Lab 7.2 Agenda: Graphing Stacked Time Series Data

- **Attendance:** needed for today's work
- **Returns & Comments:** Lab 6, Appendix 2, & any outstanding items
- **Distribute:** multiple graph paper sheets

Graphing Stacked Time Series Data Lab (focus):

Complete a draft stacked time series graph using your screen's rationalized data. (Show your instructor before leaving today; **marked as you leave the lab. Worth 1%)**

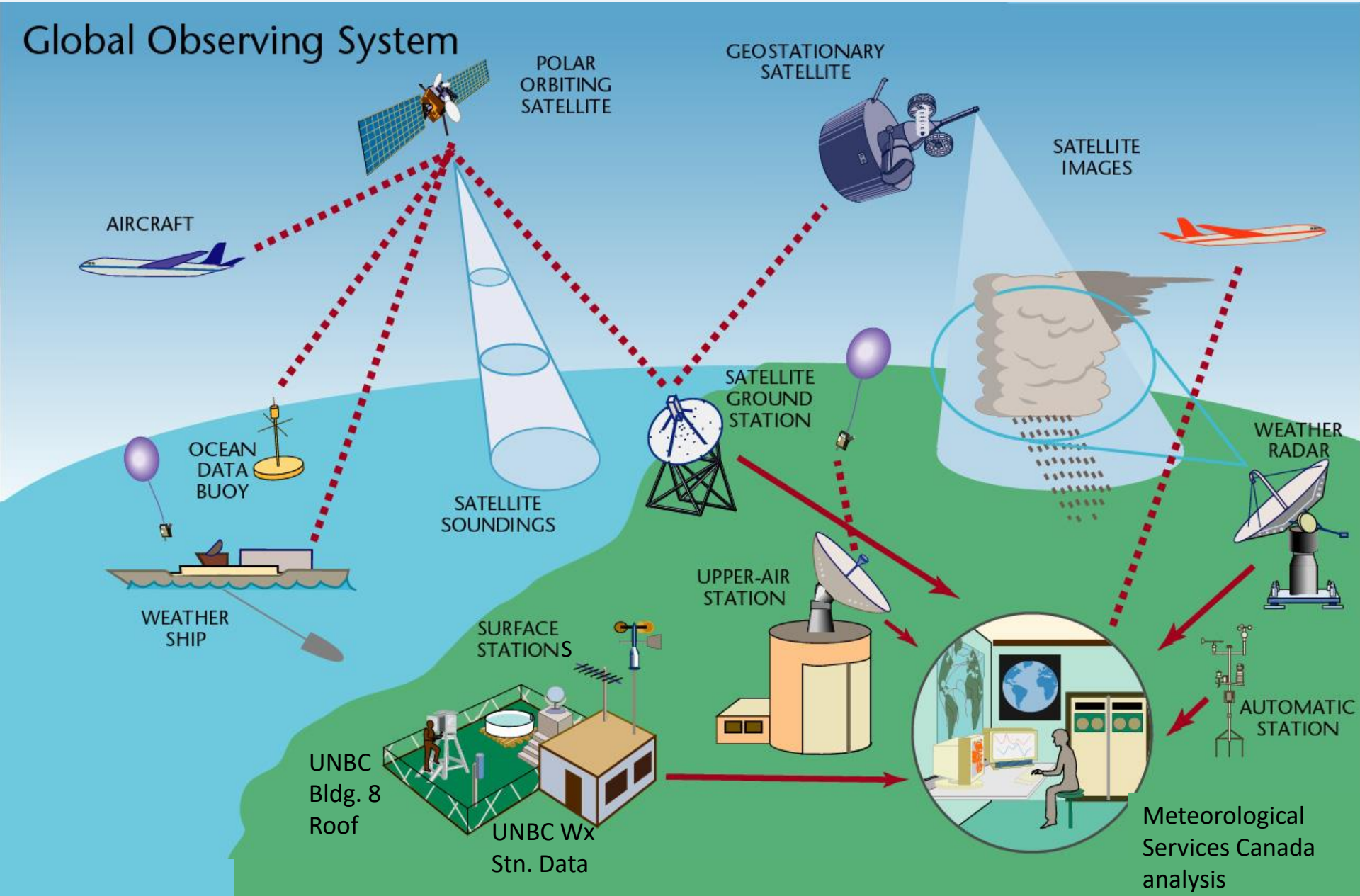
Before leaving today…

- **Instructor must mark your draft graph before you leave!** (be as complete as possible;)
- **Sign-up** for your **15-minute instructor meeting next week** → schedule will be posted on the lab website (see side menu on cyclone)
- **Organize your weather maps & satellite images** (integrate them; organize /match by time each day – helps you see how maps & images relate to stacked time series graphs
- **Due after today's lab: Nothing! Instead prepare for Instructor meeting** (worth 2%)
  Be ready to present, discuss & explain your WxProj ideas. Have an outline.
  - Discuss your 4-day weather story (to the best of your current ability)
  - Provide supporting evidence for your ideas using as many data sources as you can!
  - Bring: Your draft roof-data graph, UNBC Wx Stn graph, diary, Appendix 2, selected electronic weather maps /satellite images, and your current questions.

