

Meteorological Service of Canada

MSC STDS 2 - 2001

SITING STANDARDS FOR METEOROLOGICAL OBSERVING SITES

Introduction

The objective of these standards are to describe siting requirements for, obtaining representative temperature, moisture, precipitation, and wind data at airport and non airport meteorological observing sites.

This document provides the criteria for correct and representative exposure of meteorological instruments consistent with World Meteorological Organization (WMO) recommendations, individual instrument manuals, and manufacturer's recommendations. These siting standards have been developed to ensure that meteorological data collected is sound, representative, and comparable with collected data from other sites. While references to compound size may be ideal and general, such exposure criteria may be modified to meet local and system-specific requirements only upon review and approval of such proposed changes by the national or respective regional Meteorological Service of Canada (MSC) authority. "Every effort shall be made to meet these standards to ensure the validity of both the data collected and the forecasts generated from this data."

This document does not require a change to existing installations solely to comply with the standards. It shall be applied as new stations or compounds are established.

Instruments for measuring other parameters may be located on the site providing they do not compromise the siting requirements of the existing instruments.

Throughout the document the terms should and shall are used. The term should is used to denote a recommended practice, an established or conventional procedure that is to be followed wherever possible. The term shall is used to indicate that the instructions are mandatory.

It may not always be technically, economically, or operationally feasible to fully comply with all the specified siting standards. After considering user requirements and the impact the variance may have on data quality, MSC Regional Directors may grant exemptions. In such cases, the responsible manager shall provide written notification to the Director General, Atmospheric Monitoring and Water Survey Directorate. This notification shall include a description of the variance and the rationale on which the exemption is based.

Siting Standards - General

In all cases applicable instrument manuals and circulars shall be consulted to obtain siting and installation requirements for specific systems.

Sites shall be located where they are representative for the purpose for which the site is established. Therefore, careful consideration should be given to the purpose of a site prior to its selection. For example, a site which is representative of a micro-climate within a large region should not be selected as a site for synoptic observations.

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In selecting sites for synoptic observations, the objective is to choose a site which is representative of a relatively large area with common features. In order to achieve this goal it is necessary to select sites which are not influenced by small scale geographical or man-made features which are unique to the site but not common to the area for which the data are required. Conversely, if the area is mountainous and contains numerous lakes, then the site should be selected to reflect the effect of these features.

The same principle applies to specialized sites. In the case of an airport site, it shall be selected to represent conditions over the runway complex. Thus, if the runways are subject to valley effects, cold air drainage, etc., the site should be selected to represent these effects.

An object is considered to be an obstruction if the included lateral angle from the instrument to the ends of the object is 10 degrees or more. Minimum distances from obstructions are specified in order to prevent the rain shadow effect from affecting precipitation data, or turbulence from affecting wind data. If the obstructions are trees, it is recommended that the distances be increased to allow for growth over a long period of time.

In cases where the terrain rises abruptly, for example, a steep cliff, the feature should be treated as an obstruction and be subject to the same minimum distances as trees or buildings.

Anemometer siting standards are shown as a separate type of site. In most cases the anemometer can not be located in the primary area since the data will be compromised by not meeting the siting criteria (ten times the height of the obstruction) or it will not represent the location for which wind is required.

Generally, sites on flat land with few obstructions will yield representative data where the terrain is flat and free from obstructions. In forested, mountainous, or built-up areas, moderately sheltered sites which meet the minimum distances from obstructions should be selected because they will yield data which are representative of the particular region.

Meteorological observing sites shall be created in the location of interest by using three areas of exposure to insure that the data will be representative for the purpose it is intended. The areas are as follows:

Primary Area - This is the area where the instruments or sensors are physically located. The primary area should be located on level open ground and covered preferably by short grass or where grass does not grow, on natural ground of that geographical area. The primary area ground surface should be such that the instruments are easily accessible by foot traffic for readings or maintenance. This area should not contain potholes, puddles, hummocks, sidewalks, boardwalks etc. Sensors are placed in the primary area according to the siting specifications for that sensor. Generally, sensors shall be located so that they are at a distance from vertical obstructions (e.g., trees, buildings, other sensors, etc.) of at least four times the height of the obstruction for rain gauges, and two times the height of the obstruction for Stevenson screens.

