# Agrometeorological Bulletins – The Case of Canada

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## Introduction

In Canada, agrometeorological services are provided by two federal departments: the Department of Environment (through the Meteorological Service of Canada (MSC) and the Department of Agriculture and Agri-food (AAFC). The MSC is responsible for the provision of meteorological information applicable to the agricultural sector. AAFC conducts agricultural research and development (R&D) and provides information on plant diseases, pest infestations, pasture and dugout using inputs from various sources, including from Environment Canada.

The Department of Environment, commonly known as Environment Canada (EC) is organized into five more or less independent regions that provide various agrometeorological information and products to respond to their clients' needs. Consultation services and special products are provided on a cost recovery basis.

The private sector is slowly gearing up to provide value-added products for the agricultural sector. Some organizations have their own network and provide specialized information to their clients. In all cases EC (MSC) works in partnerships with the private sector facilitating its development.

## Meteorological Service of Canada - MSC

### Agrometeorological Bulletins and Contents

There are no standard agrometeorological bulletins issued by the MSC. Some regions produce bulletins while others do not. Agricultural information is usually included in the body of the public forecast bulletin during the growing season. Information on relative humidity, drying index and precipitation amounts are usually included for free for the first two days

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of the forecast. Frost warnings and special weather statements such as for dry weather and heavy precipitation are provided free of charge.

The Regions have commercial services for consultation and specialized user designed products. Information such as 5 day forecast, amounts of precipitation, growing degree-days and corn heat units are usually charged to clients. To illustrate please see figure 1, a regular farm forecast issued by Ontario Region and figure 2, a specialized forecast issued in co-operation with the provincial department of Agriculture of Prince Edward Island to assist potato growers with decision-making on the spraying of pesticides.

**Figure 1. Agrometeorological Bulletin issued by Ontario Region, August 2001**

**Middlesex-Oxford**
Today..Sunny With Cloudy Periods.

Winds Southwest 30 km/h.

High Near 34. Minimum Humidity 50 Percent.

Drying Index Very High at 79.

Tonight..30 Percent Chance of Showers. Risk of a Thunderstorm Overnight.

Winds Southwest 20 km/h.

Low Near 22. Maximum Humidity 95 Percent.

Friday..30 Percent Chance of Showers. Risk of a Thunderstorm in the Morning.

Winds Northwest 20 km/h.

High Near 27. Minimum Humidity 50 Percent.

Drying Index High At 54.

**Southwestern Ontario**
Saturday and Sunday. Sunny With Cloudy Periods. Low Near 15. High Near 28.

Monday. Sunny With Cloudy Periods. Low Near 17. High Near 30.

Normals for the Period..Low 14. High 26.

**Latest Observations on Aug 9, 2001 Edt**

| Station | Time | Weather | Tmp (C) | Dew (C) | Wind (Km/H) | Rh (%) | Pres (Kpa) | Wind Chill or Lcl) Humidex (C) |
|---|---|---|---|---|---|---|---|---|
| London | 0900 | Sunny | 29 | 20 | W 17 | 58 | 101.30 | 37 (Hum) |

**Climate Data for Wednesday August 08.**

| Station | High (C) | Low (C) | Mean (C) | Precip (mm) | Chu | Gdd (Base 5 C) |
|---|---|---|---|---|---|---|
| London | 37.0 | 18.5 | 27.8 | Nil | 27 | 23 |

**Seasonal Accumulations For London**

| Parameter | Period | Year | Value |
|---|---|---|---|
| Growing Degree Day | Apr 1 To Aug 7 | 2001 | 1398 |
| **(Base 5; Celcius)** | | **2000** | **1310** |
| **Corn Heat Unit** | **Apr 23 To Aug 7** | **2001** | **2151** |
| | **May 6 To Aug 7** | **2000** | **1970** |
| Precipitation | Apr 1 To Aug 7 | 2001 | 169 Mm |
| | | 2000 | 564 Mm |

**The Accumulation of Corn Heat Units (CHUs) Starts on the Third Day of Three Consecutive Days of Mean Temperatures of 12.8 ° C or Greater**

**Data Sources**

Data used for public forecast bulletins are also used to derive agricultural information. These data come from the regular MSC surface observing network, model output and form the basic database used in the forecast production system. Where available, data from the farming communities, other levels of government and the private sector are also used in deriving agrometeorological information.