Lab 7.2:

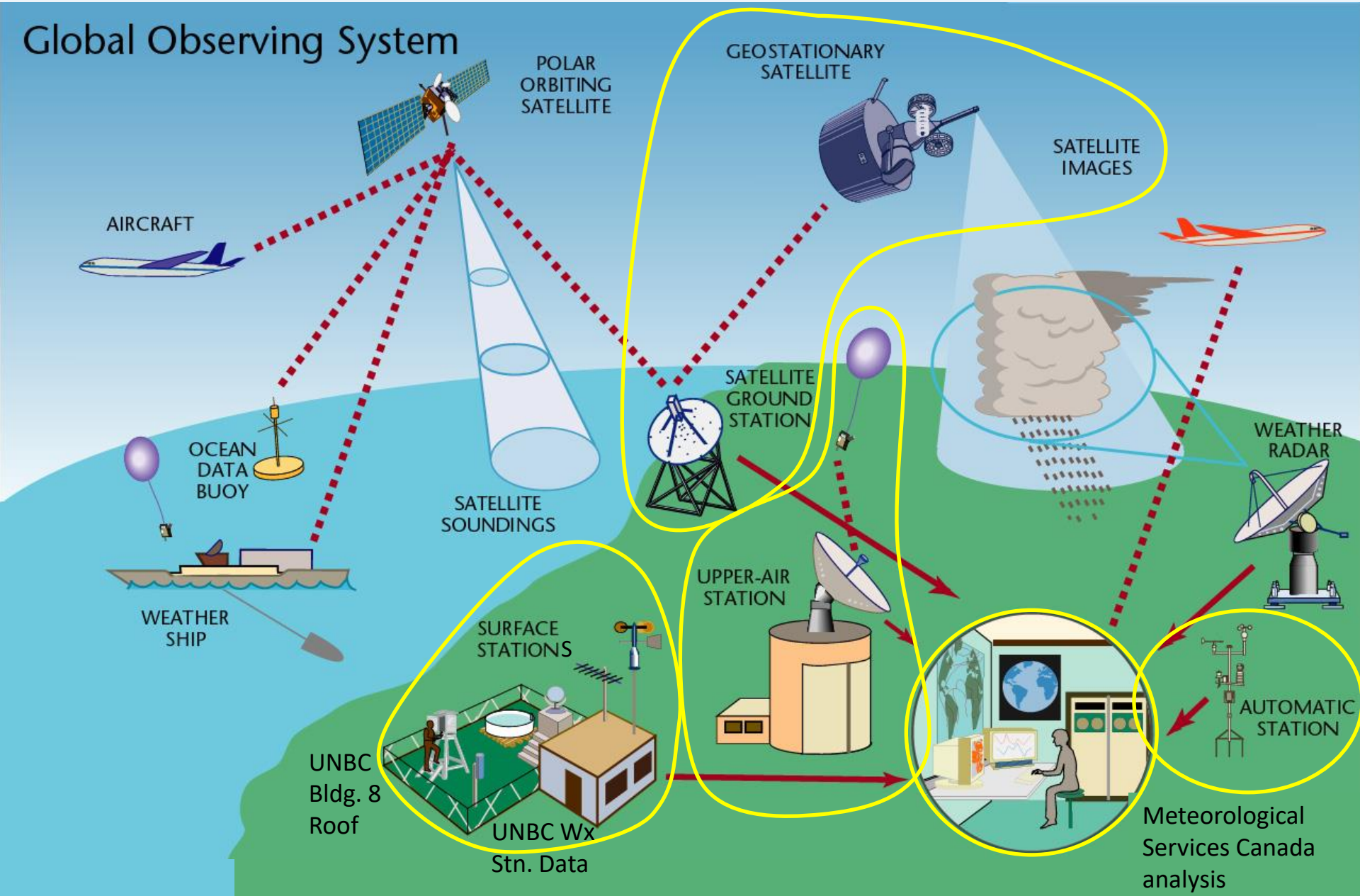
Integrating Data

Use local & synoptic data to interpret the weather at UNBC for our 4 days…..



