WEATHER OBSERVATION & ANALYSIS PROJECT (Wx Proj)

OBJECTIVE

To use a case study research model to describe and explain the weather that occurred in Prince George during a specified, four-day weather observation period. The project includes experience:

- observing and recording weather data using a variety of basic instruments and techniques
- appropriately identifying and resolving data problems (data quality control /rationalization)
- converting measurements into standard weather observation values (data rationalization)
- skillfully presenting, graphing, and analyzing data to interpret the experienced weather pattern
- integrating collected data with synoptic and local weather data to create a concise, well written report that describes, interprets and explains the experienced weather.

METHOD

Your case study will monitor Prince George's weather for a specified four-day period using personal weather observations and measurements, along with local and synoptic data from the variety of sources indicated below. Monitoring will involve a combination of group and individual work, but each student must produce an original, concise, individually written report supported by the evidence shown in their data. Your report will interpret and explain the weather pattern that occurred over the specified four days in terms of the local and synoptic weather conditions. **The course schedule shows the observation period dates and project component deadlines.**

During the four-day weather observation period you are responsible for collecting the following types of data: Roof-top weather observations (done with a partner or partners), personal weather diary, and information from specified local and synoptic electronic sources. Here are the details:

1. **Roof-top Data Collection:** During the labs preceding the data collection period, you will learn how to observe weather, use necessary meteorological equipment, and report your observations and measurements in a standardized format. Here is how the roof-top data collection works:

   Once per day, at an assigned hour (nominally 8 am, noon, or 4 pm), you and your data collection partner(s) will make a series of weather observations using assigned instruments from a particular Stevenson screen on the roof of the Teaching Lab Building (Bldg.8). Your observation time, and partner(s) are determined in labs before the start of the observation period and are based on your scheduling needs /availability. Your team's observations, in combination with those made by other student-teams that are observing at the other times, form your roof-top dataset.

   Your roof-top weather measurements and observations are recorded on your assigned data collection sheet which is always kept in a small weather observation room on the Teaching Lab roof. Consequently, you need to record two observations (made on the 2nd floor of the Teaching Lab on your own paper) and transfer these values to your roof-top data collection sheet when you get to the roof. All roof-top data collection sheets are made available during the week after the observation period.

2. **Personal Weather Diary:** To successfully complete the Wx Proj, you must pay attention to the weather in Prince George as it is happening. Your required weather diary records the weather conditions when you are not making measurements on the Building 8 roof. It should include evening observations and is best if not done at scheduled times. A minimum of four observations per day (spread over day and night) are required. It should indicate your impressions of the weather, especially while conditions are changing. It provides qualitative observations that complement the quantitative roof-top data. Writing a weather diary will help you identify and understand the weather patterns that Prince George experienced.

   Your diary observations are not an alternate set of measurements or "best guesses" of the measured roof-top weather data and each entry does not require the same weather observations. Rather, multiple times each day, using point form, clearly report the environmental conditions. Indicate:
   - the time, date and location of your entry
   - weather changes, dominant sky condition /cloud type /visibility
   - relative warmth or cold and how temperatures feel like they are changing
   - precipitation (when relevant: rain or snow and when they started and stopped if possible)
   - wind (strength, approximate direction, gustiness)
   - interpretive weather comments including anything you found unusual or interesting (e.g. fog, ground frost, thunder, lightning, etc.).

   Your goal is to notice weather changes throughout the day and night. Make your diary observations as you can but realize the importance of observing weather changes as when they are occurring. Remember, each entry must indicate the date, time and your location.

   At the **end of each day,** review your diary observations and **summarize the day's weather pattern** in a sentence or two.

   At the **end of the four days**, review all your daily summaries and observations. Then write a **paragraph summarizing the weather that occurred during the entire observation period**.

   Your original hand-written weather diary is marked and submitted right after the data collection period (see schedule).

   Your diary will be incorporated into your report (as *Appendix 1*) in its original hand-written form. So, plan your diary format in advance. It must be clear, legible and written on paper that you can: 1) carry with you, and 2) later integrate into your report.

3. **Local and Synoptic Electronic Data:** Synoptic (or large scale /regional) information helps you explain why Prince George experienced the weather that occurred. Unfortunately, we never know which synoptic information is most relevant until after the weather has occurred. Consequently, during the observation period, we must gather more local and synoptic weather data than will get used.

   During lectures and labs, you will learn how to collect, interpret, and use a wide range of local and synoptic weather information from publicly available websites. The following weather products are required information sources. Each must be properly cited and referenced when used in your report:

a. ***UNBC Weather Station*** **(*UNBC Wx Stn*) graph**: Located on top of the Research Lab, the UNBC Wx Stn is directly across from our ENSC 201 roof-top weather observation site. It provides 24-hour tracking of complementary weather observations. This graph, your roof-top datasheet and your diary are the record of the observation period's weather. Viewing this graph each day can improve your ability to see weather patterns as they occur.