Each region is responsible for observing sites in its area of responsibility and collates the observations before sending them to the Canadian Meteorological Centre (CMC) for analysis and use in the atmospheric models. Analyzed data are sent back to the regions for their use in forecast production. (See figure 3)

MSC Atlantic - Maritimes Weather Centre

WBCN20 CWHX 310615

Farm Weather Forecast for the Mill River District issued by Environment Canada at 5 am Saturday July 31 1999. Valid for today and Sunday with an outlook for Monday Tuesday and Wednesday.

| Day | Time (ADT) | Temp (deg C) | DewPt (deg C) | Wind (km/h) | Amount (mm) | POP (%) | Weather |
|---|---|---|---|---|---|---|---|
| Sat | 05 am | 18 | 16 | S 20 | - | 0 | - |
| | 08 am | 19 | 16 | SW 20 | - | 0 | - |
| | 11 am | 21 | 16 | SW 17 | - | 0 | - |
| | 02 pm | 23 | 17 | S 19 | - | 0 | - |
| | 05 pm | 23 | 18 | S 21 | - | 0 | - |
| | 08 pm | 21 | 17 | S 24 | - | 0 | - |
| | 11 pm | 20 | 17 | S 23 | - | 0 | - |
| Sun | 02 am | 19 | 17 | SW 25 | - | 0 | - |
| | 05 am | 18 | 16 | SW 25 | - | 0 | - |
| | 08 am | 19 | 17 | S 26 | 1.3 | 77 | Rain |
| | 11 am | 19 | 18 | S 30 | 9.5 | 77 | Rain |
| | 02 pm | 19 | 18 | S 35 | 7.9 | 82 | Rain |
| | 05 pm | 19 | 18 | S 28 | 4.5 | 82 | Rain |
| | 08 pm | 20 | 19 | SW 31 | - | 7 | - |

*Outlook...*

*Monday.. Sunny with cloudy periods.*
*Low 19 High 21 Pop 10 Mean 6am-9pm wind 12 kmh.*

*Tuesday.. Sunny with cloudy periods.*
*Low 18 High 19 Pop 0 Mean 6am-9pm wind 9 kmh.*

*Wednesday.. Sunny with cloudy periods.*
*Low 18 High 19 Pop 0 Mean 6am-9pm wind 8 kmh.*

***Today's Drying Conditions - Good to Excellent***
***Sunday's Drying Conditions - Unfavourable***
***Yesterday's Evapotranspiration - 4.758 mm***
***Yesterday's Precipitation - 0.1 mm***

***Growing Season since May 1, 1999***
***Growing Degree Days - Base5: 1089.5 Base 7: 919.9***
***Base 10: 664.7***
***Evapotranspiration - 313.5 mm***
***Total Precipitation - 119.6 mm***

END

Fig 3: Example of the client product. Days 1 and 2 in bold, outlook (Days 3 to 5) in italics, observed data and seasonal running totals in bold, italics.

