions |
| Average height of the bush | About 2.5m |
| Bush vegetation type | regenerating jack pine |
| Maintenance details | prune in the fall and summer if necessary |

Collector and shield specifications (manual configuration)

| | |
|--|--|
| Model | |
| Inlet area | |
| Installation height (measured at the top of the collector) | |
| Number of collectors available for the experiment | |
| Shield type | |

Weighing gauge specifications (automatic configuration)

| | |
|---|----------------|
| Make and model | Geonor T-200B3 |
| Serial number | |
| Firmware version (if applicable) | |
| Number of transducers (if applicable) | 3 |
| Height of installation (measured from the top of the gauge) | 2m |

| | |
|------------------------------------|--|
| Heater configuration and algorithm | USCRN type heater with SPICE algorithm (-5 to +2 deg C) |
| Output data message format | "TIMESTAMP","RECORD",... "GeoBushHz_Avg(1)","GeoBushHz_Avg(2)","GeoBushHz_Avg(3)","GeoBushmm_Avg(1)","GeoBushmm_Avg(2)","GeoBushmm_Avg(3)","GeoBush_RimT_Avg","BushHeaterOn_Max",... |
| Frequency of data sampling | 1 min |

Single Alter shield

| | |
|---|---|
| According to the SPICE instructions? | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Attached to the post of the weighing gauge? | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| If different, provide details: | |

Picture. Field Reference Type R0



ROG in bush looking west (left) and south (right)

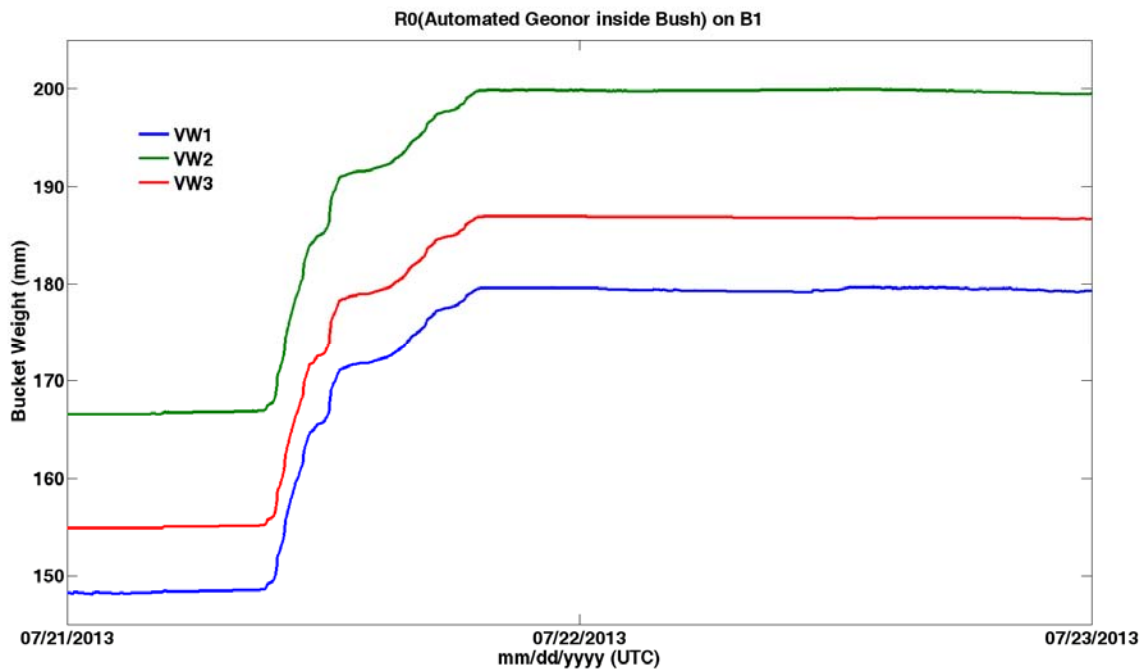


ROG in bush looking east (left) and north (right)

Table. Field Calibration of Reference Type R0 (if applicable)

| Gauge Location (Pedestal) | Time UTC | Total Weight (water+bottle) grams | Empty Bottle Weight grams | Water Weight grams | Sensor Readings mm | | | Sensor Differential (mm) | | | Calibration Amount mm | Difference | | | |
|------------------------------|-------------|--------------------------------------|------------------------------|-----------------------|-----------------------|-------------|-------------|-----------------------------|-------------|-------------|--------------------------|-----------------|-----------------|-----------------|-------|
| | | | | | V W 1 mm | V W 2 mm | V W 3 mm | V W 1 mm | V W 2 mm | V W 3 mm | | V W 1 mm / % | V W 2 mm / % | V W 3 mm / % | |
| B1 (Oct 16) | Start | 22:32 | 1520.2 | 52.94 | 1467.26 | 186.00 | 190.44 | 185.55 | 72.95 | 74.53 | 73.47 | 73.36 | 0.41 | -1.17 | -0.11 |
| | End | 22:39 | | | | 258.95 | 264.97 | 259.02 | | | | | 0.56 | -1.59 | -0.15 |

48h Observation Table for Reference Type R0 (Manual) or Plots (Automatic)



Field Reference Type R1 (Manual)

| | |
|---|-----|
| Measurement frequency, planned | N/A |
| Measurement methodology planned (volume, weight, etc) | N/A |

Additional information required: Provide details of the planned measurement procedure.

Configuration of the DFIR fence

| | |
|--|-----|
| Description of surrounding obstacles (including distance/direction from, height, and type) | N/A |
| Diameter | N/A |
| Height of the outer fence (measured at the top) | N/A |
| Height of the inner fence (measured at the top) | N/A |
| Length of slats | N/A |
| Width of slats | N/A |
| Slat material | N/A |

Collector and shield specifications

| | |
|--|-----|
| Model | N/A |
| Inlet area | N/A |
| Installation height (measured at the top of the collector) | N/A |
| Number of collectors available for the experiment | N/A |
| Shield type | |

Picture. Field Reference Type R1 (Manual)

Table. Field Calibration of Reference Type R1 (Manual)

48h Observation Table for Reference Type R1 (Manual)

Field Reference Type R2 (Automatic)

R2G at C7

Configuration of the DFIR fence

| | |
|--|--|
| Description of surrounding obstacles (including distance/direction from, height, and type) | The R2G is located on the south eastern edge of a 50 m x 30 m clearing within a Jack Pine forest that was clear cut in 2002. On the South and Eastern sides of the fences, approximately 5-10 m away is the edge of the Jack Pine re-growth. On the Northern side of the fence, the edge of the bush is approximately 10 m away. To the west of the fence are the pedestals with other precipitation gauges. |
| Diameter | 12 m |
| Height of the outer fence (measured at the top) | 3.5 m |
| Height of the inner fence (measured at the top) | 3.0 m |
| Length of slats | 1.5 m (4 ' 11") |
| Width of slats | 2 5/8" (Spacing 2 5/8 ") |
| Slat material | Pressure Treated wood |

