Synoptic Meteorology I

**Lab 11: Soundings and Skew-T Diagrams, Part I**

Wednesday December 7th, 2022

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Due: December 14th, 2022, at 2:30pm

**Objectives**:

* Use soundings to infer clouds and precipitation types, inversions, and temperature advection, and to compute the wet-bulb temperature and equivalent potential temperature.
* Use the parcel method to identify the LCL, LFC, EL, CAPE/CIN, and convective temperature.

**Things to know:**

Feel free to use the Internet and collaborate with your colleagues when answering these questions. For Parts I, II and III, the requested plots must be obtained using the Jupyter Notebooks on our JupyterHub before you can complete the questions. Be sure to review the concepts covered in these tutorials rather than just complete the tasks they require as you may be asked to use these concepts in a future lab.

**Part I: Basic Interpretation (63 pts)**

1. Complete the Jupyter Notebook exercise. (10 pts)
2. Using the Skew-*T*/ln-*p* diagram you created for MPX on September 29th, 2012 at 1200 UTC, identify:
3. The vertical layer of the inversion nearest the surface (e.g., 850-775 hPa; 3 pts).
4. The pressure level at which the tropopause is located (in hPa; 3 pts).
5. The most-likely precipitation type, if any (3 pts).
6. Layers that could potentially have clouds. (Write as: Clouds: 925-850 hPa.) Explain why you think there are clouds in these layers (6 pts).
7. Using the Skew-*T*/ln-*p* diagram you created for SGF on January 13th, 2007 at 0000 UTC, identify:
8. The vertical layer of the inversion nearest the surface (e.g., 850-775 hPa; 3 pts):
9. The sign of horizontal temperature advection over the layer in (a) (3 pts):
10. Layers that could potentially have clouds. (Write as: Clouds: 925-850 hPa.; 3 pts):
11. The most-likely precipitation type, if any. Explain your reasoning (6 pts).
12. Using the Skew-*T*/ln-*p* diagram you created for ILN on January 17th, 2004 at 1200 UTC, identify:
13. The vertical layer of the inversion nearest the surface (e.g., 850-775 hPa; 3 pts).
14. The sign of horizontal temperature advection over that layer (3 pts).
15. The most-likely precipitation type, if any. Explain your reasoning (6 pts).
16. Use the Skew-*T*/ln-*p* diagram you created for RAP on October 5th, 2013 at 0000 UTC to:
17. Record all layers of warm- and cold-air advection (Write as: CAA: 925-700 hPa; 5 pts)
18. What type of precipitation is most likely falling at the surface, if any? Explain your answer. (6 pts)

**Part II: Identifying Thermodynamic Variables (12 pts)**

Use the Skew-*T*/ln-*p* diagram you created for MPX on April 24th, 2009 at 1200 UTC to complete the following problems. Show all work for questions 6 and 7 on the sounding.

1. Find the wet-bulb temperature ( for air parcels originating at 800 hPa, 700 hPa, and 600 hPa. (6 pts)
2. Find the equivalent potential temperature ( for an air parcel originating at 550 hPa (3 pts).
3. The precipitable water value for this sounding is 0.86 inches. Identify the PW percentile for this time of the year in which this observation falls at MPX using the SPC sounding climatology page: <https://www.spc.noaa.gov/exper/soundingclimo/>. (3 pts)

**Part III: Stability (25 pts)**

Use the parcel method to answer each of the questions below. Show your work on your Skew-*T*/ln-*p* diagrams.

1. Using the Skew-*T*/ln-*p* diagram you created for OUN on May 5th, 2007 at 0000 UTC, find and record (on the sounding; 2.5 points each):
2. The Lifted Condensation Level (LCL)
3. The Level of Free Convection (LFC)
4. The Equilibrium Level(s) (EL).
5. Shade any CAPE and hatch any CIN.
6. The convective temperature (.
7. Using the Skew-*T*/ln-*p* diagram you created for MPX on August 7th, 2013 at 0000 UTC, find and record (on the sounding; 2.5 points each):
8. The Lifted Condensation Level (LCL)
9. The Level of Free Convection (LFC)
10. The Equilibrium Level(s) (EL).
11. Shade any CAPE and hatch any CIN.
12. The convective temperature (.

**Part IV: Skew-*T*/ln-*p* Diagram Interpretation, Continued (Graduate Students Only; 10 pts)**

1. Using the Skew-*T*/ln-*p* diagram for MPX on the next page: (1.5 pts each)
   1. Record all layers of warm- and cold-air advection (Write as: CAA: 925-700 hPa).
   2. The vertical layer of the inversion nearest the surface (e.g., 850-775 hPa):
   3. Layers that could potentially have clouds. (Write as: Clouds: 925-850 hPa)
   4. The pressure level at which the tropopause is located (in hPa):
2. Precipitation was falling at the time of the Skew-*T*/ln-*p* diagram for MPX. From the list, below select what type of precipitation is occurring and explain why you chose that precipitation type. (4 pts)
   1. Freezing Rain
   2. Sleet
   3. Snow
   4. Rain

Chart

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