**Figure 2: Special bulletin for Potato Growers – Atlantic Region**

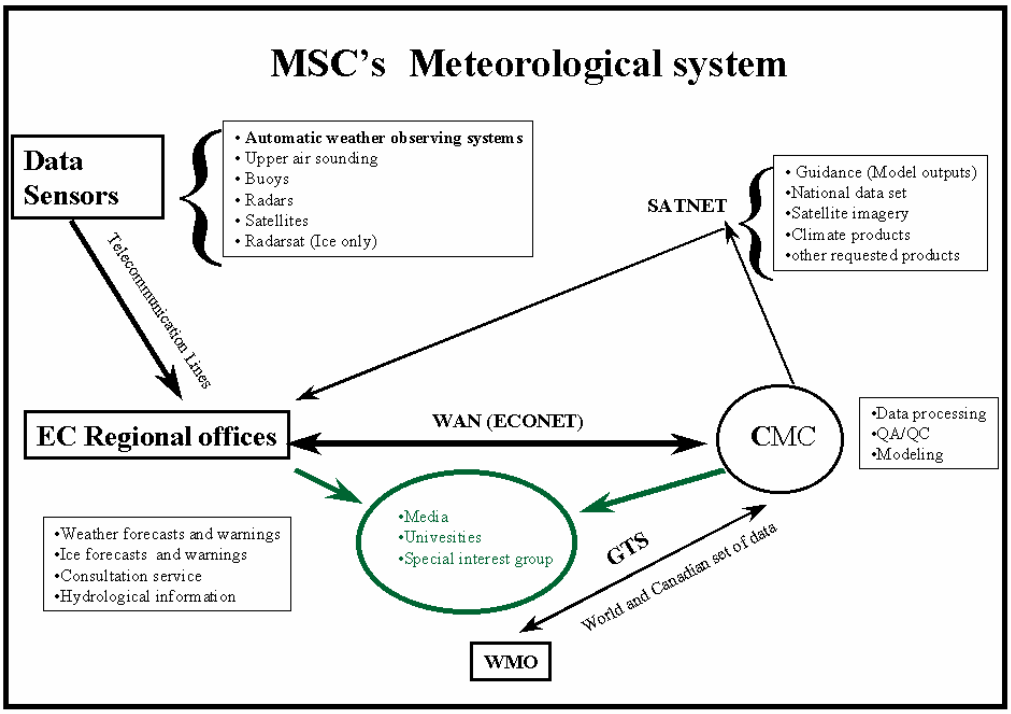



**Figure 3: MSC's Meteorological System**

## Target Audience and Dissemination Methods

The main users of MSC agrometeorological products are farmers, extension agencies, provincial Ministries of Agriculture, agricultural research facilities, agricultural engineers, and commodity experts. Chemical companies also use MSC information (mainly climate information) for the planning of production and dispatch of their products. Various means are used to distribute the information: Internet, FTP, media wire, ATADs (Automatic Telephone Answering Devices), weather radio and e-mail.

## Feedback from Users and Economic Values of Agrometeorological Bulletins

Although there is no organized way of obtaining feedback from users, most of the products are available on the Internet and effort is being made to allow users to make comments via this medium. As to the economic value of agrometeorological bulletins, very little has been done but some global studies on the impacts of MSC environmental predictions (e.g.

temperature, winds, precipitation, humidity) on agriculture were conducted. The following is a summary of findings:

"Day-to-day weather associated with temperature, precipitation, and winds has the potential to disrupt decision-making, thereby adding to the "cost of doing business". Thus accurate weather and climate information can make an important contribution in ensuring the economic efficiency and competitiveness of weather sensitive industries in Canada (Agriculture, public and recreation, construction, forestry, utilities, transport and fisheries). The benefit/cost ratio of short-term weather information for weather sensitive Canadian industries has been estimated (to be in excess of 10 to 1. " (The DPA Group Inc, 1985).

Findings from other studies include:

- A University of Guelph Masters thesis in 1996 estimated that the value of the EC precipitation forecast information to hay and winter wheat farmers in Southern Ontario to be in the range of over $50 to $85/ha. Gross values for hay farmers were estimated at over $56M per year in 1994 and 1995.
- Improved use of current forecasts has been shown to have economic and environmental benefits through increased efficiency of fertilizer applications. A 1997 study suggests that 15% of all fertilizer used is wasted when washed away by heavy rains, with $22M annual potential saving with more effective use of precipitation forecasts. Environmental benefits of better-forecast utilization include reduced nitrogen pollution in the soil and water.
- Cost of recent prairie droughts have been less than expected due to improved climate forecasting, which permits drought-prevention strategies such as piling snow to enable more water to enter the soil.
- A 1992 study on the use of weather information in spraying fungicide on tomato crops in southern Ontario determined that timing the spraying based on weather information (temperature and dew point) resulted in $500K savings in a 10,000 hectare. Benefits include labor and cost savings for growers; reduced likelihood that target disease organisms will become chemical-resistant due to over-use; and decreased chemical load on the environment.