Single Alter shield

| | |
|---|---|
| According to the SPICE instructions? | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Attached to the post of the weighing gauge? | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| If different, provide details: | |

Weighing gauge (WG)

| | |
|---------------------------------------|---------------------------------|
| Make and model | GEONOR, T-200B3, 600 mm |
| Serial number | VW1:15812, VW2:15912, VW3:16012 |
| Firmware version (if applicable) | N/A |
| Number of transducers (if applicable) | 3 |

| | |
|---|--|
| Height of installation (measured from the top of the gauge) | 3 m |
| Heater configuration and algorithm | USCRN Heater with SPICE algorithm |
| Output data message format | "TIMESTAMP", "RECORD",... "GeoC7Hz_Avg(1)", "GeoC7Hz_Avg(2)", " GeoC7Hz_Avg(3)", "GeoC7mm_Avg(1)", "GeoC7mm_Avg(2)", "GeoC7mm_Avg(3)", "GeoC7_RimT_Avg", "GeoC7_HeaterOn_Max", |
| Frequency of data sampling | 20 sec , 1500 cycle average, 1 minute average |

Precipitation detector

| | |
|---|--|
| Make and model | Vaisala DRD11A |
| output data message format | "TIMESTAMP", "RECORD",... "PdetectVolts_Avg", "Pdetect_Max" |
| Data sampling frequency | 1 Minute |
| Height of installation. <i>DAT team recommend the following place for an optical precipitation detector or precipitation type sensor inside the DFIR:</i> | 2.25 m |
| <i>• Inside the inner fence</i> <i>• 75 cm below the gauge opening, corresponds to half way down the inner fence</i> | |
| Location of installation relative to WG in reference system. <i>DAT team recommend to locate the optical precipitation detector or precipitation type:</i> <ul style="list-style-type: none"> <i>• perpendicular to the main wind direction</i> <i>• if possible using two precipitation sensors at different places to account for different wind directions.</i> <i>• in the middle between Alter and inner fence</i> | Precipitation detector is installed on the inner fence of C7 (DFIR). Thies optical detector to be installed similarly before October 2013. |

Picture. Field Reference Type R2 (Automatic)



R2G in clearing (C7) looking north (left) and east (right)

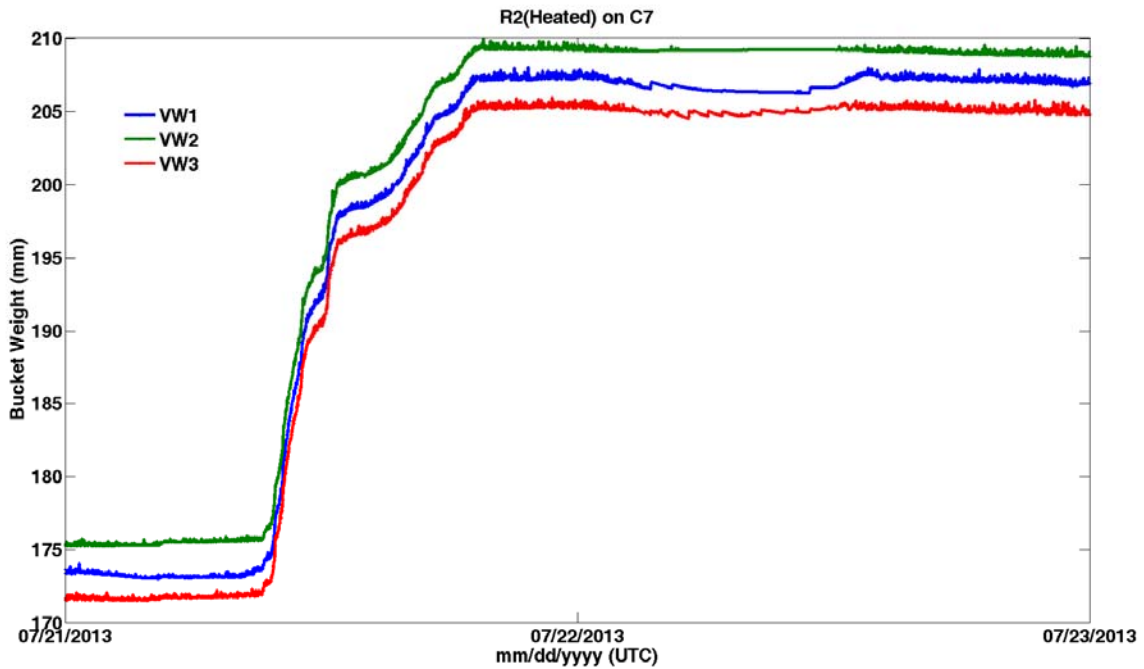


R2G in clearing (C7) looking south (left) and inside the inner fence (right)

Table. Field Calibration of Reference Type R2 (Automatic)

| Gauge Location (Pedestal) | Time UTC | Total Weight (water+bottle) grams | Empty Bottle Weight grams | Water Weight grams | Sensor Readings mm | | | Sensor Differential (mm) | | | Calibration Amount mm | Difference | | | |
|------------------------------|-------------|--------------------------------------|------------------------------|-----------------------|-----------------------|-------------|-------------|-----------------------------|-------------|-------------|--------------------------|-----------------|-----------------|-----------------|------|
| | | | | | V W 1 mm | V W 2 mm | V W 3 mm | V W 1 mm | V W 2 mm | V W 3 mm | | V W 1 mm / % | V W 2 mm / % | V W 3 mm / % | |
| C7 (Sept 12) | Start | 20:53 | 1550.06 | 36.12 | 1513.94 | 251.82 | 254.36 | 249.81 | 75.31 | 76.33 | 74.94 | 75.70 | 0.39 | -0.63 | 0.76 |
| | End | 20:57 | | | | 327.13 | 330.69 | 324.75 | | | | | 0.51 | -0.84 | 1.00 |

48h Plot. Field Reference Type R2 (Automatic)



Field Reference Type R3 (Automatic)

R3G Unshielded on C3 and Shielded on C4

| | |
|---|---|
| Presence of a WG with a single Alter shield? | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Presence of a WG with no shield? | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Description of surrounding obstacles (including distance/direction from, height, and type) | The R3 reference gauges are located in the middle of the clearing, at the C3 and C4 posts. To the east are C1 and C2 posts which are currently empty. To the far east is the 2 nd and smaller junction box and the R2G. To the west of C3 and C4 are posts C5 where the Geonor 1500 is located and C6 which is currently empty. Between C3 and C4 is post C8 where the 2m and 3m anemometers are located. The distance between C4 and the southern edge of the forest is 5m and the distance between C3 and the northern edge of the forest is 5m. See site layout. |
| Distance between WGs (as close as possible, but exceeding minimum distance between gauges for a Class 1 siting configuration (as per WMO guidelines): Generally a flat area within 10m of instrument. This area surrounded by generally open space with a slope of less than 1:3 (19°) that is considered to be representative of the large scale area. | 10 m (estimated) |

