Term Project
Introduction to Weather and Climate
Fall 2011

The term project[1] constitutes 25% of your final course grade. Its successful completion is mandatory of all students. Note that doing the project and passing it does not guarantee that you will pass the course (grade of D or higher). **On the other hand, failing the project (50% or lower) or not doing it guarantees that you will fail the course (grade of E).**

Analysis of Surface Weather Observations

Part I

Collect daily surface weather observations at Tucson International Airport (TUS), which are recorded by the National Weather Service, Tucson Office at approximately 5 pm local standard time. Note that 5 pm MST is 00:00 UTC. UTC (Universal Time Coordinated) time is London U.K. standard time. You need to pick the available observation time that is closest to 00:00 UTC. Generally this will be about 5-7 minutes before the hour. (e.g. 23:53 UTC; you must look as observation time can vary by a few minutes.) Do this everyday for a three-week period, including the intervening weekend days. Candidate 3-week periods are:

Analysis period #1: September 26 (Monday) to October 14 (Friday)
Analysis period #2: October 3 (Monday) to October 21 (Friday)
Analysis period #3: October 10 (Monday) to October 28 (Friday)
Analysis period #4: October 17 (Monday) to November 04 (Friday)

You must do one of the analysis periods above. The advantage of the choosing an earlier period is that you can finish your project earlier in term and not have to worry about it competing for time with projects in other classes toward the end of the semester; the disadvantage is that the weather in Tucson can be pretty "dead" (no rain; no frontal passages; no abrupt temperature or no abrupt moisture changes) early in the fall. The advantage of choosing a later autumn period is that it is becomes more likely that at a "significant" weather event would occur. Note that whatever period you pick, the due is **5:00 pm November 13th**, just 9 days after the end of the last period. Choose your 3-week period accordingly.

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[1] This project closely follows ones given by Prof. Christopher Castro and Prof. Elizabeth Ritchie in their sections of *Introduction to Weather and Climate*. Your instructor acknowledges their generosity to share ideas.

Your surface weather observation should include the following:

- Temperature
- Wind speed and direction
- Sky conditions: Cloud coverage
- Pressure
- Dew point
- Significant weather at the time of observation (e.g. thunderstorm)
- Total accumulated precipitation during the 24-hour period that ends at 5 am MST (12:00 UTC) the next local calendar day.

Daily surface observations at TUS (Tucson International Airport) for the prior 960 hours (28 days) can be obtained directly from NWS Tucson forecast at the link… http://www.wrh.noaa.gov/mesowest/getobext.php?wfo=twc&sid=KTUS&num=960. Note that some days/times may be missing owing to hardware failure and power outages. Instruments can fail too. And they can go offline. Stuff happens.

Weather Underground http://www.wunderground.com/history/ also maintains a *deep archive* of hourly reports. How one gets data for Tucson International Airport should be self-evident via the dropdown menus. A shortcut to get hourly data for September 15th, for example, is cut-n-paste the following link into your browser's menu bar… http://www.wunderground.com/history/airport/KTUS/2011/9/15/DailyHistory.html?req_city=Tucson+International&req_state=AZ&req_statename=Arizona . The string "2011/9/15" would change accordingly for a different date. For example, you would change the string to "2011/9/22" to get hourly data for September 22th 2011. Standard caveats and disclaimers apply to data availability in the archive at http://www.wunderground.com/ .

Recent station plots for TUS can be obtained from a copy and paste of the following link IF the data remain in the NCAR archives…about one week under ideal circumstances. For example, to obtain the map with a local time closest to September 22nd, 2011 for 5 pm MST (which is actually midnight London time for the following calendar day: 00:00 UTC YYYYMMDD=20110923), navigate to… http://www.rap.ucar.edu/weather/surface/displaySfc.php?region=las&endDate=20110922&endTime=23&duration=0.Note how I had to put the proper UTC date/time of 20110922…September 22nd …that corresponds to the local MST date of 20110922…September 22nd …that is closest to 5 pm MST to obtain the proper map. It turns out that the closest time to 5 pm MST is typically 23:43 UTC, YYYYMMDD=20110922…but *it is always a few minutes before UTC turns 00:00*.