Integrating WxProj Data

Our local & synoptic data sources



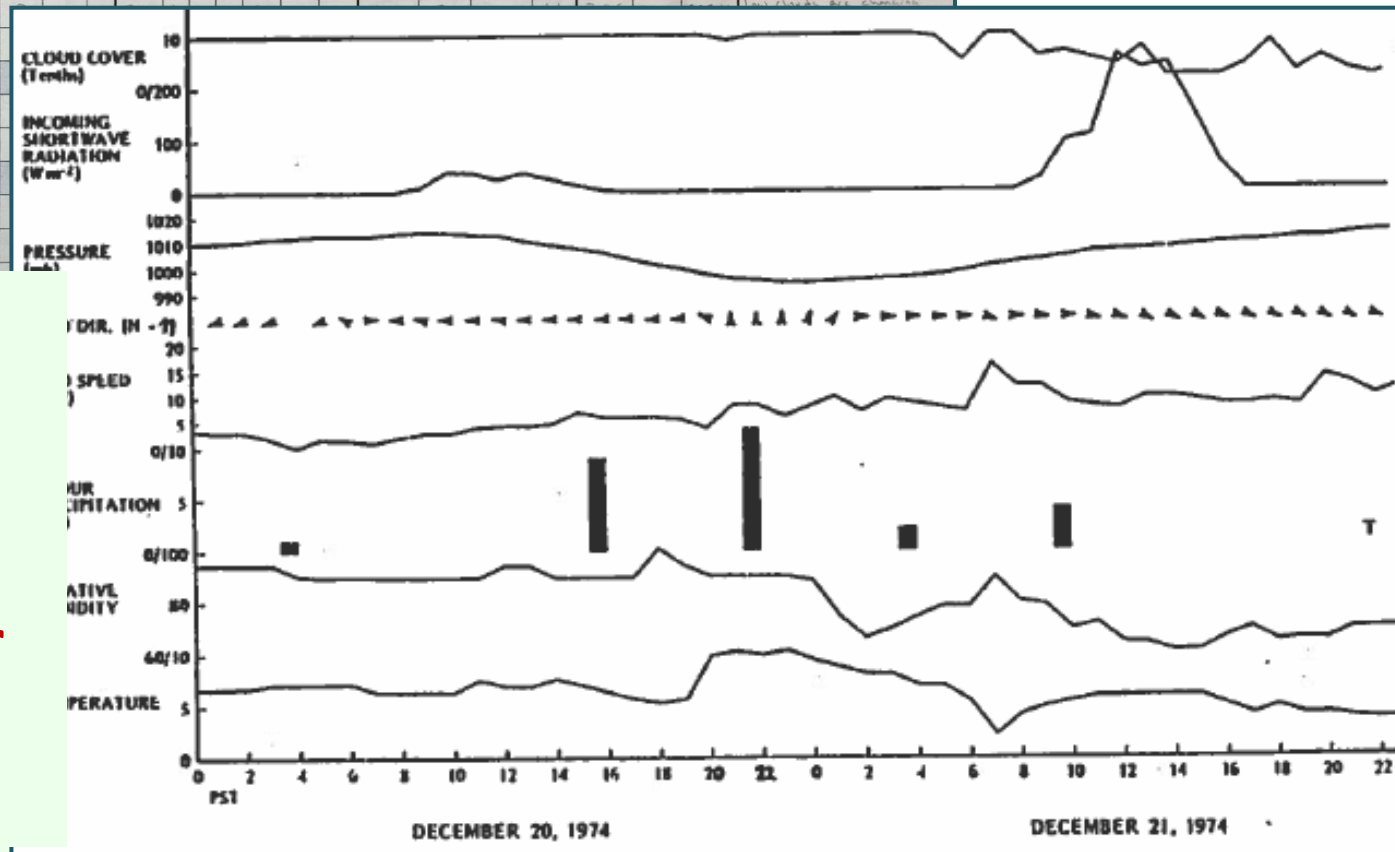
Today: Graphing your UNBC Bldg. 8 Roof Data ←