Weighing gauge (1 of 2)

| | |
|---|---|
| Make and model | GEONOR, T-200B3,600 mm (Unshielded) |
| Serial number | VW1:14910, VW2:15010, VW3:14410 |
| Firmware version (if applicable) | N/A |
| Number of transducers (if applicable) | 3 |
| Height of installation (measured from the top of the gauge) | 2 m |
| Heater configuration and algorithm | USCRN with SPICE algorithm |
| Output data message format | "TIMESTAMP", "RECORD",... "GeoC3Hz_Avg(1)", "GeoC3Hz_Avg(2)", "GeoC3Hz_Avg(3)", |

| | |
|----------------------------|---|
| | "GeoC3mm_Avg(1)", "GeoC3mm_Avg(2)", "GeoC3mm_Avg(3)", "GeoC3_RimT_Avg", "GeoC3_HeaterOn_Max", |
| Frequency of data sampling | 20 sec (1500 cycles averaged per scan), averaged and output at 1-min |

Weighing gauge (2 of 2)

| | |
|---|---|
| Make and model | GEONOR, T-200B3,600 mm (Shielded) |
| Serial number | VW1:14310, VW2:14210, VW3:19013 |
| Firmware version (if applicable) | N/A |
| Number of transducers (if applicable) | 3 |
| Height of installation (measured from the top of the gauge) | 2 m |
| Heater configuration and algorithm | USCRN heater with SPICE algorithm |
| Output data message format | "TIMESTAMP", "RECORD",... "GeoC4Hz_Avg(1)", "GeoC4Hz_Avg(2)", "GeoC4Hz_Avg(3)", "GeoC4mm_Avg(1)", "GeoC4mm_Avg(2)", "GeoC4mm_Avg(3)", "GeoC4_RimT_Avg", "GeoC4_HeaterOn_Max", |
| Frequency of data sampling | 20 sec (1500 cycles averaged per scan), averaged and output at 1-min |

Single Alter shield

| | |
|---|---|
| According to the SPICE instructions? | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Attached to the post of the weighing gauge? | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| If different, provide details: | |

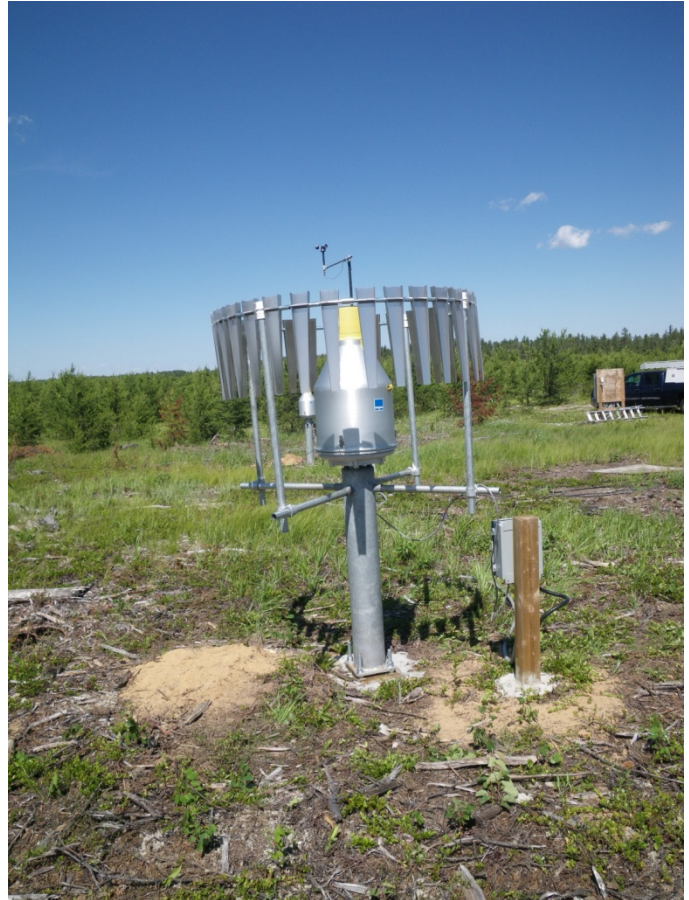
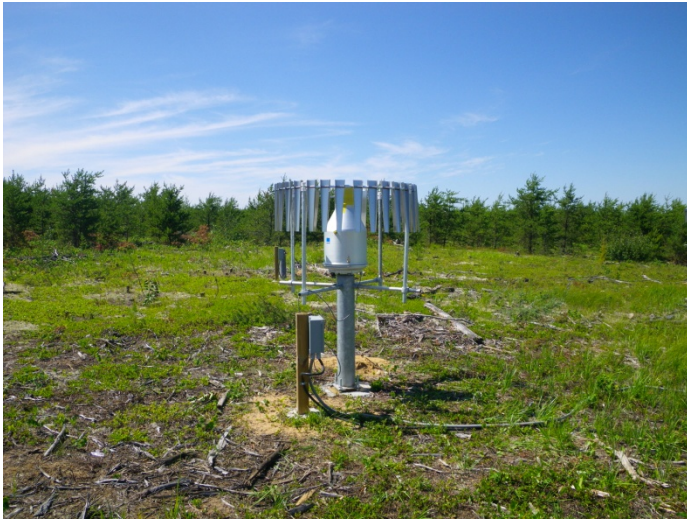
Precipitation detector

| | |
|---|---------------------------------|
| Make and model | N/A |
| Data output format | N/A |
| Data sampling frequency | N/A |
| Height of installation. | N/A |
| Location of installation relative to WGs in reference system. | See note above regarding DRD11A |

Pictures. Field Reference Type R3 (Automatic).



R3G Unshielded on C3 looking west (top left), south (top right), north (bottom left) and east (bottom right)

