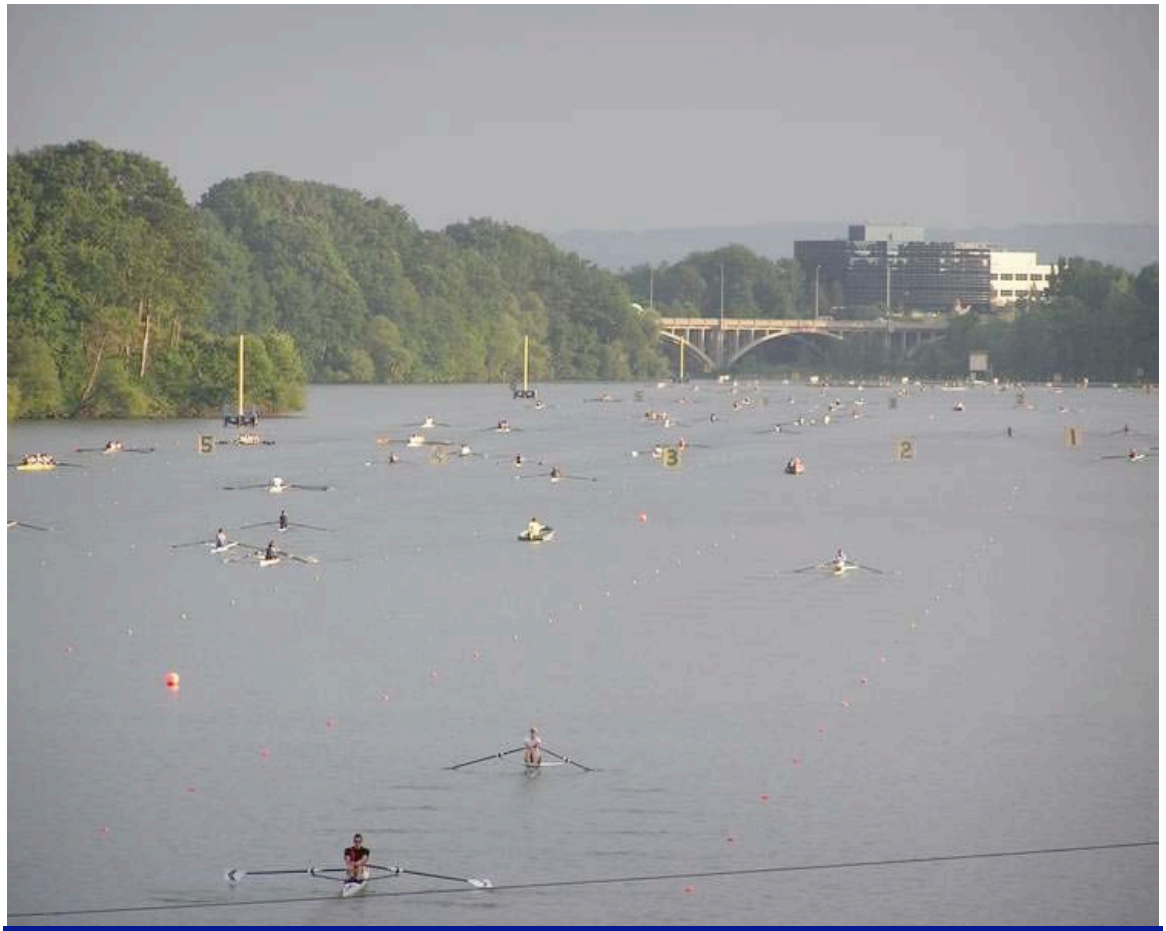
ROWING CANADA AVIRON

Weather Protocol



Prepared by Rob Millikin

Acknowledgments

Environment Canada officials (Geoff Coulson, Warning Preparedness Meteorologist and Tony Chir, Project Manager for Wind, Weather and Waves) were most supportive and encouraging with advice and suggestions in the preparation of this document for the safety and benefit of the sport of Rowing. Their support is most deeply appreciated.

This document has benefited from and makes extensive use of Environment Canada's weather web site www.weatheroffice.ec.gc.ca as a main source of weather data. This remarkable service of the Government of Canada is available to anyone who surfs the net. It is an area of the government where a citizen really gets the benefit of our tax dollars.

The suggestions and editorial comment submitted by Charles Thornton (Chairman), Brian Fiori, and James Cooper of Rowing Canada Aviron's Safety and Events Committee, is greatly appreciated in the preparation of this Weather protocol.

Information regarding the Author

Rob Millikin has been a licensed official of Rowing Canada Aviron for the past ten years. He has officiated many times at the Royal Canadian Henley, Coupe Canada Cup, the Canada Summer Games, Ontario Summer Games, RowOntario Championships, CSSRA Championships, CORA Regattas and Canadian University Championships and was a National Official at the FISA World Masters Championships in Montreal.

He rowed for the Leander Boat Club of Hamilton in the early 1950's and is a founder, Past President and Coach at the Durham Rowing Club. Rob served Rowing Ontario as a Vice President and Secretary in the 1990's.

He spent over thirty-five years in civil aviation as a private pilot and as an air traffic controller. He retired in 1989 as Manager of the Control Tower, Lester B. Pearson International Airport in Toronto.

With his professional background he has served as the official Weather Advisor at the Royal Canadian Henley, Canada Cup, and the Row Ontario Championships over the past five years.

He has owned four boats, (two sail, one steam powered and one gas powered) and has been sailing/boating for over thirty years. All this experience has given him a working knowledge of weather. Rob is not a meteorologist and makes no claim to being one.

The methodology used in the development of this protocol is the same as that used in determining when the most severe weather would reach an airport, affecting the flights that would be using that airport, adapted to the rowing environment.

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Preamble

For the past one hundred years, weather during a regatta has always been a concern to the Local Organizing Committees, the Chief Umpire and the crews involved.

When the weather is fine there are smiles all around. But when the weather becomes threatening there is usually a deepening concern, especially as the sky darkens, angry clouds form and the wind rises. In the past, methods used to determine when the crews should be taken off the water have been varied. In some cases regattas have been delayed unnecessarily by concerns about approaching adverse weather - thunderstorms or very high winds. In other cases adverse weather has arrived before the organizers stopped the regatta. Officials and organizers didn't possess timely, accurate and local weather information upon which they could make informed decisions.