1st Step of your analysis

But…

Screen B Instrument 3

TIME	TEMPERATURE			HUMIDITY (Note wick state & instrument type in the indicated columns)						PRECIPITATION (Note when precipitation is from melted rain gauge)				SKY Condition & CLOUD							WIND				PRESSURE			COMMENTS
														SKY	Amount (8ths)			Cloud type: Use 2-letter cloud abbreviations & double dashes for layers you cannot see.			Visual Observation		UNBC Weather Station					
m earliest e & time	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 = Weleler	Snow Depth (mm) Ruler measurement	Snow Water Equivalent SWE (mm)	Rain gauge (mm) T = Trace	M = from melted rain gauge	CLR FEW SCT BKN OVC OBSCD MISG	low	mid	high	low	mid	high	Direction Bearing (8-point compass)	Beaufort number	Direction Azimuth (degrees °) from north	Speed (m/s)	Barometer (mm Hg)	Barometer Temp. (°C)	Corrected Pressure (hPa)	
2 7:46	-2.0	-8.5	-7.0	-6.3	F	-6.2	3.6	98.4	A	--	○	0	--	BKN	6	1	--	ST	As	--	SW	1	240	2.0	700.8	20.0	932.0	Fog in lower town/not in sky view First on the hour
2 12:30	-2.0	-8.0	-2.0	-3.7	F	-2.1	3.5	78.8	A	0	○	0	--	OVC	0	0	8	--	--	CS	E	2	101	0.4	700.6	21.0	931.8	Clouds changed
2 3:30	0.0	-3.0	-1.0	-1.5	F	1.4	6.9	78.5	A	--	○	--	--	SCT	--	2	2	--	As	Cl	SW	1	248	1.4	700.4	22.0	931.2	
3 8:05	-0.5	-13.0	-12.5	-10.4	F	-10.2	2.7	95.7	A	--	○	○	--	CLR	--	--	--	--	--	--	SW	0	229	0.4	703.4	21.0	935.3	First on lunch, streaks clouds on the horizon
3 12:30	-8.0	-13.0	-8.0	-8.0	F	-7.9	3.2	96.4	A	0																		
3 3:50	-6.0	-8.0	-6.0	-7.6	F	-6.4	3.8	81.6	A	--																		
8:04	-8.0	-15.0	-13.0	-10.9	F	-10.4	2.5	97.6	A	--																		
12:21	-11.0	-13.0	-11.0	-9.5	F	-9.5	2.6	1000	A	--																		
3:45	-5.0	-11.0	-5.0	-5.8	F	-5.3	4.0	92.7	A	--																		
7:35	-4.5	-13.5	-13.0	-11.4	F	-10.6	2.9	93.8	A	--																		
12:36	-6.0	-13.0	-6.0	-7.2	F	-5.1	4.6	73.6	A	0																		
3:45	-2.0	-6.0	-2.0	-4.6	F	-2.2	5.4	74.1	A	0																		



↑ Data must be **correctly** rationalized!

Address any QC or calculation errors before plotting.

Graphing Stacked Time Series Data (worth 1%)

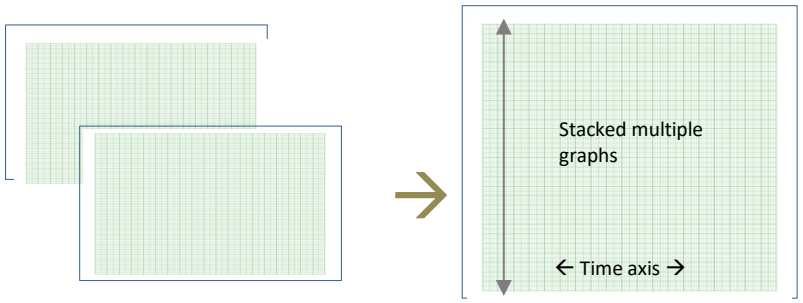
Complete your stacked time series graph using your screen's rationalized data (marked in-lab as you leave)

If needed…
…all final dataset values must be correct before plotting.
Address any measured /calculation issues.

Before leaving today's lab, your instructor must mark your draft graph!

Plot your screen's rationalized data - makes weather patterns clear

(shows connections & relationships between weather variables).



Best drawn by hand on a taller graph….

Join 2 or 3 graph sheets along their 11" (long-side of the page). Then rotate the pages to graph multiple stacked graphs on the longest side (so the time axis is on the 11" (inch) side & you have more height for multiple y-axis graphs).