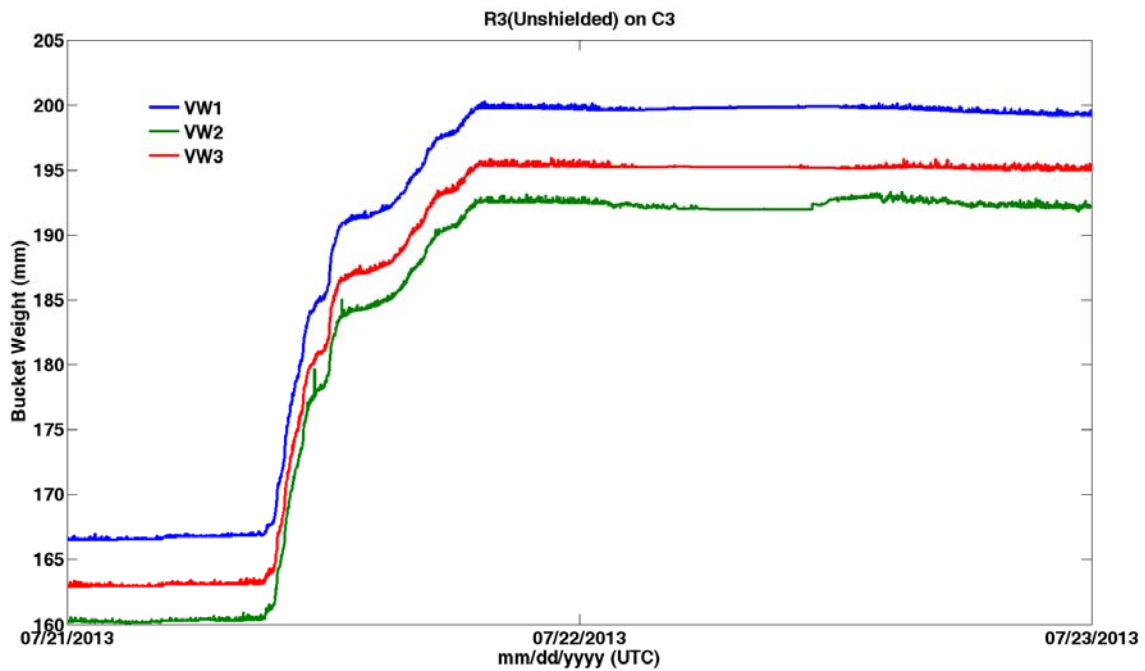


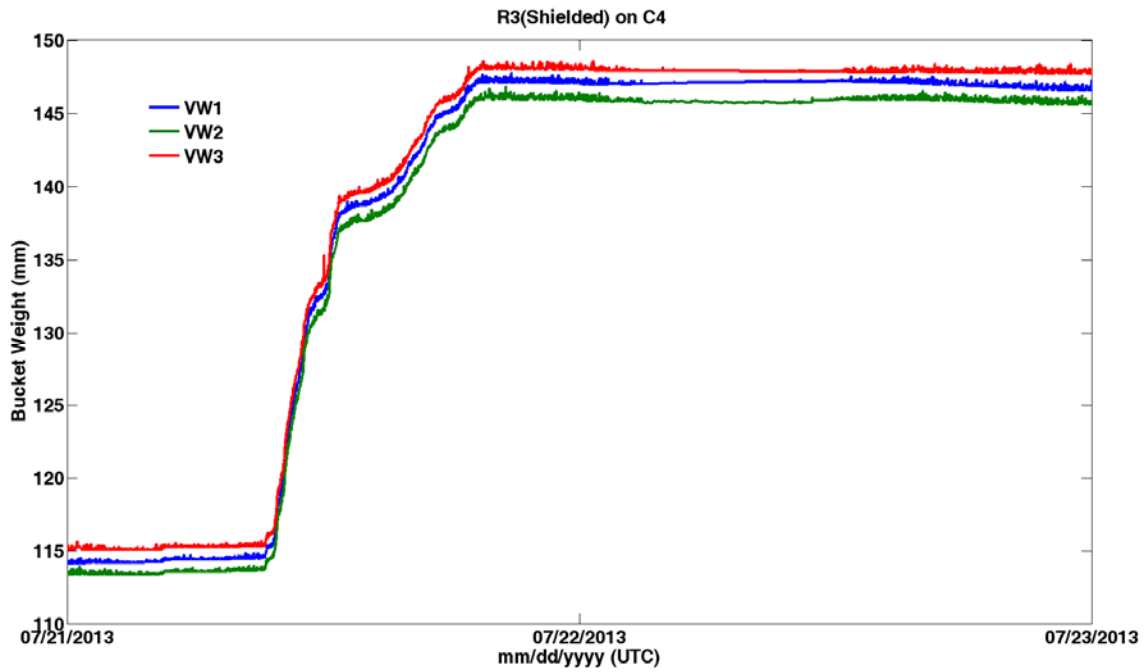
R3G Shielded on C4 looking south (top left), east (top right), west (bottom left) and north (bottom right)

Table. Field Calibration of Reference Type R3 (Automatic) Weighing Gauges 1 and 2

| Gauge Location (Pedestal) | Time UTC | Total Weight (water+bottle) grams | Empty Bottle Weight grams | Water Weight grams | Sensor Readings mm | | | Sensor Differential (mm) | | | Calibration Amount mm | Difference | | | |
|------------------------------|-------------|--------------------------------------|------------------------------|-----------------------|-----------------------|-------------|-------------|-----------------------------|-------------|-------------|--------------------------|-----------------|-----------------|-----------------|-------|
| | | | | | V W 1 mm | V W 2 mm | V W 3 mm | V W 1 mm | V W 2 mm | V W 3 mm | | V W 1 mm / % | V W 2 mm / % | V W 3 mm / % | |
| C3 (Sept 12) | Start | 20:44 | 1555.51 | 33.87 | 1521.64 | 242.90 | 234.62 | 237.69 | 76.74 | 74.89 | 75.93 | 76.08 | -0.66 | 1.19 | 0.15 |
| | End | 20:46 | | | | 319.64 | 309.51 | 313.62 | | | | | | | |
| C4 (Sept 12) | Start | 20:47 | 1555.74 | 34.98 | 1520.76 | 189.60 | 188.55 | 190.90 | 76.74 | 76.07 | 76.46 | 76.04 | -0.70 | -0.03 | -0.42 |
| | End | 20:49 | | | | 266.34 | 264.62 | 267.36 | | | | | | | |

48h Plots. Field Reference Type R3 (Automatic). Weighing Gauges 1 and 2





Field Reference for the Measurement of Snow on the Ground

| | |
|--------------------------|--|
| Method used | Depth and density/SWE measurement on snow course with 1 minute point observations via SR50 in clearing |
| Equipment used | SR50, snow stakes, ESC30 snow tube |
| Frequency of measurement | Manual measurements every 2 weeks over the winter season, 1 week during snow melt if necessary. |

Manual snow on ground measurements will be used as a reference for the CS725 SWE sensor intercomparison. A 5 point snow course has been set up to obtain a representative sample of snow water equivalents through and around the clearing. One of these measurement locations will be inside the footprint of the CS725. SWE measurements will be made every 2 weeks over the winter season and every week during snow melt if necessary. SWE measurements will be made with a ESC30 snowtube according the Environment Canada guidelines.

Picture. Field Reference for the Measurement of Snow on the Ground

Not available

Table. Field Calibration for the Measurement of Snow on the Ground

N/A

48h Observation Table. Field Reference for the Measurement of Snow on the Ground

Not available

SECTION A3: INSTRUMENT METADATA REPORT

For each instrument under test and each instrument used to provide ancillary measurements, an Instrument Metadata Report should be completed in full and submitted as part of the POP Report.

Instrument Metadata Report

IMPORTANT: Please copy this form (as necessary) and complete separately for each instrument under test and each instrument that will be used to provide ancillary measurements during WMO SPICE.