   Despite the proximity of these two roofs, each location records slightly different information; consequently, the UNBC Wx Stn graph complements but does not replace your roof-top weather observations. Both must be used in your report.

   Find the graph at https://cyclone.unbc.ca/wx - the "5-day Standard Plot" is the most useful. **Collect one graph at the end of the observation period so that all four days are on the same image, and you can see the entire period at once.**

b. **Synoptic weather maps:** These provide information about the spatial extent of weather systems, and allow you to understand weather events and their evolution at a larger regional scale. Using a chronological sequence of maps shows how storms move and change to produce the sequence of weather events we experience. The *Surface Analysis* and *500 hPa Analysis* maps are most useful. Each day, collect **all four Surface** and **one of the 500 hPa** maps produced by Environment and Climate Change Canada (ECCC).

   Find these ECCC weather maps at https://weather.gc.ca . For Surface maps, select *Analyses & Modelling*; then under *Analyses*, select *Surface.* Select the *Complete (Northern Hemispheric coverage)* maps as they have been analyzed and interpreted by meteorologists who have located fronts and weather systems for you.

   The 500 hPa maps are also found at the prior link. Go to *Analyses & Modelling*; then under *Analyses* select *Upper Air Analyses*. Use the Upper Air Analysis list to select *500 hPa: Geopotential height, 1000-500 hPa thickness.* **Your instructors will show you how to efficiently collect all these maps at just one time per day.**

c. **Satellite Images:** These show the cloud patterns associated with storms. You must collect <u>eight infrared (IR) satellite images per day</u> (one every 3 hours). Save satellite images showing IR data at the same time as each Surface Analysis map, and also collect satellite images that show what happened in-between. Consequently, for a 24-hour period you have eight satellite images that are 3 hours apart.

   Satellite images complement weather maps by showing the actual weather indicated on the Surface Analysis and other maps. Because satellite images are produced at a much higher frequency than weather maps, they can "catch" weather details that are missed by maps when the weather changes quickly and enable better interpretation of synoptic-scale storms.

   Find ECCC satellite imagery at https://weather.gc.ca/satellite; use the *GOES West* links.

   The US National Oceanic Atmospheric Administration (NOAA) *Northern Pacific* sector at https://www.star.nesdis.noaa.gov/GOES/sector.php?sat=G17&sector=np also shows our weather. Choose Band 13 (IR wavelength 10.3 µm).

<u>**Electronic Data Collection Tips**</u>

Collecting and organizing weather maps and satellite images: Times can be confusing. All weather products are identified by their times at zero longitude which is located in Greenwich, (a suburb of London) England. So, look for times in Greenwich Mean Time (GMT) or Zulu (Z) or Coordinated Universal Time (UTC) (these are all the same) and convert them to local time.

Generally, the providers of weather maps and images (Environment Canada, NOAA) overwrite their products as newer ones are produced. So, **gather these products in "real time" once-a-day, at the same time each day. This is the most efficient way to collect your images**. Save images in as high a resolution as possible so that later as you enlarge and crop parts of your images, they are sharp. Make sure to include type, date and time labels on your saved maps and satellite images so you know what each one is. Finally, as you save your weather materials, create a file naming system that easily organizes the collected electronic materials by date, time, and type. This makes finding useful material much easier later.

You will be busy during the data collection week: Practice finding, saving, and organizing your electronic weather resources from their original source and from https://cyclone.unbc.ca/wx and https://cyclone.unbc.ca/wxv before the weather project data collection period starts. Part of the project evaluation is based on how well you select and use your local and synoptic data in your report.

Consider primary versus secondary sources of online information: Some weather images are repackaged and available for longer periods of time at on our Weather Viewer (WxV) at https://cyclone.unbc.ca/wxv. WxV is therefore a **secondary source** of these images and this **affects your referencing.** Specifically, you should cite the **original sources**. Ask for help from the UNBC Academic Success Center https://www.unbc.ca/academic-success-centre if you are not sure how to reference and cite such material.

To find NOAA data on WxV, select *SATELLITE* and view the *IR* (infrared) links. The *Goes-W Alaska* link (which provides a good view of the weather approaching northern BC) and the *Goes-W W-Canada* (which relays the Environment Canada IR satellite data) or *Goes-W N-Pacific* links are useful.

Extra Resources: If you want to look for other relevant websites for your report, carefully evaluate the type and quality of information. **Remember, forecasts are not useful for this report.** The report is only about documenting and explaining what actually happened; it is not about weather predictions.