But times have changed. Regatta Organizers and the Chief Umpire can now have access to weather technology and weather information on a real time, local basis through Environment Canada and the Internet to enable them to make informed and timely decisions.

There is no such thing as a "sudden" storm. Every storm announces its coming in some fashion such as dropping temperatures, lowering skies, shifting winds and certain cloud formations. Many of these warnings can be tracked through Environment Canada's web site www.weatheroffice.ec.gc.ca. This site contains much valuable information. The areas of the site that we should be especially interested in are the severe storm advisories, radar images, satellite images and weather analysis maps (showing isobars of pressure that indicate wind conditions).

Access to this Weather office, coupled with the information contained in the Environment Canada Publication "Wind, Weather and Waves", can give us a reasonably good understanding of the basics of weather. In addition, since weather affects almost every thing that we do out doors, it is prudent to observe cloud formations, weather radar and other data on a daily basis to gain proficiency and confidence in our ability to forecast the arrival and departure of adverse weather. However, some training in interpreting the information obtained is necessary.

As regatta organizers we can never forget that we have rowers on the water and that we are in part responsible for their safety. At the same time the competitors have trained for a particular regatta and many may have traveled considerable distances to compete. We therefore have a requirement, as officials, to balance any delays due to weather against getting the regatta completed based on the best weather information available to us.

This "Protocol" has been developed primarily for use by RCA Umpires at national championship regattas that are directly sanctioned by Rowing Canada Aviron. It will be useful for provincial rowing associations and clubs holding regattas in arriving at decisions in the interests of safety based on weather in their local areas.

Rob Millikin,
Durham Rowing Club

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Weather Protocol

Introduction

This protocol is intended to establish procedures at RCA sanctioned national regattas for predicting and managing the arrival of adverse weather, which with experience, will lead to the development of standards for weather monitoring and management at all sanctioned regattas.

Any official can be trained as a Weather Advisor to the Regatta Chair or Chief Umpire who will make the final decision. Weather forecasting is always going to be a variable science approaching art. This protocol provides guidance, which must be supplemented by training from someone experienced in interpreting weather information. Thus far, extremely accurate forecasting of a storm's density and track has sometimes proven elusive, even for the professional meteorologist.

This protocol is set out under the following headings:

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Weather preparations prior to the regatta

Setting up Regatta Weather Central

A Regatta Weather Central is a specific weather station set up at the regatta site. It has a collection of instruments for monitoring particular weather conditions such as temperature, air pressure, wind direction and speed, humidity, radiation shields, (UV) etc. It is where the officials tasked with monitoring the weather for the regatta are stationed and where all the weather information is available for analysis by the official assigned to the weather. It would have high-speed access to the Interment and a computer capable of receiving high-speed access to the Environment Canada website at www.weatheroffice.ec.eg.ca

The Regatta Weather Central should be set up in a sheltered location with, if possible, a 360-degree view of the horizon. If this is not possible then an unobstructed view to the west, in Canadian latitudes, is essential. It should be equipped with the following:

Furniture:	Desk and chairs.
Communications:	VHF radio with a minimum of three separate channels to provide direct communication with the Control Commission, Starter and Finish Tower.
	Outside dial-up communication (for communication with the local weather office)
A Computer:	capable of Web access to Environment Canada Weather Network (www.weatheroffice.ec.gc.ca)
Computer Linkup:	Vital to the process is high-speed Internet access.
	Access to wireless computer link to Internet for regatta sites, which do not have permanent high-speed, hard-wire internet access.

In addition, the following optional equipment is <u>strongly recommended</u>:

Barometer	Although not an immediate indicator a change in pressure over a short period of time does indicate movements of a weather system
Thermometer	Not an immediate indicator but a sharp change in temperature is often an indication of a fast moving weather system
Wind Direction indicator	Is the wind backing or veering? This can be a strong indicator of an approaching or receding weather system.
Wind Speed indicator	Increasing wind velocity often signals an approach of a weather system, or its passing, with especially brisk winds.
Humidity indicator	Increasing humidity is often associated with the advent of precipitation. It also has an effect on the humidex.

The foregoing equipment can be contained within one, easily transported unit. A mobile weather station could be shipped from one RCA national championship site to another site as required.

An example of the information that a typical mobile weather station can contain is set out in Appendix 1. All of it is useful to assist a Weather Official at the Regatta Weather Central to make informed decisions.

An RCA official, acting as a Weather Advisor, with the proper equipment and instruction, should be able to forecast the time that:

- the storm will arrive
- no further boats will be launched
- the last race, prior to the storm, should commence and be completed
- all crews and regatta personnel should sheltered and equipment tied down
- the storm will continue
- the storm will end
- the Control Commission can commence calling the crews to launch
- racing can re-commence

Guidance on using the Environment Canada web site to assist in these determinations is contained in Appendix 2.

In addition to predicting the arrival of thunderstorms, this information enables winds to be determined as to their speed and direction and the possibility of fog assessed by monitoring the dew point. Also of note, given the conditions encountered by Canadian rowers, is the information pertaining to wind chill (relevant to the hypothermia factor) and the Heat Index re heat prostration.

Coaches and other rowing personnel should be welcome in Regatta Weather Central, so that it becomes a place where weather education can be conducted and where the web site information and navigational path through the web sites can be made available to the coaches to take back to their clubs. This would increase awareness of the tools and information that can be used to predict the weather when taking athletes on the water for training, right to the grassroots of the sport.

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Determining Regatta Close Down and Restart times

Prior to the start of a regatta it is important to establish:

- how long before the anticipated arrival of a storm should the course be clear of boats and personnel – 15 minutes might be a minimum standard, and
- how long it will take the slowest boat and the volunteers to return to the dock from the furthest location at the regatta.

From this, one can calculate when to stop rowers from taking to the water, recalling crews, officials and other volunteers who are on the water.

