

Term Project
Introduction to Weather and Climate
Spring 2012

The term project¹ constitutes 30% of your final course grade. Its successful completion is mandatory of all students. Stated simply:
Doing and passing the project doesn't guarantee that you pass the course (grade of D or higher).
But not doing or failing the project (50% or lower) guarantees that you don't pass (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 the 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: February 06 (Monday) to February 24 (Friday)

Analysis period #2: February 13 (Monday) to March 02 (Friday)

Analysis period #3: February 20 (Monday) to March 09 (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. A second advantage is that the likelihood of "interesting" weather occurring in Tucson is higher earlier in the winter (rain; frontal passages; abrupt temperature or abrupt moisture changes; anomalous cold snap. Note that whatever three-week period you pick, the due is **5:00 pm April 1st**, or two weeks after the end of Spring Break. So choose your period accordingly.

¹This 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. Just make certain that you get data for TUS and not DMA or another Tucson site. A shortcut to get hourly data for February 6th, for example, is cut-n-paste the following link into your browser's menu bar... http://www.wunderground.com/history/airport/KTUS/2012/2/6/DailyHistory.html?req_city=NA&req_state=NA&req_statename=NA. The string "2012/2/6" would change accordingly for a different date. For example, you would change the string to "2012/7/22" to get hourly data for February 7th 2012. Standard caveats and disclaimers apply to data availability in the archive at <http://www.wunderground.com/>.

Recent station plots for the Southwest U.S. with TUS data can be obtained from a copy and paste of the following link IF the data remain in the NCAR archives... almost one week under ideal circumstances. For example, to obtain the map for a local time that is closest to February 7th, 2012 for 5 pm MST (which is actually midnight London time for the following calendar day: 00:00 UTC YYYYMMDD=20110208), navigate to... <http://weather.rap.ucar.edu/surface/displaySfc.php?region=las&endDate=20120208&endTime=00&duration=0>. Note how I put the proper UTC date/time of endDate=20120208 and endTime=00... that corresponds to the MST date of 20120207...February 7th ...that is closest to 5 pm MST to obtain the desired map. *Do not let the label of 00:43 fool you.* The map with the 5 pm MST reports are labeled at the UTC time that the computer generates the plot, 00:43 UTC or 5:43 pm MSt, so you would set endDate=20120208 and endTime=00 as described.

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 February 6th 2012 (if

the date has not been purged or has not come yet!) or the first day of Analysis period #1, you would change the *endDate* string to 20120207” as shown: <http://www.rap.ucar.edu/weather/surface/displaySfc.php?region=las&endDate=20120207&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. Its menu is straightforward and intuitive to use. I highly recommend that you explore the <http://www.mmm.ucar.edu/imagearchive/> link. It can be a valuable resource of weather maps for your project.

Another site to obtain historic surface weather maps (and upper-air maps too) with station model plots for the Southwest is Plymouth State College at URL <http://vortex.plymouth.edu/u-make.html>. The menu is powerful and flexible, but it complex to set correctly; I only recommend its use for the most patient webbers and passionate weather weenies. Unfortunately, I am not in a position to field individual’s questions or offer tutoring.

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 (last two pages) shows two periods of abrupt change or extreme (by TUS standards) 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 The Weather Underground 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 wunderground <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, April 1, 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 or three days prior to the due date to give yourself plenty of time to make certain your materials are properly uploaded. Stuff happens when d2l is involved.

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. If you fear stuff happening to you, start the project now and finish it long before before the deadline...think how nice it would feel to have the project done before Spring Break!

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> .

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$\begin{array}{r} 49 \\ 27 \\ \hline 185 \end{array}$ <p>Feb 27</p>	$\begin{array}{r} 70 \\ 21 \\ \hline 175 \end{array}$ <p>Feb 28</p>	$\begin{array}{r} 76 \\ 23 \\ \hline 155 \end{array}$ <p>Mar 01</p>	$\begin{array}{r} 76 \\ 24 \\ \hline 158 \end{array}$ <p>Mar 02</p>	$\begin{array}{r} 176 \\ 26 \\ \hline 134 \end{array}$ <p>Mar 03</p>	$\begin{array}{r} 73 \\ 23 \\ \hline 158 \end{array}$ <p>Mar 04</p>	