Note; Values quoted in Canadian dollars

## Agriculture and Agri-Food Canada (AAFC)

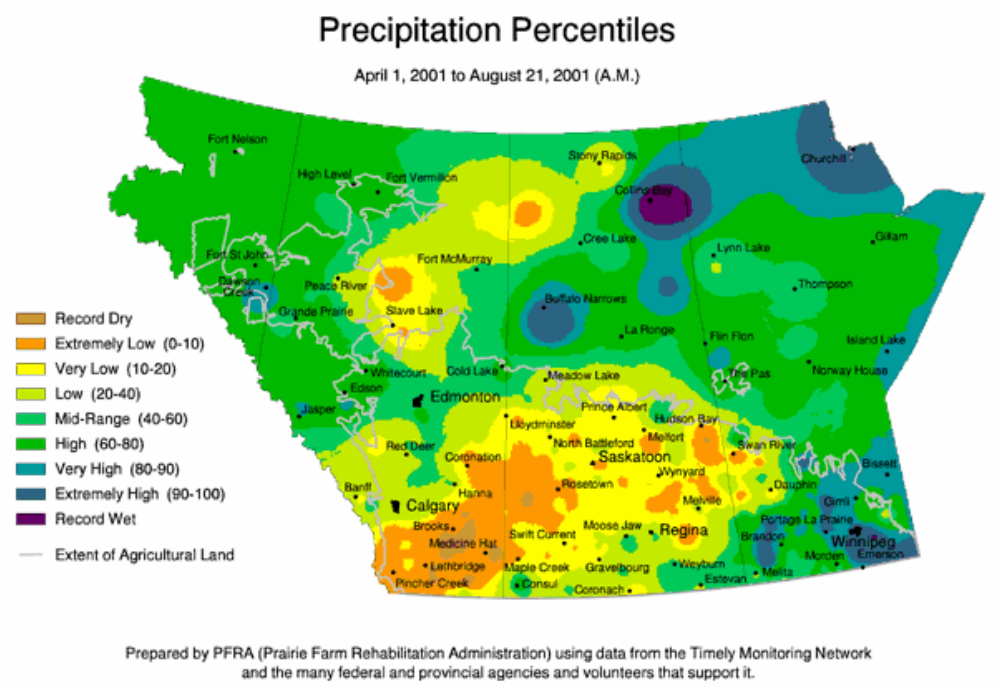
Agriculture and Agri-Food Canada provides information, research and technology, policies and programs to achieve security of the food system, health of the environment and innovation for growth.