WEATHER OBSERVATION PROCEDURES

Observation techniques and procedures are learned during labs that precede the observation period. A practice-run of the entire data collection process will occur before the data collection week. Though students work in groups to collect weather measurements from an assigned Stevenson screen at a scheduled time, everyone must write their own original, independent, individual report.

During the 4-day data collection period, students work in groups of two or three. Each group records their roof-top weather observations at one of three scheduled times (8 am, noon, and 4 pm plus or minus 30 minutes) using an assigned set of instruments. The group's data collection is graded as a unit so group members are expected to work together when taking measurements. Exchange quick contact information (cell numbers, email addresses, and make contingency plans so you can compensate for each other if short-notice problems arise). There are mark deductions for groups that miss assigned observations.

Three groups (pairs/threes) form the larger team of six to nine students that collect all the data from one set of instruments. The Senior Lab Instructor (SLI) organizes the data collection teams to create a feasible observation schedule, so that all group members can participate during the four weather observation days. Once the schedule is finalized, copies are posted on the website, at the door to the roof, and beside the *UNBC Weather Display*.

Observations must be completed within 30 minutes of the set data collection times. As your group becomes more efficient, 10 minutes is usually long enough to complete your roof-top observations. All ENSC 201 roof-top observations are recorded on assigned data collection sheets that are attached to clipboards and kept in a small room on the roof of the Teaching Lab Building. Observations are recorded in time-order and data collection clipboards /sheets <u>always remain on the roof</u>. At the end of the data collection period they are made available. Accurate measurement /observation techniques, equipment care, appropriate reporting, and neat, legible data records are critical to successful data collection and saving time trouble-shooting bad data when writing your report. See the project data collection table at the end of this section for an example of a completed data recording sheet.

<u>**Avoid data entry errors by always recording directly on the roof-top data collection sheet and reviewing it before you are done**</u>. While making your daily roof-top observations, review the data being recorded by the other groups contributing to your datasheet. Check for observation consistency (e.g. maximum temperatures being equal or greater than minimum values; current air temperatures being between max and min; wet-bulb temperatures being lower or equal to air temperatures; precipitation data making sense; etc.). If values seem questionable, try to identify the error and ask an instructor to verify if there is a problem with someone else's data record. Instructors may be able to alert other observers to try to correct the problem before it occurs again. If you are correct about a data problem, also make specific notes about the issue (date, time, type of observation, explanation of the problem) on a separate sheet. These notes may be useful when reviewing data, the week after our data collection period. <u>But, never change recorded roof-top datasheet values</u>. During the labs after our data collection, you will rationalize your data -- review the quality of your team's work, attempt to understand /explain /repair data issues, and convert values into meaningful units. Then these notes may be very helpful.

Ensure the satellite images and weather maps you collect represent the needed local time and show our location. Mentally convert map and image-time from Z (Zulu), UTC (Coordinated Universal Time) or GMT (Greenwich Mean Time) (they are the same) to Pacific Standard Time (PST) to check. Also ensure your collected surface maps have fronts identified on them.

Observation Details:

The following summarizes key information for using each roof-top instrument and shows how to efficiently sequence your observations. Demonstrations and summary handouts are provided during the labs preceding our data collection period. These handouts are also available as a booklet attached to each data collection clipboard. Refer to these pages to recall specific details /reporting codes when making your observations.

Start data collection by **obtaining the Lab Building roof key from the Security Desk.** They know the *Weather Project Observation Schedule* and will sign out a key to you or your partner(s) at your assigned time. Bring your student card or other photo identification. Only scheduled students are allowed on the roof. You must return the key to the Security Desk within half an hour of obtaining it.

Stop at the second floor on your way up to the roof, record the *UNBC Weather Station Display* wind, and mercury barometer readings and note the time you started taking readings. Write these on a separate piece of paper and transfer them to your screen's data collection sheet when you get to the roof.

- **Wind Speed and Direction:** These are observed using both visual and instrumented methods.
  - **Measured Wind – UNBC Weather Station:** Measured wind data are displayed in table form on the second floor UNBC Wx Stn display during the data collection week. These measurements come from the anemometer located on the Research Building roof with data displayed on https://cyclone.unbc.ca/wx. Record numerical wind speed, (m/s) and azimuth direction (degrees from north) for the 10-minute period nearest your observation time. Accurately transfer this data onto your screen's roof-top data sheet when you get to the roof and can start making your visual wind observations.
  - **Make visual wind observations when you get on the roof**. Use appropriate visual cues to report the Beaufort number (wind speed), and the north-south orientation of instruments on the tallest weather pole, or the Library building's orientation to report the wind direction. Wind direction is recorded as a numberless 8-point compass reading (N, NE, E, SE, S…etc.). Wind is always reported as the direction it is coming from.
- **Atmospheric Pressure:** Before leaving the second floor, read and record the mercury barometer's atmospheric pressure in millimeters (mm) of mercury AND record the barometer's temperature. Then accurately transfer these values onto your roof-top data collection sheet. To minimize calculation errors, students will individually convert all their barometer readings to corrected pressure values (in hPa) during data rationalization, so do not report a converted value on the roof-top data sheet. Information showing how to convert these readings is presented with the pressure lab and accompanies the barometer.

