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A Survey of Canadian Climate/Environmental Monitoring Networks



Canadian Forest Service
Great Lakes Forestry Centre

Information Report
GLC-X-30

Canada

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The Great Lakes Forestry Centre, Sault Ste. Marie, Ontario

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A survey of Canadian climate/environmental monitoring networks.

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Overview

The Environment and Climate Change Canada's (ECCC) Canadian Centre for Climate Services (CCCS) provides Canadians with data, information and support to consider climate change in their decisions. The CCCS is working in collaboration with the Meteorological Service of Canada (MSC) and Natural Resources Canada (NRCan) to identify and understand existing weather and climate monitoring networks across the country. This work supports the MSC's Collaborative Monitoring program, which aims to strengthen the national capacity to monitor weather and climate through collaboration with provinces and territories, federal departments, as well as other network operators/data owners (e.g. academia, regional/municipal governments, Indigenous organizations, private sector). Among other benefits for NRCan, this kind of collaborative effort helps to identify datasets that could be useful to supporting climate mapping (e.g., McKenney et al. 2011) relevant to sustainable development in the forest and other sectors.

Here we summarize the results of a survey with 99 municipal/regional governments, academia, and private organizations about weather stations operated by these organizations. The survey, implemented between January and February 2021, identified that the majority of organizations collecting information about water-related variables were not currently sharing their data with the Water Survey of Canada. Most organizations were open to sharing their data and expressed interest in having access to other organizations' data as well. The key recommendation from this research is to continue outreach to ensure sharing of these data with ECCC and/or provincial and territorial agencies to improve national and local forecasts and analyses.

Background

The ownership, number and types of weather stations in Canada has changed substantially over the past five decades. For example, the number of temperature and precipitation stations has declined substantially since the late 1990s in Canada (MacDonald et al., 2020). Readers are referred to Mekis et al. (2018) for a description of Environment and Climate Change's (ECCC's) precipitation monitoring network and a map of surface weather and climate stations in Canada.

There have been increasing calls exploring the use of weather and environment monitoring stations outside of ECCC in Canada's current archive. As a result, in 2019 ECCC began identifying potential sources of incremental weather monitoring that would be used to strengthen their reporting on climate-related variables. This report summarizes the responses from almost 100 organizations (primarily municipal/regional governments, academia, and private organizations) across Canada with respect to weather and environment stations. Perspectives are also provided for further analysis and outreach activities.

Methods

A 71-question survey was devised for administration in AllCounted (www.allcounted.com) and sent to organizations across Canada that had previously been identified as collecting weather or environment data. The survey asked respondents about 15 wide-ranging types of measurements including temperature, precipitation, snow, water quality/quantity and wind.

The survey launched on January 15, 2021 and concluded on February 28, 2021. A first reminder email was sent out between January 25th and January 28th, and a second reminder between February 23rd and 25th. The survey instrument is reproduced in Appendix 1. Out of 159 contacts identified, 99 completed a survey (62.3%; see Table 1). Of the 99 completed surveys, 87 respondents reported that they collected weather or environment data (87.9%).

Table 1. Number of Contacts, Respondents, and Response Rate by Region.

Region	Number of Contacts	Respondents	Response Rate
British Columbia	35	23	65.7%
Prairies	34	22	64.7%
Ontario	41	32	78.0%
Quebec	37	16	43.2%
Atlantic	12	6	50.0%
Territories	0	0	-
Total	159	99	62.3%

Results

The following sections of the report summarize the high-level, or topline findings from the survey.

Appendix 2 contains AllCounted output detailing the number and percentage of respondents for each survey question option. This report provides a high-level summary of the types and locations of environment and weather monitoring.

Types of Weather and Environment Data Collected

The largest number of respondents reported collecting precipitation data (66; see Table 2). In addition, there were 48 organizations monitoring air temperature (number of stations may be much higher), 37 organizations monitoring snow, 31 measuring wind, and 30 monitoring humidity. With respect to water, there were 36 organizations recording data on surface water, 32 on stream discharge, 29 for ground water, and 26 for water temperature. There were fewer than ten respondents reporting solar radiation, ambient air quality, road surface or swell measurements.

Table 2a: Number of Respondents Collecting Each Type of Weather/Environment Data (and %)

Type of Weather/Environment Data	Number of Respondents	% All Question Responses
Precipitation	66	88.5
Air temperature	48	66.7
Snow	37	50.0
Surface water quality or quantity (e.g. rivers, lakes, streams, reservoirs or bodies of water that are open and visible at the surface of the surrounding land)	36	44.9
Stream or river discharge	32	41.0
Wind	31	44.9
Humidity	30	43.6
Barometric/Atmospheric pressure	29	41.0
Ground water quality or quantity (e.g., bodies of water that are sub-surface and not visible at the surface of the surrounding land)	29	37.2
Water temperature	26	32.1
Soil temperature/moisture/conductivity	10	12.8
Solar radiation	9	11.5
Road surface temperature	7	9.0
Ambient air quality	3	3.9
Cloud height and/or composition	1	1.3
Swell (wave height and/or swell height)	1	1.3
Other	4	3.9

Purpose and Standard of Monitoring Activity

Organizations collecting weather information were most likely to report that they used the data for water management and flood forecasting (71.7% and 63.3% of 60 organizations answering this question).

Table 2b: Number of Respondents Collecting Each Type of Weather/Environment Data (and %)

Type of Weather/Environment Data	Number of Respondents	% All Question Responses
Water management	43	71.7
Flood forecasting	38	63.3
Snow monitoring	33	55.0
Water quality monitoring	31	51.7
Meteorological monitoring	26	43.3
Road safety	14	23.3
Research (climate change, ecological, etc.)	14	23.3%
Education/General interest	7	11.7%
Air quality monitoring	6	10%
Agricultural monitoring	3	5%
Marine safety	2	3.3%
Aviation	1	1.7%
Fire forecasting	1	1.7%

However, most respondents indicated they are not operating their stations under any standard (30 of 54 respondents). Fourteen organizations reported using MSC standards and five reported using a World Meteorological Organization (WMO) standard.

Size of Weather Networks

Forty-two organizations indicated that they were part of a network that monitors this environmental information (55.3% of respondents collecting some type of data). In total, there were 22 networks reported of less than 10 stations, 23 networks of 10-49 stations, six networks of 50- 99 stations, and four networks of 100-199 stations.

Organizations that were part of monitoring networks tended to report multiple types of weather/environment measurements. For instance, organizations contributing to a network of 100-199 stations all reported monitoring air temperature, precipitation, snow, and water measurements. In comparison, respondents reporting precipitation measurements were most likely not to be part of a larger network (59.1%), compared to organizations monitoring other environmental indicators (see Table 3).

Table 3: Size of Monitoring Network by Type of Measurement Response

Type of Measurement	Not part of network	10-49 stations	50-99 stations	100-199 stations	Total stations
Air temperature	23 (47.9%)	17 (35.4%)	4 (8.3%)	4 (8.3%)	48
Humidity	14 (46.7%)	11 (36.7%)	4 (13.3%)	1 (3.3%)	30
Wind, solar radiation, barometric pressure, ambient air quality, cloud height	16 (37.2%)	18 (41.9%)	5 (11.6%)	4 (9.3%)	43
Precipitation	39 (59.1%)	17 (25.8%)	6 (9.1%)	4 (6.1%)	66
Snow	14 (37.8%)	15 (40.5%)	4 (10.8%)	4 (10.8%)	37
Road/soil surface temperature	5 (29.4%)	9 (52.9%)	2 (11.8%)	1 (5.9%)	17
Surface/ground/stream water, swell, water temperature	16 (36.4%)	19 (43.2%)	5 (11.4%)	4 (9.1%)	44

Location of Observation Networks

All the observation locations reported by respondents were south of 55°N (see Figure 1). Most respondents reported multiple types of observations (e.g., precipitation and temperature).

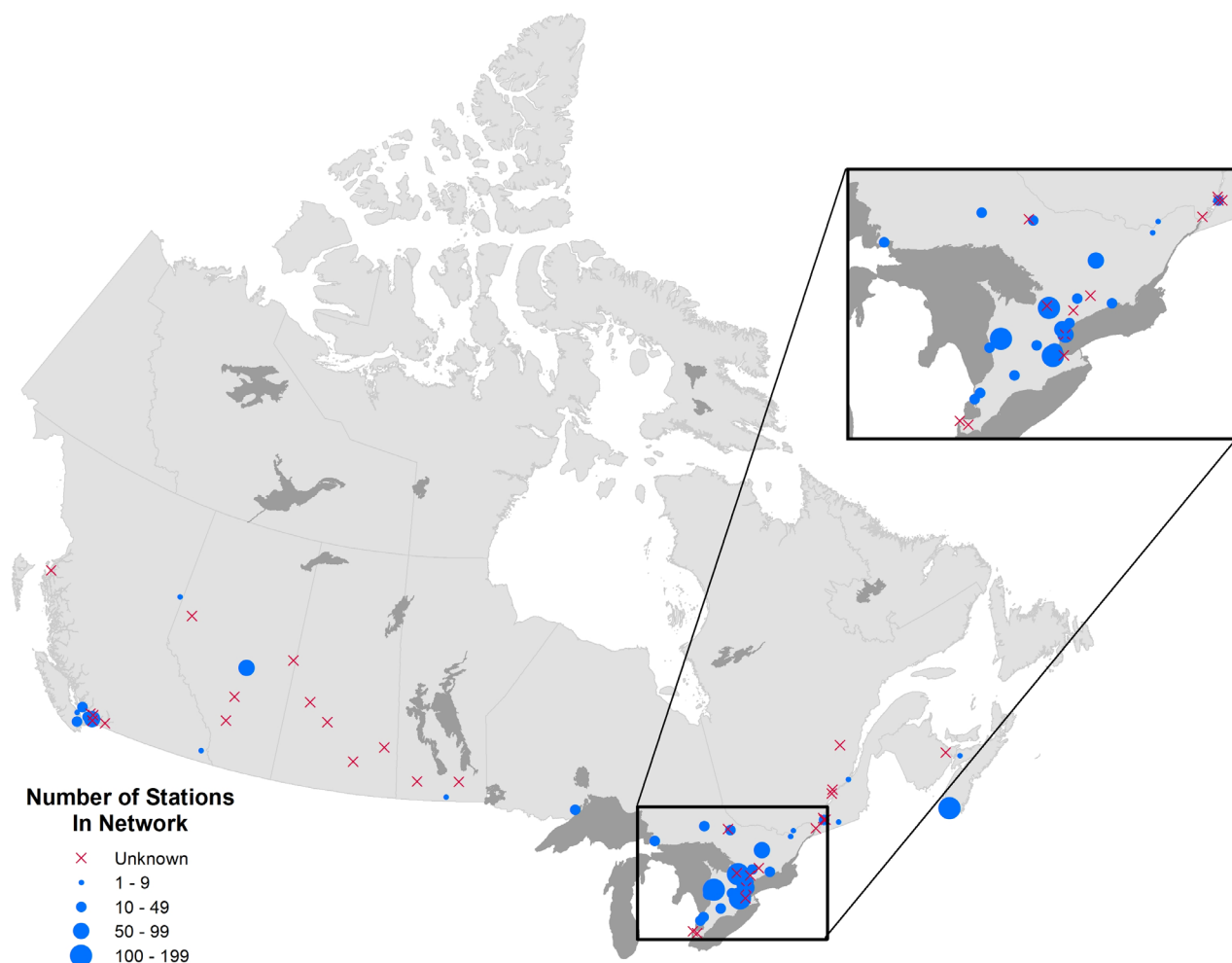


Figure 1. Observation locations by size of network

Note: there are other observing networks either not captured by the current survey, some in the far north that did not respond. Some other networks (not shown) are already sharing data with ECCC.

Operation

Most organizations surveyed with a network indicated that this network operates year-round (56 respondents or 73.7%). In comparison, only five respondents reported a seasonal network, and 15 organization reported a mix of year-round and seasonal operations. All but one organization reported that their monitoring sites would continue into the foreseeable future.

Data Sharing

A majority of participants indicated that they would be willing to share their data with ECCC (57.8% of 71 respondents). In terms of current practices, most organizations reported that they shared their data with one or more external organizations (71.6% of 60 respondents), and only three of these respondents indicated that the data were provided for a fee. Most respondents indicated they would like to receive data sets from other programs in their geographic area (61.4% of 70 respondents). Of 37 organizations collecting water data, only four reported providing their data to the Water Survey of Canada.

Concluding comments and recommendations

High quality monitoring of environmental conditions such as temperature and precipitation is critical to the safety of Canadians and environmental stewardship. Here we reported on an effort to gather data from various organizations that may help augment ECCC's monitoring with other networks. Respondents were generally open to sharing the data they collect, and many expressed appreciation for the opportunity to inform future opportunities for collaboration.

Survey respondents reported that precipitation was the most commonly monitored parameter. Consistent with this trend, most respondents indicated their purpose for monitoring was either flood forecasting or water management. Unfortunately, most respondents indicated they are not operating their stations under any standard. This does impose some limitations on sharing where standards are important for particular applications. There are various rationales as to why this is the case, however it does point to a need for national standards on the collection and distribution of weather and climate data.

A majority of respondents reported the following:

- their networks will continue operating for the foreseeable future;
- they are freely sharing their data with other organizations;
- they would be willing to share the collected data with ECCC; and
- their organization would like access to other datasets in their area.

Efforts are ongoing to assist data sharing where appropriate from these and other networks with ECCC and/or provincial and territorial agencies. Data sharing could help to improve national and local forecasts and modeling efforts analyses such as national mapping initiatives and even hydrological studies. This survey has helped reveal much potential with/from the various data sources.

Finally it should be noted that despite new data sharing opportunities noted above through the MSC's Collaborative Monitoring program, data from network operators across the country are already being brought into ECCC systems for use in forecasts and models and where possible are shared publicly via the MSC Datamart (see: https://ecccc-msc.github.io/open-data/msc-datamart/readme_en/).

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Appendices

Appendix 1

Climate and Environmental Station Network Inventory

Environment and Climate Change Canada's (ECCC) Canadian Centre for Climate Services (CCCS) provides Canadians with data, information, and support to consider climate change in their decisions. The CCCS is working in collaboration with the Meteorological Service of Canada (MSC) and Natural Resources Canada (NRCan) to identify and understand existing weather and climate monitoring networks across the country. This work supports MSC's Collaborative Monitoring program, which aims to strengthen the national capacity to monitor weather and climate through collaboration with provinces and territories, federal departments, as well as other network operators / data owners (eg. academia, regional / municipal governments, Indigenous organizations, private sector). This survey is intended to collect information about existing weather and climate monitoring stations and networks, including parameters, collection methods and data sharing practices. Information provided will contribute to the ongoing collaborative monitoring efforts conducted by the MSC. Please answer each question based on the information you or your network collects. The survey should take approximately 8-12 minutes to complete.

1. Do you or your organization collect any environmental or climate data?

- ☐ Yes
☐ No

2. Please identify yourself and your organization, including your contact information below:

3. Which environmental parameters do you collect?

- ☐ Air temperature
☐ Humidity
☐ Wind
☐ Solar radiation
☐ Barometric / Atmospheric pressure
☐ Ambient air quality
☐ Cloud height and/or composition
☐ Precipitation
☐ Snow
☐ Soil temperature / moisture / conductivity
☐ Road surface temperature
☐ Surface water quality or quantity (e.g. rivers, lakes, streams, reservoirs or bodies of water that are open and visible at the surface of the surrounding land)
☐ Ground water quality or quantity (e.g. bodies of water that are sub-surface and not visible at the surface of the surrounding land)
☐ Stream or river discharge
☐ Water temperature
☐ Swell (wave height and/or swell height)
☐ Other (please specify)

4. Does your network operate year-round or seasonally?
- ☐ Year-round
 - ☐ Seasonal
 - ☐ Mix
 - ☐ Unsure
5. During which months is your site operational? (Check all that apply)
- ☐ ALL MONTHS
 - ☐ January
 - ☐ February
 - ☐ March
 - ☐ April
 - ☐ May
 - ☐ June
 - ☐ July
 - ☐ August
 - ☐ September
 - ☐ October
 - ☐ November
 - ☐ December
 - ☐ Unsure
6. Is your site part of a network that monitors this environmental information?
- ☐ Yes
 - ☐ No
 - ☐ Unsure
7. Does your monitoring network include parameters that are being measured manually?
- ☐ Yes
 - ☐ No
 - ☐ Unsure
8. How many sites are in your network?
- ☐ Less than 10
 - ☐ 10-49
 - ☐ 50-99
 - ☐ 100-199
 - ☐ 200-499
 - ☐ More than 500
 - ☐ Unsure
9. How many years has your network been in operation?
- ☐ Less than 1 year
 - ☐ 1-5 years
 - ☐ 6-10 years
 - ☐ 11-15 years
 - ☐ More than 15 years
 - ☐ Unsure

10. Will these sites continue to operate for the foreseeable future?
- ☐ Yes
 - ☐ Unsure
 - ☐ No - when do you anticipate these sites will cease to operate?