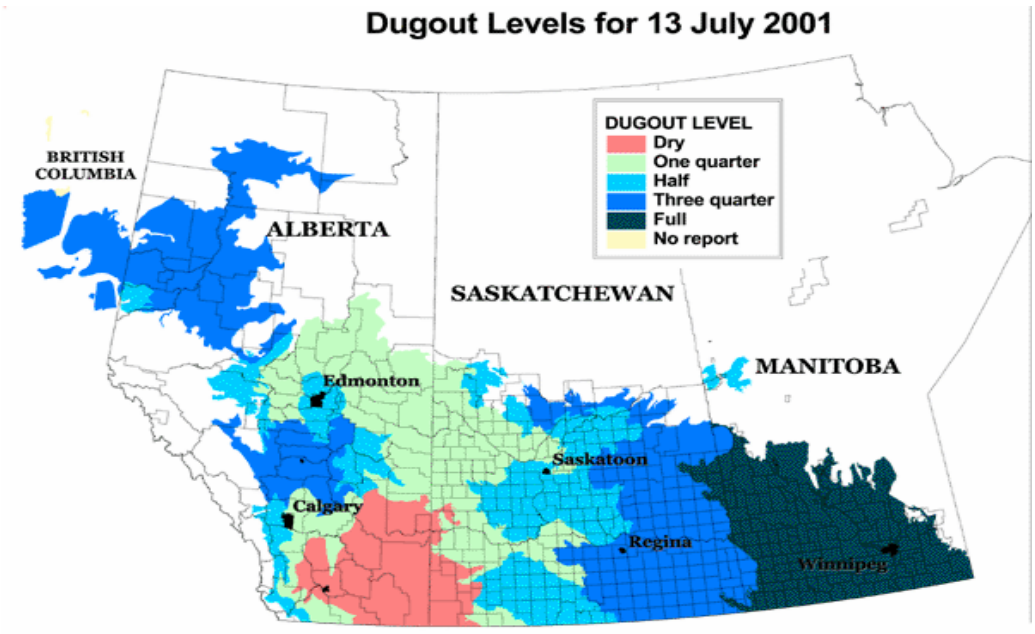
In addition to regular weather information provided by Environment Canada, a branch of AAFC, the Prairie Farm Rehabilitation Administration (PFRA) provides special agrometeorological support to the Canadian Prairie which represents about 80% of Canadian farm lands. Dugout, drought condition maps and precipitation and temperature anomaly maps are made available on the Internet. Data from Environment Canada, the Timely Climate Monitoring Network (TCMN) and other agencies are used to derived these maps. Examples of these maps are provided in figure 4. TCMN data are climate data gathered on a timely basis (every day or on a weekly basis) by volunteers on a contractual basis ($1500/year) for the period February to October of each year. Environment Canada provides training. TCMN data are quality assured by Environment Canada and managed by a private company, Agrometeorological Centre of Excellence (ACE) which sells the quality assured data to subscribers such as the PFRA.

AAFC, through its research directorate and in coordination with Environment Canada, issue bulletins on Diamond back moth infestation potential for all Canadian farmlands. Environment Canada trajectory models are used to infer potential area for infestation.

## Shortcomings and Limitations for the Preparation of Agrometeorological Bulletins

The lack of resources to develop and implement standard agrometeorological bulletins tailored to user needs is a major issue the MSC is addressing. The present situation of adding some agrometeorological information to public bulletins does not usefully target the agricultural sector. The advent of Internet provides MSC and AAFC with an excellent dissemination vehicle but this technology is not yet widely used by farmers.




**Suggestions for Improved Agrometeorological Bulletins**

**Figure 4: Examples of AAFC (PFRA) Products**

## Suggestions for Improved Agrometeorological Bulletins

In order for the agrometeorological bulletins to be useful and effective it is suggested that separate, stand-alone agrometeorological bulletins be issued with the following content:

- A warning section: (Frost, Heavy rain, Hail)
- Basic contents - Forecasts (up to 48h): Sky conditions, Temperature, winds, precipitation amount, Relative Humidity, drying index.
- Additional information:
  - Growing degree days to date versus last year
  - Total precipitation amount to date versus last year amount for the same period
  - Corn Heat Unit (CHU)
  - Any other relevant information
- Outlook section: Day 3, 4 and 5 with the following information: Sky condition, max and min temperatures and average wind speed.

It is also suggested that MSC commercial services be limited to consultation services only. Data packaging and specialized products should be left to the private sector, thus contributing to its development

## References

**The DPA Group Inc, 1985. Economic Value of Weather Information in Canada, DPA Final Report to Environment Canada.**

Abstract: The major requirement of this study is to estimate the current value of short-range weather forecasts to the entire Canadian economy. For this study, a pragmatic, empirical and descriptive approach was adopted. The study describes how, when and why weather information is used by individual companies and estimates the economic value of observations and short-range forecasts to each company. These empirical estimates have been extrapolated to each industry sub-sector and aggregated to provide an estimate of the economic value of short-range weather forecasts to the Canadian economy as a whole.