Secondary Area - This provides protection and an undisturbed zone surrounding the primary zone. The secondary area should generally be level with turf, natural grass or the natural ground for the geographical location. The secondary area should be protected by a single rail, cable or chain link fence as necessary to provide security for the instrumentation and to prevent encroachment from vehicles, humans and large animals. The primary and secondary areas, together, are also referred to as the meteorological compound.

Protected Area - This area surrounds the secondary area and provides protection from itinerant activities and operations that may compromise the sensor readings. The area should be

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undeveloped, cleared of tall vegetation and shall be without obstructions. The area should be free from buildings, active roads, tarmacs, vehicle parking areas, taxiways, snow clearance operations, exhaust from aircraft, vehicle and aircraft movement or any activity or object that may adversely affect meteorological readings. The protected area may contain the anemometer provided the anemometer siting standards are met.

After a site is completed it is important to prepare and maintain documentation of the site. This documentation should include photographs and scaled drawings indicating the features of the site, the location of the instruments and ducting, and any other information which aids in accurately describing the site.

See the attached diagrams showing appropriate layouts for meteorological exposures.

Siting Standards - Airport - Meteorological Station

The purpose of these stations is to obtain data representative of the runway complex for the support of forecasting and aircraft operations.

If the runway complex is affected by features such as slopes which result in cold air drainage or ponds which result in increased humidity etc., then the site should be located to reflect these effects.

The site should be located:

- (i) on open, level ground with a primary area at least 15m x 15m covered with short grass or at least on natural ground with a secondary turf covered area of at least 30m x 30m, surrounded as necessary by a single rail, cable, or chain link fence, and a protected area of 90m x 90m centered on the primary area.
- (ii) such that sensors shall be at a distance from vertical obstructions of at least four times the height of the obstruction for rain gauges, and two times the height of the obstruction for Stevenson screens
- (iii) in an area which provides ease of access for the observer and for the maintenance of instruments and the installation of electrical ducts
- (iv) not more than 3 km from the geometric centre of the runway complex, i.e., the airport reference point (ARP)
- (v) in accordance with Airport Zoning Regulations

Locations for sites which shall be avoided are:

- (i) the top of hills
- (ii) in hollows, at the bottom of narrow valleys, and near hills or ridges, etc.
- (iii) near isolated ponds or streams
- (iv) near roads ,tarmacs, vehicle parking areas where snow clearance operations or exhaust from aircraft, vehicles, or buildings can affect the site
- (v) where there is excessive human or animal traffic
- (vi) where excessive drifting snow accumulates
- (vii) where future development of the airport is likely to occur

Siting Standards - Non Airport - Meteorological Station

These sites are designed to obtain synoptic data of the region in which they are located, for both forecasting and climatological purposes.

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The site should be located:

- (i) on open, level ground with a primary area at least 15m x 15m covered with short grass or at least on natural ground with a secondary turf covered area of at least 30m x 30m, surrounded as by a single rail, cable, or chain link fence, and a protected area of 90m x 90m centered on the primary area.
- (ii) such that sensors shall be at a distance from vertical obstructions of four times the height of the obstruction for rain gauges, and two times the height of the obstruction for Stevenson screens.
- (iii) in an area which provides ease of access for the observer and for maintenance of instruments and the installation of electrical ducts.

Locations for sites which shall be avoided are:

- (i) the top of hills
- (ii) in hollows, at the bottom of narrow valleys, and near hills or ridges, or cliffs
- (iii) near isolated ponds or streams
- (iv) near roads where snow from snow clearance operations, or dust, can affect the site
- (v) where there is excessive human or animal traffic
- (vi) where excessive drifting snow accumulates
- (vii) near vehicle parking areas
- (viii) where heat is exhausted by vehicles or buildings

Siting Standards - Precipitation and Precipitation and Temperature Stations

These stations are designed to obtain climatological data of the region in which they are located.