Walk up to the roof and use the key to get onto the weather observation patio. Close the door behind you. When making your roof-top observations, propping the door open affects the thermometers in the nearest Stevenson screens. Open your Stevenson screen only when you are making measurements. Then close your Stevenson screen when you are not actually reading the instruments inside as leaving it open affects the thermometers.

Psychrometer temperature equilibration: To remain liquid, water for the psychrometers is stored inside the weather equipment room. Psychrometers work by measuring the temperature change due to evaporation causing a difference between the wet and dry-bulb thermometers. Since evaporation varies for frozen and unfrozen conditions, depending on the air's temperature, different measuring procedures are used (see *Relative Humidity Determination* below). If it is warm enough to use your +50 to -5 °C psychrometer (view the 2nd floor Wx Display temperatures to know), properly wet its wet-bulb sock and put your psychrometer in your Stevenson screen (i.e. a shaded place). This will give it time to adjust to outside temperatures before taking your readings. Make your other observations while waiting for it to equilibrate. If you bring equipment (a water bottle/sling psychrometer) outside, return them indoors before you leave to prevent them from freezing solid and possibly cracking.

- **Air Temperature and Max/Min Temperature:** Stevenson screens protect the thermometers from direct sunlight striking them, as this would elevate their temperature values. Air temperature is always defined as the temperature taken in the shade. Open your Stevenson screen, leave the thermometers inside, and take the readings as quickly as possible to avoid such problems. Read and record the present air temperature from the mercury level on either the maximum or minimum side of the max/min thermometer (both sides should be within a degree of each other). Record the present air temperature reading in the correct column. Read the maximum and minimum temperatures at the bottom of their respective pins and record their values in the correct columns. Properly reset both pins. Close the Stevenson screen door.

[Tip: Once you have your humidity measurements, check the psychrometer's dry-bulb temperature is within 2 degrees of the present air temperature on the max/min thermometer. They should be consistent with each other at each observation time, and discrepancies larger than 2 ^{o}C should be reported to your instructor and possibly noted in the comments column.]

- **Humidity Determination - instructors will advise about which psychrometer to use:**
  - **For non-frozen temperatures**, use your screen's sling psychrometer by wetting the wick, letting the temperatures equilibrate outside, and then aspirating the psychrometer by rotating it until temperatures are stable (this may take 3-5 minutes). Read dry-bulb and wet-bulb thermometers. Report these temperatures in their correct columns on the data sheet. (Remember: The present air temperature from the dry-bulb thermometer should be no more than 2 ^{o}C different than the current temperature from the max/min thermometer. If they are not, check you are reading these correctly. Report problems to your instructor.)
  - **For temperatures well below 0 ^{o}C,** a cold-air sling psychrometer (reading to -30 ^{o}C), or Assman psycrhometer will be used. Instructors will assist with making a wet-bulb ice film and reading this psychrometer when it is required. There is only one of these instruments. As it is very delicate use it carefully. With each use, the formation of a thin ice film over the wet-bulb thermometer sock is required. Once this film is formed, it measures humidity in the same way as a non-frozen psychrometer. If weather allows, we will demonstrate this procedure in advance of the data collection week.

Each student must calculate their RH values and report these only on their personal data collection sheet. As demonstrated in the Humidity Lab, use wet and dry-bulb thermometer measurements to determine the relative humidity (%) using the psychrometric equation. For non-freezing conditions use: $\lambda_{\text{over water}} = 66$ Pa ^{o}C^{-1}. For frozen conditions use: $\lambda_{\text{over ice}} = 58.2$ Pa ^{o}C^{-1}. Only calculated %RH values are used in your project report. (Estimates of % RH from psychrometric tables or equipment will not be used for our dataset.)

- **Precipitation Data:** Observe and record any rainfall collected in your rain gauge as millimeters of water. AFTER taking the measurement (and checking it!) your rain gauge MUST be emptied. The scale on your rain gauge converts the collected volume (milliliters) of rainfall into its depth (millimeters) of equivalent rainfall. In addition to measuring the amount of rainfall, check that the rain gauge opening is not obstructed and that the gauge is properly put into its holder. If rain freezes in the rain gauges during our observation period, specific instructions will be given on how to melt it and take accurate measurements.

