

**Ministry of the Environment and Climate Change
Regional Meteorological Data
Processed with AERMET 16216
(October 2017)**

The regional meteorological data was developed by the Ministry of the Environment and Climate Change's (MOECC's) Environmental Monitoring and Reporting Branch (EMRB) for use in AERMOD modelling under Ontario Regulation 419/05: Air Pollution – Local Air Quality (O. Reg. 419/05).

This data and the ministry's Air Dispersion Modelling Guideline for Ontario ([ADMGO](#)) are available at [the Ministry's website](#). This data is also available on CDs upon request from the ministry's Public Information Centre located at 900 Bay Street, Toronto, ON M7A 1N3, 416-325-4000.

This data includes the updated AERMOD-ready regional meteorological data in addition to the original AERMET-ready surface and upper air data.

- The AERMOD-ready regional meteorological data provides a unique, easily accessible, ready-for-use resource for air dispersion modellers. **No approval is required to use the appropriate AERMOD-ready regional meteorological datasets.**
- In cases where the surface characteristics at a site cannot be characterized by the AERMOD-ready regional meteorological data, the AERMET-ready data may be used with site specific land use conditions -- **the original AERMET-ready (surface and upper air) data must be used as-is.** The choice of surface characteristics (surrounding land use) must be well documented and provided as part of a proponent's submission. Proponents must obtain approval from EMRB if values for the surface characteristics, other than those presented in the [ADMGO](#), are proposed. It is strongly recommended that modellers consult EMRB for guidance or review prior to the completion of model runs.

AERMOD-ready local or site-specific meteorological data may be obtained from EMRB by submitting a completed [site specific meteorological data request form](#) by [e-mailing to EMRB](#) or by regular mail to The Environmental Monitoring and Reporting Branch, 125 Resources Rd, Toronto ON M9P 3V6.

EMRB should be consulted for customized meteorological data for use with non-regulatory AERMOD defaults (e.g. wet/dry deposition) and more complex modelling applications (e.g. odours, combined air modelling and monitoring).

Terms of use for this data are available on the [ministry's website](#). Environment Canada and the National Oceanic and Atmospheric Administration (NOAA) must be accredited as the source of the original meteorological data used to produce this data.

Regional Meteorological Data

EMRB has prepared the regional meteorological data for use in Tier 2 modelling as described in the [ADMGO](#). The surface meteorological data was obtained from the Toronto (Pearson Airport), London, Sudbury and Ottawa stations, in Ontario, along with the International Falls (Minnesota) and Massena (New York) stations, in the United States. It contains ceiling height, wind speed and direction, air temperature, total cloud opacity and total cloud amount for the 5 year period from 1996 to 2000.

Table 1 lists the locations of the surface meteorological sites and the upper air station used for each site. Table 2 provides the co-ordinates of the upper air stations.

Table 1. Surface Meteorological Sites Location and Corresponding Upper Air Stations

Surface station	ID	Latitude	Longitude	Height above sea level, metres	Province/ State	Upper Air Station to be used
Sudbury	6068150	46.62	-80.8	348	ONT	White Lake
Ottawa	6106000	45.32	-75.67	114	ONT	Maniwaki
London	6144475	43.03	-81.15	278	ONT	White Lake
Toronto	6158733	43.67	-79.6	173	ONT	Buffalo
Massena	72622 (94725)	44.9	-74.9	65	NY	Albany
International Falls	72747 (14918)	48.57	-93.37	359	MN	International Falls

Note: Anemometer height is 10 meters for all stations

Table 2. The Location of Upper Air Sites

Upper Air station	ID	Latitude	Longitude
White Lake	726320	42.7	-83.47
Maniwaki	7034480	46.23	-77.58
Buffalo	725280	42.93	-78.73
Albany	725180	42.75	-73.8
International Falls	727470	48.57	-93.37

The surface meteorological data was pre-processed to give a minimum wind speed of 1 m/s and to reduce the amount of missing data. The pre-processing steps were:

1. Treatment of Wind Speed and Direction for calm/missing conditions.

If the original data had approximately 5% or more missing or calm hours, these missing/calm hours were first filled by a nearby station with similar climatology. To be specific, missing/calm hours in original International Falls and Massena datasets were filled by Kenora and Dorval data, respectively. The remaining missing/calms hours (if less than 6 consecutive hours) were then interpolated. The interpolated wind directions were randomized. Wind speeds were set to 4 km/h for hours with wind speeds lower than 4 km/h.

2. Interpolation of missing values.

For each meteorological element, missing data was filled with those from a nearby station. For remaining missing hours, linear interpolation was applied if the number of missing hours was up to six consecutive hours in a row. Missing data at the very beginning and at the very end of

the data was left as "missing" (no extrapolation is applied). If the number of consecutive hours with missing values for the element was more than 6, the values were left as "missing".