11. Where are the stations in this network deployed?

- ☐ National
- ☐ British Columbia
- ☐ Alberta
- ☐ Saskatchewan
- ☐ Manitoba
- ☐ Ontario
- ☐ Quebec
- ☐ New Brunswick
- ☐ Nova Scotia
- ☐ Prince Edward Island
- ☐ Newfoundland
- ☐ Yukon Territories
- ☐ Northwest Territories
- ☐ Regional - multiple provinces (please specify)

12. What type of organization do you work under?

- ☐ Federal government
- ☐ Provincial / Territorial government
- ☐ Regional government
- ☐ Municipality
- ☐ Indigenous government or enterprise
- ☐ Private enterprise
- ☐ Academic
- ☐ Other (please specify)

13. Please provide the name of the organization that owns the network.

14. Do you use data from the Meteorological Service of Canada for your operations?

- ☐ Yes
- ☐ No

15. What types of data do you use from the Meteorological Service of Canada (MSC)?

- ☐ Surface weather observations
- ☐ Marine observations
- ☐ Upper air soundings
- ☐ Weather radar imagery
- ☐ Water levels and flows
- ☐ Satellite imagery
- ☐ Other (please specify)

16. Where do you access data from the Meteorological Service of Canada? (Check all that apply)

- ☐ Weather Office (<https://weather.gc.ca/>)
- ☐ Water Office (<https://wateroffice.ec.gc.ca/>)
- ☐ MSC Datamart (<https://dd.meteo.gc.ca/>)
- ☐ MSC GeoMet (https://eccc-msc.github.io/open-data/msc-geomt/readme_en/)
- ☐ Climate Data Online (<https://climate.weather.gc.ca/>)
- ☐ ClimateData.ca (<https://climatedata.ca/>)
- ☐ Other (please specify)

17. Do you use real-time or historical data?

- ☐ Real-time data
- ☐ Historical data

18. Which data characteristics are most important for your operations? (Check all that apply)

- ☐ Timeliness
- ☐ Completeness
- ☐ Accuracy
- ☐ Quality
- ☐ Spatial distribution
- ☐ Authoritative source
- ☐ Other (please specify)

19. What are the main applications of the data your network collects?

- ☐ Agricultural monitoring
- ☐ Air quality monitoring
- ☐ Avalanche control
- ☐ Aviation
- ☐ Education / General interest
- ☐ Fire forecasting
- ☐ Flood forecasting
- ☐ Marine safety
- ☐ Meteorological monitoring
- ☐ Road safety
- ☐ Research (climate change, ecological, etc.)
- ☐ Resource management
- ☐ Snow monitoring
- ☐ Water management
- ☐ Water quality monitoring

20. Do you perform quality assessment on your data and how soon after receipt of data? Quality assessment refers to a series of quality check routines that result in non-compliant or suspicious data being flagged to facilitate control measures or provide cautionary metadata for users.

- ☐ Do not quality assess data
- ☐ Quality assessment process is automated and takes place as our data is being received
- ☐ Within a day of receiving data
- ☐ Within a month of receiving data
- ☐ Within a year of receiving data
- ☐ Unsure
- ☐ Other (please specify)

21. Do you apply quality corrections to your data and how soon after receipt of data? Quality correction refers to the modification or removal of suspicious or erroneous data.

- ☐ Do not quality correct data
- ☐ Quality correction process is automated and takes place as our data is being received
- ☐ Within a day of receiving data
- ☐ Within a month of receiving data
- ☐ Within a year of receiving data
- ☐ Unsure
- ☐ Other (please specify)

22. Do you share your network data?

- ☐ Yes
- ☐ No
- ☐ Unsure

23. Who provides service and maintenance to your site(s)?

- ☐ In-house technicians
- ☐ Third party contractor

24. Is the data from your sites available on-line?

- ☐ No
- ☐ Unsure
- ☐ Yes (please provide a website link if applicable)

25. What station standards do your sites operate under?

- ☐ World Meteorological Organization (WMO)
- ☐ Meteorological Service of Canada (MSC)
- ☐ Canadian Forest Fire Danger Rating System (CFFDRS)
- ☐ None
- ☐ Other (please specify)

26. How often do you visit your sites to provide service and maintenance?

- ☐ Never
- ☐ Daily
- ☐ Weekly
- ☐ Monthly
- ☐ Quarterly
- ☐ Bi-annually
- ☐ Annually (once per year)
- ☐ Once every two years
- ☐ Once every three years
- ☐ Once every five years or more
- ☐ Seasonally (please specify when you visit)

Air temperature data

27. Which unit of measurement do you record air temperature in?

- ☐ Degrees Celsius
- ☐ Degrees Fahrenheit
- ☐ Kelvin
- ☐ Unsure
- ☐ Mix / Other (please specify)

28. At what height are your air temperature sensors placed?

Wind data

29. Which unit of measurement do you record wind speed in?

- ☐ KMH (kilometers per hour)
- ☐ MPH (miles per hour)
- ☐ Knots
- ☐ Meters per second
- ☐ Unsure
- ☐ Other (please specify):

30. At what interval is your wind speed averaging done?

- ☐ 1 minute
- ☐ 2 minutes
- ☐ 10 minutes
- ☐ Other (please specify):

31. Do you record peak wind speeds?

- ☐ Yes
- ☐ No
- ☐ Unsure

32. At what height are your wind speed sensors placed?

33. Do you collect data for wind direction?

- ☐ Yes
- ☐ No
- ☐ Unsure

34. Which unit of measurement do you record wind direction in?

- ☐ Not applicable - do not record wind direction
- ☐ Cardinal Direction (i.e., N, NE, NNE)
- ☐ Unsure
- ☐ Other (please specify):

35. At what interval is your wind direction averaging done?

- ☐ 1 minute
- ☐ 2 minutes
- ☐ 10 minutes
- ☐ Other (please specify):

36. At what height are your wind direction sensors placed?

Solar radiation data

37. Which type of solar radiation sensors are you using?

- ☐ Pyranometers – short wave lengths to measure heat energy
- ☐ Net Radiometers – measures the difference between incoming solar radiation from the sky and outgoing radiation from the ground
- ☐ Global Solar Radiation – the sum of direct, diffuse and reflected solar radiation
- ☐ Photosynthetic Radiation Sensors (PAR Sensors to measure spectral range for photosynthesis used by plants)
- ☐ Unsure
- ☐ Other (please specify):

Barometric / Atmospheric pressure data

38. Which unit of measurement do you record barometric / atmospheric pressure in?

- ☐ Hectopascals (hPa)
- ☐ Millibars (mb)
- ☐ Kilopascals (kPa)
- ☐ Mercury (inHg)
- ☐ Unsure
- ☐ Other (please specify):

39. Do your sites offset barometric / atmospheric pressure readings to sea level?

- ☐ Yes
- ☐ No
- ☐ Unsure

Ambient air quality data

40. Which parameters are you monitoring for ambient air quality? (choose all that apply)

- ☐ PM 2.5
- ☐ PM 10
- ☐ Ozone (O₃)
- ☐ Carbon monoxide (CO)
- ☐ Carbon dioxide (CO₂)
- ☐ Nitrous oxide (NO)
- ☐ Nitrous dioxide (NO₂)
- ☐ Sulfur dioxide (SO₂)
- ☐ Methane (CH₄)
- ☐ Other (please specify):

Precipitation data

41. Which precipitation gauges are you using? (choose all that apply)
- ☐ Standpipe gauges that use a pressure transducer to measure water level
 - ☐ Weighing rain gauges
 - ☐ Tipping bucket rain gauges
42. How many of your precipitation gauges have a wind shield?
- ☐ All of the sensors have a wind shield
 - ☐ Most of the sensors have a wind shield
 - ☐ Some of the sensors have a wind shield
 - ☐ None of the sensors have a wind shield
 - ☐ Unsure
43. Are your precipitation gauges heated?
- ☐ All of the sensors are heated
 - ☐ Some of the sensors are heated
 - ☐ None of the sensors are heated
 - ☐ Unsure

Snow data

44. How many of your sites collect data to measure the weight of snow? (eg., snow pillows, or other sensors)
- ☐ All sites
 - ☐ Most sites
 - ☐ Certain sites
 - ☐ No sites
 - ☐ Unsure
45. How many of your sites use snow depth sensors?
- ☐ All sites
 - ☐ Most sites
 - ☐ Some sites
 - ☐ Certain sites
 - ☐ No sites
 - ☐ Unsure
46. What technology are you using to measure snow depth?
- ☐ Ultrasonic distance sensors
 - ☐ Gamma radiation sensors
 - ☐ Laser distance sensors
 - ☐ Other (please specify):

Soil data

47. At what depth are your soil moisture sensors placed, if in use?
- ☐ 0-25 cm below ground surface
 - ☐ 26-50 cm below ground surface
 - ☐ Over 50 cm below ground surface
 - ☐ Unsure
 - ☐ Site does not use soil moisture sensors
48. At what depth are your soil conductivity sensors placed, if in use?
- ☐ 0-25 cm below ground surface
 - ☐ 26-50 cm below ground surface
 - ☐ Over 50 cm below ground surface
 - ☐ Unsure
 - ☐ Site does not use soil conductivity sensors
49. If some of your sites use soil temperature sensors, at what depth are they placed?
- ☐ 0-10 cm below surface
 - ☐ 11-30 cm below surface
 - ☐ 31-50 cm below surface
 - ☐ 51-100 cm below surface
 - ☐ More than 100 cm below surface
 - ☐ Unsure
 - ☐ None of the sites use soil temperature sensors

Road surface temperature data

50. At what depth are your road surface temperature sensors placed?
- ☐ 0-10 cm below surface
 - ☐ 11-30 cm below surface
 - ☐ 31-50 cm below surface
 - ☐ More than 50 cm below surface
 - ☐ Unsure
 - ☐ Other (please specify):

Water data

51. What method(s) are you using to monitor surface water levels?
- ☐ Pressure transducers
 - ☐ Radar level sensors
 - ☐ Float gauges
 - ☐ Bubbler systems
 - ☐ Do not monitor surface water levels
 - ☐ Other (please specify):

52. Are your surface water sites referenced to or have conversions to terrestrial or space-based geodetic data?

- ☐ Yes
☐ No
☐ Unsure

53. Do you contribute surface water level data to the Water Survey of Canada?

- ☐ Yes
☐ No
☐ Some data
☐ Unsure

54. Please describe how you are monitoring surface water quality.

55. What method(s) are you using to monitor ground water levels?

- ☐ Pressure transducers
☐ Radar level sensors
☐ Float gauges
☐ Bubbler systems
☐ Do not monitor ground water levels
☐ Other (please specify):

56. Are your ground water sites referenced to or have conversions to terrestrial or space-based geodetic data?

- ☐ Yes
☐ No
☐ Unsure

57. Please describe how you are monitoring ground water quality.

Manual data collection

58. Which parameters, if any, are being measured manually?

- ☐ Air temperature
- ☐ Humidity
- ☐ Wind
- ☐ Solar radiation
- ☐ Barometric / Atmospheric pressure
- ☐ Smog / smoke
- ☐ Cloud height and / or composition
- ☐ Precipitation
- ☐ Snow
- ☐ Soil temperature / moisture / conductivity
- ☐ Road surface temperature
- ☐ Surface water quality or quantity
- ☐ Ground water quality or quantity
- ☐ Stream or river discharge
- ☐ Water temperature
- ☐ Swell (wave height and / or swell height)
- ☐ Other (please specify):

59. How are you collecting these parameters? Please describe the process.

60. How frequently do you measure and record these parameters?

61. How are these data placed in your master database?

Data sharing

62. With whom do you share your network data (please provide entity name)? Please list all organizations.

63. Do you share your data for free, or for a fee?

- ☐ Free
- ☐ For a fee
- ☐ Unsure

64. How do you transmit data from your sites?

- ☐ UHF/VHF Radio Link
- ☐ UHF/VHFLAN connection
- ☐ Cellular connection
- ☐ Satellite
- ☐ Other (please specify):

65. What time zone is your data recorded in?

- ☐ UTC Time
- ☐ PST (Pacific Standard Time)
- ☐ MST (Mountain Standard Time)
- ☐ CST - Central Standard Time
- ☐ EST -Eastern Standard Time
- ☐ AST -Atlantic Standard Time
- ☐ NST - Newfoundland Standard Time
- ☐ Other (please specify):

66. Do you use local daylight savings time when storing your data?

- ☐ Yes
- ☐ No
- ☐ Unsure
- ☐ Other (please specify):

67. How often do you record and store data at your site?

- ☐ Every minute or less
- ☐ Every two minutes
- ☐ Every 5 minutes
- ☐ Every 10 minutes
- ☐ Every 15 minutes
- ☐ Every 30 minutes
- ☐ Hourly
- ☐ Daily
- ☐ Monthly
- ☐ Do not record / store data at site (please specify where you record and store your data)

68. Please describe the frequency at which your data is transmitted from your sites

- ☐ Every minute or less
- ☐ Every 2 minutes
- ☐ Every 3 minutes
- ☐ Every 5 minutes
- ☐ Every 10 minutes
- ☐ Every 15 minutes
- ☐ Every 30 minutes
- ☐ Hourly
- ☐ Daily
- ☐ Monthly
- ☐ Other (please specify):

69. Would you be willing to share your data with Environment and Climate Change Canada?

- ☐ No
- ☐ Unsure
- ☐ Yes (please specify the organization and contact details)

70. Would you like access to data sets from other programs in your geographic area?

- ☐ No
- ☐ Unsure
- ☐ Yes (please specify what types of data you would like to access)

71. Do you know of any other entities, companies or organizations that are running any type of environmental monitoring programs in your area?

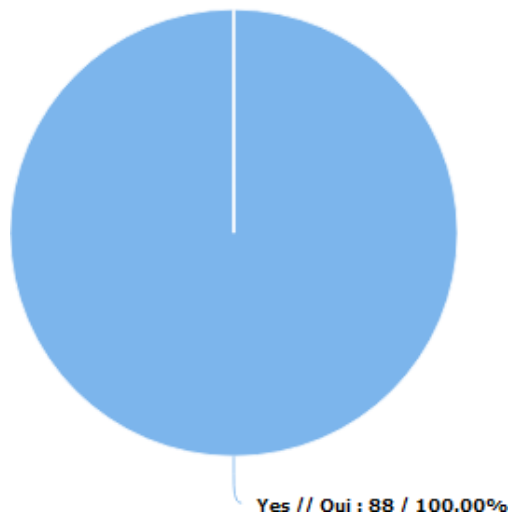
- ☐ No
- ☐ Unsure
- ☐ Yes (please specify the organization and contact details)

Appendix 2

Summary Response

Page 1

Do you or your organization collect any environmental or climate data?