To obtain plots for other days, you must edit the above link before running it. For example, to obtain the surface plot closest to 5 pm MST for Sept. 26th 2011 (if the date has not been purged or has not come!) or the first day of Analysis period #1, you would change the string "20110922" (YYYYMMDD) to "20110926" as shown:

http://www.rap.ucar.edu/weather/surface/displaySfc.php?region=las&endDate=20110926&endTime=23&duration=0. Note that some days/times may be missing owing to power outages or purging of old data.

High-quality, daily surface maps and upper-air maps for 1200 UTC only can be obtained at http://www.hpc.ncep.noaa.gov/dailywxmap/index.html. The maps generally run 24 hours behind real-time. Hourly surface maps with superimposed GOES satellite imagery and Doppler radar imagery can be obtained at http://www.mmm.ucar.edu/imagearchive/. The archives of surface, satellite and radar maps are generally posted online within 12 hours of analysis time. I highly recommend that you explore the http://www.mmm.ucar.edu/imagearchive/ link.

Part II

Construct the following diagrams:

1. The station model for TUS at 5 pm MST for each day. You will have a total of 19 station models (5 days for three workweeks; 2 days for two intervening weekends). I suggest using a calendar form for your presentation. See page 6 for the scanned calendar with station model plots from the spring 2011 semester.

2. Time series plots of temperature, pressure, dew point, and total 24 h precipitation; the 24-hour accumulation period for precipitation is the interval 5 am to 5 am MST that surrounds your station plot for 5 pm MST. You may plot these as you wish. I suggest that you use a program such as Excel…if you are experienced using the program. See pages 7 for Excel plots of time-series plots from the spring 2011 semester. Otherwise, scanned copies of carefully drawn hand charts are your only option.

Identify ONE period of two or three ***consecutive*** days with "interesting" weather for Tucson. Collect complementary data or analyses (surface maps, satellite or radar imagery, hourly surface reports) to help you diagnose the weather at a detail beyond the TUS 24-hourly surface observation. If you examine the intervening hourly reports, it might help you identify and diagnose an "interesting" period. Other complementary evidence could include, for example, satellite or radar imagery, upper air data, a local or national weather map, or the local National Weather Service forecast discussion.

Use the related links posted on the class website, the above links and *awareness of the weather around you* as a starting point. I leave it to you to define what constitutes an interesting weather day. Broadly speaking, you need to be looking for things like an abrupt change in surface conditions; record breaking temperatures (always possible but not likely to occur during any random 3 week period); strong winds (faster than 20-25 mph); occurrence of precipitation; snow and/or severe weather (for we dreamers). **Once again, you identify just ONE period of at no more than three consecutive days of observations.**

"Interesting" weather events generally stand out in the data. An examination of the station plots and time-series for February 2011 (pages 6 and 7) shows two periods of abrupt change or extreme conditions.

1) Feb01-Feb03: Tucson experienced a 20°F cooling from Feb01 to Feb02, and set record cold MIN temperatures for mornings of Feb03 and Feb04. Surface weather maps and hourly surface data for Tucson reveal a rare incursion of polar air spilling over the Continental Divide into the Sonoran Desert. Go to hourly data at http://www.wunderground.com/history/airport/KTUS/2011/2/3/DailyHistory.html .
2) Feb26-Feb27: Tucson recorded an 18°F cooling, wind shift and sharp pressure rise over the Feb26-Feb27 period while measuring 0.21" rain. This is a classic signature of a wintertime cold front from the Pacific passing through Tucson, which a review of the weather maps and hourly Tucson data confirms. In fact, the hourly plots indicate that snow occurred at the airport just before sunrise on the 27th! Go to hourly data at http://www.wunderground.com/history/airport/KTUS/2011/2/27/DailyHistory.html .

