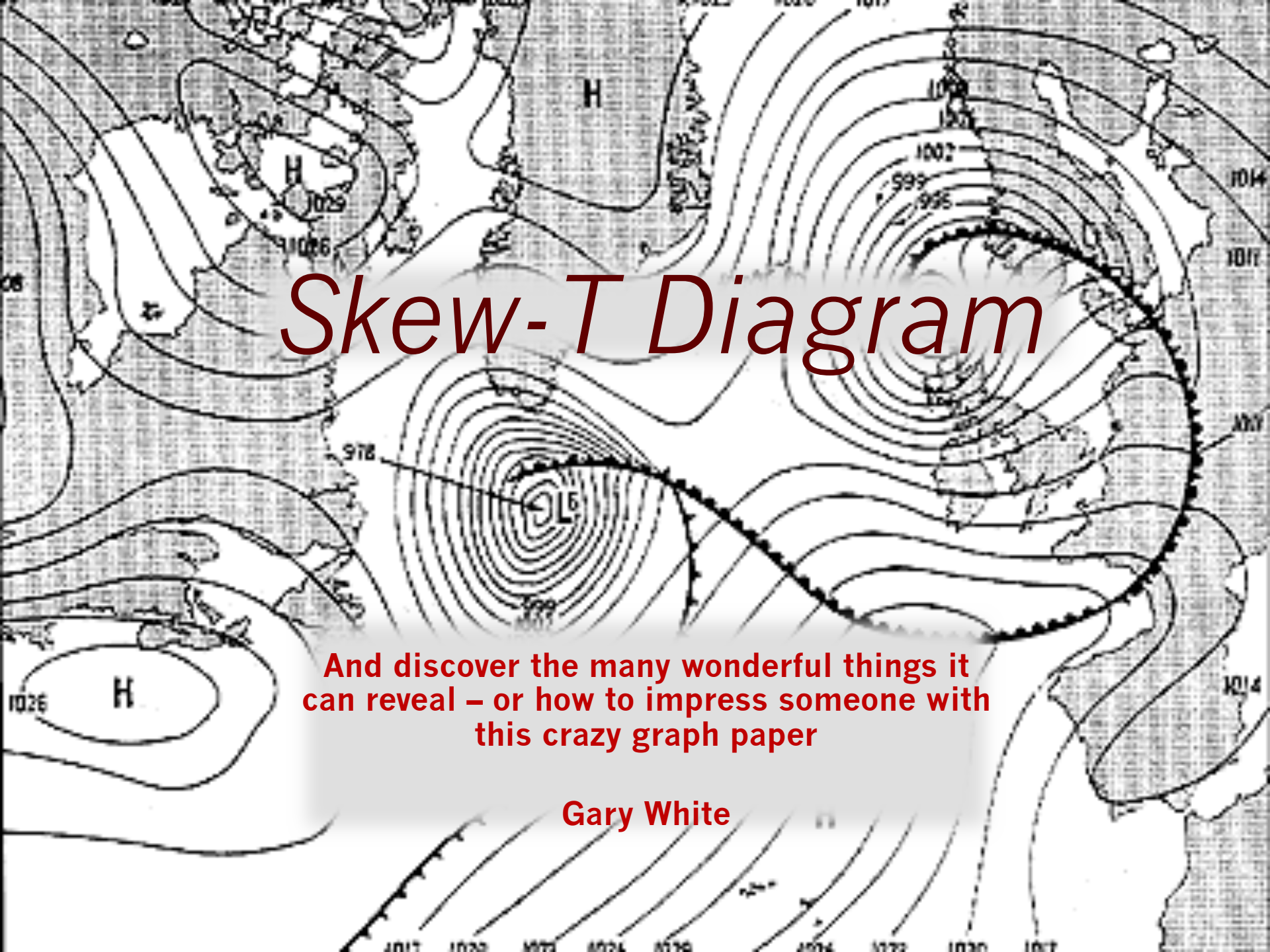


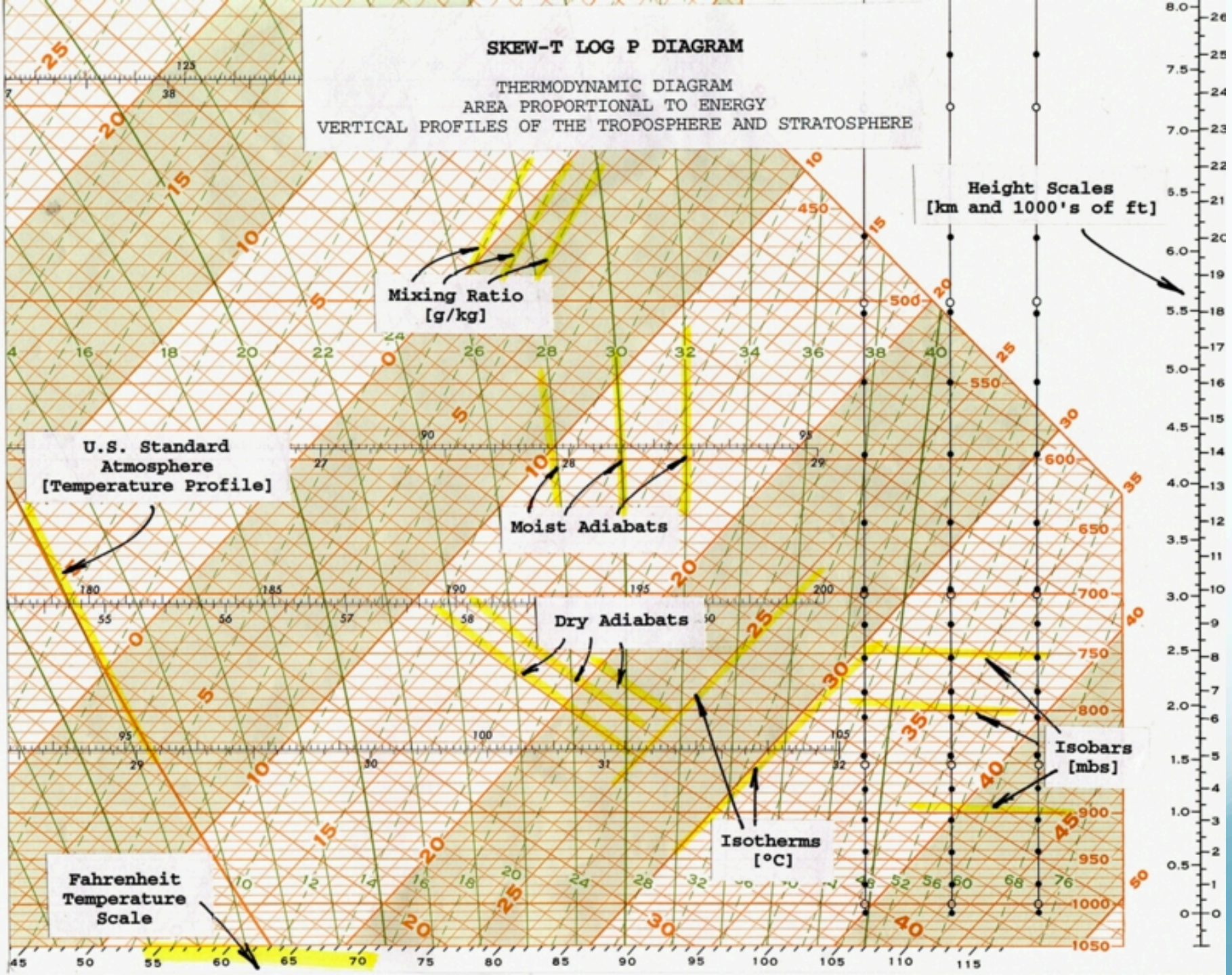
Skew-T Diagram

And discover the many wonderful things it can reveal – or how to impress someone with this crazy graph paper

Gary White

Objective(s)