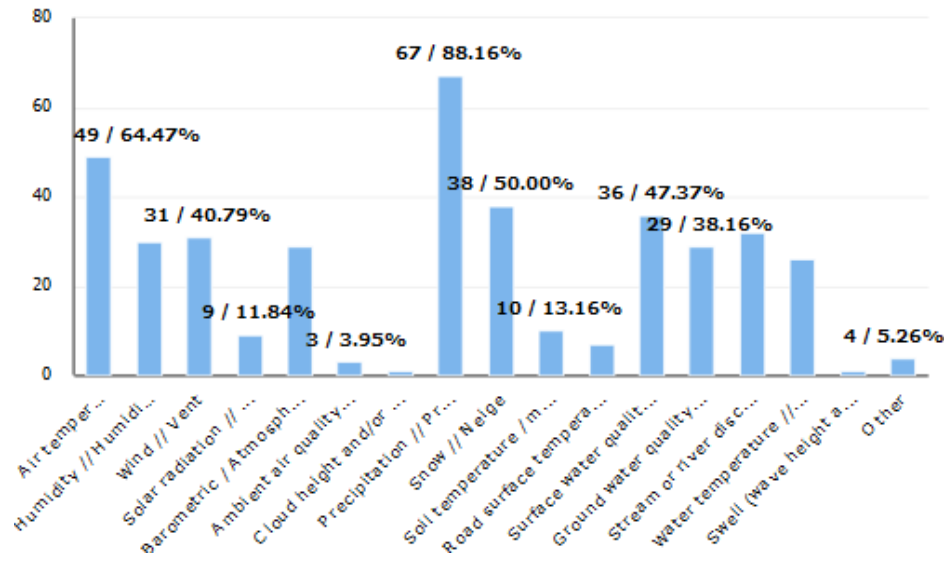


Answered 88, Skipped 0, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Yes	88	100.00	100.00
No			

Please identify yourself and your organization, including your contact information below:

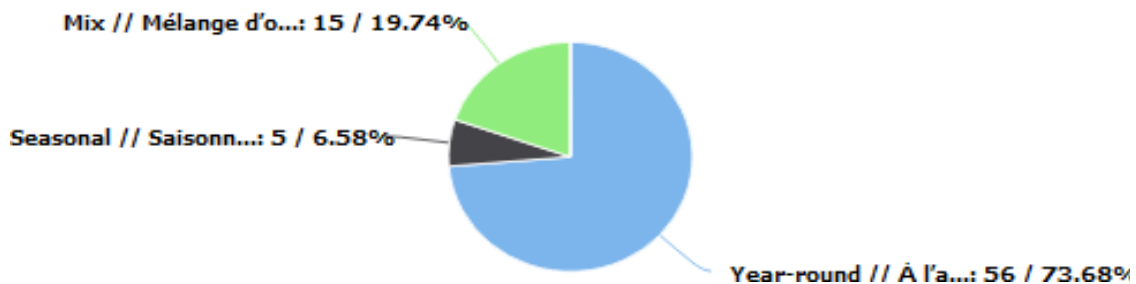
Which environmental parameters do you collect?



Answered 76, Skipped 12, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Cloud height and/or composition	1	1.32	1.14
Swell (wave height and/or swell height)	1	1.32	1.14
Ambient air quality	3	3.95	3.41
Other	4	5.26	4.55
Road surface temperature	7	9.21	7.95
Solar radiation	9	11.84	10.23
Soil temperature / moisture / conductivity	10	13.16	11.36
Water temperature	26	34.21	29.55
Barometric / Atmospheric pressure	29	38.16	32.95
Ground water quality or quantity (e.g. bodies of water that are sub-surface and not visible at the surface of the surrounding land)	29	38.16	32.95
Humidity	30	39.47	34.09
Wind	31	40.79	35.23
Stream or river discharge	32	42.11	36.36
Surface water quality or quantity (e.g., rivers, lakes, streams, reservoirs or bodies of water that are open and visible at the surface of the surrounding land)	36	47.37	40.91
Snow	38	50.00	43.18
Air temperature	49	64.47	55.68
Precipitation	67	88.16	76.14

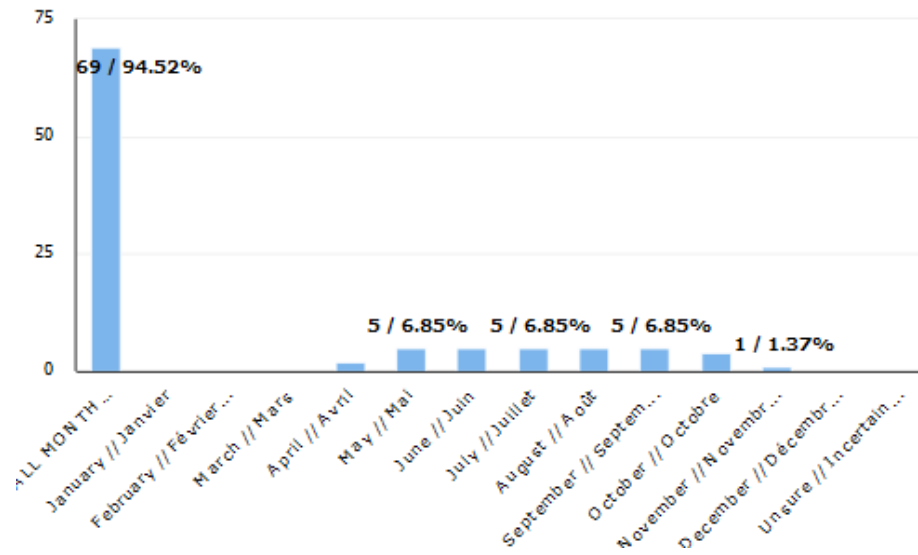
Does your network operate year-round or seasonally?



Answered 76, Skipped 12, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Year-round	56	73.68	63.64
Seasonal	5	6.58	5.68
Mix	15	19.74	17.05
Unsure			

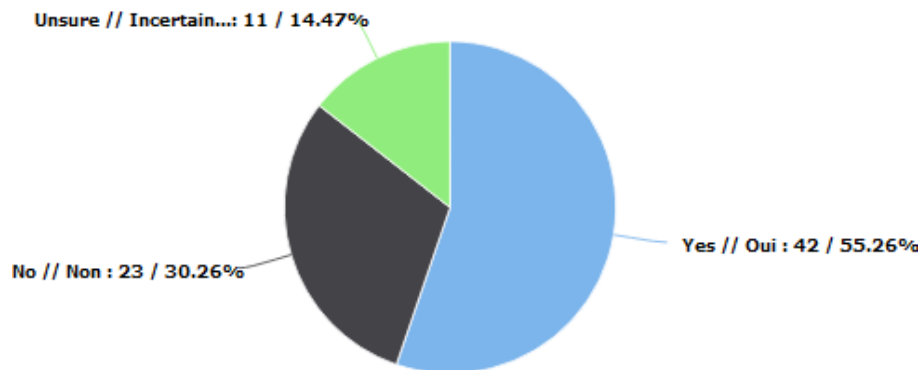
During which months is your site operational? (Check all that apply)



Answered 73, Skipped 15, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
ALL MONTHS	69	94.52	78.41
January			
February			
March			
April	2	2.74	2.27
May	5	6.85	5.68
June	5	6.85	5.68
July	5	6.85	5.68
August	5	6.85	5.68
September	5	6.85	5.68
October	4	5.48	4.55
November	1	1.37	1.14
December			

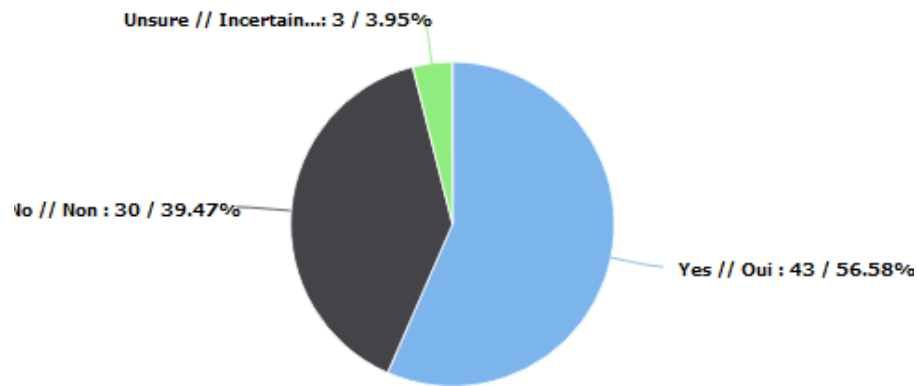
Is your site part of a network that monitors this environmental information?



Answered 76, Skipped 12, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Yes	42	55.26	47.73
No	23	30.26	26.14
Unsure	11	14.47	12.50

Does your monitoring network include parameters that are being measured manually?

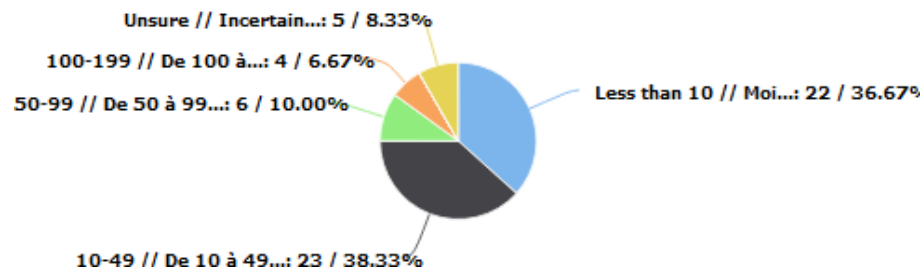


Answered 76, Skipped 12, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Yes	43	56.58	48.86
No	30	39.47	34.09
Unsure	3	3.95	3.41

Page 3

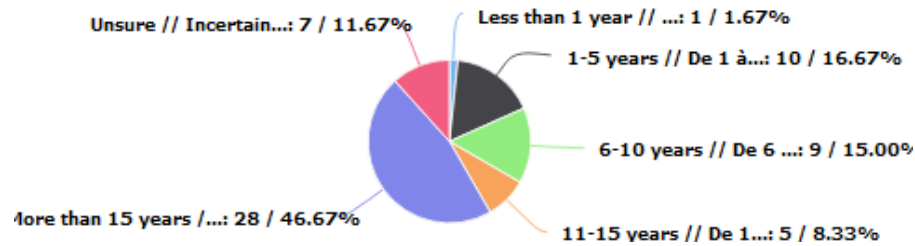
How many sites are in your network?



Answered 60, Skipped 28, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Less than 10	22	36.67	25.00
10-49	23	38.33	26.14
50-99	6	10.00	6.82
100-199	4	6.67	4.55
200-499			
More than 500			
Unsure	5	8.33	5.68

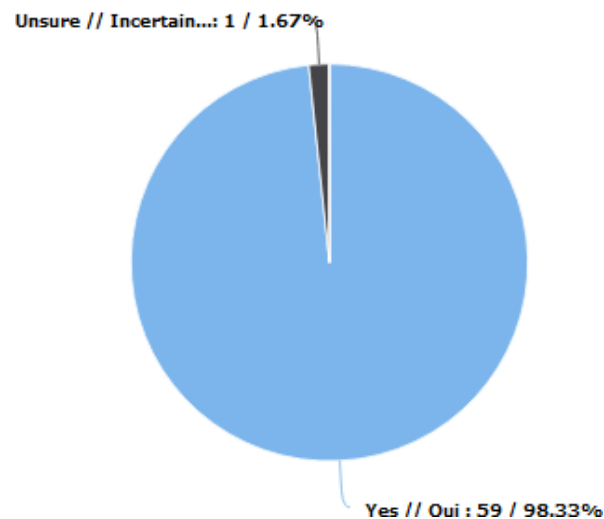
How many years has your network been in operation?



Answered 60, Skipped 28, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Less than 1 year	1	1.67	1.14
1-5 years	10	16.67	11.36
6-10 years	9	15.00	10.23
11-15 years	5	8.33	5.68
More than 15 years	28	46.67	31.82
Unsure	7	11.67	7.95

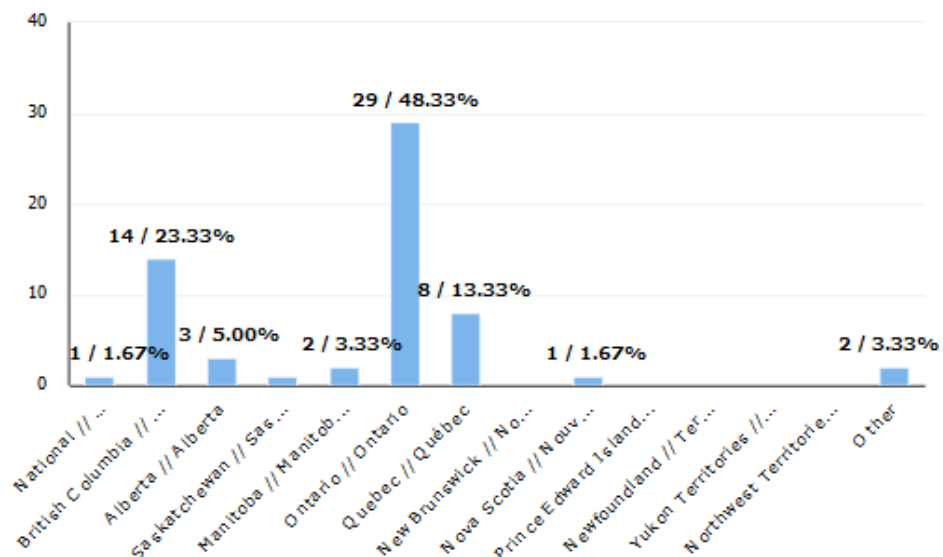
Will these sites continue to operate for the foreseeable future?



Answered 60, Skipped 28, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Yes	59	98.33	67.05
Unsure	1	1.67	1.14
Other			

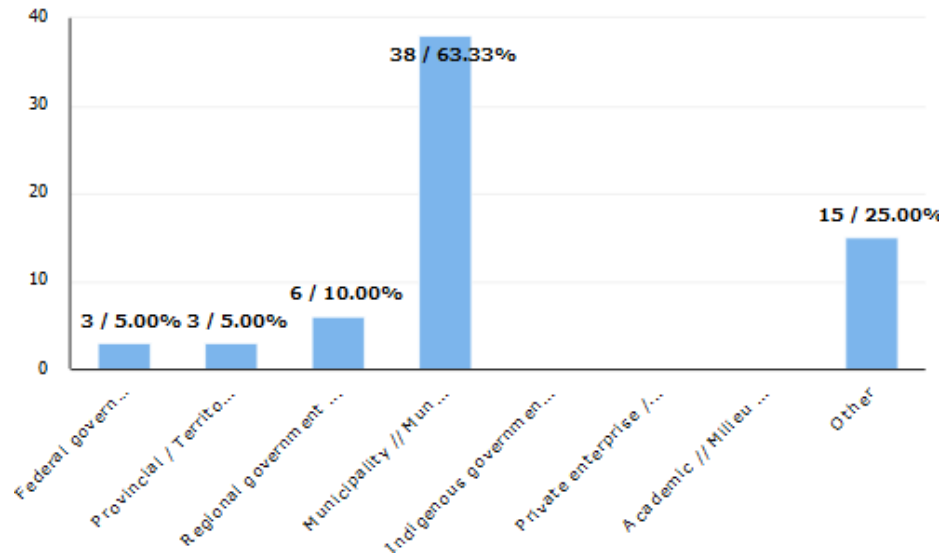
Where are the stations in this network deployed?



Answered 60, Skipped 28, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
National	1	1.67	1.14
British Columbia	14	23.33	15.91
Alberta	3	5.00	3.41
Saskatchewan	1	1.67	1.14
Manitoba	2	3.33	2.27
Ontario	29	48.33	32.95
Quebec	8	13.33	9.09
New Brunswick			
Nova Scotia	1	1.67	1.14
Prince Edward Island			
Newfoundland			
Yukon Territories			
Northwest Territories			
Other	2	3.33	2.27

What type of organization do you work under?