For example, if the safety "standard" is that in the event of the approaching adverse weather conditions:

- all boats and personnel should be off the water at least 15 minutes prior to the estimated time of arrival of the storm, and
- it takes 15 minutes to clear the course of all boats and personnel, and
- the storm is estimated to arrive at 12.30 . . .

then boats must be stopped from going on the water for races that start after 12.00, the last race must be the 12.00 race and the course must be clear of all boats and personnel by 12:15.

If the storm is expected to pass at 1:15, races might be called to the water at 1:30 with a first race start time of 1:45. That gives a time frame of 30 minutes after the estimated passing time of the storm for racing to restart the regatta.

The average storm travels at 25-40 kilometers an hour, so that a storm 15 minutes away is just 6 to 10 kilometers from you. So the reality is that 15-minutes is a realistic minimum standard until we have gained more experience.

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Weather System Codes

Warnings about approaching adverse weather, particularly a decision to clear the course, should be relayed to the Umpires, Control Commission and the Starter as soon as possible. The communiqués should be short and to the point. Therefore it is recommended that a Storm Colour Code Warning be incorporated in the communication terminology.

- **Code Red** – Storm is upon the course or very, very close. Seek the nearest available shelter.
- **Code Grey** – No boats on course and get all personnel under cover. Storm 15 minutes or less away and within 8 kilometers. This condition will continue for 15 minutes after the storm has passed or moved at least 8 kilometers away.
- **Code Orange** – Stop all new departures, finish the races under way. Get athletes and equipment under cover.
- **Code Yellow** – Caution, storm is imminent. All on water Umpires and Starters to start watching the skies for hazardous developments. (Quickly changing cloud patterns and or colours, lightning strikes in the distance, wind direction changes, sudden changes in temperature etc.)
- **Code Blue** - Adverse Weather possible. Risk of thunderstorms present.
- **Code Green** – All clear, no weather related problems at the site.

All regatta personnel, officials, umpires, coaches and athletes should be aware of the Codes used by the Regatta Weather Central. Therefore these codes should be posted in a prominent place.

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Monitoring the Weather
Prior to the Regatta

Five days before the scheduled start of a regatta officials should start paying attention to the weather forecasts on local TV and radio stations. Look for the pressure highs and lows, as well as the temperature highs and lows. These will give an early warning of what may be expected during the regatta. For example, in Ontario, from May to September, at 04:00 hrs. and again at 16:30 hrs. the Environment Canada severe weather meteorologist will issue a "Convective Weather Statement" that details the risk of thunderstorm activity for the next day or two. This information, coupled with the severe "Thunderstorm Watches" that may later be issued can provide a number of hours of lead-time regarding the approach of potentially dangerous weather. Both of these advisories are available on the weather web site at www.weatheroffice.ec.gc.ca

For information as to a storm's severity before it arrives, monitor the storms that are progressing towards you. Often they will pass near an airport or major city and all one has to do is go to the Five Day forecasts on the web site, select the airport or city, and see what is currently happening at that site. Hamilton, London and Pearson airports have been used in assisting the weather determination at the RowOntario Championships and the Royal Canadian Henley. At the Coupe Canada Cup in Montreal, the airports at Ottawa and Kingston are utilized as the advance indicators.

If one is adjacent to the marine environment, such as St. Catharines, Welland and the east or west coasts, go to the marine information and determine what is happening at the remote buoys regarding wind, temperature and wave height. Severe variances between the temperatures shown at those sites or adjacent airports and those that you are experiencing at the time, can assist in determining the severity and direction of the approaching storm.

Monitoring the Weather
During the Regatta

During the course of the regatta, approaching weather should be monitored at Regatta Weather Central through the Environment Canada web site, local weather radio stations and visual observation. Such monitoring should start before the course is open for training or racing.

The first area to check is whether there are storm warnings for the region of the regatta. The next is the radar images for the region shown in the two closest weather radar sites. Once the vector and speed of the approaching storm is determined, it is relatively easy to make an informed decision. (See Appendix 2 on use of Radar).

The satellite images and weather analysis maps on the web site also provide valuable information on developing weather conditions.

A weather briefing should be made each day at the Coaches and Umpires pre-race meetings.

Stopping the regatta

Once it has been determined that adverse weather is approaching the regatta site the Regatta Weather Central should alert the chief official and invoke the weather colour code system. Thereafter the approach of the weather system should be closely monitored both on the Environment Canada web site and by making external observations. Once the storm's arrival is predicted to be close to the predetermined point for stopping boats going on the water the code orange alert should be given to regatta officials.

If the code red stage is reached before all boats are off the water they should be directed to proceed to the nearest safe shore for landing and leave the water immediately.

Regatta Weather Central should try to give the umpires, coaches and competitors all the information it has as early as possible, particularly for what event launching of boats will be stopped and when it is expected that racing will resume. Keeping everyone informed allows others to make informed individual decisions in relation to their situation.

Have an action plan if you decide to suspend racing for the rest of the day. Prepare for the worst but prepare alternative plans in case the weather improves faster than anticipated.

If the regatta is in the early spring or late fall have an area where coaches and competitors can gather under cover to prevent the possibility of hypothermia occurring. It does not take much under damp conditions for hypothermia to be a major factor. Conversely in the summer months, watch the humidity, high temperatures and amount of the crews' exposure to the sun.

We now have the capability to monitor the weather closely and the officials can now make plans for what to do in almost all weather conditions.