A) Instrument Name: _____ GEONOR 1500mm T-200B3M _____
 Instrument number __1__ of _1__

| | |
|----------------------------------|---------------------------------|
| Manufacturer | GEONOR |
| Model | T-200B3M 1500mm |
| Serial number | VW1:33412, VW2:33512, VW3:33612 |
| Firmware version (if applicable) | N/A |

Field configuration

| | |
|--------------------------|--------------------------------------|
| Location on site | Pedestal C5 (Please See Site Layout) |
| Orientation | N/A |
| Height (measured at top) | approx 2.5m |
| Shield (if applicable) | Installed |
| Heating (if applicable) | Unheated |

Data output

| | |
|--|---|
| Data communication protocol | Logger data downloaded at site |
| Output data message format (include description of fields) | TIMESTAMP, "RECORD", "GeoC5Hz_Avg(1)", "GeoC5Hz_Avg(2)", "GeoC5Hz_Avg(3)", "GeoC5mm_Avg(1)", "GeoC5mm_Avg(2)", "GeoC5mm_Avg(3)" |
| Data sampling frequency | 20 sec (1500 cycles averaged per scan), averaged and output at 1-min |

Instrument Picture.

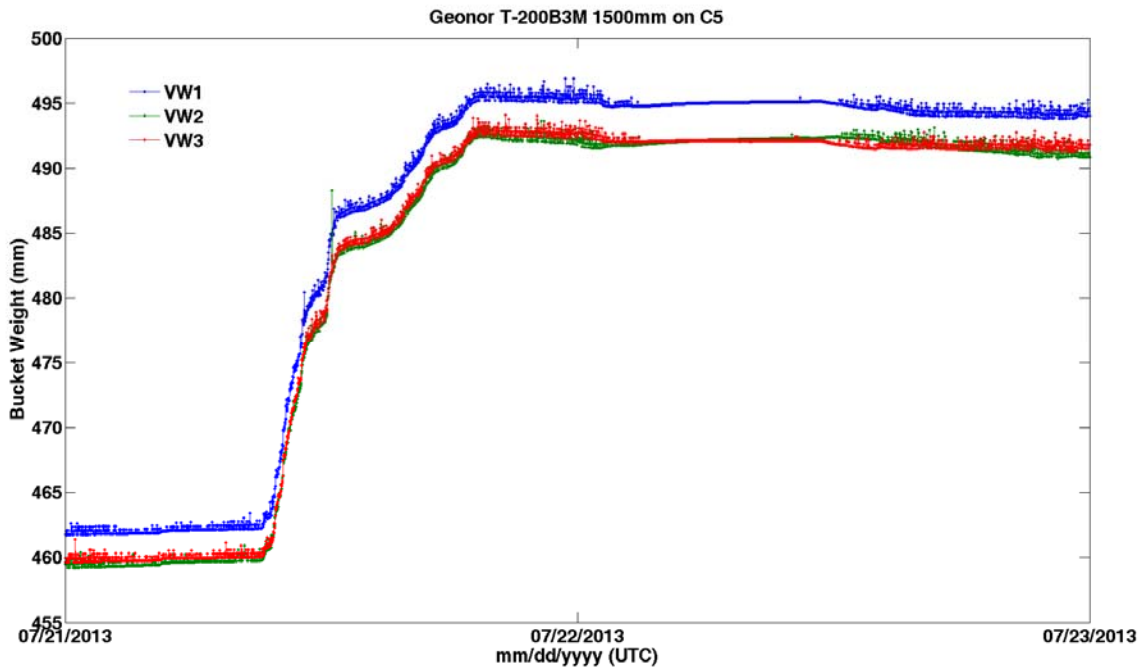


Geonor T-200B3M 1500mm gauge on C5 looking west (top left), north (top right), east (bottom left) and south (bottom right)

Field calibration (if any).

| Gauge Location (Pedestal) | Time UTC | Total Weight (water+bottle) grams | Empty Bottle Weight grams | Water Weight grams | Sensor Readings mm | | | Sensor Differential (mm) | | | Calibration Amount mm | Difference | | | |
|------------------------------|-------------|--------------------------------------|------------------------------|-----------------------|-----------------------|-------------|-------------|-----------------------------|-------------|-------------|--------------------------|-----------------|-----------------|-----------------|-------|
| | | | | | V W 1 mm | V W 2 mm | V W 3 mm | V W 1 mm | V W 2 mm | V W 3 mm | | V W 1 mm / % | V W 2 mm / % | V W 3 mm / % | |
| C5 (Oct 17) | Start | 16:57 | 1521.51 | 51.26 | 1470.25 | 305.59 | 303.45 | 305.80 | 74.05 | 74.26 | 73.81 | 73.51 | -0.54 | -0.75 | -0.30 |
| | End | 17:07 | | | | 379.64 | 377.71 | 379.61 | | | | | -0.74 | -1.02 | -0.40 |

48h Plot.



B) Instrument Name: ___ HMP45C Temp/RH sensor _____
 Instrument number ___1___ of ___1___

| | |
|----------------------------------|---------------------|
| Manufacturer | Campbell Scientific |
| Model | HMP45C |
| Serial number | TBD |
| Firmware version (if applicable) | N/A |

Field configuration

| | |
|--------------------------|----------------------------------|
| Location on site | C8 (Please see site layout near) |
| Orientation | N/A |
| Height (measured at top) | 1.5 m |
| Shield (if applicable) | Unaspirated Radiation Shield |
| Heating (if applicable) | N/A |

Data output

| | |
|--|--|
| Data communication protocol | Logger data downloaded at site |
| Output data message format (include description of fields) | "TIMESTAMP","RECORD",..."C8_Temp_Avg","C8_RH_Avg",..." |
| Data sampling frequency | 20 seconds, average to 1 minute |

Instrument Picture.