Interviews were held with users of weather information from each of the major economic sectors and climate regions of Canada. The application of weather information was examined for each major weather sensitive activity and estimates obtained of the costs and value of taking modified

actions based on short-range weather forecasts. The calculated net value for each user interviewed is the net value allowing for all of the costs involved, including the costs of taking action when forecasts prove to be either correct or incorrect and the costs incurred by lost value when a non-forecast threat event occurred.

Net estimates of the value of weather information were related to the total value of output for each user interviewed in order to obtain a coefficient showing the value of short-term forecasts as a proportion of total output. The individual estimates most often provided a narrow range of value coefficients, for example from 4% to 11% of total output. Considering the frequency of consistent responses, a conservative (average) estimate of the value coefficient for each economic sub-sector was then made and applied to the entire sub-sector.

Conclusions: The estimates of the approximate first order (direct) economic value of short-term weather forecasts are as follows:

| Sector | $ Millions |
|---|---|
| Agriculture | 685-785 |
| Public and Recreation | 300-400 |
| Construction | 100-200 |
| Forestry | 90-100 |
| Utilities | 80- 85 |
| Transport | 55- 60 |
| Fisheries | 20- 50 |
| Total | $1330-1680m |

The budget for the MSC Weather Services program sub-activity was approximately $124 million in 1983/84. Thus, the benefit/cost ratio of short-term weather information would be in excess of 10 to 1. Considering that the quantified value of short-term forecasts calculated in this study under-estimate the total value involved (since non-quantifiable benefits such as safety were left out and other important industries such as defense, which benefit from weather information and are included in the budget, were not included), the actual benefit/cost ratio would be much higher than 10 to 1.

**Jason Robert Turner, 1996. "Value of Weather Forecast Information for Dry Hay and Winter Wheat Production in Ontario".** A Thesis presented to the Faculty of Graduate Studies of the University of in partial fulfillment of requirements for the degree of Master of Science May 1996.

Abstract: A framework for estimating the value of weather forecast information in agricultural production was developed. Certainty equivalent profit models were developed to estimate weather forecast information value for dry hay and winter wheat harvest using 1994 and 1995 forecast data from Windsor, London and Waterloo weather office. Values for Environment Canada, improved and perfect forecast methods were estimated. Impact of producer risk preference on forecast value was investigated. Average value of the Environment Canada, improved and perfect forecast was $53.74/ha/yr, $65.79/ha/yr and $90.46/ha/yr respectively for dry hay harvest. Risk preference had no impact on the value of forecast information for dry hay production. Average value of the Environment Canada forecast for winter wheat harvest ranged from $84.72/ha/yr to $161.08/ha/yr for Arrow-Pratt coefficient values of 0.01 to 0.00001 respectively. Perfect forecast average value ranged from $161.08/ha/yr to $174.03/ha/yr for Arrow-Pratt coefficient values of 0.00001 to 0.01 respectively.

**http://www.weatheroffice.ec.gc.ca:** weather website of Environment Canada

**http://www.agr.ca:** Agriculture and Agrifood Canada website

## Acronyms

| | |
|---|---|
| **EC** | Environment Canada (Department of Environment) |
| **MSC** | Meteorological Service of Canada |
| **CMC** | Canadian Meteorological Centre |
| **WAN** | Wide Area Network |
| **GTS** | Global Telecommunication System |
| **SATNET** | SATellite NETwork |
| **AAFC** | Agriculture and Agri-Food Canada (Federal Department of Agriculture) |
| **PFRA** | Prairie Farm Rehabilitation Administration |
| **FTP** | File Transfer Protocol |
| **WMO** | World Meteorological Organization |
| **ATAD** | Automatic Telephone Answering Device |
| **TCMN** | Timely Climate Monitoring Network |
| **ACE** | Agrometeorological Centre of Excellence |