Appendix 1

Information that a mobile weather station should contain

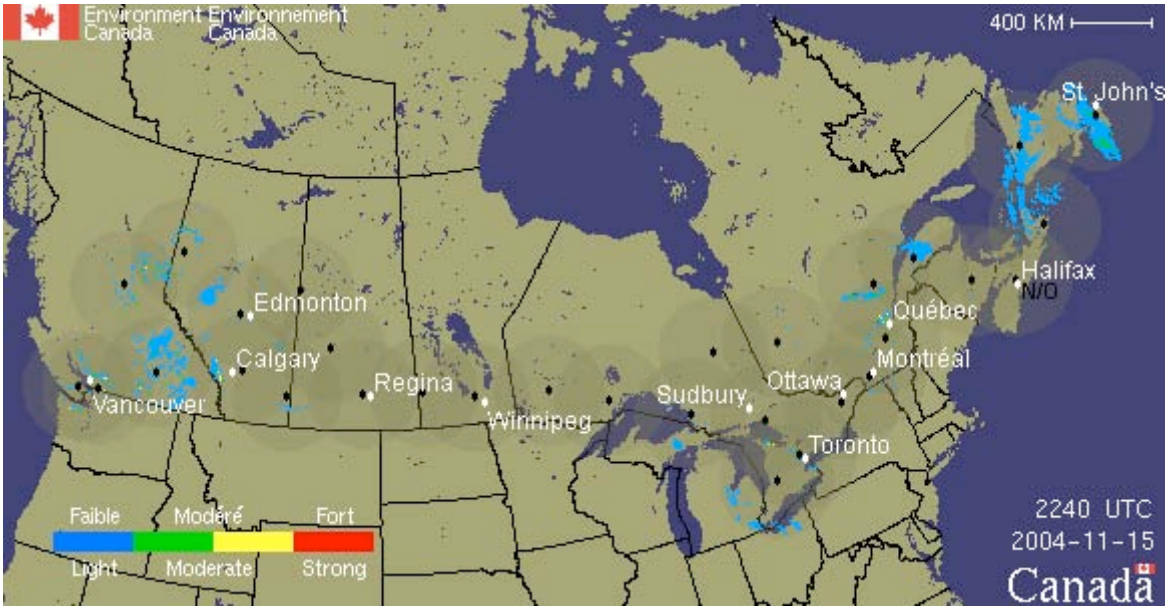
A typical mobile weather station can contain the following information, all of which is useful to a Weather Central at a rowing regatta to assist the Weather Official in making an informed decision.

• *FUNCTIONS*	*RANGE and ACCURACY*	
Barometric Pressure (elev. -460 to 3650 m)	Current	880 to 1080 mb (±1.7); 26 to 32 in of Hg (±0.05); 660 to 810 mm (±1.3)
	Trend (3 hour)	2 mb/hr = rapidly; 0.7 mb/hr = slowly (5 position arrow)
Temperature	Indoor	0° to 60° C (±0.5°); 32° to 140° F (±1.0°)
	Outdoor	-40° to 60° C (±0.5°); -40° to 140° F (±1.0°)
Wind Speed		2 to 120 mph (±5%); 2 to 104 kts (±5%) 3 to 193 kph (±5%); 1 to 54 m/s (±5%)
Wind Direction	Current	16 compass point (±.3 point) and 0° to 360° (±7°)
	Dominant	10 minute average for last hour
Humidity	Indoor	10 to 90% RH (±5%)
	Outdoor	0 to 100% RH (±3%)
Dewpoint		-76° to 54° C (±1.5°); -105° to 130° F (±3.0°)
Rainfall	Daily & Storm	0 to 999.9mm; 0 to 99.99" (±4%)
	Monthly & Yearly	0 to 19,999mm; 0 to 199.99" (±4%)
Rain Rate		up to 2540 mm/hr; 100"/hr (±5%)
Wind Chill		-84° to 54° C (±2°); -120° to 130° F (±4°)
Heat Index		-40° to 57° C (±1.5°); -40° to 135° F (±3°)
Graphs	100+ functions	Displayed on the console screen

Date & Time	12 or 24 hour	Includes Sunrise & Sunset times
Moon Phase	8 phases	Icons – new moon to full moon
Forecast		5 Weather icons and ticker tape display
Evapotranspiration	Daily Monthly & Yearly	0 to 999.9 mm (99.99") (±5%) 0 to 1999.9 mm (199.99")
Solar Radiation Intensity		0 to 1800 Watts/sq. m (±5%)
Apparent Temperature (Temp-hum-sun-wind Index)		-68° to 64°C (±2°) -90° to 148°F (±4°F)
UV Index		0 to 16 (±8%)
UV Dose		0 to 199 MEDs (±8%)

Appendix 2

Use of the Environment Canada Weather Radar



In Canada we are fortunate to have an Environment Canada Doppler Radar site within range of every rowing club and regatta course in the country.

There are many sites from coast to coast and the beauty of it is that normally two or more of the radars will have an overview of every rowing club in Canada. The safety improvement implications are enormous for the sport of rowing.

The Weatheroffice website displays the radar imagery with the same immediacy and frequency as the radar information available in the Weather Centre. It takes roughly 10 minutes for the radar to complete a full scan and produce a variety of radar products (one of which is available on Weatheroffice). So anyone accessing radar imagery on Weatheroffice is getting the latest available information.

Every radar system has anomalies and that is why information from a radar source should always, where possible, be verified by other factors such as cloud formations and visual references. These anomalies are listed at the end of this appendix.

One of radar's prime anomalies is that it cannot usually see directly overhead its own antenna, for there is a null area directly above the station. If one were to look at the schematics of the radar beam in the illustrations in the anomaly section, one can see that the beam extends outwards and upwards but not immediately overhead. To overcome this deficiency simply go to adjacent radar station and look back over your primary site.

Bearing in mind the radar anomalies mentioned above the following series of radar pictures, taken at ten-minute intervals, would show you the track and velocity of a weather system.

The display can be played like a CD player using the symbols set out below, thus one can detect time, distance, direction and travel very easily.

The example used in the following section of the radar system at Montreal, is not a really good example, for it is simply a rain system with, no thunderstorm activity, although it does have patches of heavy rain. It will serve the purpose of this exercise, which is to determine the track and velocity of a weather system.

Any colour observed in the blues and green is usually rain. This is not too bad and rowing after all is a water sport. It is when the yellows and reds start popping up one really should start paying attention. They serve as an indication of possible thunderstorm activity. That is when you start to use other indicators such as lightning detectors, sound of thunder, types of clouds etc.

The following pictures of the McGill Weather Radar were taken on October 4th, 2004 commencing at 1740 Universal Coordinated Time. (Formerly Greenwich or Zulu Time) The 24-hour clock system is used to alleviate any confusion between AM and PM. For those that wish to remain confused, the time has been converted to 1:40, 1:50, 2:00 (the 2:10 is missing) 2:20, 2:30, and the 2:40 pm. There is enough information to provide a determination of position, speed and direction.

