

## **Lab 11 - AOS 330**

### **More Meteorological Measurements and Observations**

#### **1 Objectives**

- Learn to use a sling psychrometer to measure dry-bulb and wet-bulb temperature.
- Learn to convert the above measurements to dewpoint and relative humidity.
- Introduction to sky, visibility, and present weather observations.

#### **2 Materials and Equipment**

- Sling psychrometer with built-in slide rule
- Bottle of distilled water
- Thermodynamic diagram (e.g., Skew-T)
- Psychrometer handout
- Normand's Rule handout
- Humidity table

#### **3 Part I**

##### **3.1 Introduction**

Temperature and humidity are important not only because they have a strong effect on human comfort, agriculture, etc., but also because of their importance for atmospheric dynamics and energetics. Without temperature differences, there would be no pressure differences and thus no wind. Without atmospheric moisture there would be no clouds or precipitation.

##### **3.2 Fundamentals**

There are a variety of devices for automatically measuring both temperature and humidity. However, the simplest and most reliable standard method is the sling psychrometer. This instrument consists of two mercury thermometers, one of which has a moistened bulb. The sling psychrometer is gently twirled to ventilate both thermometers. Other types of psychrometers use fans to ventilate a pair of thermometers in a fixed or portable housing. The dry-bulb thermometer measures the actual air temperature; the wet-bulb thermometer generally measures a somewhat lower temperature on account of evaporation of moisture from the wick. The humidity of the air determines the rate of evaporation and thus the degree to which the wet-bulb temperature is depressed below the dry-bulb temperature. When the relative humidity is high, the difference is small; when the air is very dry, the difference can be large. There is a variety of ways to convert the raw wet-bulb and dry-bulb measurements to something more useful, like relative humidity and/or dewpoint. We will use three different methods.

##### **3.3 Procedures**

1. Before going onto the roof, carefully read the handout instructions for using the sling psychrometer.
2. Once on the roof, find a spot in a shady area but with adequate exposure to the breeze (if present). Moisten the wet-bulb thoroughly with distilled water. Observe the dry-bulb and wet-bulb temperature. Record your values to the nearest 0.1 degree (you will have to

estimate by interpolating by eye between the tick marks). When you are finished with your own measurement,

3. Tell the instructor what your wet-bulb and dry-bulb readings were. If they differ too much from what he/she thinks you should have gotten, he/she may ask you to repeat the measurements. Hint: The most common error is that your wet-bulb temperature will be too warm for any of several possible reasons (not exposed long enough, bulb too dry, etc.).

4. Estimate the relative humidity and/or the dewpoint, using each of the following methods:

- Thermodynamic diagram (dewpoint and relative humidity)
- Table (relative humidity only)
- Humidity slide rule (relative humidity only)

5. Record your results in your lab writeup. If there are large differences between your results obtained using the different methods, then go back and check your procedure. Differences in dewpoint should be no more than a degree or two. Differences in RH should not exceed a few percent.

Relative Humidity Table

Table to convert the wet bulb temperature to relative humidity. Find the row with the same wet bulb temperature and the column with the same difference between the air temperature and the wet bulb temperature. The intersection of the row and column is the relative humidity of the air.

Wet Bulb Temp [C]	Difference between air temperature and wet bulb temperature [C]																	
[C]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
5	87	73	59	46	34	21	8	.	.	.	.	.	.	.	.	.	.	.
6	87	74	61	49	36	24	12	.	.	.	.	.	.	.	.	.	.	.
7	88	75	63	51	39	27	16	.	.	.	.	.	.	.	.	.	.	.
8	88	76	64	52	41	30	20	9	.	.	.	.	.	.	.	.	.	.
9	89	77	65	54	43	33	23	13	.	.	.	.	.	.	.	.	.	.
10	89	78	67	56	45	35	25	15	7	.	.	.	.	.	.	.	.	.
11	90	79	68	57	47	37	28	18	10	.	.	.	.	.	.	.	.	.
12	90	79	69	59	49	40	30	21	13	.	.	.	.	.	.	.	.	.
13	91	80	70	60	51	42	33	24	16	8	.	.	.	.	.	.	.	.
14	91	80	71	61	52	43	35	27	19	11	.	.	.	.	.	.	.	.
15	91	81	72	62	54	45	36	28	21	14	7	.	.	.	.	.	.	.
16	91	82	72	64	55	47	39	31	24	16	9	.	.	.	.	.	.	.
17	91	82	73	65	56	48	41	33	26	19	12	.	.	.	.	.	.	.
18	92	83	74	66	58	50	42	35	28	21	15	8	.	.	.	.	.	.
19	92	83	75	66	59	51	44	37	30	23	17	11	.	.	.	.	.	.
20	92	83	75	67	60	52	45	38	32	25	19	13	6	.	.	.	.	.
21	93	84	76	68	61	53	47	40	33	27	21	15	9	.	.	.	.	.
22	93	84	77	69	62	54	48	41	35	29	23	18	11	6	.	.	.	.
23	93	85	77	70	63	55	49	43	36	31	25	20	13	8	.	.	.	.
24	93	85	78	70	63	56	50	44	38	32	27	21	15	10	5	.	.	.
25	93	85	78	70	63	57	50	44	39	33	28	22	17	12	8	.	.	.
26	93	85	78	71	64	58	51	46	40	34	29	24	19	14	10	5	.	.
27	93	85	78	71	65	58	52	47	41	36	31	26	21	16	12	7	.	.
28	93	85	78	72	65	59	53	48	42	37	32	27	22	18	13	9	5	.
29	93	86	79	72	66	60	54	49	43	38	33	28	24	19	15	11	7	.
30	93	86	79	73	67	61	55	50	44	39	35	30	25	21	17	13	9	5