Part III

Write a tight summary of your findings. Your weather briefing should include:
1) An analysis of the time series plots.
2) A defense of how you identified interesting weather days.
3) A description of the weather during the interesting period, using the additional collected data beyond the surface observations.
4) Use of course concepts to diagnose the weather during the period.
I consider the last point the most important component of the project (see grading algorithm), so do an excellent job with your diagnosis. Include 2 to 3 supplementary figures from additional data or analyses collected for the interesting days, but no more than 4 figures under any circumstances. (Figures not counted against the page limitation.) The teaching team will view a deficient or excessive number of figures, or figures of marginal value, unfavorably. Your write-up must be **no longer than two double spaced pages using #12 Times font**; the limit does not include figures. That is very little space (about 25% of the words in this description), so choose your words judiciously.

GRADING STANDARDS

Your grade will be based the following criteria, in no order of importance for points 2 through 4.
1) Sound, succinct diagnosis of the weather during your period of interest that is based on course concepts. *This is the most important component of the project*.
2) Sensible/Defensible reason(s) for choosing your weather event as the most interesting or significant weather during the 3-week period.

3) Demonstration of accurate and timely data collection.
4) Organization, clarity, grammar, punctuation, and overall professionalism.

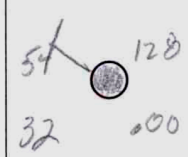
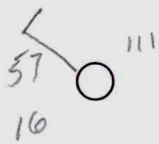
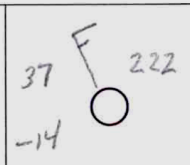
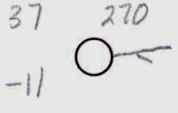
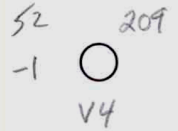
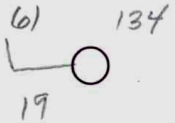
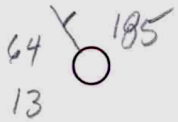
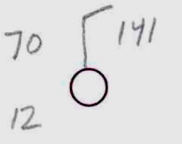
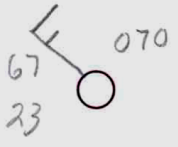
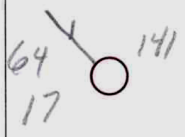
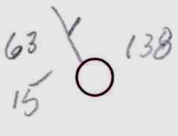
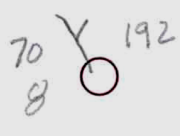
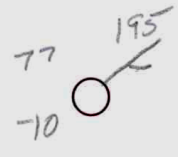
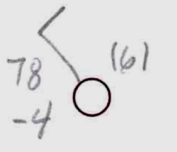
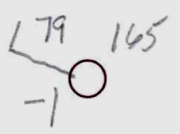
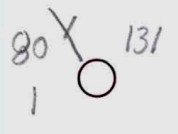
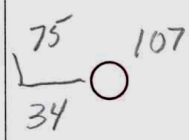
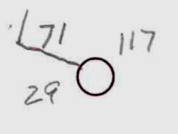
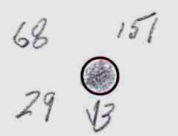
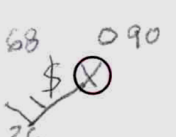
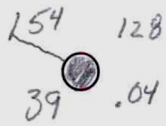
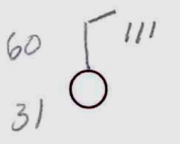
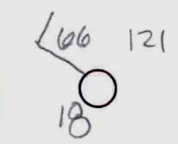
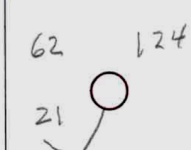
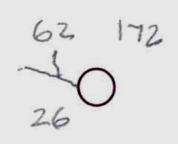
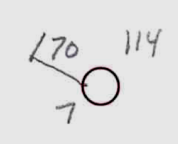
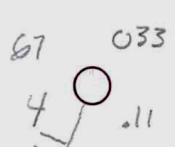
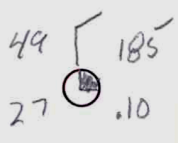
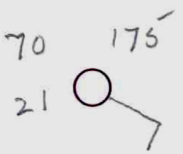
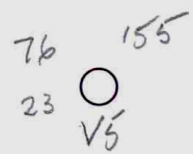
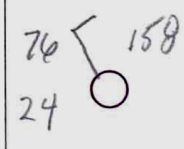
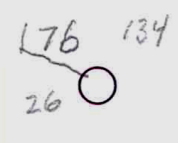
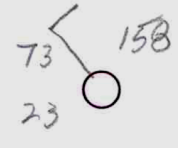
DUE DATES

