UBC ATSC 303 2023W
Lab 10c– Upper-Air Measurements (/49)

Learning Goals
By the end of this lab, you should be able to:

1. Be confident in your handling of the physical sensors and software covered in this lab.
2. Identify significant and mandatory levels in a radiosonde sounding.
3. Plot and interpret data on a tephigram or skew-T.
4. Explain the practicalities and reasons behind the way modern radiosondes and the instruments contained in them are manufactured.
5. Reinforce the learning goals from the lecture and demo.

Background
Harrison: Ch. 11
Definitions of **significant levels** and **mandatory levels:** see link on lab page of course website and Stull (Practical Met.) Ch. 5, p135
Apex method of static stability see: Stull (Practical Meteorology): Ch. 5, pp. 138-139
Blank thermo-diagrams (tephigram, skew-T, etc.) that you can print or copy: see Stull (Practical Met.) Ch. 5, p154 & 155.

Lab questions (based on sounding data files):

Part 1 – Tephigram plotting and interpretation – 2011 data
("**23Mar2011Sounding.xls**")

Equipment:

- Blank tephigram paper (Stull, Ch. 5, p155).
- Pencil

1. Using the data provided in the 2011 Excel spreadsheet ("**23Mar2011Sounding.xls**"), make a table listing all the **significant levels** i.e. significant/abrupt changes and extrema in the plotted sounding. Your table should include the **height**, **pressure**, **temperature**, **dewpoint temperature**, and **wind speed** and **direction** at each significant level. /5

2. Complete the table of mandatory levels provided in the spreadsheet (it is under a different tab). /5

3. Plot the dry-bulb and dewpoint temperatures at the mandatory and significant levels (i.e. use the entire data set) on the blank tephigram provided (use a pencil). Use a **dot** to denote your points plotted at the **significant levels,** and an **open circle** to denote your points plotted at the **mandatory levels.** /10

4. Why do we only plot:

a. Mandatory levels, and /1
b. Significant levels, /1

on a tephigram? (The answer is different for each!)

5. On your tephigram, clearly mark and label:
   a. The top of the planetary boundary layer /2
   b. The tropopause. /2

   Give an explanation for your placement of each.

6. Determine the static stability vs. height of the sounding using the nonlocal apex method. Be sure to show your work on the tephigram. /4
   HINT: see Background section for resources.

Part 2 – Sounding plotting and interpretation – 2023 data ("sonde1.csv")

1. Using the data provided in the 2023 comma-separated values file ("**sonde1data-2023.csv**"), plot the **temperature, potential temperature,** and **dewpoint profiles** vs. pressure using Excel, or a programming language. Also make a plot with the **wind speed** profile, and another with the **wind direction** (you should have **4 plots total for this question**). Hint (you'll need to solve for potential temperature) /8

2. On your temperature/potential temperature/dewpoint plot, mark where the top of the atmospheric boundary layer is, and explain how you made your decision. /3

3. Find the approximate pressure level of the jet stream core. Explain how you made your decision. /2

Further questions (based on lecture and readings)

1. Why does the Vaisala RS-90 sonde contain two capacitive humidity sensors? /2

2. Why would it not be practical to use hair as a humidity sensor in a radiosonde? /1

3. In modern radiosondes, the batteries are surrounded by two small reservoirs of water. Why? /2

4. Since it is difficult (close to impossible) to prevent exposure errors with a radiosonde, what is the main way that manufacturers help to prevent them? /1

End of lab questions