For snow, use the provided ruler to record the depth of new snowfall in millimeters (mm) from your screen's assigned section of the snow bench. Take 3 measurements and record their average value as the depth of snowfall on your data sheet. Use an undisturbed, non-wind affected area of your section of the snow bench. Remember to only clear away the snow from your section of the snow bench, so you don't affect someone else's readings. Once cleared, the next reading represents newly accumulated snow. Each student must convert their average measured mm of snow depth (from using their ruler) to its precipitation value or mm of equivalent water by dividing by 10 (as demonstrated in the lab).

- **Sky Condition and Cloud Observations:** Record sky condition, then dominant cloud type and amount in 8^{ths} for each layer (low, middle, high). Use the provided information sheets (in the booklet attached to your clipboard), posters, and/or cloud charts as reference materials. Use standard abbreviations to report cloud types on the roof-top data sheet.

  Record low, middle and high cloud amount as eighths of covered sky. Be consistent with your sky condition observation. As demonstrated in the labs, imagine grouping the cloud as a single mass for each height and then estimate the amounts by layer (divide the sky into halves, then quarters, then eighths to get an estimate). As lower cloud layers will obstruct your view of what is above them, report only what you can see. Indicate double dashed lines (--) for the layers you can't see. When there are no clouds, report the amount as zero (0) eighths for all layers and list the type as double dashed lines (--). Our cloud amounts are reported in 8^{ths} to be consistent with Environment Canada standards as this is what is reported on weather maps. [If you are using hourly data from airports, notice aviation observations report cloud amounts in 10^{ths}.] Use 8^{ths} for our roof-top observations and don't confuse these two forms of cloud observation.

Comments, Weather and Special Observations: In the *Comments* column note current weather phenomena that may aid in interpretation of the data (i.e. currently occurring precipitation, special conditions such as fog, hoar frost, etc.). Also note any instrument problems or instrument damage here. MAKE SURE TO ALSO REPORT DAMAGE OR PROBLEMS TO INSTRUCTORS IMMEDIATELY.

Leave the roof-top data collection sheet and clipboard on the roof and return the keys: After recording all your observations, ensure your screen's data sheet is on the clipboard and returned to the table in the roof-top weather equipment room. RETURN THE KEY TO THE SECURITY DESK AFTER YOU HAVE FINISHED YOUR OBSERVATIONS!! During the observation period instructors will be available to assist with questions about procedures or data.

SECURITY & SAFETY CONSIDERATIONS:

Weather observations take place on the roof of the Teaching Lab Building. UNBC Security must be contacted for a key to access the weather instruments on the roof. Security will have a list of observing times and the students who are authorized to access the roof at those times. Only ENSC 201 students who are completing their assigned observations are permitted on the roof. You must return the key within 30 minutes of your observation time. The person signing out the key remains responsible for it until Security receives it back again. Do not keep keys, or be late returning them. Missing keys will result in mark deductions and billing of any related lock replacement costs to those responsible.

STUDENTS ARE NOT PERMITTED BEYOND THE RAILINGS ON THE ROOF. All of the observing equipment can be accessed and read from the area within the railings. People on the roof can be observed. Anyone reported or observed acting in an unsafe manner while on the roof will face severe consequences including removal from the project, failure of the project component, and university sanctions.

Being on the building roof requires additional safety awareness especially regarding STRONG WINDS OR THUNDERSTORMS WHEN NO ONE SHOULD BE ON THE ROOF!! If either of these events occur during your observing time, only when the wind has diminished, or the thunderstorm has passed can you access the roof. So, if there is strong wind, thunder, or lightning you CAN NOT conduct your observations. This may mean that you miss that observation time. If such an extreme weather event were to occur, instructors will indicate what to do. However, note it on your personal data recording sheet. This precaution is very important, as on the roof you are one of the highest points around and you could attract a lightning strike or be blown off the roof in extreme weather.

REPORT REQUIREMENTS

Write your report as a *case study* that presents, describes, and explains the local and synoptic weather conditions that occurred over our four-day observation period. Use up to 2000 words (~8 typed double-spaced pages using 12-point font text, and not including figures or appendices). Relate the observed conditions to their major controlling factors such as storm systems, frontal activity, air mass type (if it can be determined), and regional air circulation. Under some weather patterns, local weather factors can play a larger role than synoptic conditions. Then it may be relevant to focus on local factors such as elevation, daily changes in temperature /moisture, etc. Remember, weather forecast information is NOT relevant to your report.