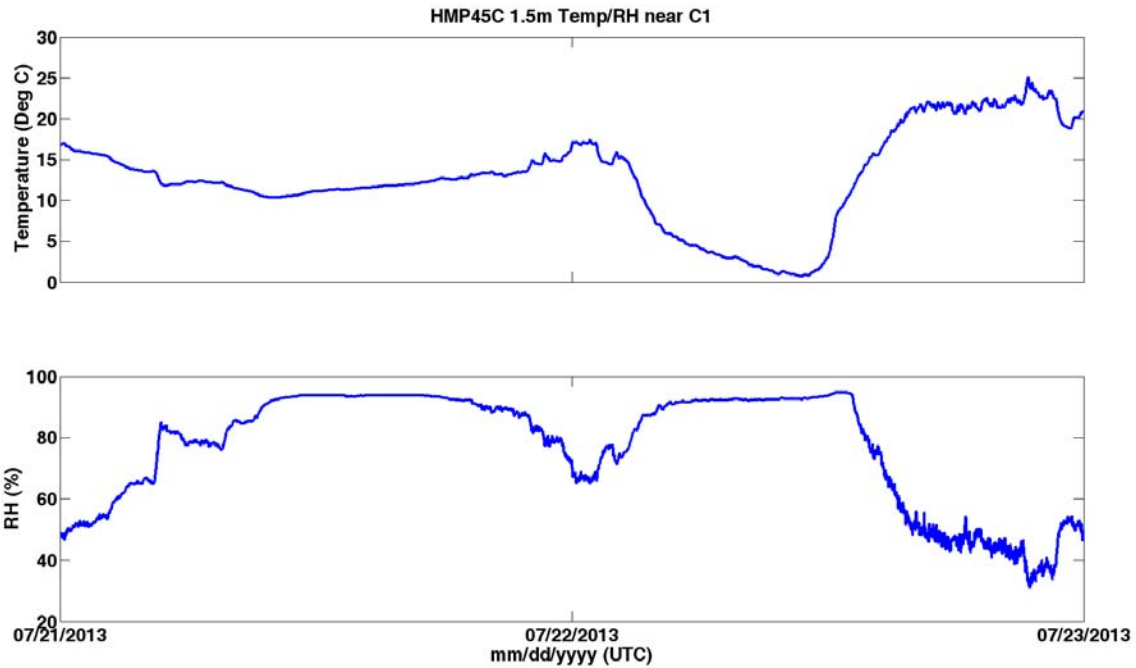


Unspirated HMP45C Temp/RH sensor (white radiation shield in centre) at C8

Field calibration (if any).

N/A

48h Plot.



C) Instrument Name: ___2 m Anemometer in clearing _____
 Instrument number ___1 of 1_____

| | |
|----------------------------------|--------|
| Manufacturer | MetOne |
| Model | 13A |
| Serial number | TBD |
| Firmware version (if applicable) | N/A |

Field configuration

| | |
|--------------------------|-----------------------------|
| Location on site | C8 (Please see Site layout) |
| Orientation | N/A |
| Height (measured at top) | 2 m |
| Shield (if applicable) | N/A |
| Heating (if applicable) | N/A |

Data output

| | |
|--|--|
| Data communication protocol | Logger data downloaded at site |
| Output data message format (include description of fields) | "TIMESTAMP", "RECORD",... "C8_2m_Wind_Spd_Avg, m/s" |
| Data sampling frequency | 20-sec averaged and output at 1-min |

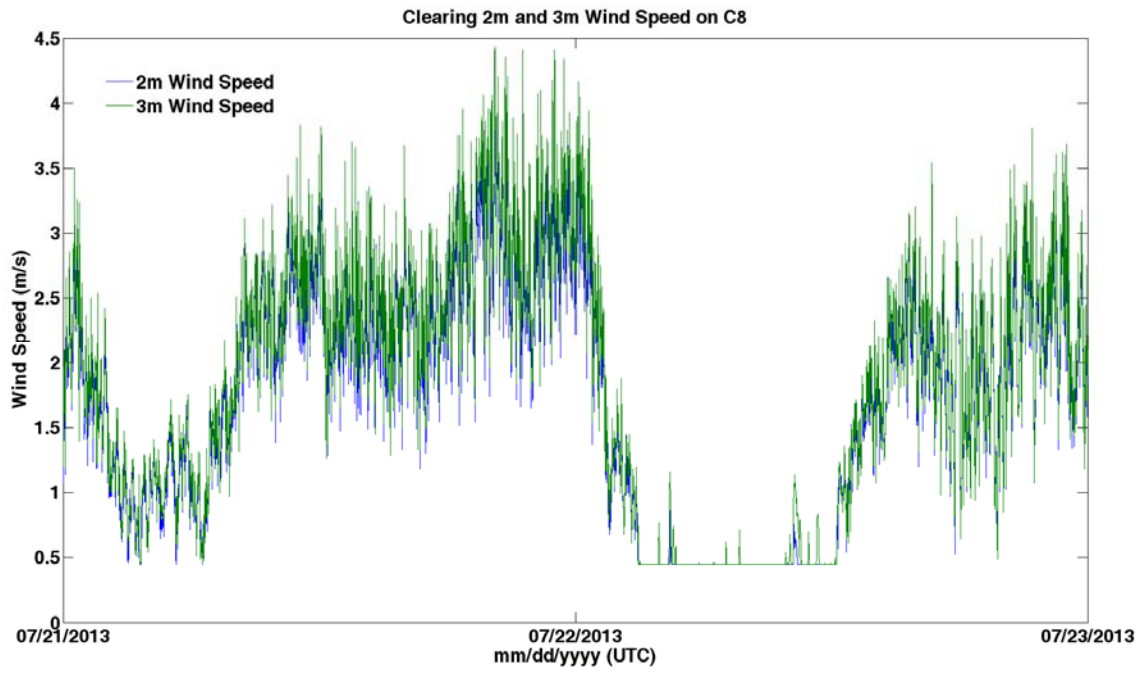
Instrument Picture.



Field calibration (if any).

N/A

48h Plot.



D) Instrument Name: __3m Anemometer in clearing_____
Instrument number __1 of 1 _____

| | |
|----------------------------------|---------|
| Manufacturer | Met One |
| Model | 13A |
| Serial number | TBD |
| Firmware version (if applicable) | N/A |

Field configuration

| | |
|--------------------------|----------------------------------|
| Location on site | Post C8 (Please see site layout) |
| Orientation | N/A |
| Height (measured at top) | 3 m |
| Shield (if applicable) | N/A |
| Heating (if applicable) | N/A |

Data output

| | |
|--|--|
| Data communication protocol | Logger data downloaded at site |
| Output data message format (include description of fields) | "TIMESTAMP", "RECORD",... "C8_3m_Wind_Spd_Avg, m/s" |
| Data sampling frequency | 20-sec averaged and output at 1-min |

Instrument Picture.

[See above](#)

Field calibration (if any).

N/A

48h Plot.

[See above](#)

F) Instrument Name: ____ 2 m Anemometer in bush_____
 Instrument number ____1 of 1 ____

| | |
|----------------------------------|---------|
| Manufacturer | Met One |
| Model | 13A |
| Serial number | TBD |
| Firmware version (if applicable) | N/A |

Field configuration

| | |
|--------------------------|-------------------------------|
| Location on site | Between B1 and B2 on Site Map |
| Orientation | N/A |
| Height (measured at top) | 2 m |
| Shield (if applicable) | N/A |
| Heating (if applicable) | N/A |

Data output

| | |
|--|--|
| Data communication protocol | Logger data downloaded at site |
| Output data message format (include description of fields) | "TIMESTAMP", "RECORD",... "B3_2m_Wind_Spd_Avg, m/s" |
| Data sampling frequency | 20-sec averaged and output at 1-min |

Instrument Picture.