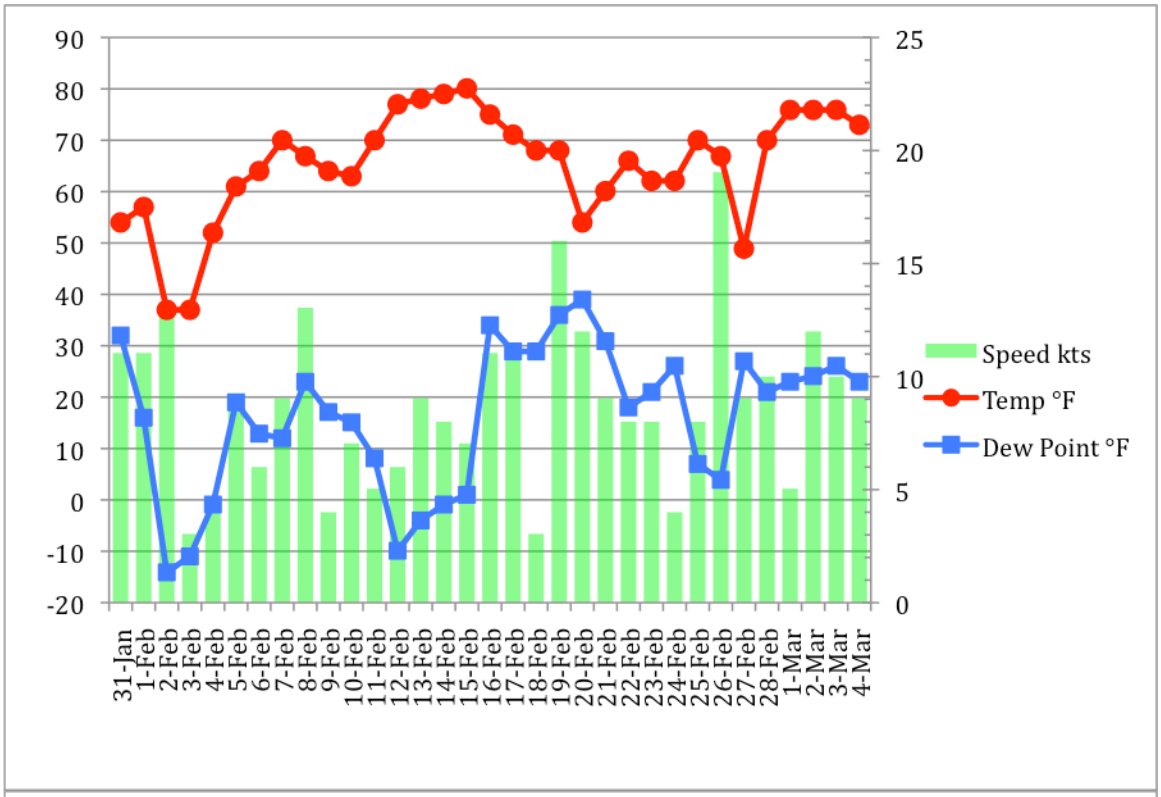
The due date is before **5:00 pm Sunday, November 13, 2011**. The assignment must be in pdf format (a .pdf file) and self-contained into a single file; no other form is acceptable. Assignments can only be submitted through d2l. This means that you must "scan" hand drawings into a digital format (.gif, .jpeg, .png) that can be imported into your word processing program. You should complete your project at least two days prior to the due date to give yourself plenty of time to make certain your materials are properly uploaded.

Late assignments, if I decide to accept them, accumulate a 10-point deduction per calendar day late. If your project is more than 5 days late, an "E" mark will be assigned to your project and course grade. Extensions of the due date will not be granted under any circumstances.