The report must use your collected **roof-top weather data (as a time-series graph), the UNBC Weather Station graph,** and an appropriate number of relevant **weather maps and satellite images** to demonstrate your understanding of **what occurred and how the local and synoptic situation affected the weather Prince George experienced over the 4-day observation period.** Analyse the data and substantiate your explanation by referring to specific patterns /trends or data that support your interpretations. Embed figures in the body of your report. All maps, graphs, images, diagrams, and appendices must have captions and be referred to in the body of your report. Use them to provide evidence for your explanation, and to clarify and condense your writing. Making the best use of your resources often involves generating your own diagrams, graphs, maps or tables from your collected information (so they show what you want to explain). You may want to quote well-written diary summaries; or use other relevant parts of your diary in your report body by extracting observations that support your interpretation of what occurred and putting them into a table (or other creative forms of data presentation - graphs, diagrams, etc.). Do not hope that a reader will synthesize information from poorly organized pre-existing material (images, maps, graphs, text), or lengthy word descriptions that could be better edited or images that could be adapted /annotated.

All non-original material must be properly cited (in the report body) and referenced (at the end) using the Council of Science Editors (CSE) 9th edition Name-Year style as summarized in an Academic Success Centre handout (ASC 2025). For websites with information like weather maps and satellite images the Name (i.e. the author) is the organization producing the images. For **sources longer than 20 pages, you must identify the page numbers used in your in-text citation**. Animations cannot be accepted in the report. If you use websites that host weather information from other sources, ensure that your reference indicates the original source of the information. This arises if you use materials (weather maps, satellite images, etc.) from ECCC or NOAA hosted by https://cyclone.unbc.ca/wxv.

- **Your writing style must be professional**. There is no requirement to follow a specific report style but you must use headings and subheadings to organize the report. **Figures must be embedded in the report body;** place them close to where you use them so your reader can see them as you are discussing them. Report organization should enhance report objectives and make your work easy to follow. **Include a title page, a table of contents, an introduction, your appropriately titled report body that presents and discusses the data, a conclusion, references, and the two required appendices** (Appendix 1 and Appendix 2 – more on these follows). Appendices provide information that would be cumbersome in the main report body. **We don't think other appendices are needed.**

The final document must be corner-stapled with a title page (i.e. no binders, portfolio covers, etc.). You are required to submit both a paper copy of your complete report and an electronic version of your report text. Do not worry about scanning non-electronic components (hand-produced graphs or appendix items) in the electronic submission. Only the paper copy of your work will be graded.

If you have questions about report writing, discuss them with your instructors well in advance of project deadlines.

Things to keep in mind:

- The Wx Proj report is a case study of the observation period. It is an original, concise, individually written description, interpretation, and explanation of the observed weather (in terms of the synoptic and local conditions).
- The report shows your analysis and explanation of what happened and why. Present your data in graphs, charts, maps, and images that enhance your explanation. Figures must be embedded in the report body. All figures should be near their corresponding text (do not put them all in one section or bury them in an appendix). Each figure must be numbered, have a caption, and be referred to in the body of your report.
- Part of your evaluation is based on how you choose to present your material. Remember, figures exist to help readers absorb your information. They provide evidence for data patterns and relationships or demonstrate specific phenomena. Be selective and only use weather information that describes current weather patterns and how they are changing. This often means that you should modify the original images you collected and adapt /create, annotate or redraw figures to better express your ideas. It also means that many of your collected images are not used. So, do not include every collected map, image, or piece of data in your report. Rather, analyze and interpret your maps and data, extract the relevant information, and only report images that assist your explanation of what occurred and why. Multiple figures (images /maps) with little annotation and no relevant interpretation detracts, rather than adds to the quality of your report. Note, that neat hand-drawn diagrams are better than computer-generated graphics that do not show the points you are trying to make. So, focus on report content, not on manipulating computer graphics for this report. Unless you created the figure, cite the original source for the figure in the caption, and list this source in the reference section of your report.

All appendices must have titles, and a brief introductory summary (i.e. statement of purpose - like an appendix caption). Put these on separate title page or at the top of each appendix. Look at your textbook for examples of how to do this properly.

- **Appendix 1** is your marked original hand-written weather diary.
- **Appendix 2** is your marked data rationalization. It consists of your original data collection sheet, your final, rationalized data set, and your tracking of needed data changes, corrections, and conversions. It must also clearly indicate the reasons for, and details of any data quality control measures you used in order to make sense of your data.

- If there are other images / maps / graphics, etc. that you think are of interest to a reader but not necessary to explain your report points, you may include them in appropriately labeled and captioned additional appendix. **But, we usually discourage this.** So, think very carefully about whether these items are better left out of your report or included in the report body. Do not pad your report with poorly related or unneeded information. Ask an instructor for advice if you are not sure how to use appendices.

REPORT EVALUATION

The Weather Observation and Analysis Project is worth 30% of the course grade: pre-report data collection /analysis work is worth 10% and the written report is worth 20%.