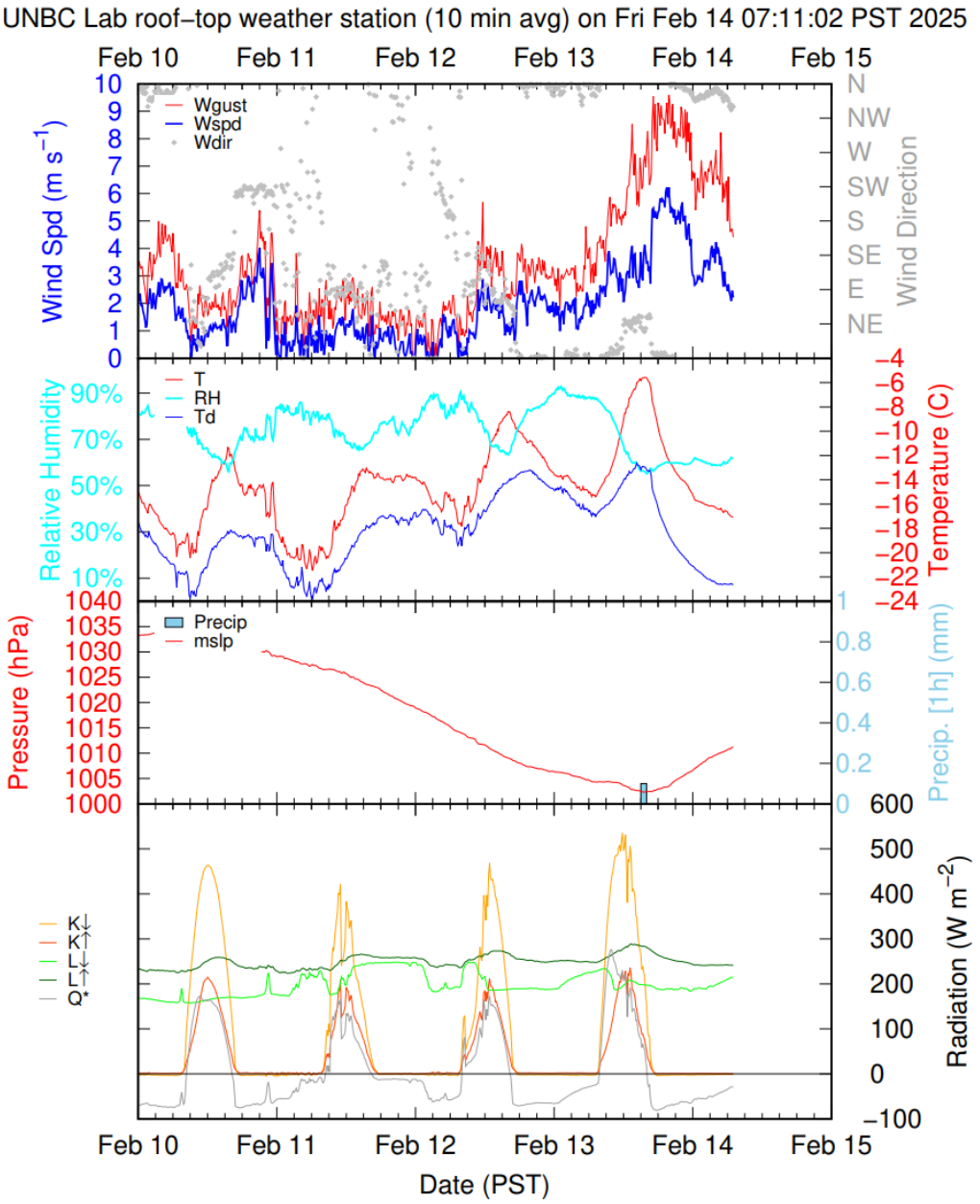
- Hand-drawn graphs save time unless you already know software that plots complex time-series well – Excel won't do this
- ***Thoughtful, well designed, graphs that clearly, correctly express your ideas are better than slick graphs that communicate a limited, poor or incorrect message.***