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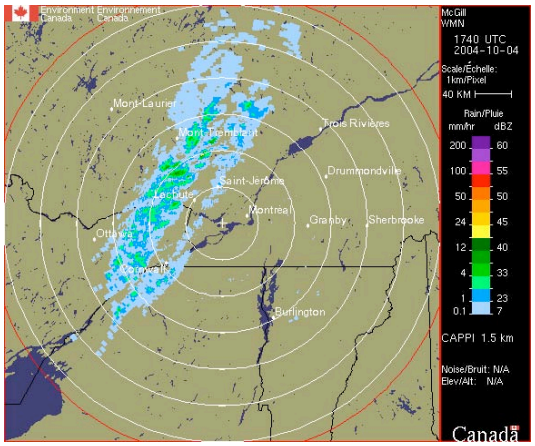
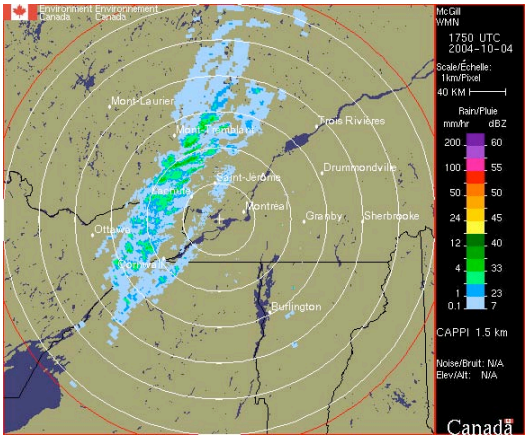
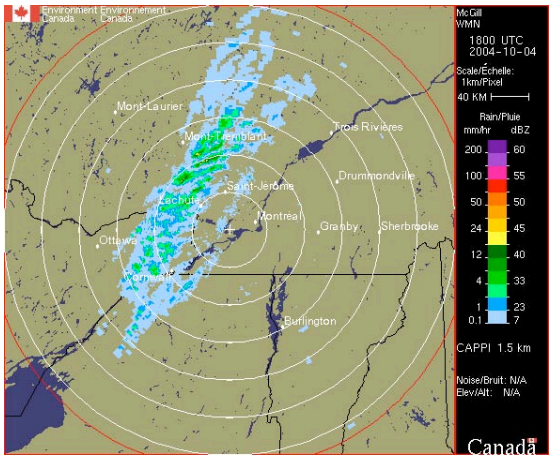
All times are in UTC (formerly Greenwich Time) Standard time
Start Time below 1740 UCT = 13:40 EDT or 1:40 pm. EDT



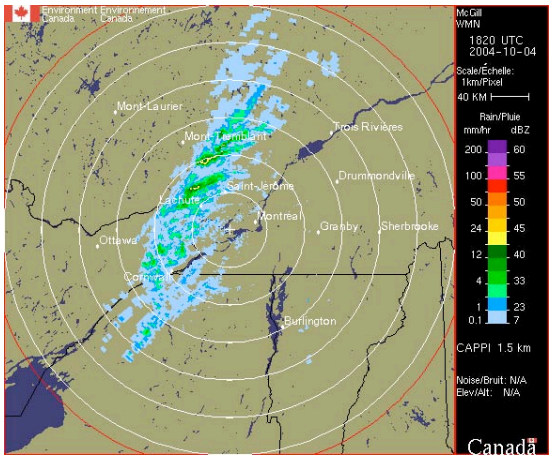
1:40 PM



1:50 PM



2:00 PM



2:20 PM

Note the range rings on the radar screens are 40 kilometers apart. (Note the 1810 UTC or 2:10 pm display is missing.)

The Olympic Rowing Basin is located on this map, on the west bank of the small piece of open water below the name Montreal. The reader will have to locate the regatta/club areas that they are concerned with, using whatever topographical features are present on the radar display maps in their area.

At 1:40 the leading edge of the system that will affect the Montreal Olympic Basin was approximately 40 kilometers west of Montreal. Note the range rings denote a distance of 40 kilometers. The trailing edge of the system is just past Ottawa some 120 kilometers away, denoting a system width of 80 kilometers

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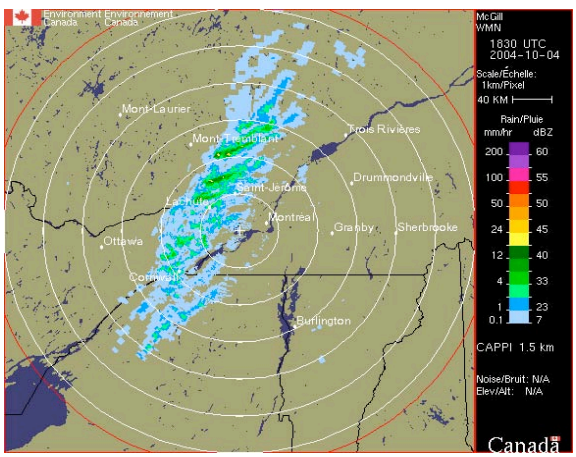
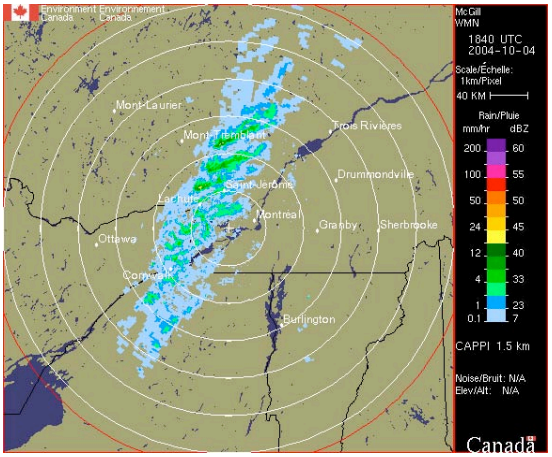
It is now 1:50, ten minutes since the first radar returns were noted. In ten minutes the leading edge of the system has moved about four kilometers. The trailing edge has moved about three kilometers. This is not unusual for systems will open and fill in periodically on their journey across the land. If the system has moved four kilometers in ten minutes then currently its speed across the ground is about (4 x 60/10 = 24) twenty four kilometers per hour. The direction of the system is easterly. This is not necessarily the wind direction.