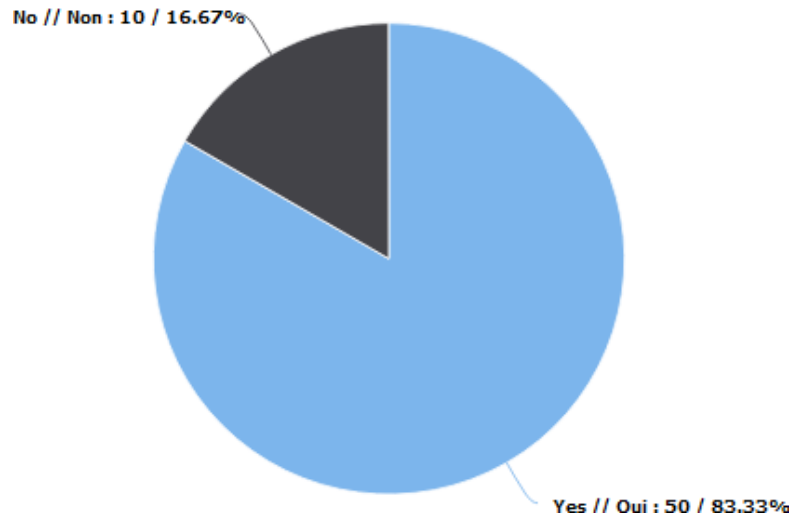


Answered 60, Skipped 28, Response Total 88

Answer Choice	Selections	% All QuestionResponses	% All SurveyResponses
Federal government	3	5.00	3.41
Provincial / Territorial government	3	5.00	3.41
Regional government	6	10.00	6.82
Municipality	38	63.33	43.18
Indigenous government or enterprise			
Private enterprise			
Academic			
Other	15	25.00	17.05

Please provide the name of the organization that owns the network

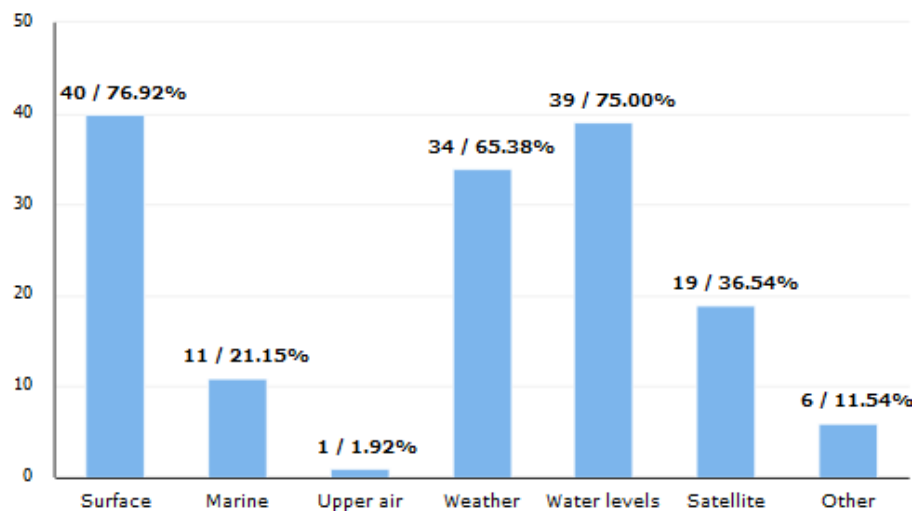
Do you use data from the Meteorological Service of Canada for your operations?



Answered 60, Skipped 28, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Yes	50	83.33	56.82
No	10	16.67	11.36

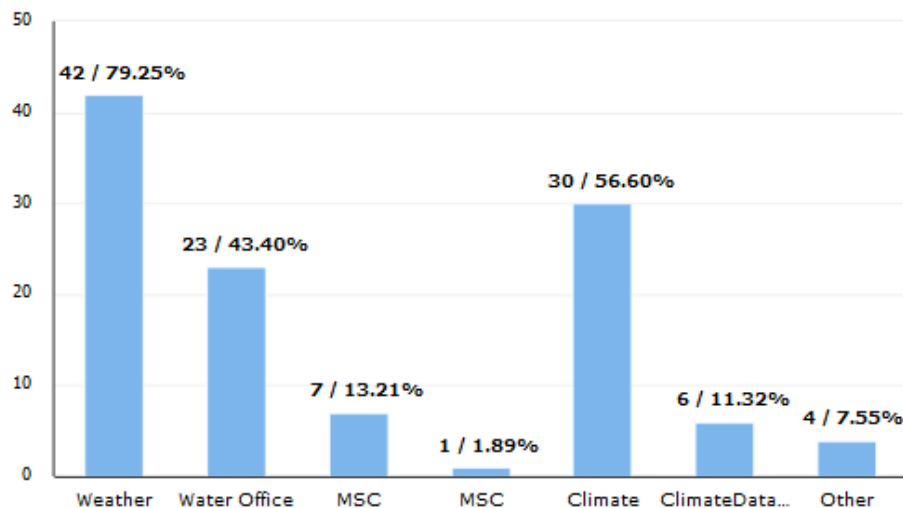
What types of data do you use from the Meteorological Service of Canada (MSC)? (Check all that apply)



Answered 52, Skipped 36, Response Total 88

Answer Choice	Selections	% All QuestionResponses	% All SurveyResponses
Surface weather observations	40	76.92	45.45
Marine observations	11	21.15	12.50
Upper air soundings	1	1.92	1.14
Weather radar imagery	34	65.38	38.64
Water levels and flows	39	75.00	44.32
Satellite imagery	19	36.54	21.59
Other	6	11.54	6.82

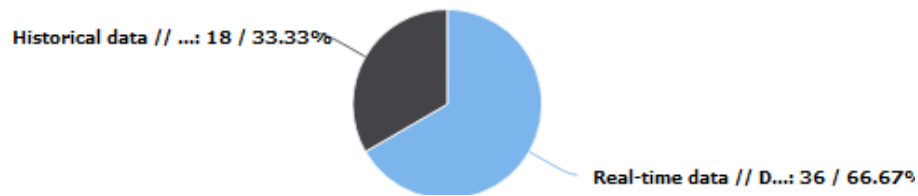
Where do you access data from the Meteorological Service of Canada? (Check all that apply)



Answered 53, Skipped 35, Response Total 88

Answer Choice	Selections	% All QuestionResponses	% All SurveyResponses
Weather Office (https://weather.gc.ca/)	42	79.25	47.73
Water Office (https://wateroffice.ec.gc.ca/)	23	43.40	26.14
MSC Datamart (https://dd.meteo.gc.ca/)	7	13.21	7.95
MSC GeoMet (https://eccc-msc.github.io/open-data/msc-geomt/readme_en/)	1	1.89	1.14
Climate Data Online (https://climate.weather.gc.ca/)	30	56.60	34.09
ClimateData.ca (https://climatedata.ca/)	6	11.32	6.82
Other	4	7.55	4.55

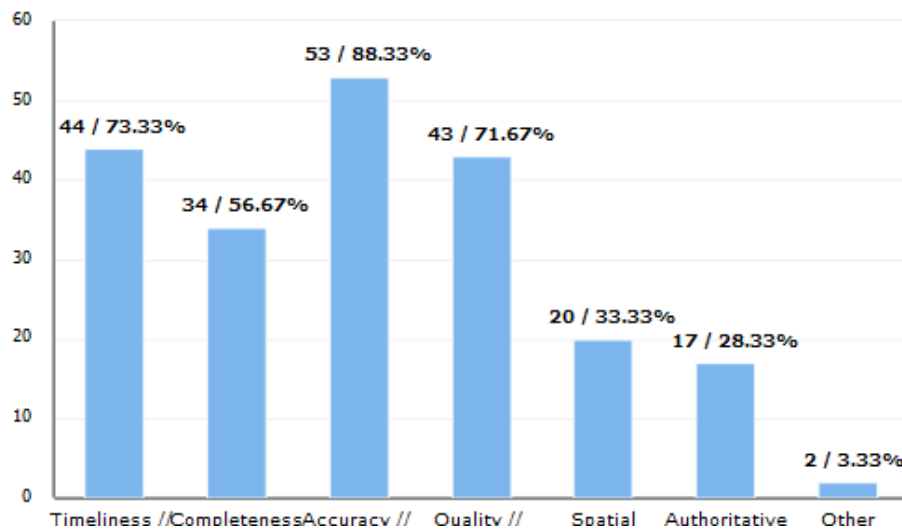
Do you use real-time or historical data?



Answered 54, Skipped 34, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Real-time data	36	66.67	40.91
Historical data	18	33.33	20.45

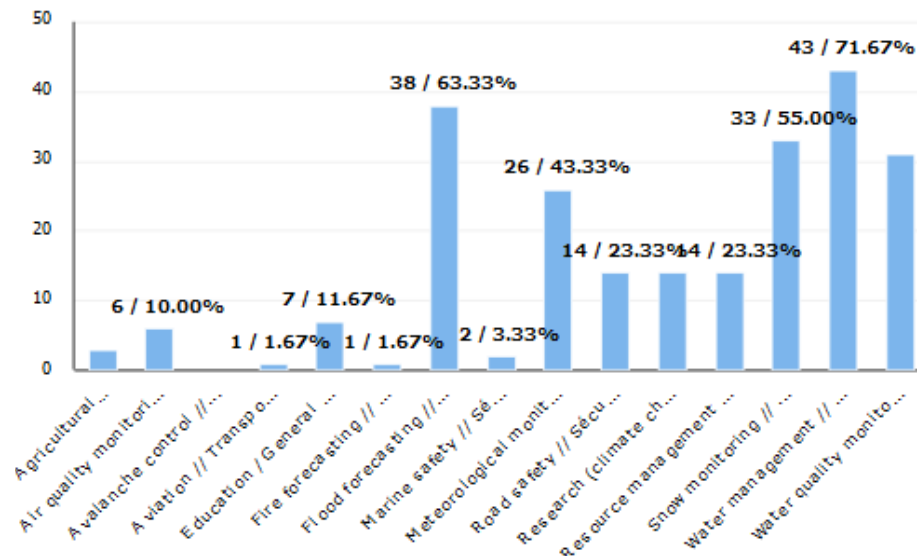
Which data characteristics are most important for your operations? (Check all that apply)



Answered 60, Skipped 28, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Timeliness	44	73.33	50.00
Completeness	34	56.67	38.64
Accuracy	53	88.33	60.23
Quality	43	71.67	48.86
Spatial distribution	20	33.33	22.73
Authoritative source	17	28.33	19.32
Other	2	3.33	2.27

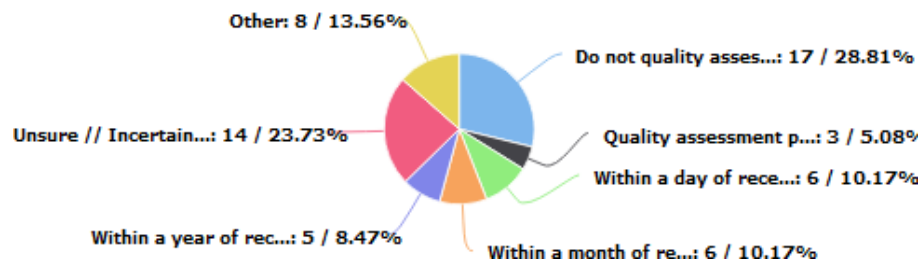
What are the main applications of the data your network collects?



Answered 60, Skipped 28, Response Total 88

Answer Choice	Selections	% All QuestionResponses	% All SurveyResponses
Agricultural monitoring	3	5.00	3.41
Air quality monitoring	6	10.00	6.82
Avalanche control			
Aviation	1	1.67	1.14
Education / General interest	7	11.67	7.95
Fire forecasting	1	1.67	1.14
Flood forecasting	38	63.33	43.18
Marine safety	2	3.33	2.27
Meteorological monitoring	26	43.33	29.55
Road safety	14	23.33	15.91
Research (climate change, ecological, etc.)	14	23.33	15.91
Resource management	14	23.33	15.91
Snow monitoring	33	55.00	37.50
Water management	43	71.67	48.86
Water quality monitoring	31	51.67	35.23

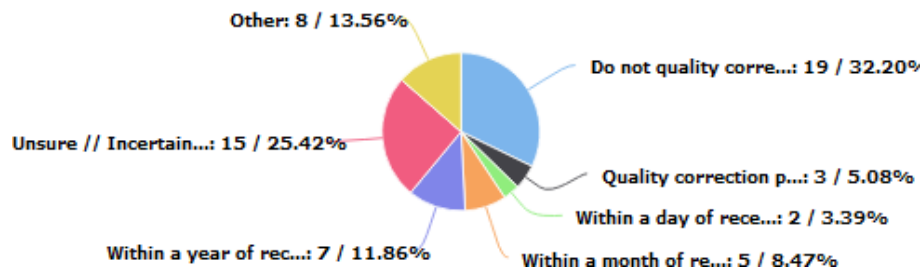
Do you perform quality assessment on your data and how soon after receipt of data? Quality assessment refers to a series of quality check routines that result in non-compliant or suspicious data being flagged to facilitate control measures or provide cautionary metadata for users.



Answered 59, Skipped 29, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Do not quality assess data	17	28.81	19.32
Quality assessment process is automated and takes place as our data is being received	3	5.08	3.41
Within a day of receiving data	6	10.17	6.8%
Within a month of receiving data	6	10.17	6.82
Within a year of receiving data	5	8.47	5.68
Unsure	14	23.73	15.91
Other	8	13.56	9.09

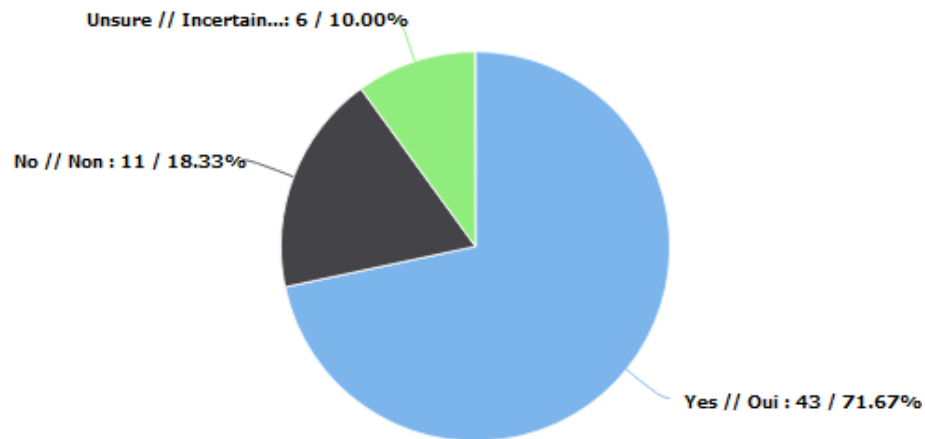
Do you apply quality corrections to your data and how soon after receipt of data? Quality correction refers to the modification or removal of suspicious or erroneous data.



Answered 59, Skipped 29, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Do not quality correct data	19	32.20	21.59
Quality correction process is automated and takes place as our data is being received	3	5.08	3.41
Within a day of receiving data	2	3.39	2.27
Within a month of receiving data	5	8.47	5.68
Within a year of receiving data	7	11.86	7.95
Unsure	15	25.42	17.05
Other	8	13.56	9.09

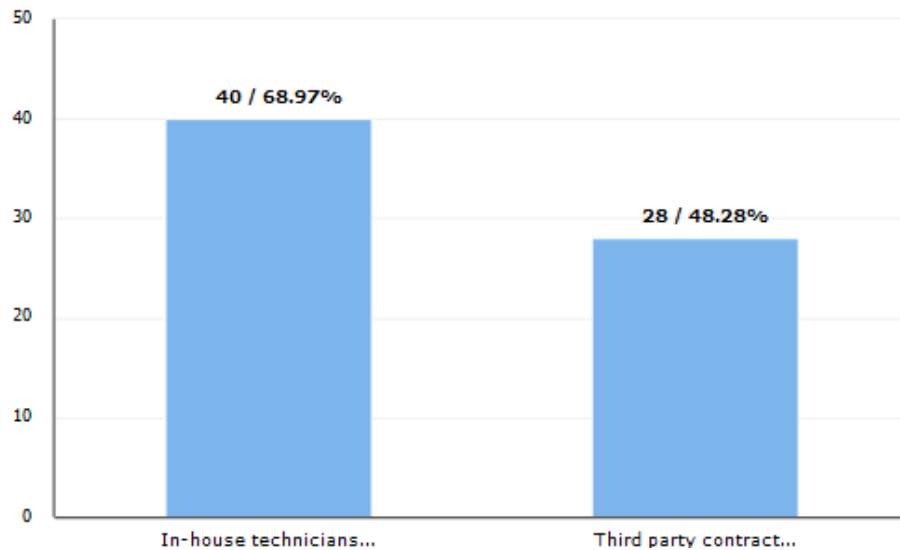
Do you share your network data?