The 10% pre-report mark is based on the quality of your:

- Data collection during the observation period: Roof top observations (2%), personal weather diary (2%), electronic data sources (1%), teamwork evaluation (1%). [total 6%]

  A ziplock bag (provided in the lab) containing your: teamwork evaluation form, personal weather diary, and electronic data sources organized on a USB key, are due in your drop box right after the observation period (submission deadline on the course schedule).

- Data quality control /data rationalization: Review your data for errors, report them, rectify them wherever possible and indicate how you resolved your data problem(s). This forms Appendix 2 of your report and will be done in lab following the observation period. [1%]
- Stacked time series graph, based on your final dataset (done in lab) and embedded as a figure in your report. [1%]
- Report Outline Meeting: Meet individually with an instructor to verbally review your analysis and explanation of the weather that occurred over the observation period and your report organization. [2%]

The 20% report mark is based on the quality of your:

- Analysis: Manipulating and displaying your data in a way that aids your explanation (e.g. your time series graph, annotated synoptic maps /drawings /photos, data summarized in charts, tables, or graphs, etc.).
- Explanation and interpretation of the weather that occurred. Use your data and analysis to support your interpretation. Show your understanding of the weather that affected Prince George over the four-day observation period and why it occurred.
- Presentation and organization of your report: having required report elements; using them appropriately, organizing them to make the report easy to follow and meet the report's objectives, writing quality; grammar; spelling.
- Referencing and citations: in-text citations in the report body, references cited list at the end of the report, using the CSE 9th Edition Name-Year style (ASC 2025), including in-text page numbers for longer works.
- Work: It is possible to earn bonus marks for excellence or originality in your analysis, presentation, and/or explanation. Impress us!

SUGGESTIONS FOR REPORT WRITING:

Titles, a table of contents, page numbers, headings, subheadings, and appendices help to organize a report and make it more coherent. All non-original information must be cited using in-text citations and an end-of-document reference list that follows the CSE 9th Edition Name-Year style and documented in a UNBC Academic Success Centre handout (ASC, 2025). If you are missing data, speak to an instructor as soon as possible to see what can be done.

Discussing and working together to analyse /interpret your data is fine. However, this is an individual independent report, so using another student's text, data, figures, graphs, etc. in your report is cheating and not allowed. This academic offense will get you into trouble so don't do it! Plagiarism is another academic offense to be avoided. Electronic submission is required and used to check for these issues.

Can you use Artificial Intelligence (AI) to draft or write this report? No! An AI assisted or produced report is not independently produced, and it is considered the same as using another person's work. See the paragraph above.

Use text, tables and figures (e.g. graphs, diagrams, maps, charts, and illustrations) to describe, explain and provide evidence for your interpretations of the observed weather pattern, and its relationship to the synoptic situation. Often a well-placed, annotated, and captioned figure that is discussed in the report describes/explains an idea better than lengthy written descriptions. Graphs also condense complex information and provide a pictorial representation of data relationships. Remember, the report writer's job is to provide information and explanation for the reader in the most accessible way; pick the best format(s) for your objective. Review the following image /graph related concepts and questions, to help you decide how, when, and where to use figures.

- What are your reasons for graphing data?
- Are there advantages and disadvantages for using a particular style of graphing (e.g. multiple graphs, multiple categories of data, time series, selecting only particular data, etc.)? Does it aid your interpretation of the weather? How?
- How do you choose axis dimensions, and their placement and orientation on the page? How should you distinguish different data points on your graph?
- How do you best represent time gaps in your data? Displaying time intervals evenly is most intuitive. Other, usually less clear ways include: using a "break-in-interval" symbol on the time axis or using dashed lines (by convention they represent interpolated data and can be used to show assumed data patterns). Pay attention to the time axis when representing gaps in time.
- Should you place multiple graphs or images in a single figure? On a single page? Which ones go together? What are the advantages and disadvantages?
- How should figure labels, titles, captions, and citations be used to properly represent your diagrams and graphs? Ensure all figures (images, graphs) and tables are numbered and accompanied by captions that include citations to their sources. Check that sources are also listed in your references.
- All figures must be referred to, discussed, and explained in your report's body. Sometimes you can streamline your writing by referring to a group of related figures to make your point.

- Don't describe what the reader can plainly see in figures (this makes them redundant); rather highlight what evidence they provide and what you want the reader to remember from them.

Data quality control (data rationalization) is part of any data-driven report. Appendix 2 is your report's error analysis; it should be referred to in the report body (usually where you discuss methods). However, when presenting your data, also consider whether you have unresolved data errors that limit your interpretation of the weather that occurred. If so, use that data appropriately, and briefly discuss these major data issues and their impact (also usually done where you discuss methods). Otherwise, it is not necessary to describe errors again as you assessed, resolved, and documented these for your graded data rationalization /quality control process.