Now one simply monitors the storm's progress, also being alert to any changes in temperature, wind direction and speed. Of special note will be the changing cloud conditions. For cloud descriptions and what they mean the reader is referred to Environment Canada's excellent publication "Wind, Weather and Waves" which is one of the best reference books available, and written in layman's language.



2:30 PM



2.40 PM

Since from the leading edge of the system to the Montreal Olympic Basin is about thirty kilometers, the system is estimated to be overhead the Basin at 3:00 – 3:10. No more boats should launch after 2.30 pm and racing should stop and crews recalled no later than 2:45 with everyone under cover by the start of the storm.

When the leading edge of the system is approximately 12 kilometers from the Olympic basin, start checking wind direction, cloud formations etc.

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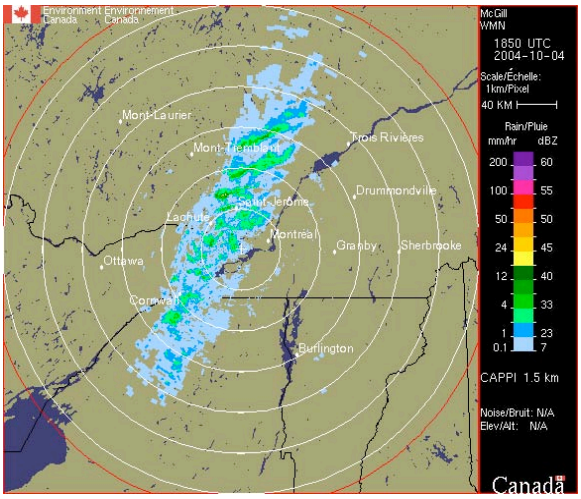
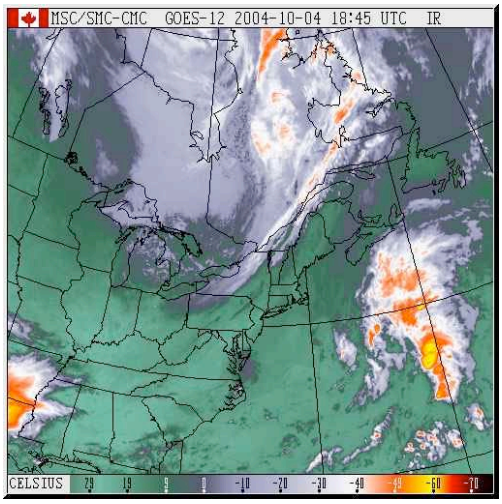


2:50 PM



2:45 PM

Leading edge now about eight kilometers west of basin. All crews should be coming off the water. It will start raining within ten minutes.

A quick glance at the Satellite information for the same period reveals that there does not appear to be any major system after this one passes by the Olympic Basin. Clouds yes, and one should also keep a sharp eye on the wind, especially if it veers quickly to the North West. A rising wind could adversely affect the water conditions on the course.

At 2.50 pm, the trailing edge of the system is still sixty kilometers west of the basin, accordingly based on the hourly movement of 24 kilometers per hour; the trailing edge should be by the Basin in two hours and thirty minutes or 5:20 pm. So one would have a decision to make. If it is a one-day regatta and crews have traveled a considerable distance to come, the Local Organizing Committee may have to bite the bullet and cancel the remaining races. On the other hand, if it is the first day of a multi-day regatta, or during the middle of a regatta like the Royal Canadian Henley, one could call the crews to start getting ready at 5.20 PM, with racing resuming no later than 5.45 pm until dusk. The storm delay would be just over three hours in duration.

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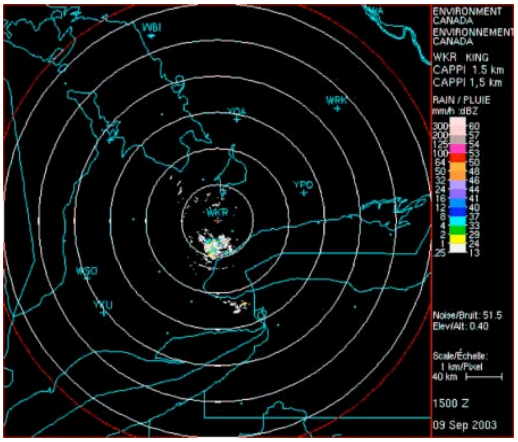
Common Radar Errors

Because of the importance of understanding the interpretation errors, the error listings contained in the Environment Canada weather web site are reiterated below in blue. Additional comments are set out in black.

Common Interpretation Errors

A picture is worth a thousand words. But sometimes what you see isn't necessarily what you get. Canadian weather radar is now easily accessible at Environment Canada's Weatheroffice website weatheroffice.ec.gc.ca. But just because something looks colourful on the radar screen doesn't mean it is raining or snowing. By the same token, just because the echoes appear weak or can't be seen at all, doesn't mean that someplace isn't getting significant rain or snow. What follows are some of the more common radar interpretation mistakes you can make.

Ground Clutter



Note - the radar beam lobe, and the fact that the lobe does not extend immediately overhead of the site.

These echoes are called "Ground Clutter" and they occur when a portion of the radar beam comes into contact with tall buildings, trees or hills.

Learn the common ground clutter "signature" in your area, so you can distinguish it from real precipitation.

Ground clutter is a common factor at the rowing sites at St. Catharines and Welland where there always appears to be light rain, where the radar beam from King City is reflected by the Niagara escarpment. The Mountains of Western Canada cause permanent echoes on Victoria, Vancouver Calgary, and Edmonton radars. The skyscrapers at Toronto or any other major city will often reflect permanent echoes. To determine what the permanent echoes are in your locale, observe the track of a weather system as it passes by. The echoes that move are the weather. The returns that do not move are the permanent echoes.