Answered 60, Skipped 28, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Yes	43	71.67	48.86
No	11	18.33	12.50
Unsure	6	10.00	6.82

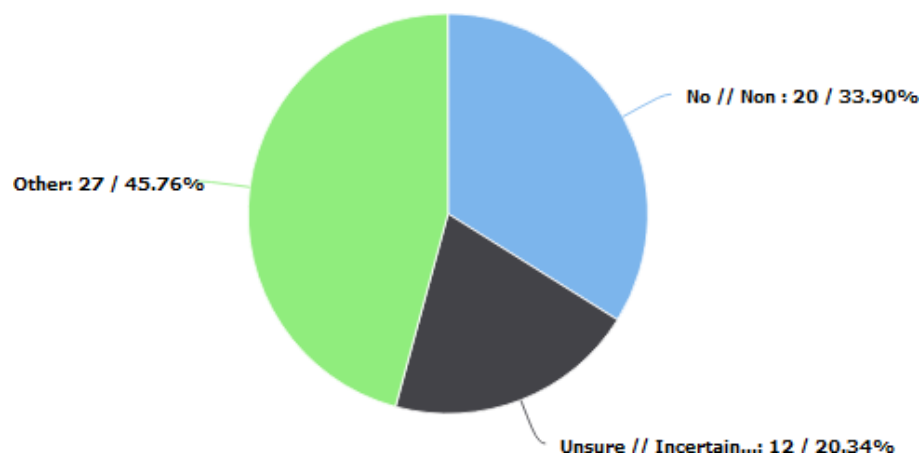
Who provides service and maintenance to your site(s)?



Answered 58, Skipped 30, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
In-house technicians	40	68.97	45.45
Third party contractor	28	48.28	31.82

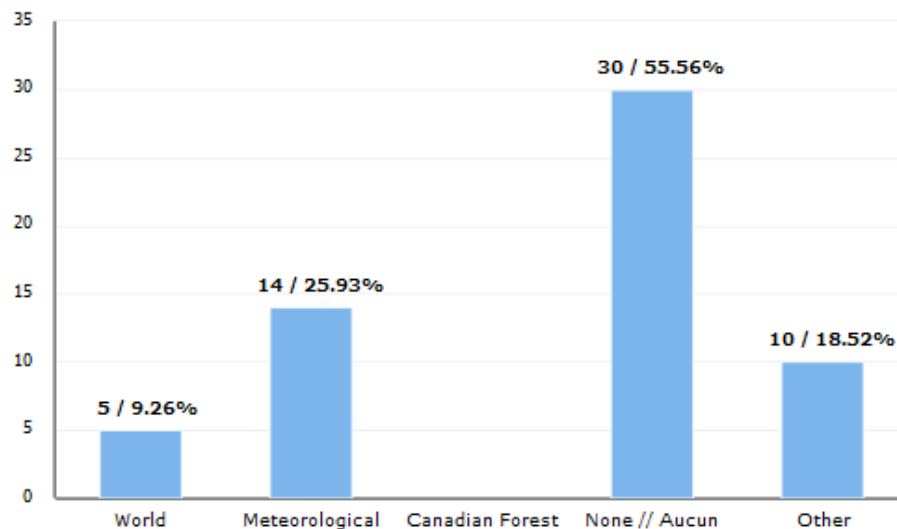
Is the data from your sites available on-line?



Answered 59, Skipped 29, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
No	20	33.90	22.73
Unsure	12	20.34	13.64
Other	27	45.76	30.68

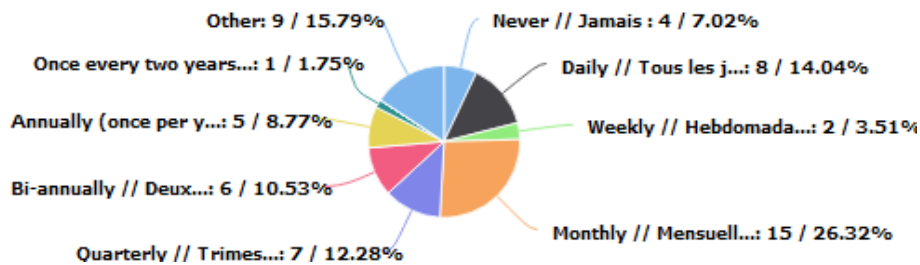
What station standards do your sites operate under?



Answered 54, Skipped 34, Response Total 88

Answer Choice	Selections	% All QuestionResponses	% All SurveyResponses
World Meteorological Organization (WMO)	5	9.26	5.68
Meteorological Service of Canada (MSC)	14	25.93	15.91
Canadian Forest Fire Danger Rating System (CFFDRS)			
None	30	55.56	34.09
Other	10	18.52	11.36

How often do you visit your sites to provide service and maintenance?

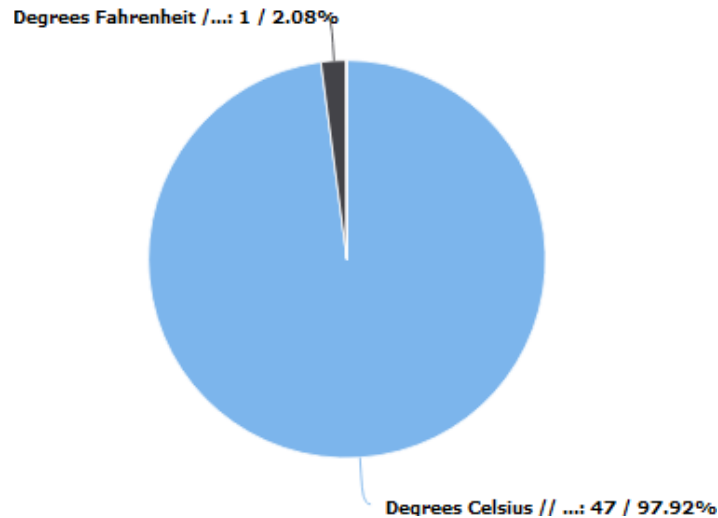


Answered 57, Skipped 31, Response Total 88

Answer Choice	Selections	% All QuestionResponses	% All SurveyResponses
Never	4	7.02	4.55
Daily	8	14.04	9.09
Weekly	2	3.51	2.27
Monthly	15	26.32	17.05
Quarterly	7	12.28	7.95
Bi-annually	6	10.53	6.82
Annually (once per year)	5	8.77	5.68
Once every two years	1	1.75	1.14
Once every three years			
Once every five years or more			
Other	9	15.79	10.23

Air temperature data

Which unit of measurement do you record air temperature in?



Answered 48, Skipped 40, Response Total 88

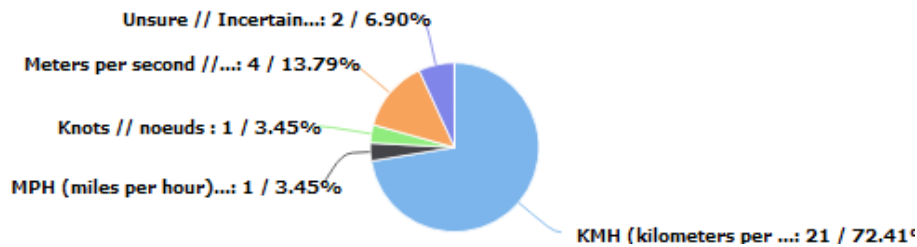
Answer Choice	Selections	% All Question Responses	% All Survey Responses
Degrees Celsius	47	97.92	53.41
Degrees Fahrenheit	1	2.08	1.14
Kelvin			
Unsure			
Other			

At what height are your air temperature sensors placed?

Answer Choice	Selections	% All Question Responses
1-5 m	23	57.5
6-10 m	5	12.5
11-20 m	1	2.5
>1000m	2	5.0
Don't know	7	17.5
Varies	2	5.0
Total	40	100.0

Wind data

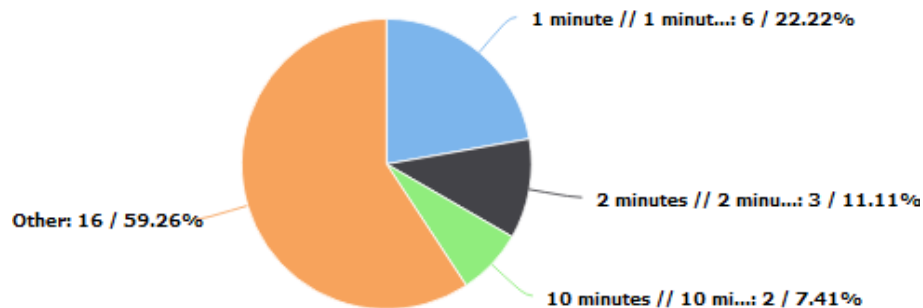
Which unit of measurement do you record wind speed in?



Answered 29, Skipped 59, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
KMH (kilometers per hour)	21	72.41	23.86
MPH (miles per hour)	1	3.45	1.14
Knots	1	3.45	1.14
Meters per second	4	13.79	4.55
Unsure	2	6.90	2.27
Other			

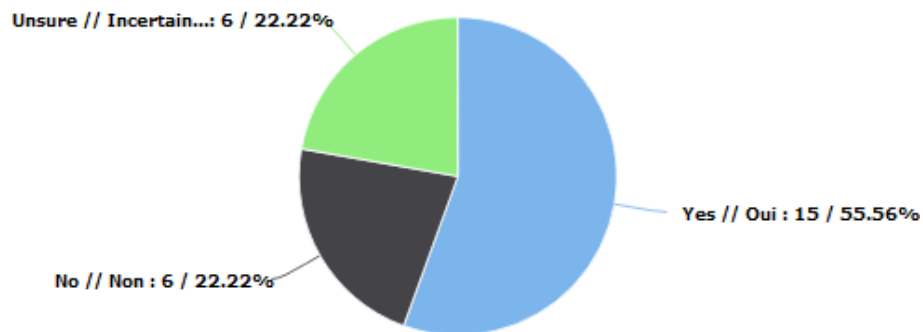
At what interval is your wind speed averaging done?



Answered 27, Skipped 61, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
1 minute	6	22.22	6.82
2 minutes	3	11.11	3.41
10 minutes	2	7.41	2.27
Other	16	59.26	18.18

Do you record peak wind speeds?



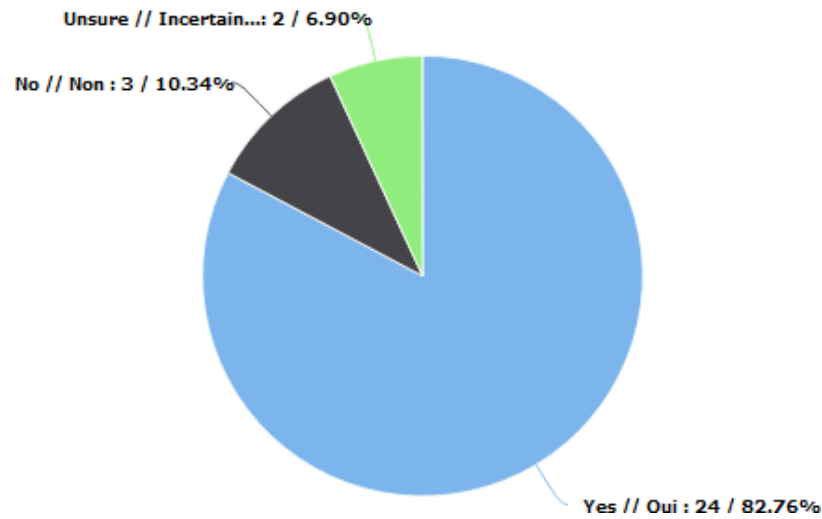
Answered 27, Skipped 61, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Yes	15	55.56	17.05
No	6	22.22	6.82
Unsure	6	22.22	6.82

At what height are your wind speed sensors placed?

Answer Choice	Selections	% All Question Responses
1-5 m	10	40
6-10 m	3	12
11-20 m	5	20
Don't know	5	20
Varies	2	8
Total	25	100

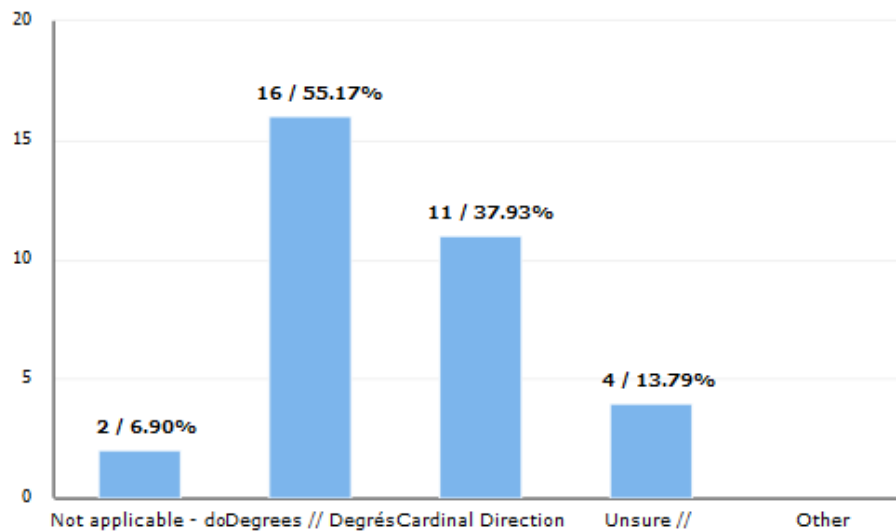
Do you collect data for wind direction?



Answered 29, Skipped 59, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Yes	24	82.76	27.27
No	3	10.34	3.41
Unsure	2	6.90	2.27

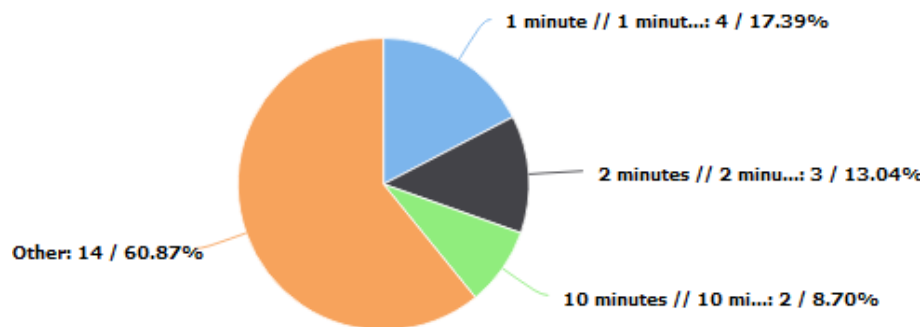
Which unit of measurement do you record wind direction in?



Answered 29, Skipped 59, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Not applicable - do not record wind direction	2	6.90	2.27
Degrees	16	55.17	18.18
Cardinal Direction (i.e., N, NE, NNE)	11	37.93	12.50
Unsure	4	13.79	4.55
Other			

At what interval is your wind direction averaging done?