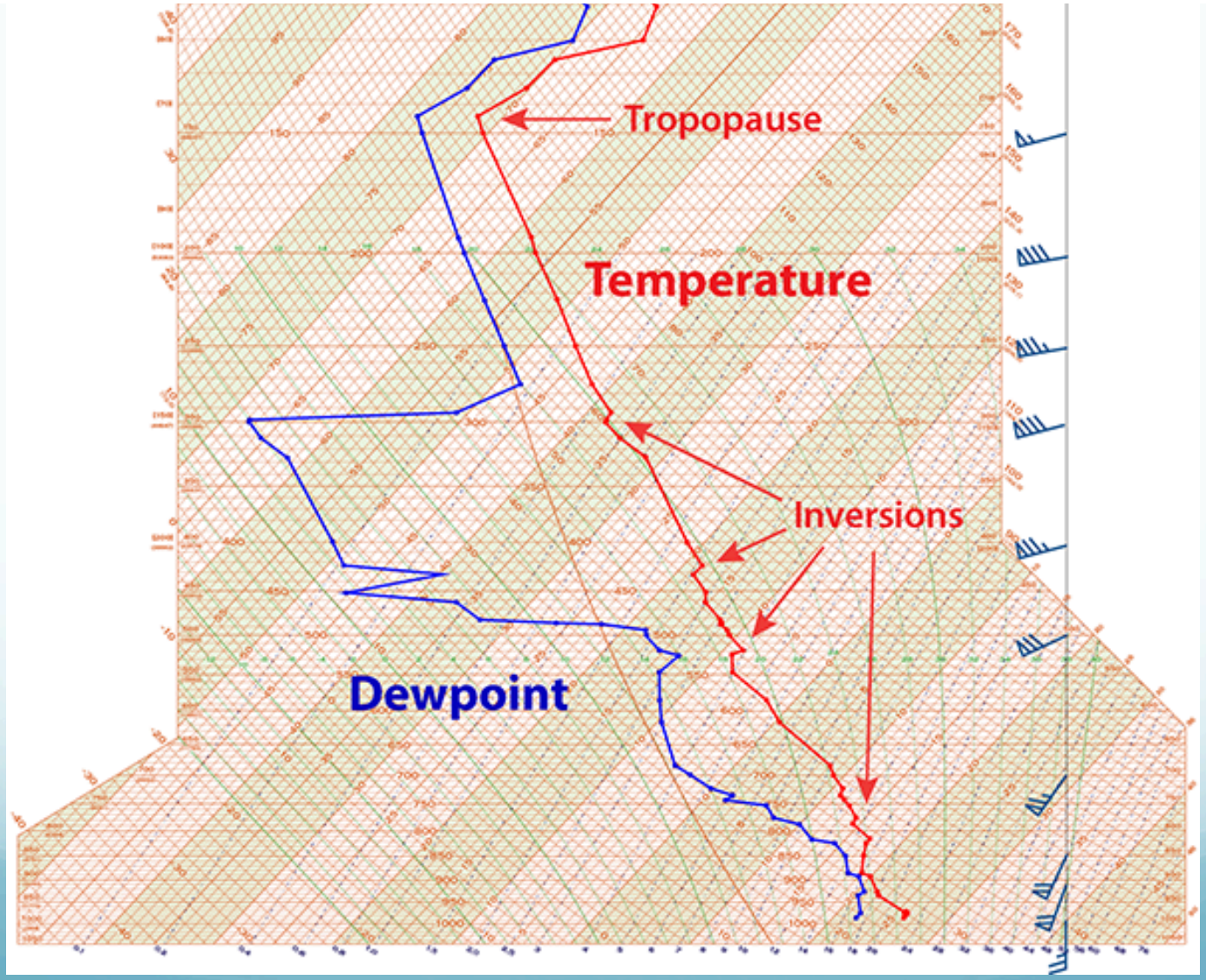
- Gain Appreciation
- Online Resources
- Consider Including Into Your Long Range Weather (Sometimes)


SKEW-T LOG P DIAGRAM
THERMODYNAMIC DIAGRAM
AREA PROPORTIONAL TO ENERGY
VERTICAL PROFILES OF THE TROPOSPHERE AND STRATOSPHERE
Height Scales [km and 1000's of ft]
Mixing Ratio [g/kg]
U.S. Standard Atmosphere [Temperature Profile]
Moist Adiabats
Dry Adiabats
Isobars [mbs]
Isotherms [°C]
Fahrenheit Temperature Scale