The site should be located:

- (i) on open, level ground with a primary area at least 15m x 15m covered with short grass or at least on natural ground with a secondary turf covered area of at least 30m x 30m, surrounded as by a single rail, cable, or chain link fence, and a protected area of 90m x 90m centered on the primary area.
- (ii) such that sensors shall be at a distance from vertical obstructions (e.g., trees, buildings, etc.) of at least four times the height of the obstruction for rain gauges, and two times the height of the obstruction for Stevenson screens.
- (iii) in an area which provides ease of access for the observer.

Locations for sites which shall be avoided are:

- (i) the top of hills
- (ii) in hollows, at the bottom of narrow valleys and near hills, ridges, or cliffs
- (iii) near isolated ponds or streams
- (iv) near roads where snow from snow clearance operations, or dust, can affect the site
- (v) where there is excessive human or animal traffic
- (vi) where excessive drifting snow accumulates.
- (vii) near vehicle parking areas
- (viii) where heat is exhausted by buildings or vehicles.

Siting Standards - Anemometer

The anemometer may be collocated with other instruments or on a separate site.

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The site should be located:

- (i) on a site similar to that for other instruments
- (ii) such that the distance from vertical obstructions shall be at least ten times the height of the obstruction
- (iii) on an area which provides ease of access for maintenance and the installation of electrical ducts.

In addition, the sites at airports should be located:

- (i) close to the geometric center of the airport (ARP) and in accordance with airport zoning regulations
- (ii) to reflect wind conditions over the runway complex

Locations which shall be avoided are:

- (i) the top of hills
- (ii) in hollows, at the bottom of narrow valleys, or near hills and ridges
- (iii) where future development of the airport is most likely to occur.

Siting Standards - Automatic Meteorological Stations

The standards for siting airport and non-airport stations generally apply to the siting of automatic stations. Equipment specifications place restrictions on the distance (cable run) that various sensors can be placed from the cabinet. Installation manuals for the various types of automatic station and sensors should be consulted for this information.

The type and number of sensors vary depending on the type of automatic station, location, and power supply.

Because the instruments are unattended for long periods of time, it is recommended that the best possible site be selected.

The site should be located:

- (i) on open, level ground at least 90m x 90m, covered with short grass or at least natural cover, protected with suitable fencing to prevent human and animal traffic, and to discourage vandalism
- (ii) such that sensors shall be at a distance from vertical obstructions of at least four times the height of the obstruction for rain gauges, and two times the height of the obstruction for Stevenson screens, and in the case of the anemometer at least ten times the height of the obstruction
- (iii) where it is accessible for maintenance
- (iv) where electrical power is available if required
- (v) with a suitable level area to accommodate an unobstructed line-of-sight for both cloud and visibility measurements, depending on the operating requirements of the system being used

Locations which shall be avoided are:

- (i) the top of hills
- (ii) in hollows, at the bottom of narrow valleys, and near ridges or hills or cliffs
- (iii) near isolated ponds or streams
- (iv) near roads where snow removal equipment can affect the site
- (v) where excessive drifting snow accumulates
- (vi) where artificial radiation will affect cloud and visibility sensors
- (vii) where there is excessive human or animal traffic