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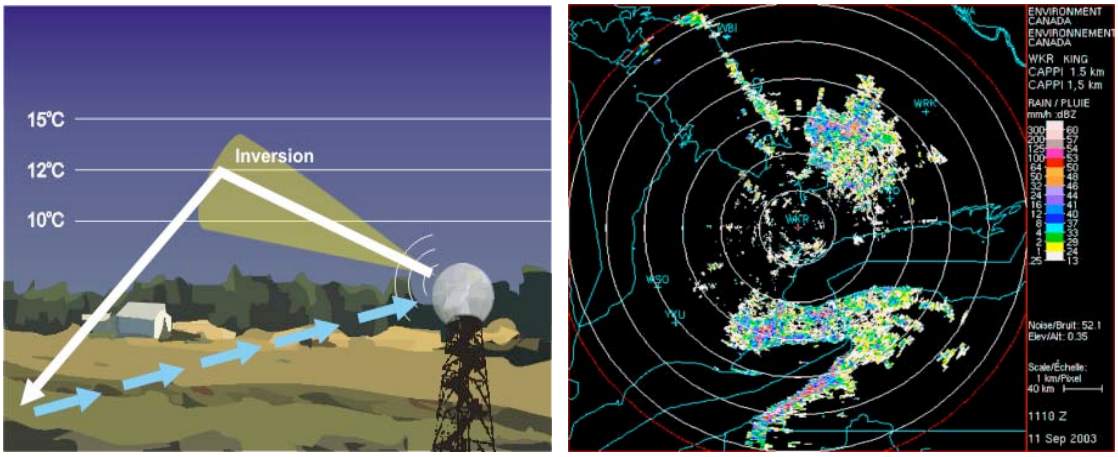
Anomalous Propagation – AP



Occurs when strong temperature inversions are present in the low levels (i.e. temperature rises with height).

It is most common on clear nights during the early morning hours. Largely dissipates by midday.

Radar beam is bent into the ground and returns a strong signal to radar.

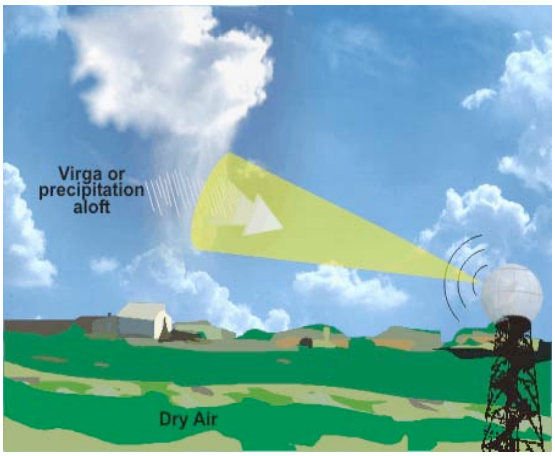
Radar echoes are NOT real. There was no precipitation occurring in the image above.

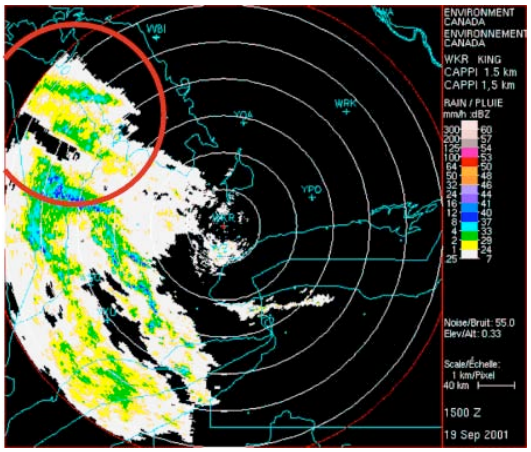
Often at Henley, or the Ontario Rowing Championships, this type of propagation occurs early in the morning. One method of verifying is simply to look and determine what cloud formations are present. Another is to select the radar site at Exeter (London) and look back across to King City Radar. This also holds true for any Environment Canada Doppler radar site in Canada. Nevertheless, when one first sees the above returns at 06:00 hrs it is very daunting.

This is why it is very important to use additional resources such as sight, hearing, cloud formations, temperature, wind direction and speed, to assist in arriving at a determination of just exactly what is coming.

Final 3/22/2005

Virga





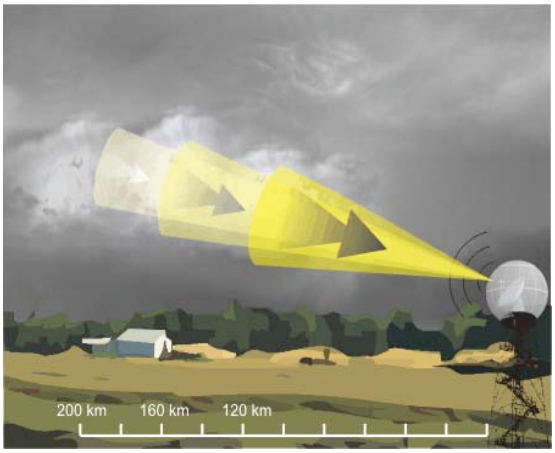
Radar detecting precipitation, that is occurring aloft, but not reaching the ground.

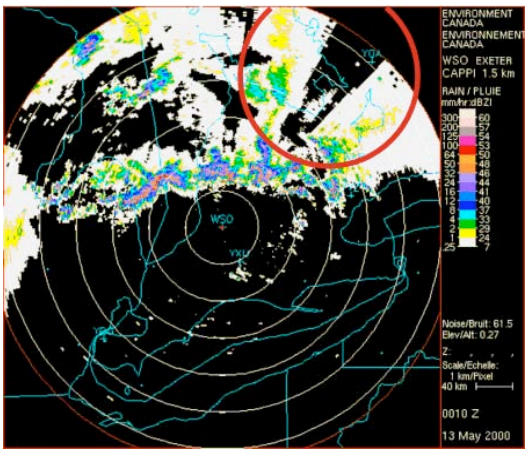
Dry conditions at low levels.

No precipitation was hitting the ground in the Bruce Peninsula in the picture above.