Answered 23, Skipped 65, Response Total 88

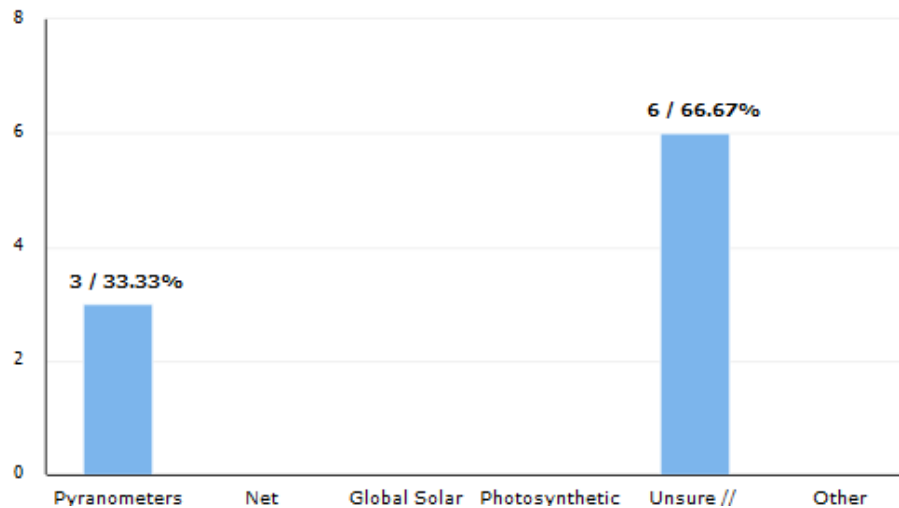
Answer Choice	Selections	% All Question Responses	% All Survey Responses
1 minute	4	17.39	4.55
2 minutes	3	13.04	3.41
10 minutes	2	8.70	2.27
Other	14	60.87	15.91

At what height are your wind direction sensors placed?

Answer Choice	Selections	% All Question Responses
1-5 m	9	37.5
6-10 m	9	37.5
Don't know	5	20.8
Varies	1	4.2
Total	24	100.0

Solar radiation data

Which type of solar radiation sensors are you using?

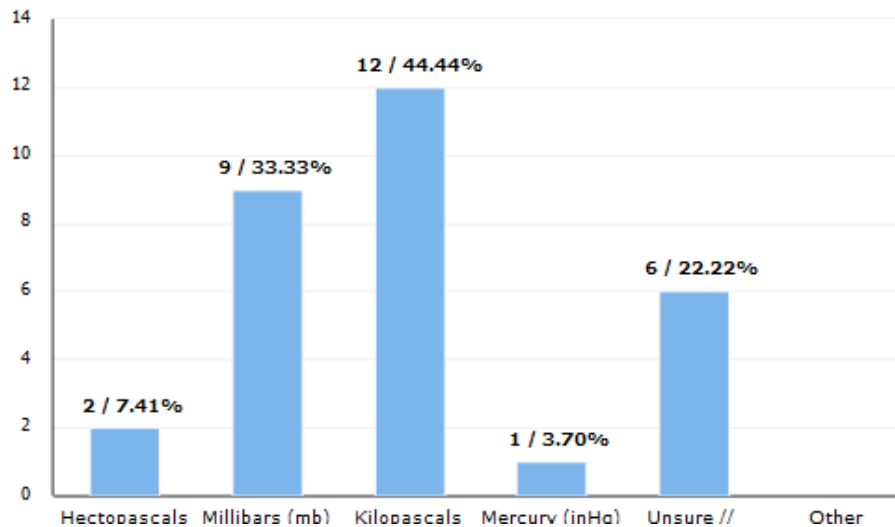


Answered 9, Skipped 79, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Pyranometers – short wave lengths to measure heat energy	3	33.33	3.41
Net Radiometers – measures the difference between incoming solar radiation from the sky and outgoing radiation from the ground			
Global Solar Radiation – the sum of direct, diffuse and reflected solar radiation			
Photosynthetic Radiation Sensors (PAR Sensors to measure spectral range for photosynthesis used by plants)			
Unsure	6	66.67	6.82
Other			

Barometric / Atmospheric pressure data

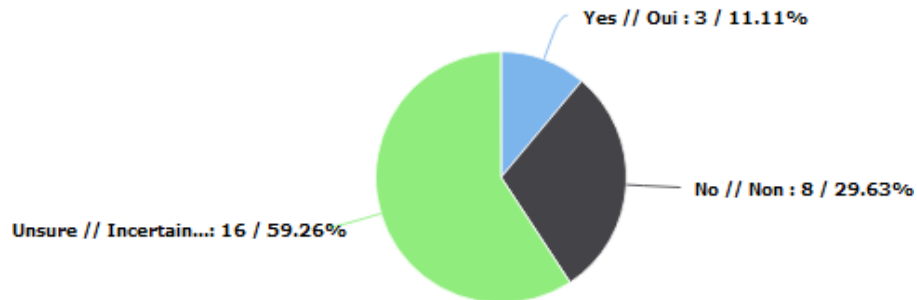
Which unit of measurement do you record barometric / atmospheric pressure in?



Answered 27, Skipped 61, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Hectopascals (hPA)	2	7.41	2.27
Millibars (mb)	9	33.33	10.23
Kilopascals (kPa)	12	44.44	13.64
Mercury (inHg)	1	3.70	1.14
Unsure	6	22.22	6.82
Other			

Do your sites offset barometric / atmospheric pressure readings to sea level?



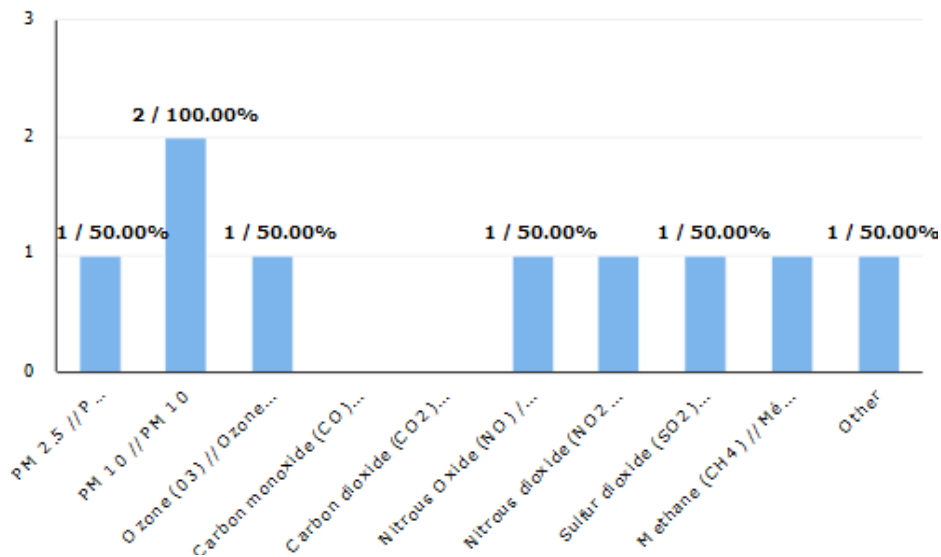
Answered 27, Skipped 61, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Yes	3	11.11	3.41
No	8	29.63	9.09
Unsure	16	59.26	18.18

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Ambient air quality data

Which parameters are you monitoring for ambient air quality? (choose all that apply)



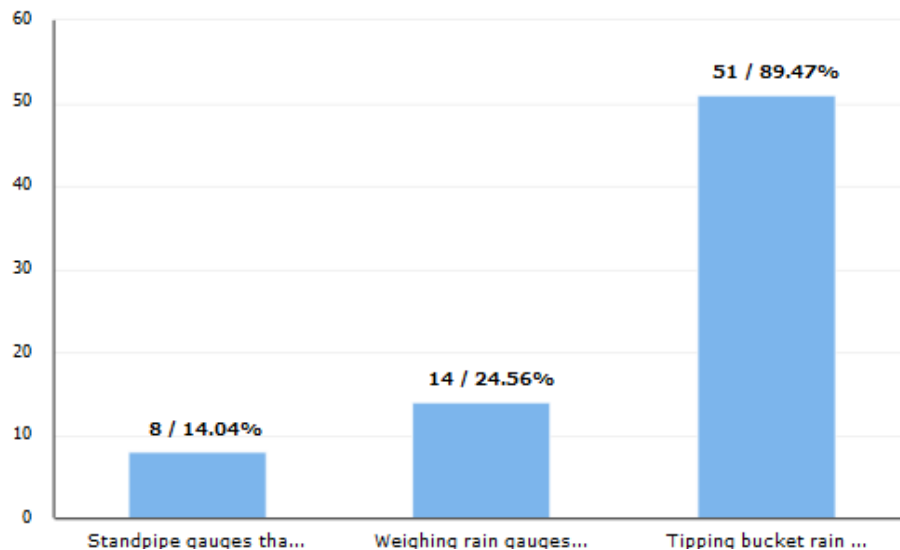
Answered 2, Skipped 86, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
PM 2.5	1	50.00	1.14
PM 10	2	100.00	2.27
Ozone (O ₃)	1	50.00	1.14
Carbon monoxide (CO)			
Carbon dioxide (CO ₂)			
Nitrous Oxide (NO)	1	50.00	1.14
Nitrous dioxide (NO ₂)	1	50.00	1.14
Sulfur dioxide (SO ₂)	1	50.00	1.14
Methane (CH ₄)	1	50.00	1.14
Other	1	50.00	1.14

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Precipitation data

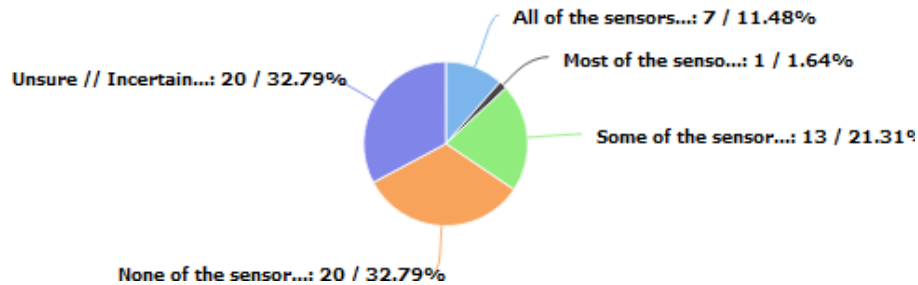
Which precipitation gauges are you using? (choose all that apply)



Answered 57, Skipped 31, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Standpipe gauges that use a pressure transducer to measure water level	8	14.04	9.09
Weighing rain gauges	14	24.56	15.91
Tipping bucket rain gauges	51	89.47	57.95

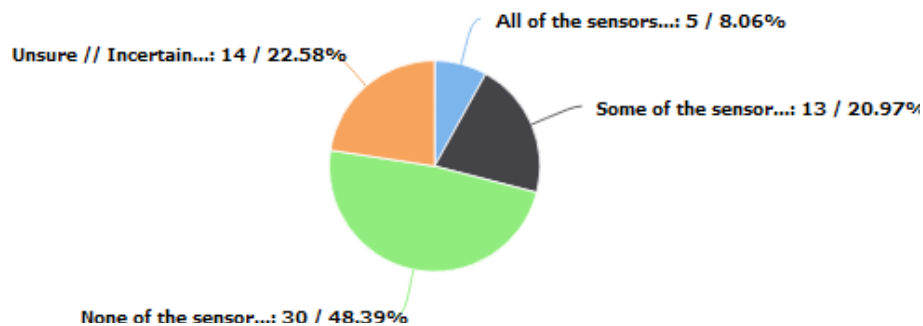
How many of your precipitation gauges have a wind shield?



Answered 61, Skipped 27, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
All of the sensors have a wind shield	7	11.48	7.95
Most of the sensors have a wind shield	1	1.64	1.14
Some of the sensors have a wind shield	13	21.31	14.77
None of the sensors have a wind shield	20	32.79	22.73
Unsure	20	32.79	22.73

Are your precipitation gauges heated?



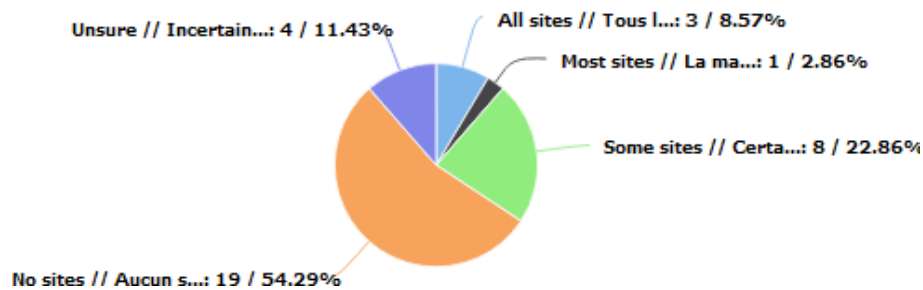
Answered 62, Skipped 26, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
All of the sensors are heated	5	8.06	5.68
Some of the sensors are heated	13	20.97	14.77
None of the sensors are heated	30	48.39	34.09
Unsure	14	22.58	15.91

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Snow data

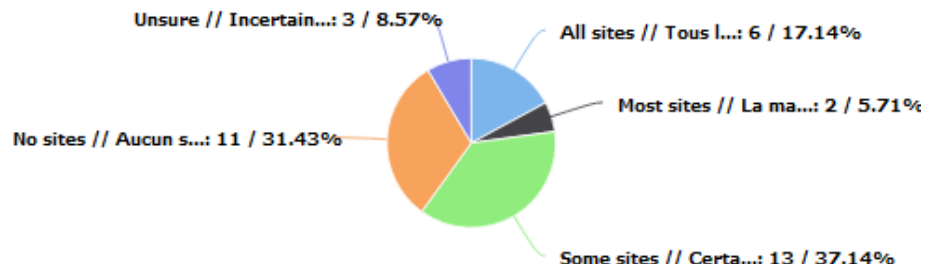
How many of your sites collect data to measure the weight of snow? (eg. snow pillows, or other sensors)



Answered 35, Skipped 53, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
All sites	3	8.57	3.41
Most sites	1	2.86	1.14
Some sites	8	22.86	9.09
No sites	19	54.29	21.59
Unsure	4	11.43	4.55

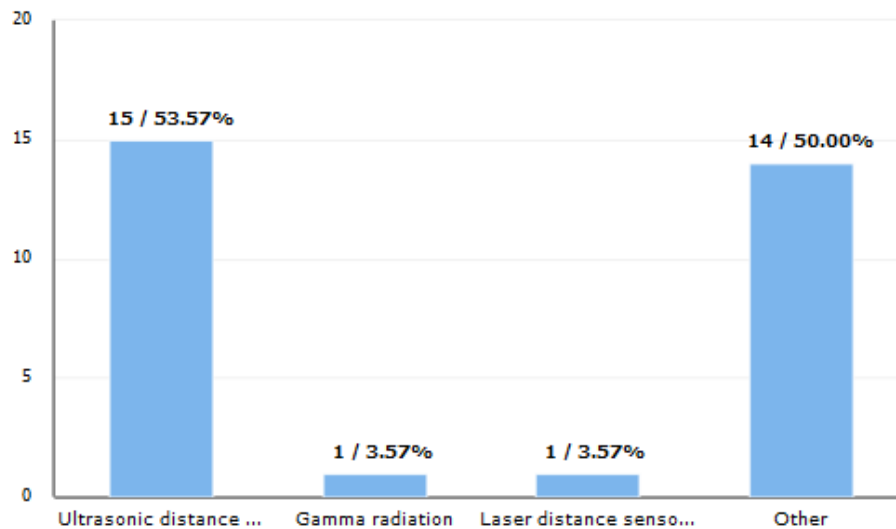
How many of your sites use snow depth sensors?



Answered 35, Skipped 53, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
All sites	6	17.14	6.82
Most sites	2	5.71	2.27
Some sites	13	37.14	14.77
No sites	11	31.43	12.50
Unsure	3	8.57	3.41

What technology are you using to measure snow depth?