AERMET Processing

Regional meteorological datasets are generated in the AERMET stage 3 processing step, using three uniform (i.e. wind independent) surface conditions, called "URBAN", "FOREST", "CROPS". In other words, it is assumed that surface conditions are the same in all directions. The surface condition parameters needed are the Albedo (A), the Bowen ratio (B_o) and the surface roughness (Z_o). The parameter values in Tables 3, 4 and 5 below were derived from data in Tables 5.1, 5.2 and 5.3 of the [ADMGO](#). **Note that the data in Tables 5.1, 5.2 and 5.3 reflect the most current land use characteristics in the AERSURFACE User's Guide (revised 2013); and supersede those presented in Tables 6.6 to 6.8 of the ADMGO (i.e. the data listed in Tables 6.6 to 6.8 of the ADMGO are outdated and should no longer be used).**

Table 3. "URBAN" Surface Conditions - all surface parameters are set to urban values

Season	Parameter		
	A	B_o	Z_o
Winter	0.35	0.5	1
Spring	0.18	1.5	1
Summer	0.18	1.5	1
Fall	0.18	1.5	1

Table 4. "FOREST" Surface Conditions - all surface parameters are set to a mixture of coniferous (50%) and deciduous (50%) forests

Season	Parameter		
	A	B_o	Z_o
Winter	0.43	0.5	0.90
Spring	0.14	0.7	1.15
Summer	0.14	0.3	1.30
Fall	0.14	0.9	1.30

Table 5. "CROPS" Surface Conditions - all surface parameters are set to a mixture of Grassland (45%), Cultivated Crop Land* (45%), Coniferous (5%) and Deciduous (5%) forest

Season	Parameter		
	A	B_o	Z_o
Winter	0.58	0.5	0.097
Spring	0.16	0.4	0.150
Summer	0.18	0.6	0.237
Fall	0.18	0.9	0.237

* In the latest AERSURFACE user's guide, the land use category Cultivated Crop Land was replaced by 4 sub-categories (81-84). For presentation purposes, we still use Cultivated Crop Land in this table caption, but its land use characteristics values are calculated as an average of the 4 sub-categories (81-84).

Geographic Application of the Regional Meteorological Datasets

The application of the regional meteorological datasets across Ontario is described in Table 6. This table lists the MOECC regions and district/area offices for which each of the meteorological datasets is most applicable. A graphical representation of the geographic application of these regional datasets is available in Figure 6.1 of the [ADMGO](#). The corresponding file names are listed in Table 7.

Table 6. Application of Regional Meteorological Datasets for MOECC Regions and District/Area Offices

Meteorological dataset	MOECC Region	MOECC District/Area Offices
Sudbury	Northern	Sudbury, North Bay, Sault Ste. Marie, Timmins
Ottawa	Eastern	Ottawa, Peterborough, Belleville
London	South Western	London, Windsor, Sarnia
	West Central	Hamilton, Niagara, Guelph
Toronto	Central	Toronto, York-Durham, Halton-Peel, Barrie
	South Western	Owen Sound
Massena	Eastern	Kingston, Cornwall
International Falls	Northern	Thunder Bay, Kenora

Table 7. Meteorological Data File Names

Meteorological Data	AERMOD-ready			AERMET-ready	
	CROPS	FOREST	URBAN	Surface	Upper Air
Sudbury	Sudbury_crops_16216.sfc Sudbury_crops_16216.pfl	Sudbury_forest_16216.sfc Sudbury_forest_16216.pfl	Sudbury_urban_16216.sfc Sudbury_urban_16216.pfl	Sudbury.txt	WhiteLake.ua
Ottawa	Ottawa_crops_16216.sfc Ottawa_crops_16216.pfl	Ottawa_forest_16216.sfc Ottawa_forest_16216.pfl	Ottawa_urban_16216.sfc Ottawa_urban_16216.pfl	Ottawa.txt	Maniwaki.ua
London	London_crops_16216.sfc London_crops_16216.pfl	London_forest_16216.sfc London_forest_16216.pfl	London_urban_16216.sfc London_urban_16216.pfl	London.txt	WhiteLake.ua
Toronto	Toronto_crops_16216.sfc Toronto_crops_16216.pfl	Toronto_forest_16216.sfc Toronto_forest_16216.pfl	Toronto_urban_16216.sfc Toronto_urban_16216.pfl	Toronto.txt	Buffalo.ua
Massena	Massena_crops_16216.sfc Massena_crops_16216.pfl	Massena_forest_16216.sfc Massena_forest_16216.pfl	Massena_urban_16216.sfc Massena_urban_16216.pfl	Massena.txt	Albany.ua
International Falls	IntFalls_crops_16216.sfc IntFalls_crops_16216.pfl	IntFalls_forest_16216.sfc IntFalls_forest_16216.pfl	IntFalls_urban_16216.sfc IntFalls_urban_16216.pfl	Intfalls.txt	Intfalls.ua