As developing writers, we encourage you to discuss your writing questions with your instructors. To aid this dialogue, lab time is used for 15 minute individual interviews where you will **meet with a course instructor** to:

- verbally outline your report - the story of the weather that occurred over the observation period;
- review the supporting information you plan to use in your report; and
- discuss how you plan to organize and write it.

This meeting is a scheduled, required, graded report element. Instructors have found that this discussion helps students organize, clarify, and confirm their thoughts early in the writing process, and helps students write their reports more efficiently and correctly. Students who better prepare for this meeting are able to gain more from it.

Finally, remember to leave time to edit and critically review your report. Ensure that you have met the report requirements, organized the material well, expressed yourself in easily understood ways, reduced jargon, and eliminated typographical and grammatical errors.

Leave enough time to ask an instructor for advice if you have questions. Instructors will meet and discuss any aspect of the project with you, including answering specific writing or content questions; but they cannot review or edit your report writing for you prior to turning it in.

REFERENCES & OTHER INFORMATION SOURCES:

In addition to the websites discussed here and handouts given in class, these resources are useful:

Ahrens CD, Jackson PL, Jackson CEJ. 2016. Meteorology today: an introduction to weather, climate and the environment. 2nd Canadian Edition. Toronto (ON): Nelson Education. (Appendices, Cloud Chart at the back of the text, Chapter 11, 12 and 15 – content on air masses, fronts, storms, and weather forecasting. Use the index for other relevant pages).

[ASC] Academic Success Centre. 2025. CSE Style. UNBC; [updated 2025 Jan]. https://www.unbc.ca/sites/default/files/sections/academic-success-centre/cse-style-2025.pdf

DATE	TIME	TEMPERATURE			HUMIDITY Note Instrument Type in RH column				PRECIPITATION Note when precipitation is from melted snow				SKY Condition & CLOUD							WIND				PRESSURE			COMMENTS
Entered from earliest to latest		Max Temp. (°C)	Min Temp. (°C)	Present Air Temp. (°C)	Wet bulb Temp. (°C)	F = wick is frozen	Dry bulb Temp. (°C)	e (hPa) RH (%) A = Assmann B = Bacharach W = Wsksler	Snow Depth (mm) Ruler measurement	Snow Water Equivalent (mm)	Rain gauge (mm) T= Trace	M = from melted rain gauge	Sky: CLR FEW SCT BKN OVC OBSCD MISG	Amount (8ths) low	Amount (8ths) mid	Amount (8ths) high	Cloud type: Use abbreviations; use dashes for layers you cannot see. low	Cloud type mid	Cloud type high	Visual Observation: Direction Bearing as an 8-point compass	Visual Observation: Beaufort number	UNBC Weather Station: Direction Azimuth as degrees (°) from north	UNBC Weather Station: Speed (m/s)	Barometer (mm Hg)	Barometer Temp. °C (report to the nearest degree)	Corrected Pressure (hPa)	
Tues. Feb. 26	8:10	5.0	1.0	1.5	1.0	--	1.5	B	0	Each student will do their own calculations here.	3.6	--	OVC	8	--	--	Ns	--	--	SE	2	120	1.8	697.2	20	Each student will do their own calculations here.	Rain ended when emptying gauge
Tues. Feb. 26	11:49	2.0	1.5	2.0	-2.0	F	2.0	W	0		T	--	BKN	3	4	--	Sc	Ac	--	--	0	280	0.3	698.4	21		
Tues. Feb. 26	4:03																								22		
Wed. Feb. 27	7:55																								20		Sundogs visible
Wed. Feb. 27	12:07																								21		
Wed. Feb. 27	4:13																								22		
Thurs. Feb. 28	8:00																								20		Snow started
Thurs. Feb. 28	11:59																								21		Heavy snow during measurements
Thurs. Feb. 28	3:45																								22		Snow ended during observations
Fri. Mar. 1	7:40																								20		Foggy on campus
Fri. Mar. 1	11:39																								21		No fog now
Fri. Mar. 1	3:43	-1.0	-4.0	-4.0	-4.0	F	-3.5	A	10		0.9	M	SCT	1	2	0	St	As	--	SE	1	173	1.1	689.3	21		Cloud diminished during reading time

Each student will do their own calculations here. (shaded columns: humidity, snow water equivalent, corrected pressure)

These example data values → show a completed data collection form. Note the values and
how they are recorded for → → each measurement as well as between measurements at the
same time. Review reporting → requirements again before we start data collection. Also,
realize that instruments are → never perfectly calibrated, so there are usually small
discrepancies between → → thermometers etc. from different Stevenson screens, but
observations should be → → consistent. More discussion of data issues will occur in labs
before /after data collection. → [The data rationalization /quality control lab will focus on
post data collection issues, so → avoid as many as possible by clarifying any confusion now.