- An accurate, clear but rougher draft graph is sufficient for instructor meetings. *A draft shows what you'll need to change for your final graph.*

Stacked Time Series (STS) Examples

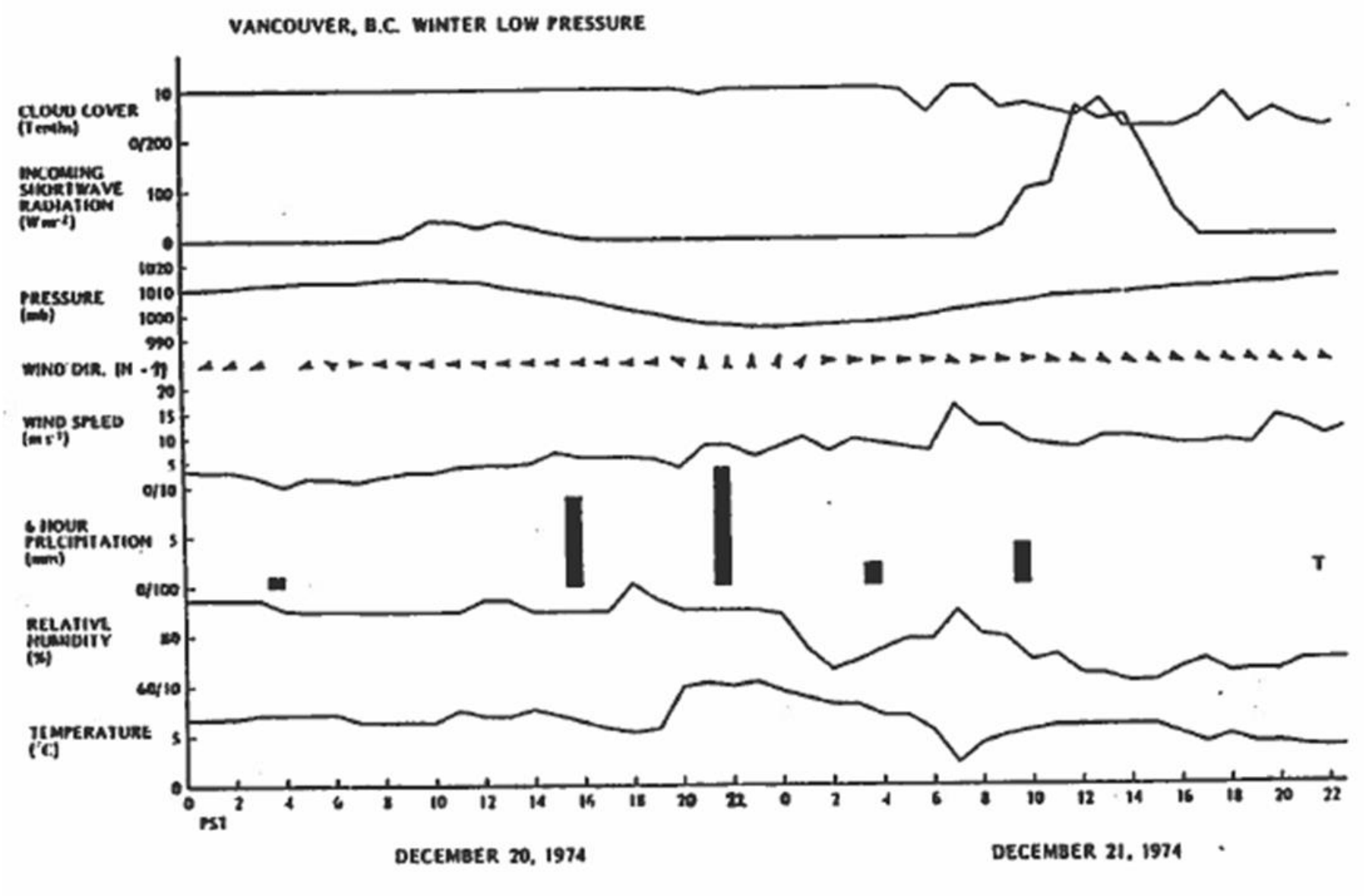
UNBC Wx Stn Graph: A complementary stacked time series graph. It supports your roof graph; & is graphed already. Use it beside your graphed roof data; each tells part of your weather story…