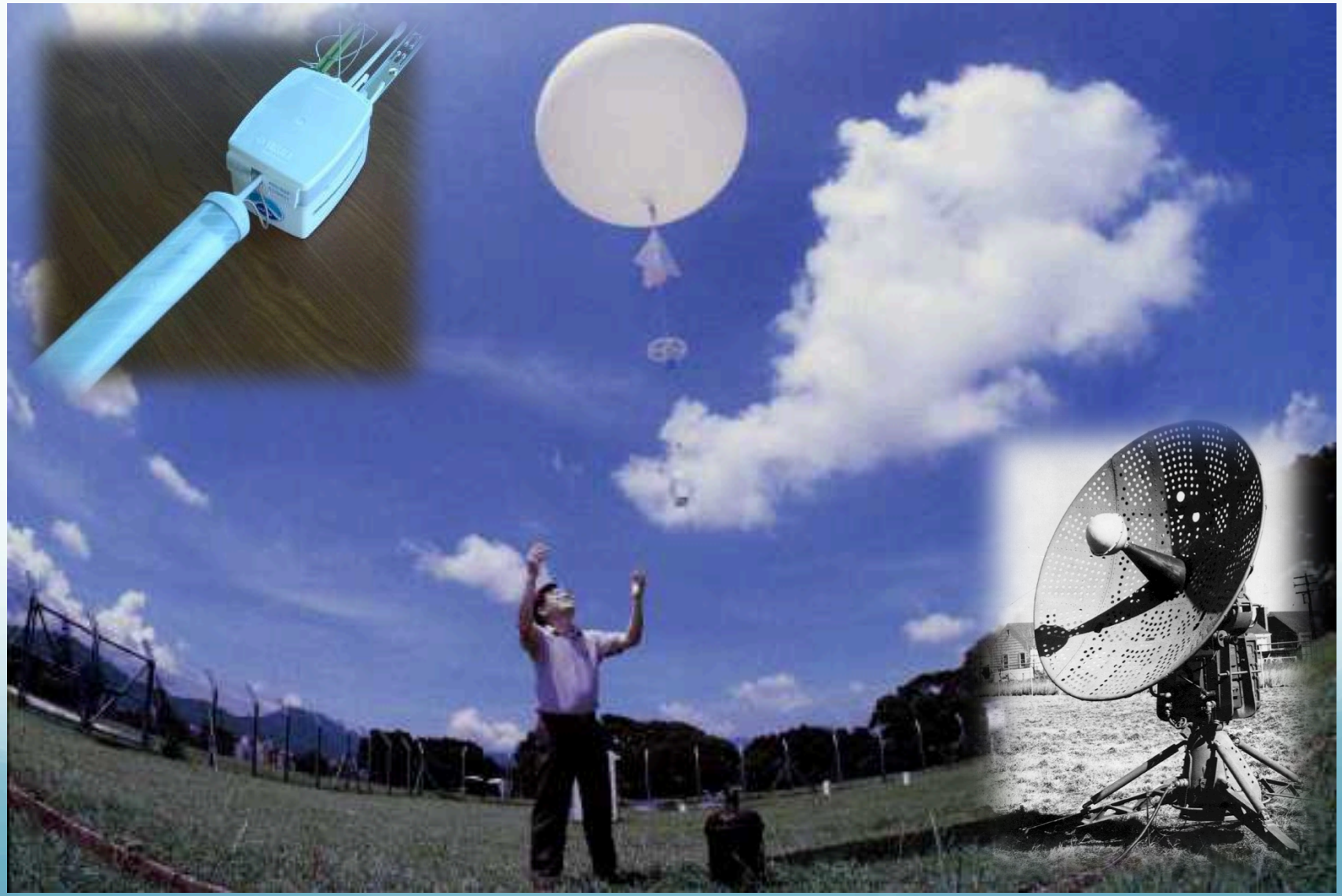
Recall

- Unsaturated Air, When Lifted, Follows An Adiabatic Process (-9.8 deg C/km)
- Dew Point, When Lifted, Follows a Constant Mixing Ratio Line
- When Air Becomes Saturated it Follows a Saturated Adiabatic Process of About -5 deg C/km
- Latent Heat (Gas going to Liquid or Liquid going to Solid) is the Reason a Saturated Parcel Cools at a Slower Rate