SITING STANDARDS FOR METEOROLOGICAL OBSERVING SITES

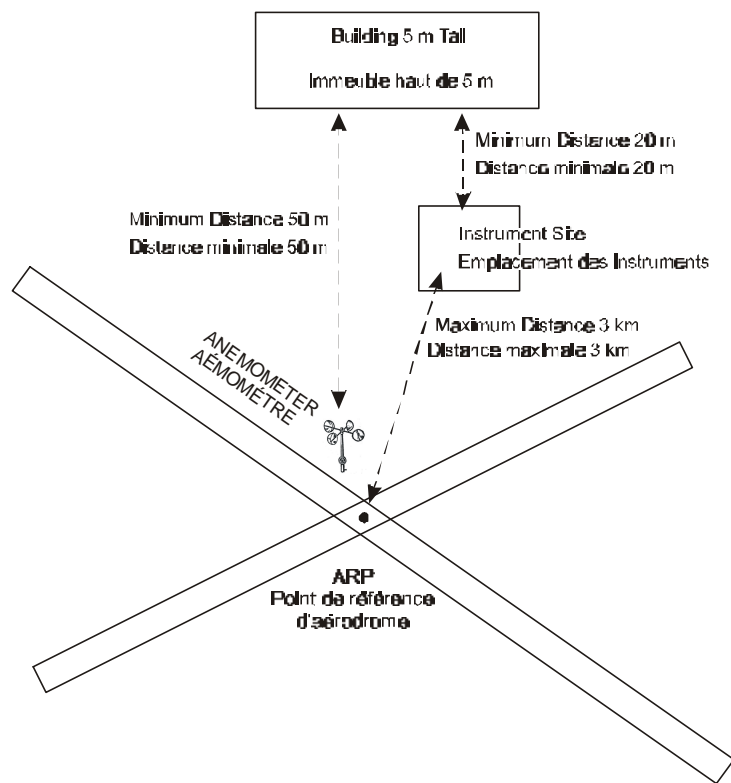
- (viii) near vehicle parking areas
- (ix) where heat is exhausted by vehicles or buildings

Examples of Meteorological Siting Layouts

The attached diagrams show the standards for meteorological compound locations at airports and ideal separations from obstructions. Also shown are sample meteorological instrument compound layouts for auto and staffed sites.