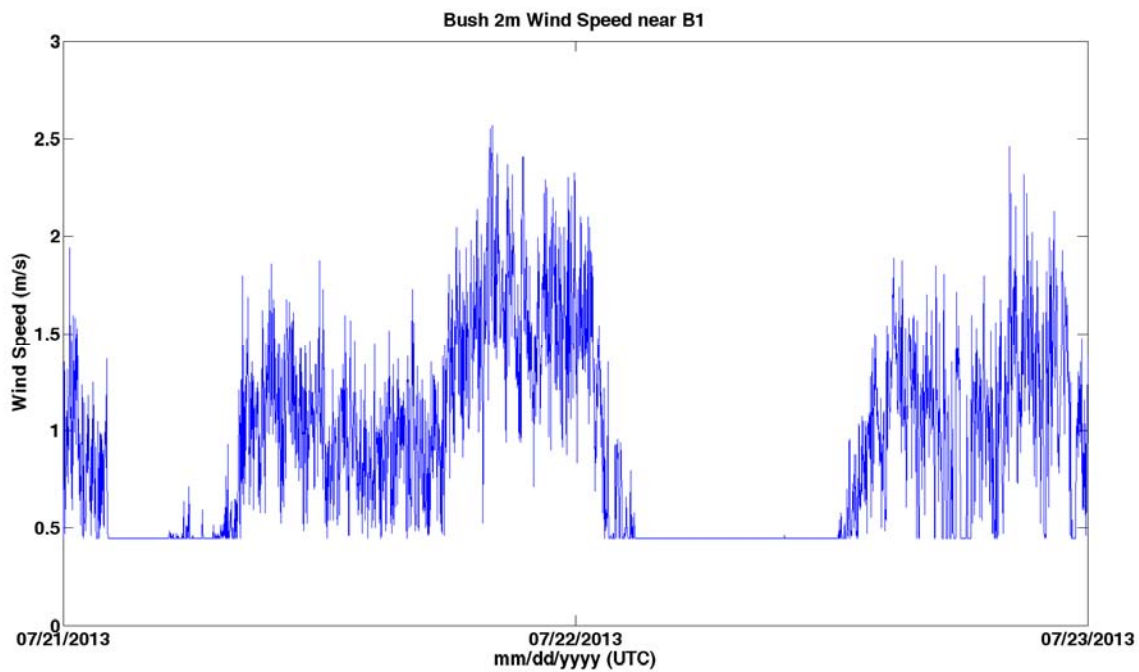


Note that this photo was taken before the instrument was moved to the location between B1 and B2. The new location is more representative of the exposure of the two bush shielded gauges

Field calibration (if any).

N/A

48h Plot.



G) Instrument Name: ____ CS725 SWE Sensor_____
Instrument number ____1 of 1 ____

| | |
|----------------------------------|---------------------|
| Manufacturer | Campbell Scientific |
| Model | CS725 |
| Serial number | TBD |
| Firmware version (if applicable) | TBD |

Field configuration

| | |
|--------------------------|---------------|
| Location on site | C2 |
| Orientation | N/A |
| Height (measured at top) | 2 m |
| Shield (if applicable) | N/A |
| Heating (if applicable) | Not activated |

Data output

| | |
|--|--------------------------------|
| Data communication protocol | Logger data downloaded at site |
| Output data message format (include description of fields) | TBD |
| Data sampling frequency | 6 hour |

Instrument Picture.



Field calibration (if any).

[In progress](#)

48h Plot.

[Not Available](#)

H) Instrument Name: ____ Parsivel Disdrometer_____
Instrument number ____1 of 1 ____

| | |
|----------------------------------|---------------------------------------|
| Manufacturer | OTT |
| Model | Parsivel (1 st generation) |
| Serial number | TBD |
| Firmware version (if applicable) | TBD |

Field configuration

| | |
|--------------------------|--------------------------------|
| Location on site | North of hut (see site layout) |
| Orientation | North/South |
| Height (measured at top) | Approximately 3m |
| Shield (if applicable) | N/A |
| Heating (if applicable) | N/A |

Data output

| | |
|--|----------------------|
| Data communication protocol | Logged to PC on site |
| Output data message format (include description of fields) | TBD |
| Data sampling frequency | 1 minute |

Instrument Picture.



Field calibration (if any).

N/A

48h Plot.

Not Available

SECTION A4: CONFIRMATION OF EXPERIMENT CONFIGURATION

TEST 1: INSTRUMENT CALIBRATION AND CHECKS

The Site Manager will organize the check and calibration of each instrument included in the experiment (as part of the reference, or as an instrument under test). The check sheets and calibration results will be included in the designated areas of Sections A2 and A3.

- The calibration and check of the WG used as part of the reference will be conducted based on the guidelines adopted by the SPICE IOC.
- The calibration and check of the instruments under test will be conducted as specified by the manufacturer prior to the installation on the SPICE site, as well as following the installation in the field.

TEST 2: INSTRUMENT VALIDATION

After the field installation of each instrument (both those that are part of the reference and those that are instruments under test), at the minimum, a **continuous 48 hour data set** of the entire test setup will be stored and examined as an indication of instrument performance. The data sets for each instrument included in the intercomparison will be reviewed for data integrity and representativeness, against the predefined data format.

The evaluation of the instrument performance at this stage will be conducted using the 48 hour time series plots provided in Sections A2 and A3. The readiness state of each instrument will be reported in the Instrument Data Validation table below.

Any discrepancies will be investigated, addressed, and documented. Following the resolution of the discrepancies, the 48-hour end to end (e2e) test will be repeated. Notes, plots, logs, will be appended to the POP table of the reference/instrument under test, and the readiness state and date will be updated in the Instrument Data Validation table.

TEST 3: SITE-TO-ARCHIVE TRANSFER VALIDATION

Once the transfer of site data files to the SPICE Data Archive at NCAR has been initiated, compare the site data with those received at the SPICE Data Archive for a 24 hour period to ensure that no errors occurred during archival or transmission.

If any errors occur, log them and following the resolution of the discrepancies, repeat the 24-hour validation test.

When the Test 3 is passed mark the check box YES in the Instrument Data Validation table below (this means that they have been also validated), with the starting date of the data transfer.

If Test 3 is not passed at the time of the Commissioning Report tick the checkbox NO and provide the expected date.

(Plots, datasets, errors logs, referred to Test 3 are **NOT** included in this document but archived by the site manager if further tests or analysis are required),

IMPORTANT:

Test 2 and Test 3 may be conducted simultaneously, depending on the site configuration.