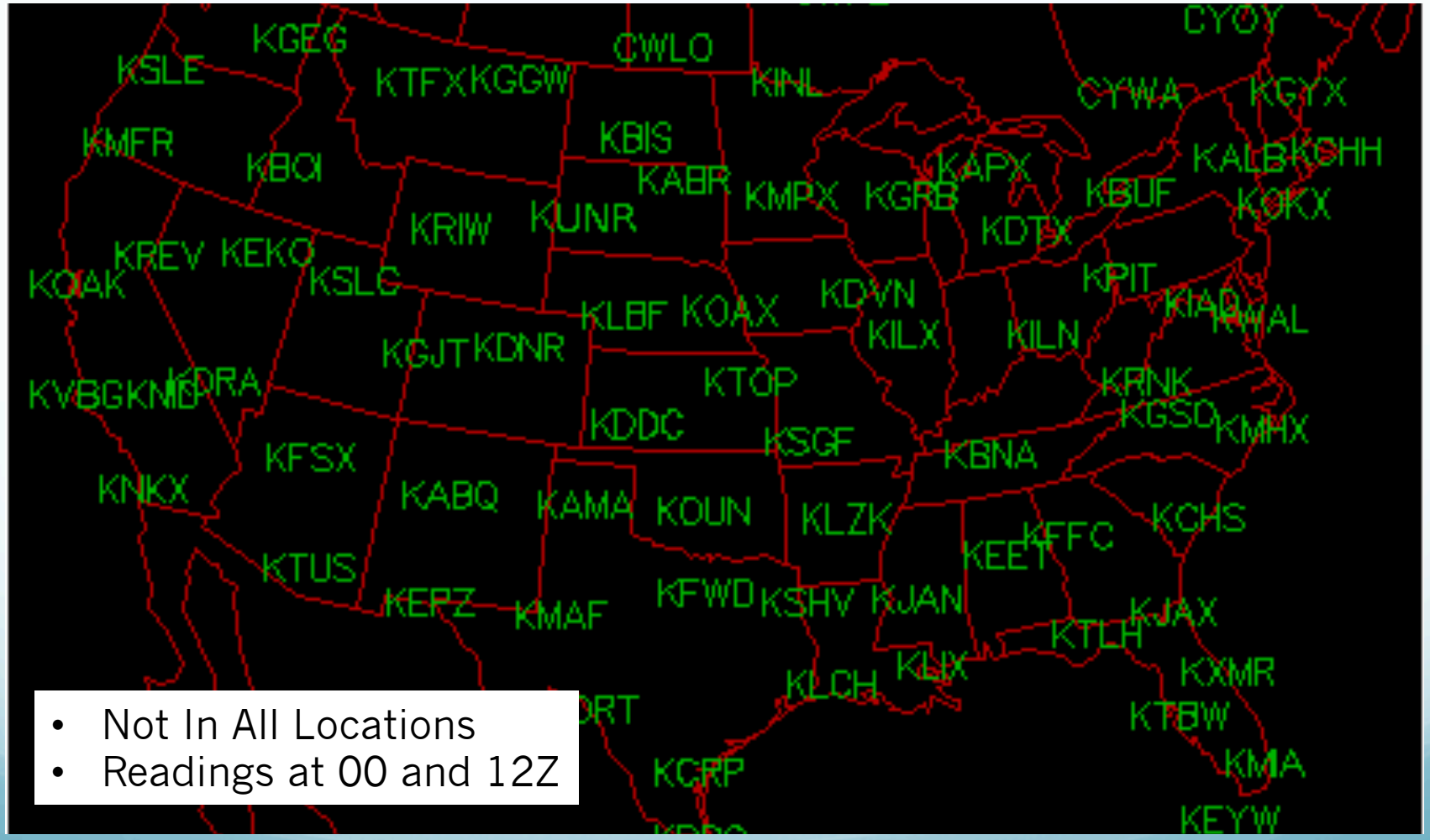
They Come in Many Formats



Radiosonde



Limitations



- Not In All Locations
- Readings at 00 and 12Z

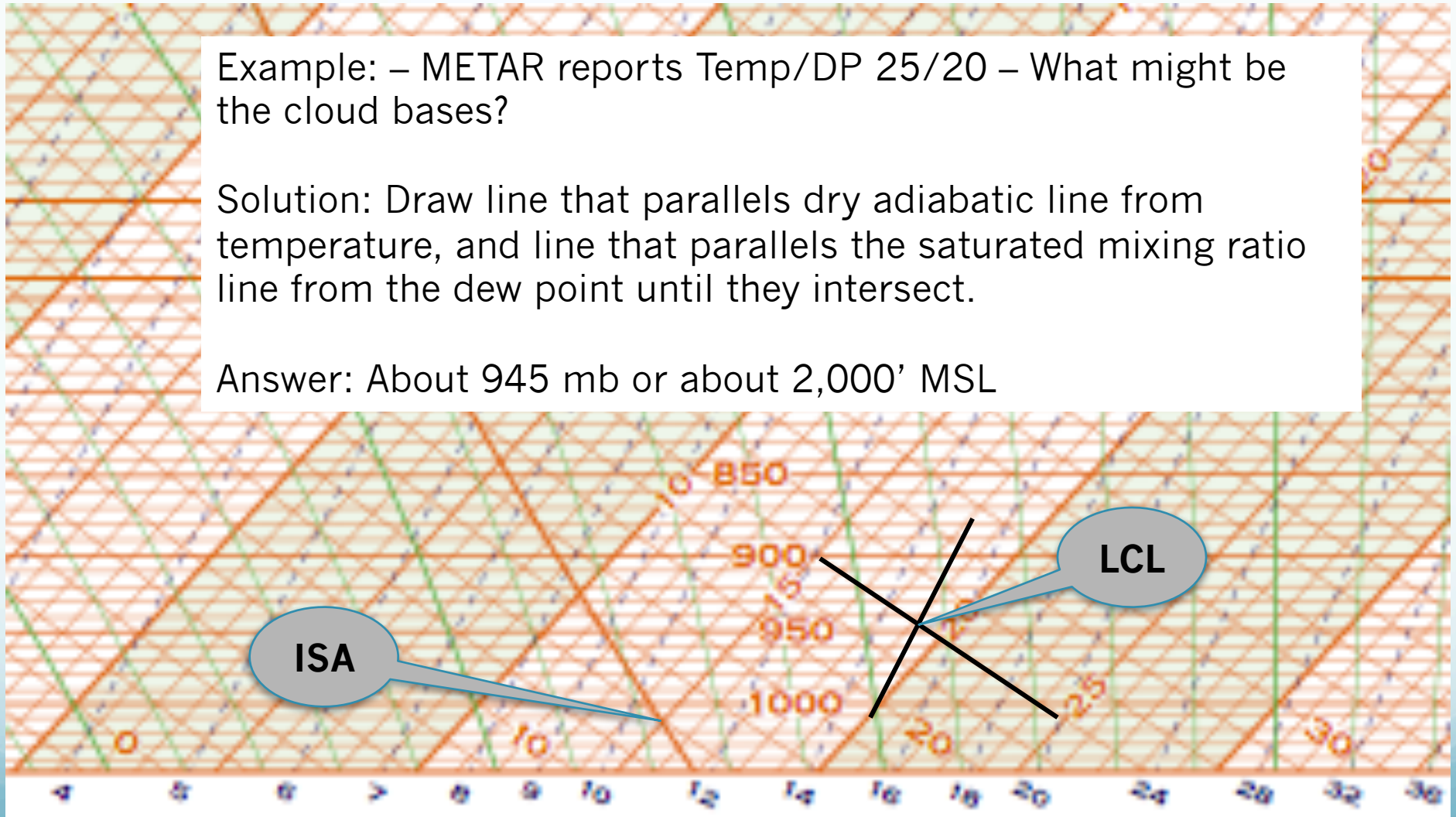
Use

- Temperature, Dew-point, Winds
- Examine Stability
- Identify Inversion Layers
- Potential Energy in Atmosphere
- Indices, e.g.
  - LCL
  - CAPE
  - LI

Example: – METAR reports Temp/DP 25/20 – What might be the cloud bases?

Solution: Draw line that parallels dry adiabatic line from temperature, and line that parallels the saturated mixing ratio line from the dew point until they intersect.