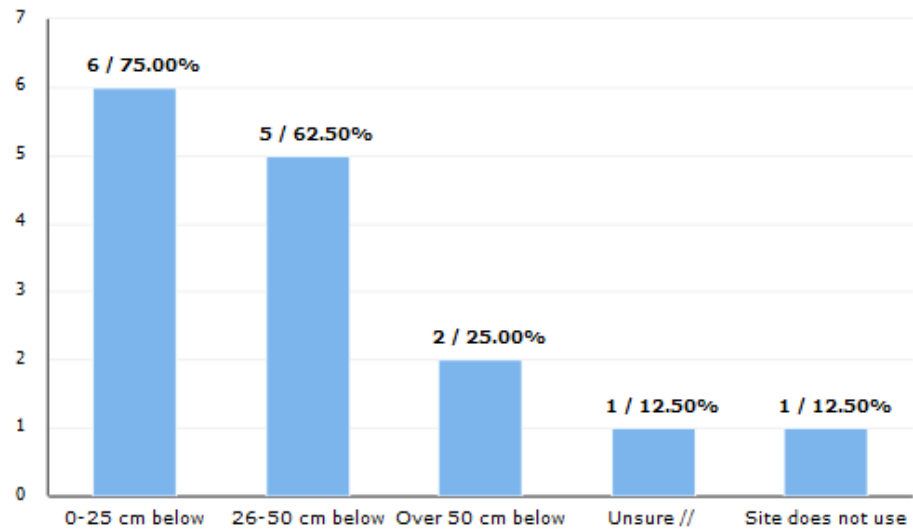


Answered 28, Skipped 60, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Ultrasonic distance sensors	15	53.57	17.05
Gamma radiation sensors	1	3.57	1.14
Laser distance sensors	1	3.57	1.14
Other	14	50.00	15.91

Soil data

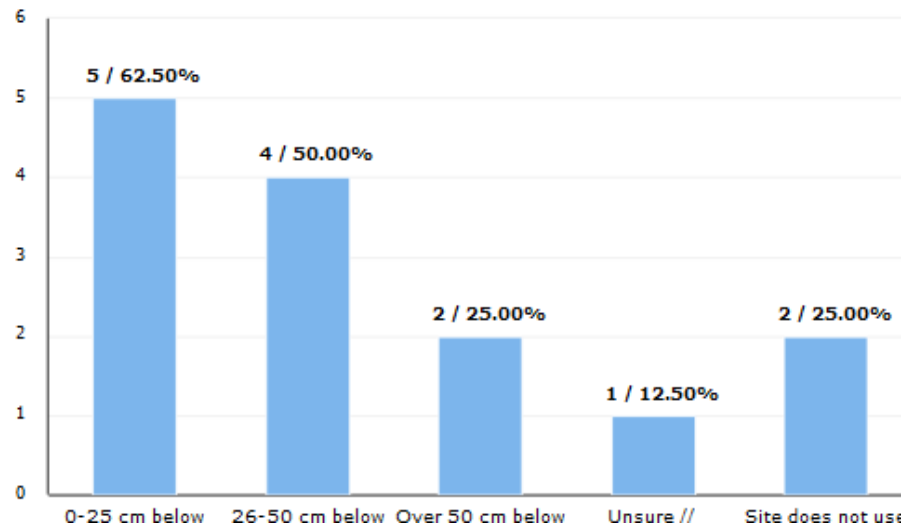
At what depth are your soil moisture sensors placed, if in use?



Answered 8, Skipped 80, Response Total 88

Answer Choice	Selections	% All QuestionResponses	% All SurveyResponses
0-25 cm below ground surface	6	75.00	6.82
26-50 cm below ground surface	5	62.50	5.68
Over 50 cm below ground surface	2	25.00	2.27
Unsure	1	12.50	1.14
Site does not use soil moisture sensors	1	12.50	1.14

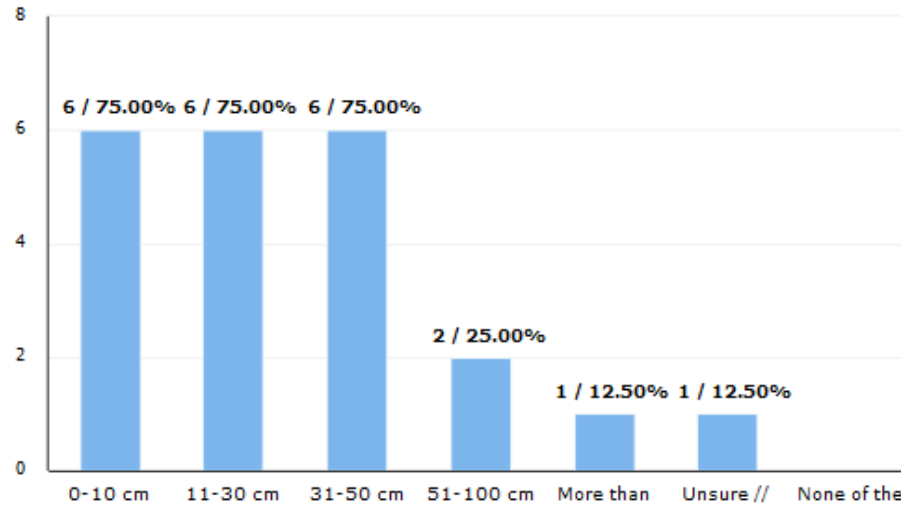
At what depth are your soil conductivity sensors placed, if in use?



Answered 8, Skipped 80, Response Total 88

Answer Choice	Selections	% All QuestionResponses	% All SurveyResponses
0-25 cm below ground surface	5	62.50	5.68
26-50 cm below ground surface	4	50.00	4.55
Over 50 cm below ground surface	2	25.00	2.27
Unsure	1	12.50	1.14
Site does not use soil conductivity sensors	2	25.00	2.27

If some of your sites use soil temperature sensors, at what depth are they placed?

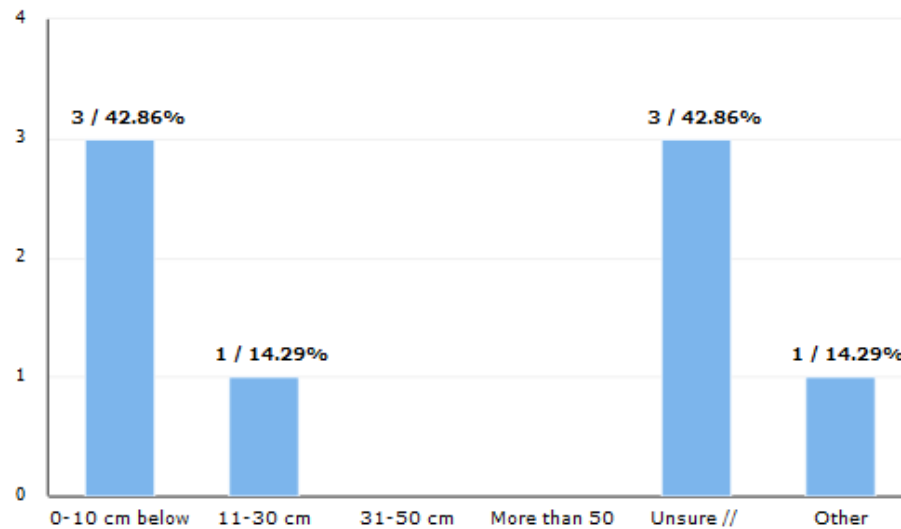


Answered 8, Skipped 80, Response Total 88

Answer Choice	Selections	% All QuestionResponses	% All SurveyResponses
0-10 cm below surface	6	75.00	6.82
11-30 cm below surface	6	75.00	6.82
31-50 cm below surface	6	75.00	6.82
51-100 cm below surface	2	25.00	2.27
More than 100 cm below surface	1	12.50	1.14
Unsure	1	12.50	1.14
None of the sites use soil temperature sensors			

Road surface temperature data

At what depth are your road surface temperature sensors placed?

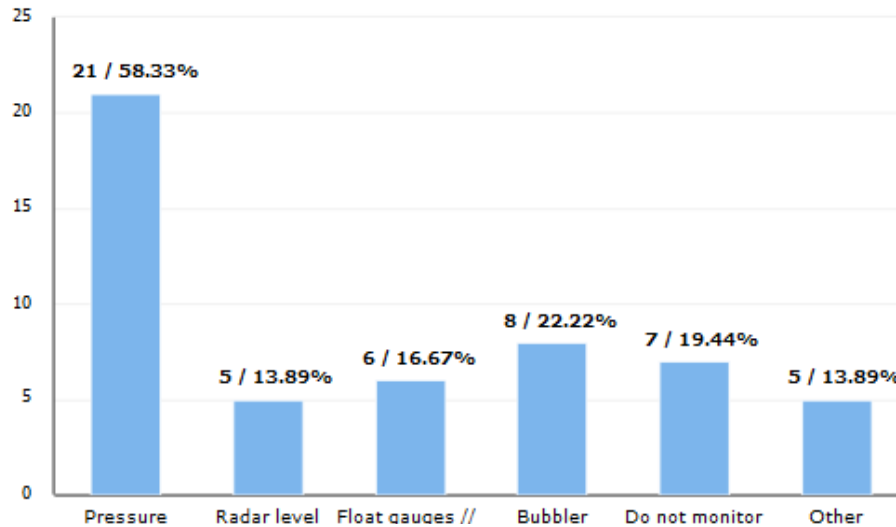


Answered 7, Skipped 81, Response Total 88

Answer Choice	Selections	% All QuestionResponses	% All SurveyResponses
0-10 cm below surface	3	42.86	3.41
11-30 cm below surface	1	14.29	1.14
31-50 cm below surface			
More than 50 cm below surface			
Unsure	3	42.86	3.41
Other	1	14.29	1.14

Water data

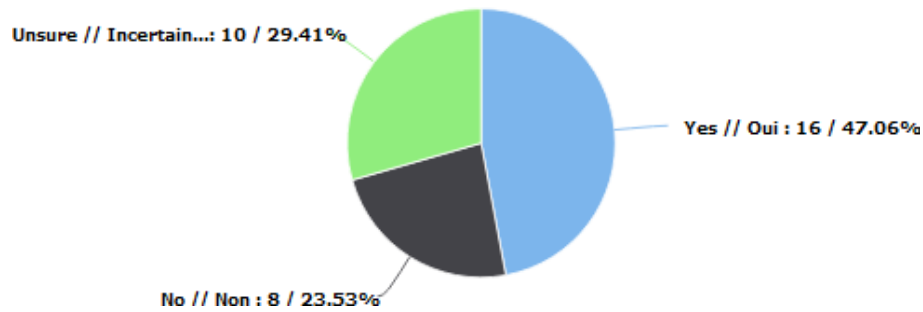
What method(s) are you using to monitor surface water levels?



Answered 36, Skipped 52, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Pressure transducers	21	58.33	23.86
Radar level sensors	5	13.89	5.68
Float gauges	6	16.67	6.82
Bubbler systems	8	22.22	9.09
Do not monitor surface water levels	7	19.44	7.95
Other	5	13.89	5.68

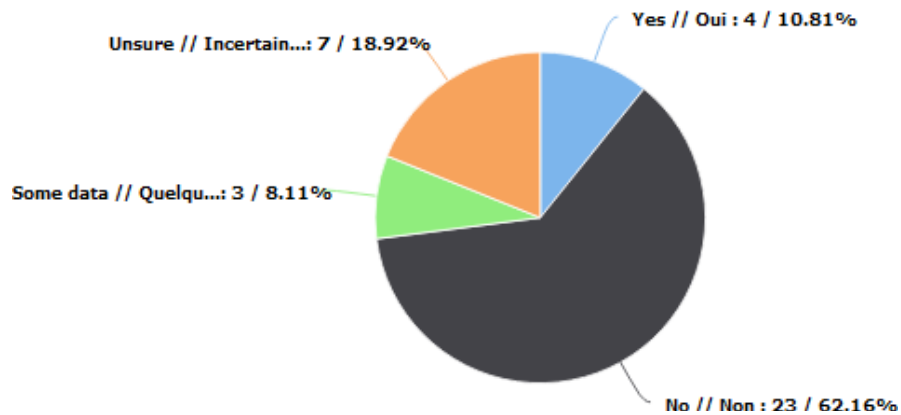
Are your surface water sites referenced to or have conversions to terrestrial or space-based geodetic data?



Answered 34, Skipped 54, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Yes	16	47.06	18.18
No	8	23.53	9.09
Unsure	10	29.41	11.36

Do you contribute surface water level data to the Water Survey of Canada?

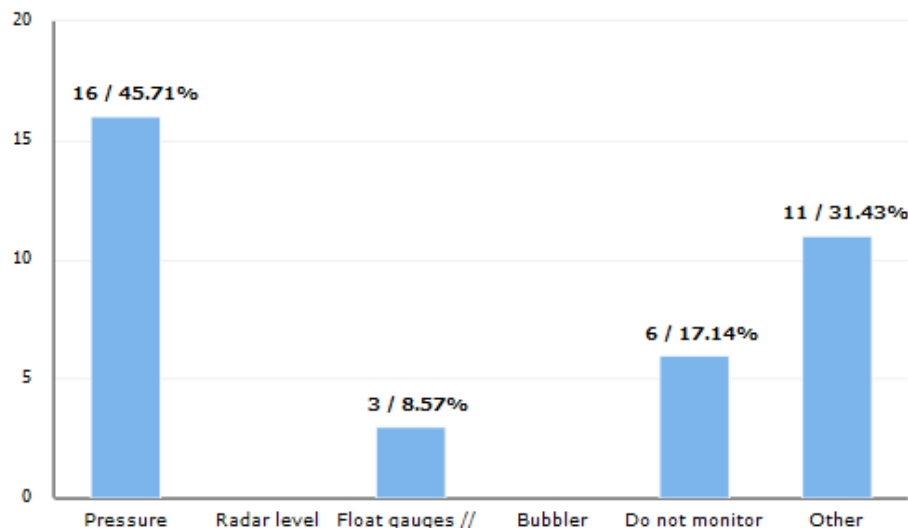


Answered 37, Skipped 51, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Yes	4	10.81	4.55
No	23	62.16	26.14
Some data	3	8.11	3.41
Unsure	7	18.92	7.95

Please describe how you are monitoring surface water quality.

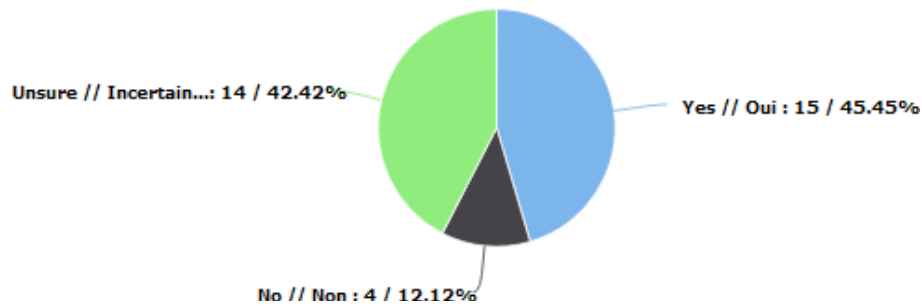
What method(s) are you using to monitor ground water levels?



Answered 35, Skipped 53, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Pressure transducers	16	45.71	18.18
Radar level sensors			
Float gauges	3	8.57	3.41
Bubbler systems			
Do not monitor ground water levels	6	17.14	6.82
Other	11	31.43	12.50

Are your ground water sites referenced to or have conversions to terrestrial or space-based geodetic data?



Answered 33, Skipped 55, Response Total 88

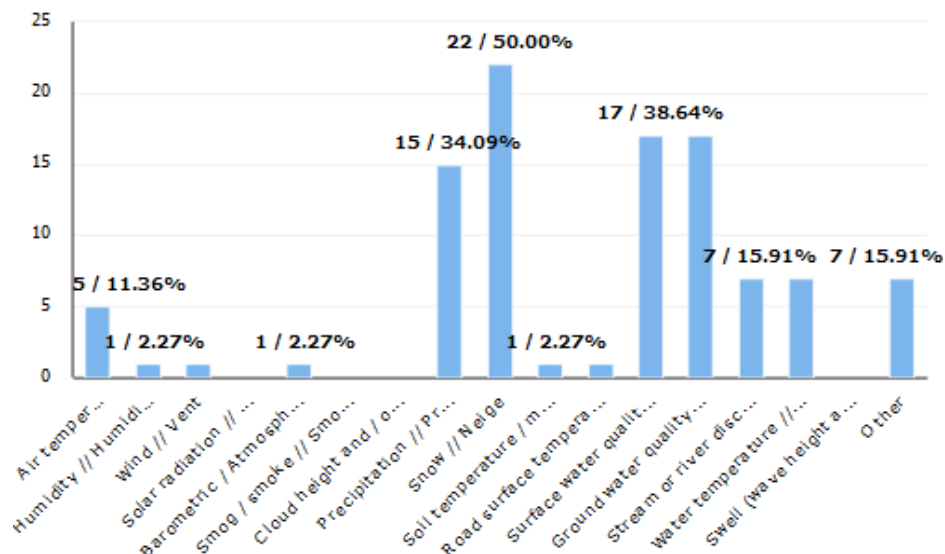
Answer Choice	Selections	% All Question Responses	% All Survey Responses
Yes	15	45.45	17.05
No	4	12.12	4.55
Unsure	14	42.42	15.91

Please describe how you are monitoring ground water quality.