Instrument Data Validation

| Instrument | Readiness (if Yes, indicate the date) | Data transfer to NCAR archive (Test 3) (If the answer is No report the expected date) | Comments |
|---|--|---|---|
| R2G (C7) | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date: July 21st, 2013 | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date: | Gauge has been operational since Feb 21, 2013 |
| ROG (Geonor in Bush, B1)) | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date: July 21st, 2013 | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date: | Gauge has been operational since Feb 21, 2013 |
| 2m Anemometer in bush (between B1 and B2) | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date: July 21st, 2013 | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date: | Operated prior to this date, under different data collection program. Note that until Sept 11, this anemometer was more exposed than the bush gauge but has been moved to be more representative. |
| ROP (Pluvio2 in Bush, B2) | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date: July 21st, 2013 | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date: | Gauge has been operational since Feb 21, 2013 but not heated until October 2013 |
| R3G Unshielded (C3) | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date: July 21st, 2013 | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date: | Gauge has been operational since Feb 20th, 2013 |
| R3G Shielded (C4) | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date: July 21st, 2013 | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date: | Gauge has been operational since Feb 20 th , 2013 but not heated or shielded until July 2013. |
| Clearing Anemometer (3m) | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date: July 21st, 2013 | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date: | Operational since Feb 20 th , 2013 |
| Clearing Anemometer (2m) | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date: July 21st, 2013 | <input type="checkbox"/> Yes <input type="checkbox"/> No Date: | Operational since Feb 20 th , 2013 |

| | | | |
|------------------------------------|--|--|---|
| | | | |
| Geonor T-200BM3 1500mm (C5) | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date: July 21st, 2013 | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date: | Gauge has been operational since Feb 20 th , 2013. No heater provided by manufacturer |
| 1.5m HMP45C Temp/RH (C8) | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date: July 21st, 2013 | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date: | Instrument has been operational since Feb 20 th , 2013 but moved to central location in clearing in July 2013 |
| DRD11A Precip Detector (C7) | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date: July 21st, 2013 | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date: | Instrument has been operational since Feb 20 th , 2013 but moved to C7 according to IOC recommendations on Sept 24, 2013 |
| CS725 SWE sensor (C2) | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date:Sept 24, 2013 | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Date:Oct 31, 2013 | Waiting for confirmation of correct installation from manufacturer before transferring data |
| Parsivel Disdrometer (near hut) | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Date:Oct 15, 2013 | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Date:Oct 31, 2013 | Installed but not operational as of Sept 27, 2013 |

SECTION A5: SITE DOCUMENTATION CHECKLIST

A **Site Documentation Checklist** is provided below to track the inclusion of requisite documentation, data plots, and photos in sections A1 to A4.

Site Documentation Checklist

| | |
|--|---|
| Site information and layout (Section A1) | <input checked="" type="checkbox"/> Included |
| Complete set of pictures documenting the overall site installation - views from N, E, S, W (Section A1) | <input checked="" type="checkbox"/> Included |
| Details of manual measurement procedure (Section A2) | <input checked="" type="checkbox"/> Included <input type="checkbox"/> Not Applicable |
| Instrument Metadata Reports for all instruments under test and all instruments used to provide ancillary measurements (Section A3) | <input checked="" type="checkbox"/> Included |
| Calibration results and check sheets for all instruments (Sections A2, A3) | <input checked="" type="checkbox"/> Included |
| Instrument data validation:, 48h time series plots (Sections A2, A3) | <input checked="" type="checkbox"/> Included |
| Instrument data validation table (Section A4) | <input checked="" type="checkbox"/> Included |
| 48h Instrument data validation: discrepancy reports (Section A4) | <input type="checkbox"/> Included <input checked="" type="checkbox"/> Not Applicable |
| Pictures of installations of all reference instruments, instruments under test, and instruments used to provide ancillary measurements (Sections A2, A3) | <input checked="" type="checkbox"/> Included |
| End-to-end data validation (Section A4; see Instrument data validation table). | <input type="checkbox"/> Full (all gauges) <input checked="" type="checkbox"/> Partial (some gauges) <input type="checkbox"/> No |
| SPICE archive end-to-end data validation: discrepancy reports (Section A4) | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Details of any workarounds (Sections A2, A3, A4) | <input type="checkbox"/> Included <input checked="" type="checkbox"/> Not Applicable |

APPENDIX B: SPICE DATA LEVELS AND DATASETS

Details of the different levels of data and associated datasets for SPICE are included below. **The present document addresses only data up to and including Level 2a.** Data of higher levels, and the associated datasets, are tentatively defined here for completeness.

Data Levels:

Level 1 data: are those collected as the output of each individual instrument, which have been converted into geophysical measurements (e.g. weight, mass, intensity), generally with high temporal resolution, and before any significant data quality control has been applied. A **Level 1** dataset contains data from only one instrument at one site.

Level 2a data: are time-synchronized data resulting from the sampling, averaging or some other signal/data processing having been applied to **Level 1** data from an individual instrument in order to separate signal from noise. These data have not been quality controlled, and should be used only for monitoring an instrument's status. A **Level 2a** dataset contains data from only one instrument at one site.

Level 2b data: are time-synchronized **Level 2a** data after a basic data quality control procedure has been applied. Basic data quality flags for validity and quality have been added. Missing records have been created and filled with a missing data quality indicator. A **Level 2b** dataset contains data from only one instrument at one site.

Level 3 data: derived by combining and further processing all **Level 2b** datasets from a site. At this level, advanced and multiple instrument data quality techniques have been applied. A **Level 3** dataset contains data from all instruments at an individual site.

Level 4 data: derived after performing an intercomparison of the **Level 3** data from one or more sites, taking into account snow climatology, wind regimes, temperatures, etc., and where applicable, differences in these from one site to another.

Datasets:

SPICE Site Dataset: A dataset comprising all **Level 1, 2a, 2b and 3** datasets from that Intercomparison Site.

SPICE Intercomparison Dataset: this is the Level 4 dataset that combines the **Level 3** data from all SPICE intercomparison sites. The **Project Team** will develop the **SPICE Intercomparison Dataset** using the Level 3 datasets from each **Intercomparison Site**. It contains summary Level 3 data and intercomparison data for all instruments and all sites.

The SPICE Dataset: The total SPICE dataset including all **SPICE Site Datasets**, **Site Documentation** and **Instrument Documentation** for all participating sites and instruments, the **SPICE Intercomparison Dataset**, and all SPICE analysis and assessment documentation.

APPENDIX C: ACRONYMS AND ABBREVIATIONS

| | |
|-------|---|
| DFIR | Double-Fence Intercomparison Reference |
| e2e | End-to-end |
| ER | Evaluating Representative |
| IOC | International Organizing Committee |
| IR | Installation Representative |
| NCAR | National Center for Atmospheric Research (USA) |
| POP | Proof of Performance |
| QC | Quality control |
| R0 | Working field reference configuration 0: manual or automatic precipitation gauge in bush |
| R1 | Working field reference configuration 1: manual precipitation gauge in DFIR |
| R2 | Working field reference configuration 2: automatic weighing gauge in DFIR |
| R3 | Working field reference configuration 3: two automatic weighing gauges; one shielded (single-Altair), one unshielded |
| SPICE | Solid Precipitation Intercomparison Experiment |
| SWE | Snow water equivalent |
| WG | Weighing gauge |
| WMO | World Meteorological Organization |