Again, use your vision to determine what cloud formations are visible in your area, especially to the West. Virga is usually seen in front of an advancing storm system appearing as wisps of falling rain, but not reaching the ground. Also note the permanent echo at Toronto, and following the line of the Niagara escarpment.

Storm Interference





Storms closest to radar reflect or absorb most of the available radar energy leaving reduced amount of energy to detect more distant storms.

Storms in the circled area were quite intense but were not being detected appropriately by the radar due to the strong storms occurring closer to the radar.

Again, go to the adjacent weather radar sites, and look back, around, and over your primary site. Normally this will allow you to see what is happening beyond and behind, your immediate storm. Thunderstorms often travel in two lines, about 70 to 90 kilometers apart.

An exception to this statement was the weather conditions encountered at the 2004 Canada Cup in Montreal.

A series of storms, originating in the Gulf of Mexico formed a weather train, moving from the Gulf of Mexico, up the Mississippi and Ohio Valleys across into Lake Erie and down the St. Lawrence Valley to Montreal. Racing was severely hampered by these storms, which was conducted in windows between the storms. In addition to thunderstorms and high winds, these systems contained several tornadoes, the closest touching down eighteen kilometers south west of the Olympic Basin. Based on the prolonged weather observed, racing was curtailed for the day and the events rescheduled for the next day.

Appendix 3

Resources

In Canada weather information and equipment is available from:

www.weatheroffice.ec.gc.ca

This is Environment Canada's web site and it has a great deal of essential information on it, including current radar presentations in your area. It is deemed essential that the Regatta Chair and Regatta Chief Umpire have information, relayed from this source, in the making of an informed decision.

www.weathersense.com

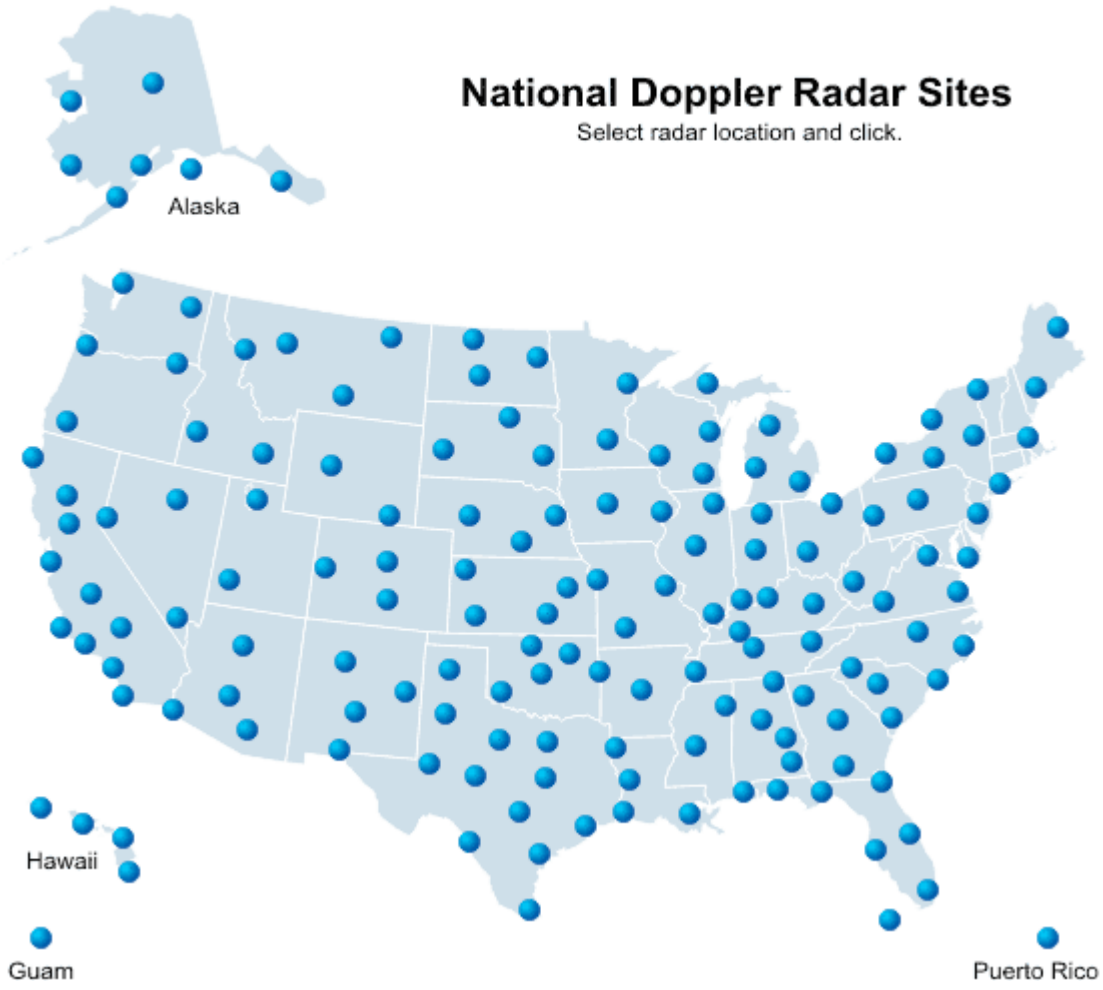
This is a small Canadian Company located in Prince Edward Island, which specializes in weather instrumentation for amateurs. It is the source of the lightning detectors used by various Rowing Canada Officials to assist in weather determination.

Environment Canada Publication "Wind, Weather and Waves"
This is one of the best weather publications in Canada at the present time, especially the descriptions and pictures of the various clouds that announce a coming weather system. This document was prepared under the Project Management of Tony Chir, and is available through Environment Canada.

In the United States weather information is available from:

http://weather.noaa.gov/radar/national.html

This is the NOAA Doppler radar site of the United States. Access to this site allows the Rowing Canada weather official to track incoming systems from deep within the United States to determine just how long a weather system might effect a region in Canada. It was used with great effect at the Canada Cup in Montreal in 2004.


National Doppler Radar Sites
Select radar location and click.
Alaska
Hawaii
Guam
Puerto Rico