Your data, consider:

- how to correctly display it
- what to display
- how to organize /stack graphs
- symbols
- colours
- how to represent it intuitively
- How to avoid misleading /confusing representations

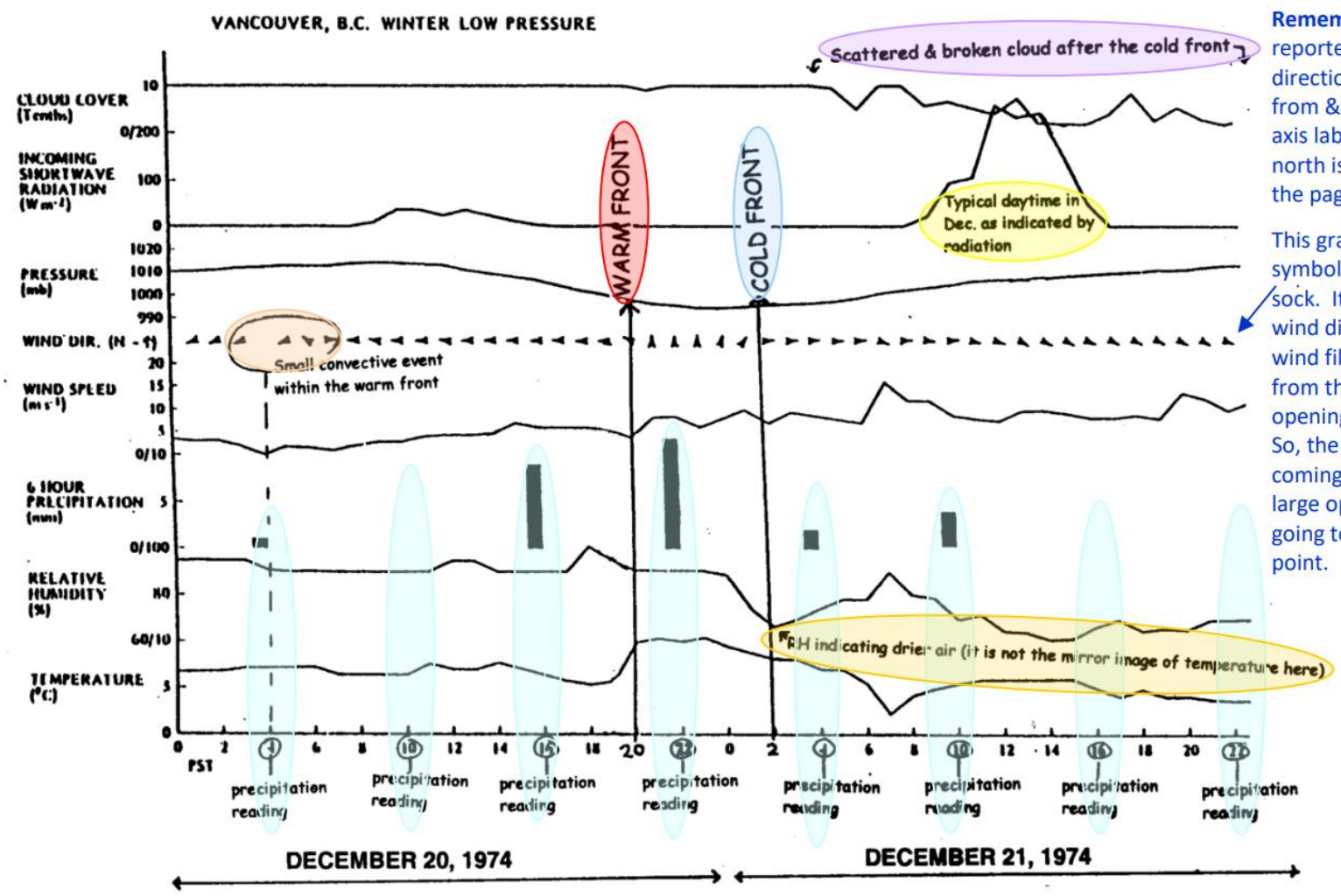


Lab 6 (Part B) is a useful example, but some data differs….



Lab 6 (Part B) answers: Analysis shows how to connect time series & synoptic data….

Figure 6.5 with annotations indicating the sequence of fronts passing Vancouver between Dec. 20 and 21



Remember: Wind is reported as the direction it comes from & the (N - ↑) axis label means north is the top of the page.

This graph's wind symbol is a wind sock. It shows the wind direction by the wind filling the sock from the large opening to the point. So, the wind is coming from the large opening and going toward the point.

Graph showing multiple time series plots which indicate the weather conditions observed at Vancouver during the passage of a winter low pressure system (December 20 to 21, 1974); the system is moving from the Pacific Ocean toward British Columbia. Source: Climate of Vancouver, J. Hay and T. Oke; reproduced with the authors permission.

Consider which variables to plot above or below each other to best see & communicate weather relationships & patterns

Ensure:

- time (x-axis) is represented equally (i.e. during the day - observations are every ~4 hours; overnight - observations are every ~16 hours)
- each stacked graph clearly shows /represents their y-axis values. *Consider if each graph must start at 0 (zero).*
- *All 0 data (zero – i.e. nothing measured)? Graph it? Consider what it means. How can you best communicate what it shows?*
- symbols are clearly defined in a key or legend (*e.g. Does an arrow show wind blowing from tip to tail? tail to tip? Does an up-arrow (↑) mean the wind comes from the North? What does each symbol show /mean?)*

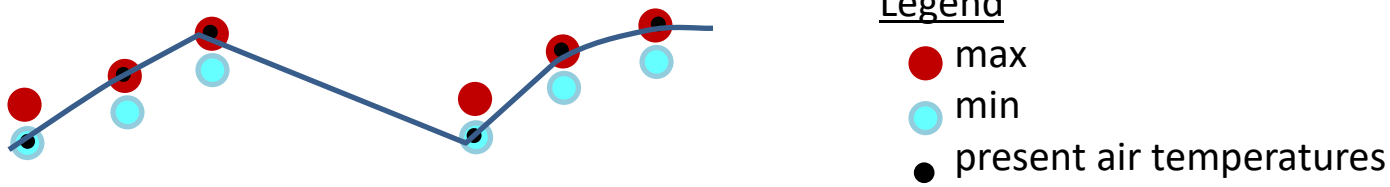
  Clearly communicate each graph's symbols using legends or annotations, so that graphed data can't be confused by your readers.

Connect graphed data points to show patterns or trends….But how?

- Some data has NO TREND (consider precipitation, cloud? others?)
- Use dashed ----- vs solid —— lines? What does each line mean? Which to use? When? How does your choice affect the interpretation?

Example: Consider how to plot temperatures… You have max, min, and present air temperatures. Best seen as 3 points (•) on the same graph rather than on 3 graphs. **What's the clearest way to relate these temperatures?**

Depends on your purpose…



- Realize…. max-min temperatures and precipitation values represent events that occurred during the previous period. *So, shading between max-min values may be a clearer representation….*

Next Week: WxProj Interviews

- **Attend for your meeting time** (Come a few minutes early to get ready – find a spot, log-on to computers if needed for memory keys, etc.)
- **Meet in the lab room** (resources available)
- **Can work in the lab room** when not meeting
- **After the lab's meetings are finished,** your instructor is available for further help for the rest of the lab
- Collect any remaining returned assignments

After instructor meetings → **No more lab assignments but…**

…come, check-in…

Instructors are available in the lab room for project consultation during lab times.