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Manual data collection

Which parameters, if any, are being measured manually?



Answered 44, Skipped 44, Response Total 88

Answer Choice	Selection s	% All Survey Responses	% All Question Responses
Air temperature	5	5.68	11.36
Humidity	1	1.14	2.27
Wind	1	1.14	2.27
Solar radiation			
Barometric / Atmospheric pressure	1	1.14	2.27
Smog / smoke			
Cloud height and / or composition			
Precipitation	15	17.05	34.09
Snow	22	25.00	50.00
Soil temperature / moisture / conductivity	1	1.14	2.27
Road surface temperature	1	1.14	2.27
Surface water quality or quantity	17	19.32	38.64
Ground water quality or quantity	17	19.32	38.64
Stream or river discharge	7	7.95	15.91
Water temperature	7	7.95	15.91
Swell (wave height and / or swell height)			
Other	7	7.95	15.91

How are you collecting these parameters? Please describe the process.

How frequently do you measure and record these parameters?

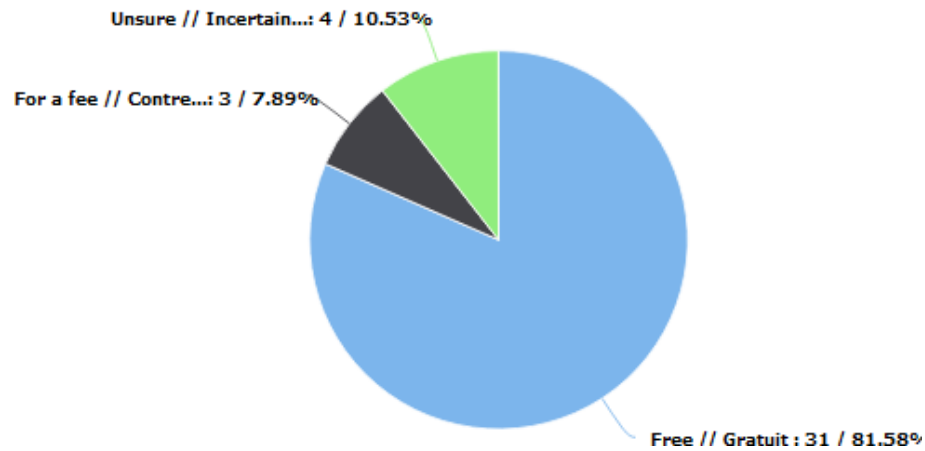
How are these data placed in your master database?

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Data sharing

With whom do you share your network data (please provide entity name)? Please list all organizations.

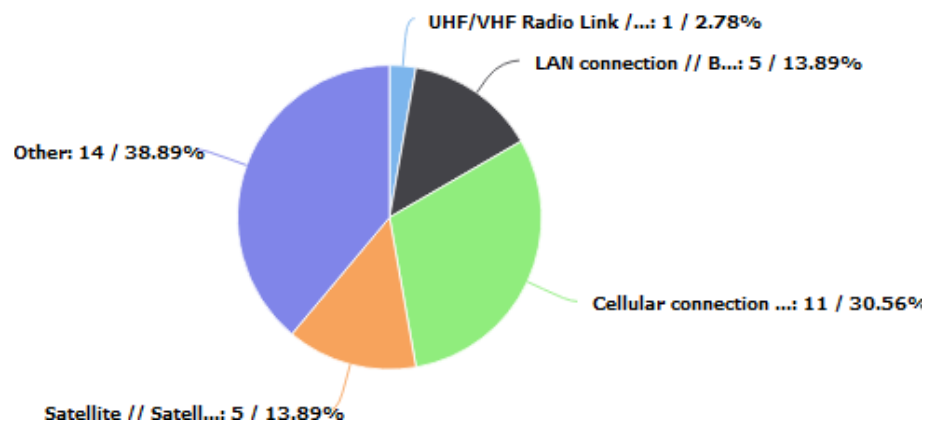
Do you share your data for free, or for a fee?



Answered 38, Skipped 50, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Free	31	81.58	35.23
For a fee	3	7.89	3.41
Unsure	4	10.53	4.55

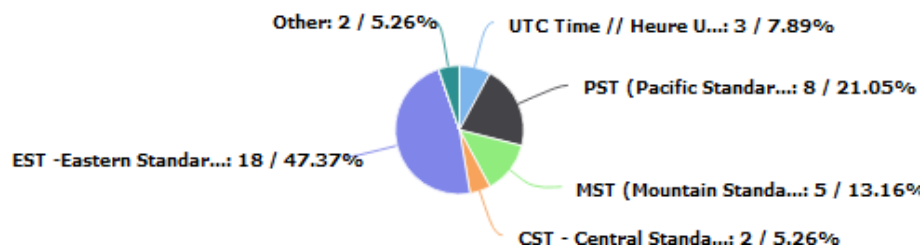
How do you transmit data from your sites?



Answered 36, Skipped 52, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
UHF/VHF Radio Link	1	2.78	1.14
LAN connection	5	13.89	5.68
Cellular connection	11	30.56	12.50
Satellite	5	13.89	5.68
Other	14	38.89	15.91

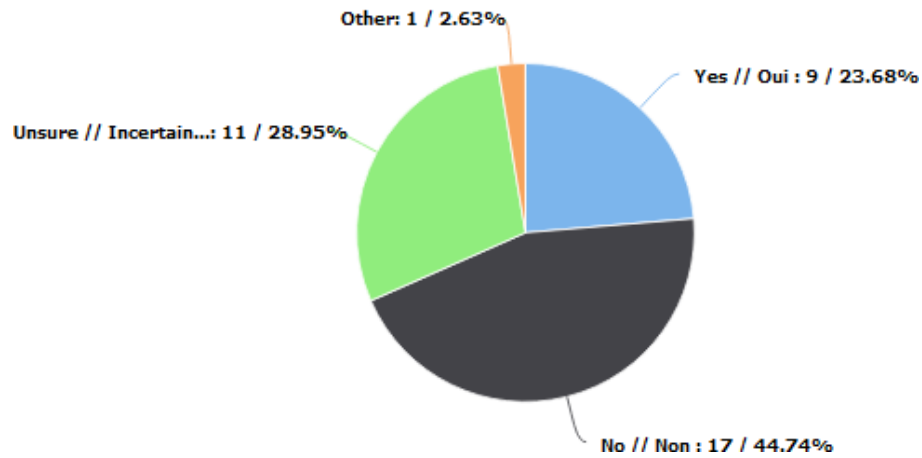
What time zone is your data recorded in?



Answered 38, Skipped 50, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
UTC Time	3	7.89	3.41
PST (Pacific Standard Time)	8	21.05	9.09
MST (Mountain Standard Time)	5	13.16	5.68
CST - Central Standard Time	2	5.26	2.27
EST -Eastern Standard Time	18	47.37	20.45
AST -Atlantic Standard Time			
NST - Newfoundland Standard Time			
Other	2	5.26	2.27

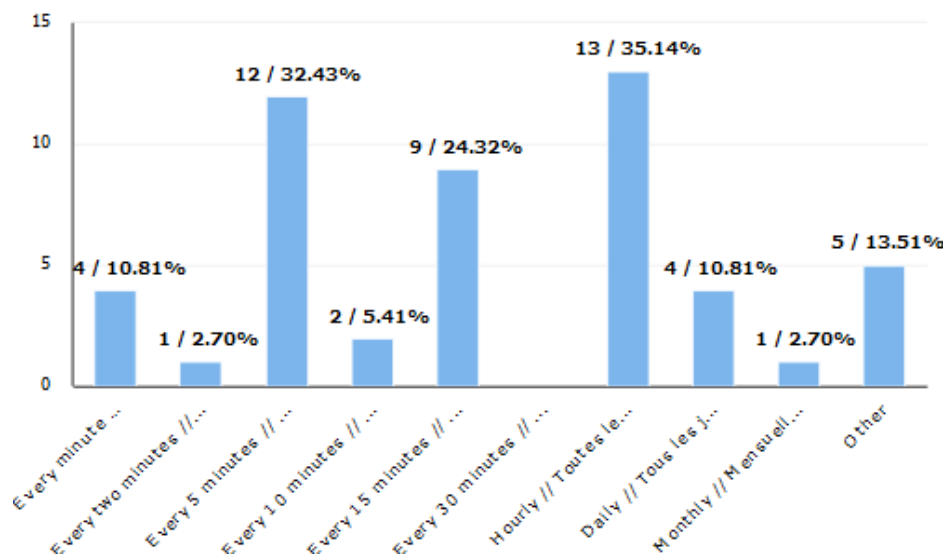
Do you use local daylight savings time when storing your data?



Answered 38, Skipped 50, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Yes	9	23.68	10.23
No	17	44.74	19.32
Unsure	11	28.95	12.50
Other	1	2.63	1.14

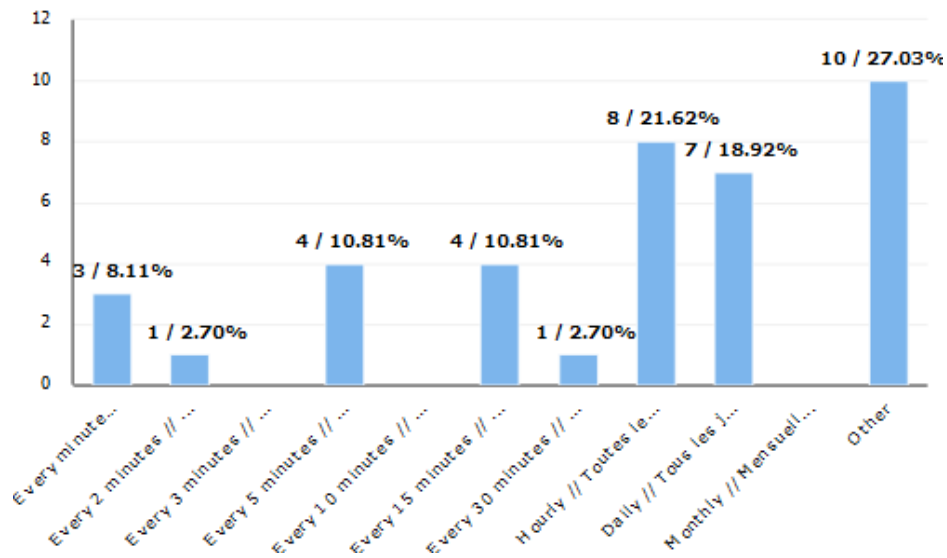
How often do you record and store data at your site?



Answered 37, Skipped 51, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Every minute or less	4	10.81	4.55
Every two minutes	1	2.70	1.14
Every 5 minutes	12	32.43	13.64
Every 10 minutes	2	5.41	2.27
Every 15 minutes	9	24.32	10.23
Every 30 minutes			
Hourly	13	35.14	14.77
Daily	4	10.81	4.55
Monthly	1	2.70	1.14
Other	5	13.51	5.68

Please describe the frequency at which your data is transmitted from your sites.

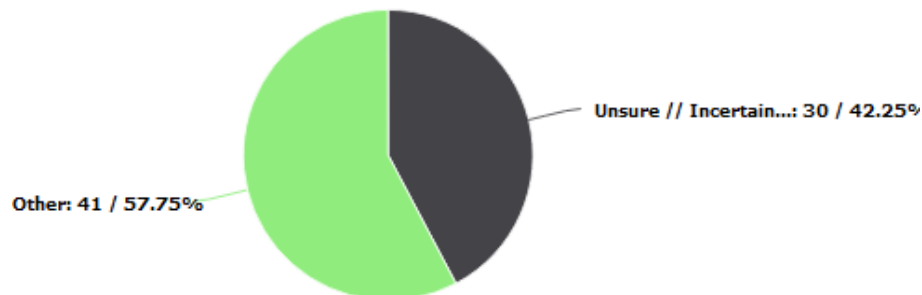


Answered 37, Skipped 51, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
Every minute or less	3	8.11	3.41
Every 2 minutes	1	2.70	1.14
Every 3 minutes			
Every 5 minutes	4	10.81	4.55
Every 10 minutes			
Every 15 minutes	4	10.81	4.55
Every 30 minutes	1	2.70	1.14
Hourly	8	21.62	9.09
Daily	7	18.92	7.95
Monthly			
Other	10	27.03	11.36

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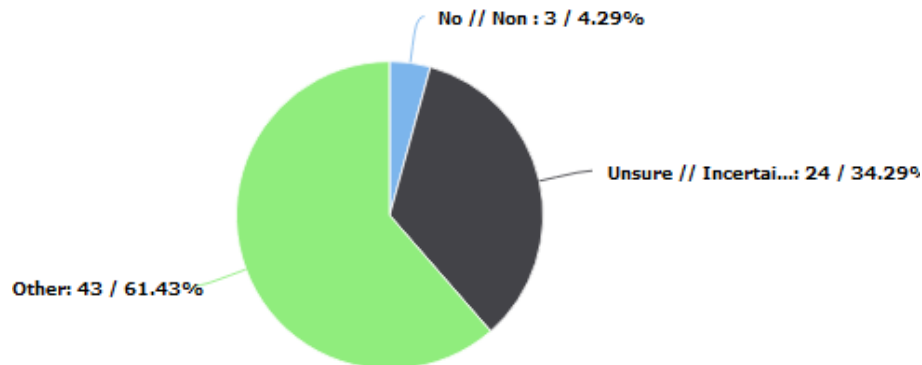
Would you be willing to share your data with Environment and Climate Change Canada?



Answered 71, Skipped 17, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
No			
Unsure	30	42.25	34.09
Other	41	57.75	46.59

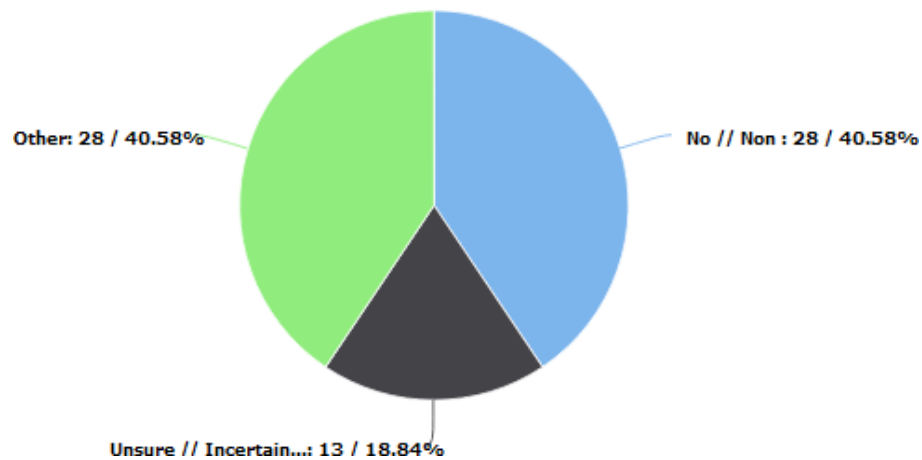
Would you like access to data sets from other programs in your geographic area?



Answered 70, Skipped 18, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
No	3	4.29	3.41
Unsure	24	34.29	27.27
Other	43	61.43	48.86

Do you know of any other entities, companies or organizations that are running any type of environmental monitoring programs in your area?



Answered 69, Skipped 19, Response Total 88

Answer Choice	Selections	% All Question Responses	% All Survey Responses
No	28	40.58	31.82
Unsure	13	18.84	14.77
Other	28	40.58	31.82



For more forestry-related publications, visit the Canadian Forest Service Publications website at:

cfs.nrcan.gc.ca/publications