A WARNING ON PLAGIARISM

I value academic integrity. In accordance with University of Arizona policy, plagiarism on this assignment is a violation of the Code of Academic Integrity and penalties described therein will be enforced. Plagiarism is defined as copying (including copying test answers) or paraphrasing someone else's work without proper citation. Every write-up will be screened by turnitin.com software to check for similarity with other classmates and papers from prior classes. DO NOT DO IT. It is becoming boringly easy to identify acts of plagiarism with today's computerized matching software. ***Please note that I am professionally mandated to investigate suspected acts of cheating and to "write up" what appear to be unequivocal ones.*** *For further details see: http://deanofstudents.arizona.edu/academicintegrity .*

	 Jan 31	 Feb 01	 Feb 02	 Feb 03	 Feb 04	 Feb 05
 Feb 06	 Feb 07	 Feb 08	 Feb 09	 Feb 10	 Feb 11	 Feb 12
 Feb 13	 Feb 14	 Feb 15	 Feb 16	 Feb 17	 Feb 18	 Feb 19
 Feb 20	 Feb 21	 Feb 22	 Feb 23	 Feb 24	 Feb 25	 Feb 26
 Feb 27	 Feb 28	 Mar 01	 Mar 02	 Mar 03	 Mar 04	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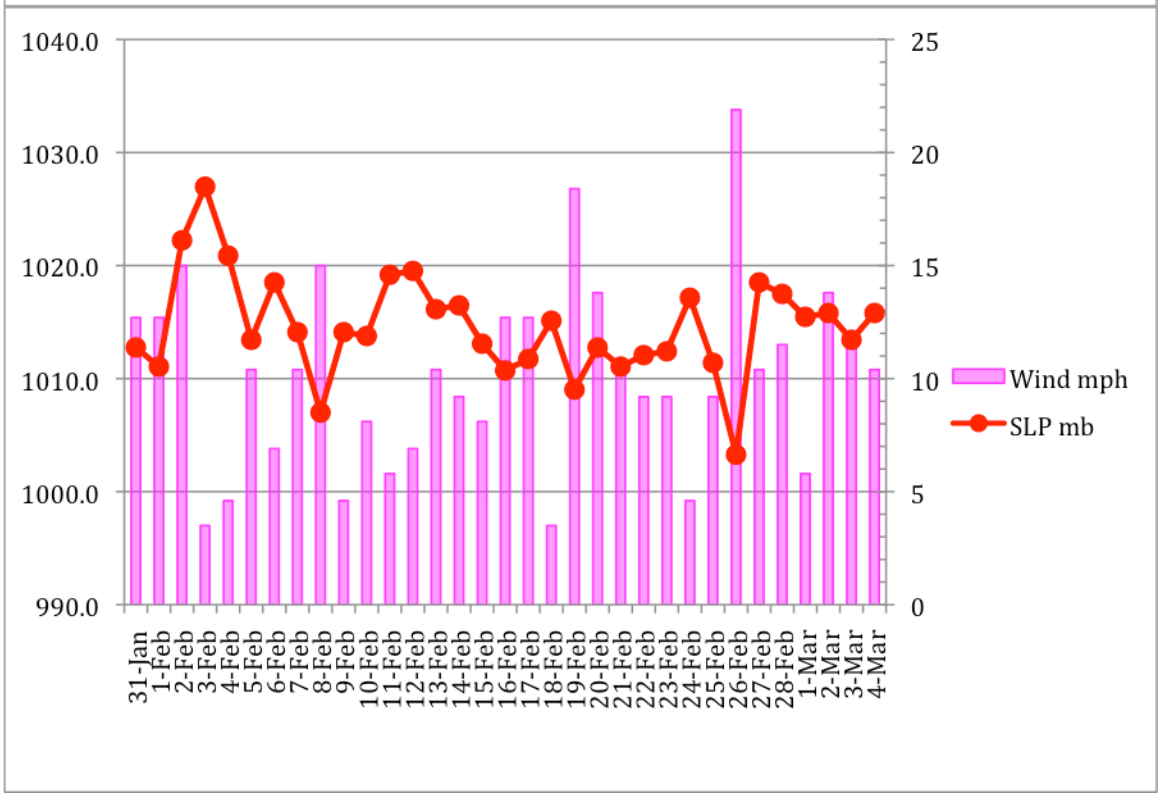
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