AOSC201: Weather and Climate Lab

Week 3: Observations & Simple Forecasts

Section 103/105

Instructor: Agniv Sengupta

Course Info

❑ AOSC201 course webpage:
https://www.aosc.umd.edu/~asengupta/AOSC201/

❑ Textbook: *Weather and Climate Laboratory Manual* (1st Edition) by Tim Canty and Travis Sluka.

❑ Having the textbook is a requirement. ***This is the last week I'll be providing photocopies of the labs.***

❑ You will need a scientific calculator for most of the labs.

Week 3 Lab: *Obs. & Simple Forecasts*

❑ Lab#4 of Lab Manual (pages 21-24)

❑ <u>50 points</u> in total

❑ Two parts of this lab:

• *Observations (Qsn #1-7)*

• *Persistence Forecasts (Qsn #8-13)*

❑ <u>GROUP Work</u>: Qsn #1-5, <u>INDIVIDUAL Work</u>: Qsn #6-13

What is a sling psychrometer?

Two thermometers: *Dry-bulb* and *Wet-Bulb*

When we whirl the psychrometer around, the *wet-bulb thermometer* has water on it that evaporates, *cooling* the bulb. The corresponding reading is the wet bulb temperature.

If the surrounding air is dry, then more of the water evaporates, so the wet-bulb gets decently cooler than the dry-bulb. If the surrounding air is moist, then less water evaporates, so the wet-bulb will be closer in temperature to the dry-bulb.

Relative Humidity: the amount of water vapor present in air expressed as a percentage of the amount needed for saturation at the same temperature.

Week 3 Lab: *Observations*

Question 1 (2 points) Directions:

- Measure the dry bulb and wet bulb temperature.

- **PLEASE DO NOT** pull the cloth off the psychrometer while measuring.

- Once you have the two temperatures, the sling psychrometer has a reference sheet to determine Relative Humidity (RH) (*Refer my website for RH reference table*).

Week 3 Lab: *Observations*

Question 1 Directions *(...continued)*:

- How to read the RH conversion chart?

-- Step 1: Air temp. is the Dry Bulb Temperature. The "*depression*" of wet-bulb is dry bulb minus wet bulb temperature.

-- Step 2: Now, locate where the depression column intersects with the air temp row, and this is your relative humidity (RH) in percentage.

- EXAMPLE: If dry bulb temp. = 75°F and wet bulb temp. = 70°F

Depression = (75 - 70)°F = 5°F, and, RH (from chart) = 78%

Week 3 Lab: *Observations*

Question 2 (2 points) Directions:

- Thermometers will be passed around.

- Give me temperature of air in the classroom in ° Celsius.

- *Conversion from °F to °C*: **T(in °C) = (F-32) * (5/9)**

Week 3 Lab: *Observations*

Question 3 (4 points) Directions:

- Determine the *density* of air using the online calculator:

  http://www.denysschen.com/denysschen/catalogue/density.aspx

- Click on "Metric" and enter the values you calculated. We are 22 meters above sea level.

- After you get density (ρ), use the ideal gas law (**p =ρRT**) to calculate pressure.

where, p = pressure, $R_{DRY\ AIR}$ = 286.9 J/kg/K, and, T = temperature (in Kelvin).

  (Hint: 1 Pascal = 1 J/m^3 , and 1 hectopascal = 100 Pascal)

Week 3 Lab: *Observations*

Question 4 (3 points) Directions:

- Observed Pressure will be provided.

- How does the *observed pressure compare to your calculated pressure* (from Qsn#3)?

- Make an educated guess while answering why there might be differences between the observed and calculated pressures.

Week 3 Lab: *Observations*

Question 5 (6 points) Directions:

- We go outside for this Question and *measure and observe* different variables using instruments like sling psychrometer, anemometer.

- Fill out the "Campus" measurements in that column (No need to measure *air pressure*, and fill out wind direction and cloud type for the "campus" column).

- When it comes to cloud cover, just look up in the sky and observe. A very general 1-3 word description is fine (e.g. clear/overcast/scattered clouds, etc. for "cloud cover").

- Then fill out the "College Park Airport" column when we come back inside. Use this website: https://w1.weather.gov/data/obhistory/KCGS.html

Week 3 Lab: *Observations*

Question 6 (6 points) Directions:

- Use the <u>first equation</u> (equation a) to calculate the wind chill.

- Temperature you enter for this equation should be the *observed temperature* in °F for "Campus" (1st column entry from Qsn #5).

- USE a scientific calculator.

Week 3 Lab: *Observations*

Question 7 (4 points) Directions:

- Provide a simple forecast for tomorrow (*no point deduction for inaccurate forecast*)

- Mention: temperature, wind speed, cloud cover, weather condition etc.

Week 3 Lab: *Persistence Forecasts*

Question 8 (4 points) Directions:

- For Questions 8-10, you will be using data from my website (titled "Persistence Data"). **DO NOT** go to the website listed in the manual.

- For Question 8, look at December 2014 for College Park.

- You must choose two variables – Mean Temperature (°F), and Mean Humidity (%), and their respective criteria to be deemed as "similar" to the previous day (within +/-5°F of previous day's temperature, and +/- 15% of previous day's mean humidity).

- **BOTH** the criteria for the 2 variables have to met **simultaneously** to be deemed "similar". Thus, record the no. of days when the weather roughly repeated itself.

[12]

Week 3 Lab: *Persistence Forecasts*

Question 9 (4 points) Directions:

- Now look at July 2014 for College Park and repeat the same process as in Qsn #8.

- USE the same set of variables and same threshold criteria as Qsn #8 for deeming a particular day's weather similar to the previous day.

Week 3 Lab: *Persistence Forecasts*

Question 10 (8 points) Directions:

- Now look at December 2014 and July 2014 for Hilo, HI and repeat the same process as in Qsn #8.

- USE the same set of variables and same threshold criteria as Qsn #8 for deeming a particular day's weather similar to the previous day.

- Are persistence forecasts for Hilo, HI more or less accurate than College Park?

Week 3 Lab: *Persistence Forecasts*

<u>Question 11 (3 points) Directions:</u>

- Provide an explanation for why the persistence forecasts for Hilo, HI may be more or less accurate than College Park?

Week 3 Lab:
Climatological Forecasts

"Weather for a particular day will be the nearly similar to the long term average for that day".

Summary

September 10: Washington, DC

Temperature (° F)	Actual	Historic Avg.	Record	▲
High Temp	75	82	98	
Low Temp	64	65	44	
Day Average Temp	70	73	-	
Precipitation (Inches)	Actual	Historic Avg.	Record	▲
Precipitation	0.02	0.11	2.79	
Month to Date	5.75	1.11	-	
Year to Date	45.85	27.51	-	

(Data courtesy: Justin Hicks)

[16]

Week 3 Lab:
Climatological Forecasts

Question 12 (2 points) Directions:

- You are comparing your answer for Question #5 (College Park airport) to the climatological means for today :

 -- Climatological average high temperature for Feb 22: **48°F**

 -- Climatological average precipitation for Feb 22: **0.1 inches**

Week 3 Lab: *Simple Forecasts*

Question 13 (2 points) Directions:

- Please note for this question, "your forecast" refers to your answer for Question #7 on the previous page of the lab manual.

Questions ?