Next Week's 15-minute Instructor Meeting (2%)

Come prepared to discuss writing your Wx Project report

Bring: 1-page draft report outline indicating your:

- understanding of the 4-day weather story – what happened, when, & why
- planned report format /report organization ideas
- supporting evidence (diary, selected from Wx maps, satellite images, graphs)
- draft stacked time series graph & the UNBC Wx graph (printed)
- current questions

How to prepare? Consider your report objectives:

- Organize your synoptic maps & satellite images by time, review them, discover the wx story

- Consider possible sources of evidence:

- weather diary (especially good end of period summaries)
- your stacked roof data time series graph (based on your rationalized data)
- 4-day UNBC weather station graph (printed)
- selected electronic synoptic data (surface & upper air maps, satellite images)

- Consider how to effectively communicate a case study & evidence

- Track /list questions

Consider… while formulating your report ideas:

- Good diary summaries help you see the weather story – they can indicate & interconnect key weather events during the period.

- Your rooftop precipitation and max-min temperature data represent the preceding time period.

- **Your stacked time series graph** & the **UNBC Weather Station graph complement each other**. Each provides supporting evidence (some overlapping, some unique). Present them on opposite report pages so you can easily integrate evidence from each when discussing these key local data sources in your report.

  It is difficult & unnecessary to integrate these 2 datasets into 1 graph. Their different measuring methods and measuring time-intervals make this a complex task. It is better to use the evidence as shown by each graph by integrating it in your report text as you discuss /explain your points.

Considerations for Report writing meetings

- How does the synoptic situation & the local weather pattern fit together? Which maps /satellite images show this connection best? Which are most relevant?

- What is the weather story? What happened? Why? Do patterns repeat? What does the evidence support?

- Realize a case study is not an experiment – no hypothesis testing - only presentation & discussion of events with evidence.

- How can you best present your weather story? "day by day"? "event by event" ? "day vs night"? Which is clearer? Less wordy? What is more easily understood by your reader?

Weather story: ***What happened, when, & why?***

Based on supporting evidence.

Select weather story evidence from your:

— **stacked time series graph of your rationalized rooftop screen data**

— **UNBC weather graph**

— **your weather diary**

→ **Local weather picture** → **Shows what happened & when**

— **selected relevant synoptic** (regional) **data:**

surface maps,
satellite images,
500 hPa (upper air maps)

→ **Synoptic weather picture** → **Shows when it happened & why**

Done Graphing & Have Time?

Prepare for your Instructor Interview (worth 2%)

- **Put** your **weather maps and satellite images in time-order. Review them.**
- **Compare them to your 2 stacked timeseries graphs** (your roof data & UNBC Wx Stn):

Try to determine the weather story…..

What was our weather?

Why did that occur?

Be ready to present, discuss, & explain (to the best of your ability) your 4-day weather story. Provide evidence to support what you say; use different types of data sources!

Come prepared for your 15-minute WxProj Report Writing Meeting. **Bring:**

- **your report outline** (printed, typically 1 page, more information below)
- **your draft, stacked time series graph** (hand-drawn from Appendix 2's Final dataset, bring Appendix 2 too)
- **a colour printed copy of the UNBC Wx Stn graph** (colours distinguish graphed lines)
- **your diary** (i.e. Appendix 1 if your diary is already formatted as Appendix 1)
- **access to selected synoptic weather data** (organized by time, consider 500 hPa, surface maps, or satellite images that explain /provide evidence for your weather (wx) story. Set-up & ready to use on a computer /memory key.)
- **prepared thoughts /current questions** about your wx story. Any related items you want to discuss.

Preparing for your WxProj Report Writing Meeting Interview (Interviews are done in your lab as scheduled)

- ❑ **Review & interpret all your data; look for interconnections /possible supporting evidence**. Consider weather patterns, look for relationships between variables, graphs, your diary, synoptic data and links to course concepts. Use all information sources. Try to explain how these provide evidence for your wx story. **Make notes on what you find**; identify the relationships; where they occur; and the sources of evidence that support them. **Consider your:**
  - **weather diary** [especially the synopses can be useful starting points]
  - **draft, stacked time series graph** based on your rationalized dataset; it must be accurate, complete, useful for interpretation. [Pictorially, it represent your data to show patterns & trends. Use it to complement & reinforce other local data.]
  - **colour printed UNBC Wx Stn graph** [shows our 4-day weather period]
  - **selected synoptic data** organized by time, indicates the larger (regional scale) weather setting. [View connected images in sequence (as demonstrated in labs /lectures). Look for changes between images to see possible reasons for our week's weather.]

- ❑ **Write an outline** (~1 page) **indicating your:**
  - current understanding of the 4-day wx story [what happened, when it occurred, why, and how you know the story]
  - plan for formatting your report: Section /subsection headings, report structure /organization ideas /questions
  - ideas for supporting evidence and how you might use it
  - questions about: Where you are stuck /something you don't know /what you think you'll do /how to proceed

- ❑ **Any report related items you wish to discuss** but there may not be time to discuss everything during this meeting.