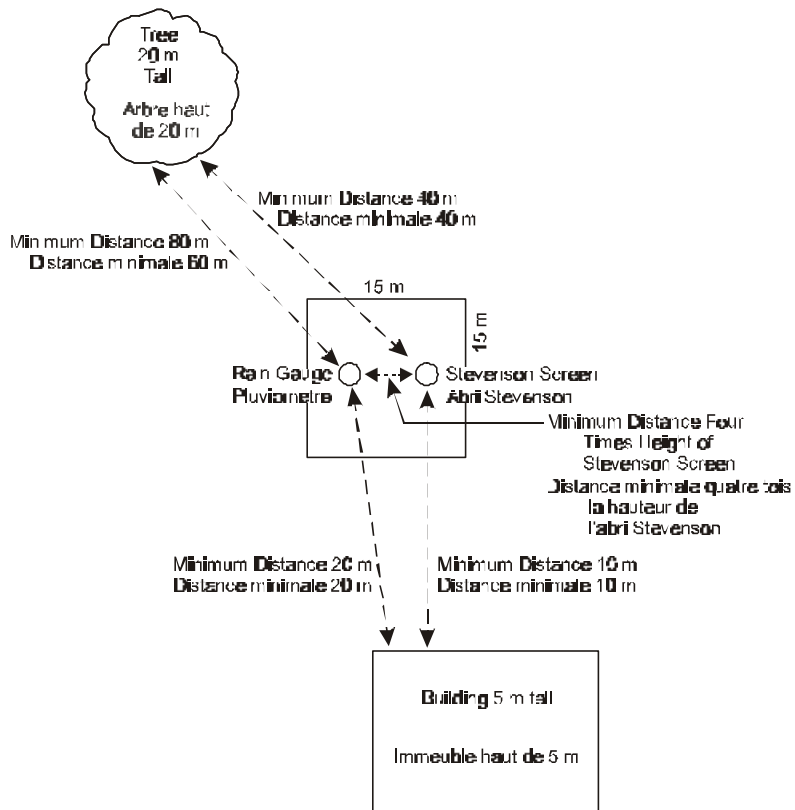
SITING STANDARDS FOR METEOROLOGICAL OBSERVING SITES

Airport Siting Standards / Normes D'Emplacement D'Aéroport



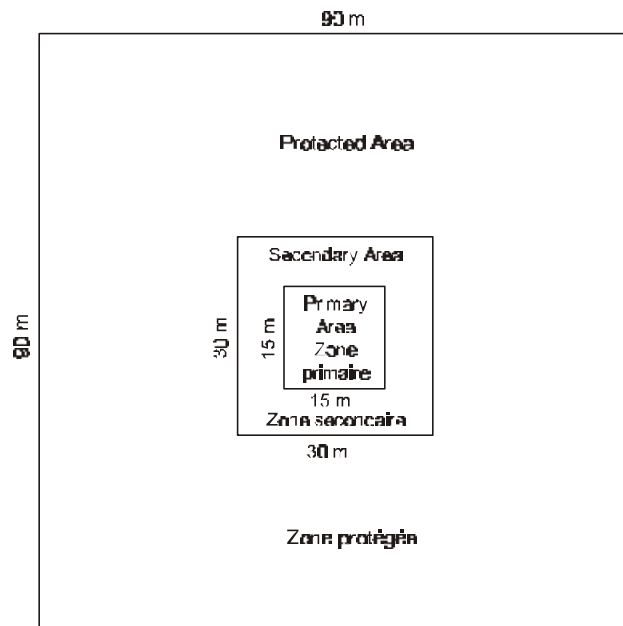
SITING STANDARDS FOR METEOROLOGICAL OBSERVING SITES

Placement from Obstructions Standards / Placement des normes d'obstructions



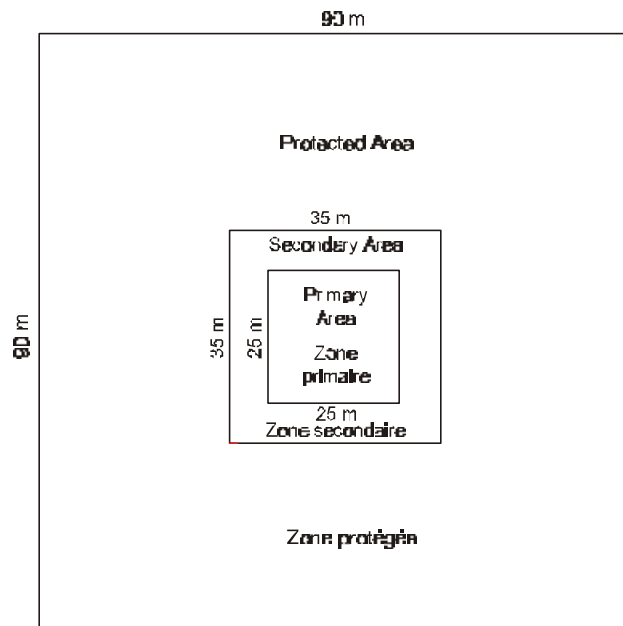
SITING STANDARDS FOR METEOROLOGICAL OBSERVING SITES

IDEAL AIRPORT AND NON-AIRPORT METEOROLOGICAL SITE SITE MÉTÉOROLOGIQUE IDÉAL À UN AÉROPORT OU HORS D'UN AÉROPORT



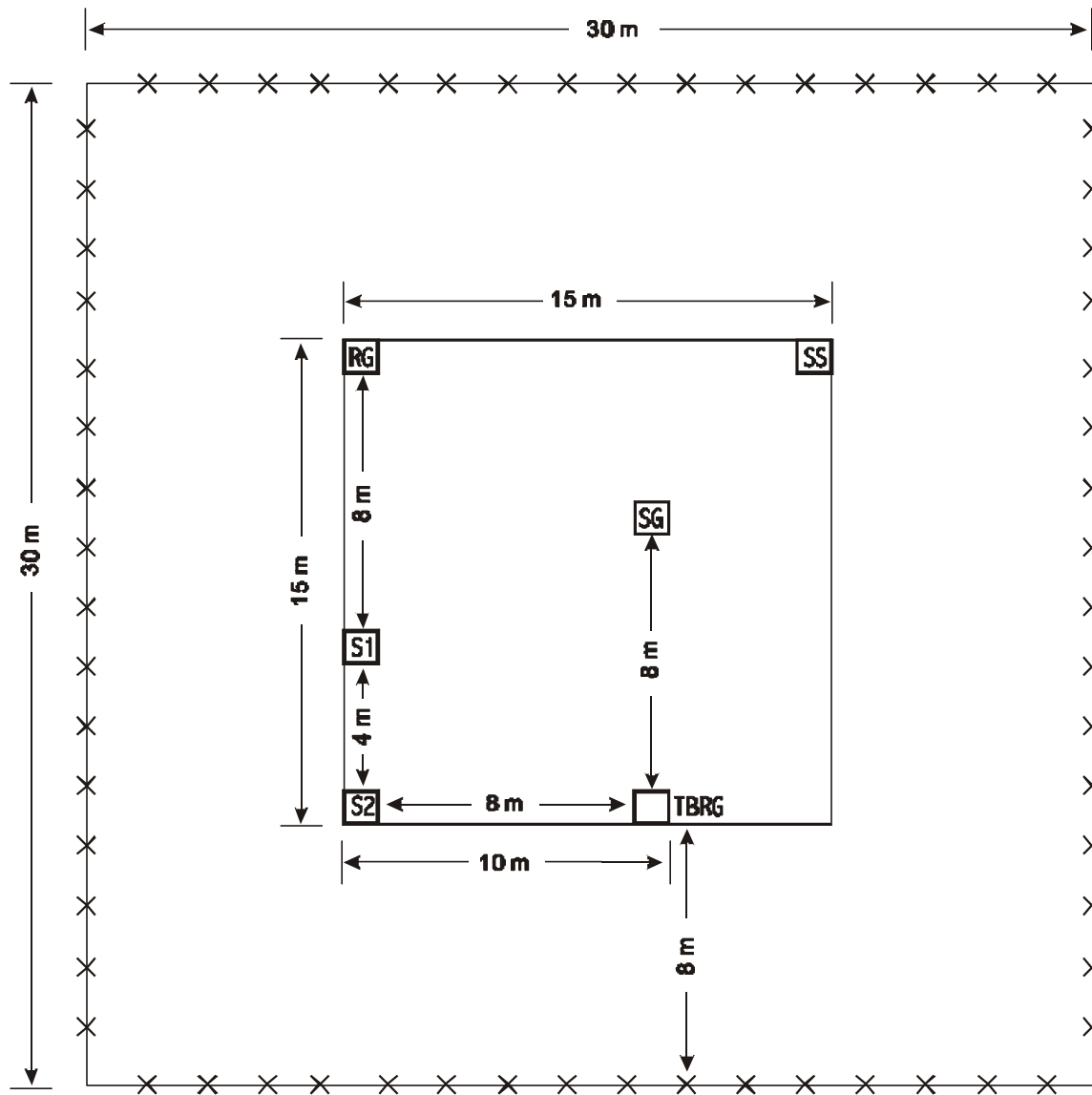
SITING STANDARDS FOR METEOROLOGICAL OBSERVING SITES

Autostation Sensor Compound Standards Normes De Composé De Capteur D'Autostation



SITING STANDARDS FOR METEOROLOGICAL OBSERVING SITES

TYPICAL METEOROLOGICAL COMPOUND – STAFFED OBSERVATIONS EMPLACEMENT MÉTÉOROLOGIQUE TYPIQUE – OBSERVATIONS FAITES PAR DU PERSONNEL



- RG = Ordinary rain gauge / Pluviomètre ordinaire
- S1 = Screen 1 / Abri 1
- S2 = Screen 2 / Abri 2
- SG = Nipher snow gauge / Nivomètre Nipher
- TBRG = Tipping bucket rain gauge / Pluviomètre à auget basculeur
- SS = Sunshine recorder / Héliographe
- x-x- = 2 m security fence / Clôture de sécurité de 2 m