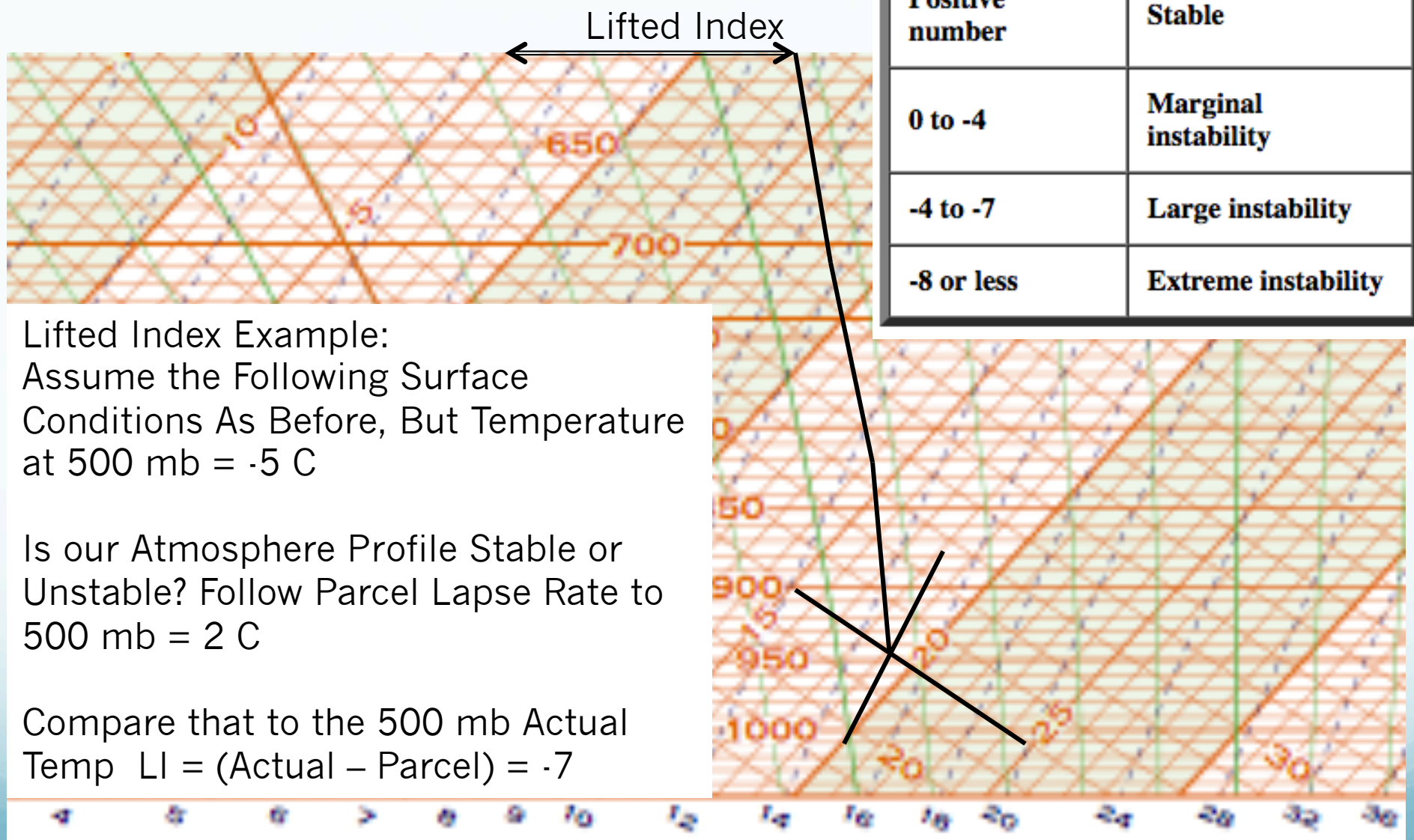
Answer: About 945 mb or about 2,000’ MSL



So What Did We Do?

- Applied ‘Artificial Lifting’ to Our Surface Measurements and Estimate Lifted Condensation Level (LCL)
- Recall Dry Air Has a Lapse Rate of - 9.8 C/km
- Our Un-Saturated Air Parcel (Where the Dew Point Was) Follows the Mixing Ratio Line
- At the LCL, the Parcel Becomes Saturated and Condensation Occurs
- Let’s Look at ‘Stability’
  - Specifically the 500 mb Lifted Index

LIFTED INDEX	
Positive number	Stable
0 to -4	Marginal instability
-4 to -7	Large instability
-8 or less	Extreme instability



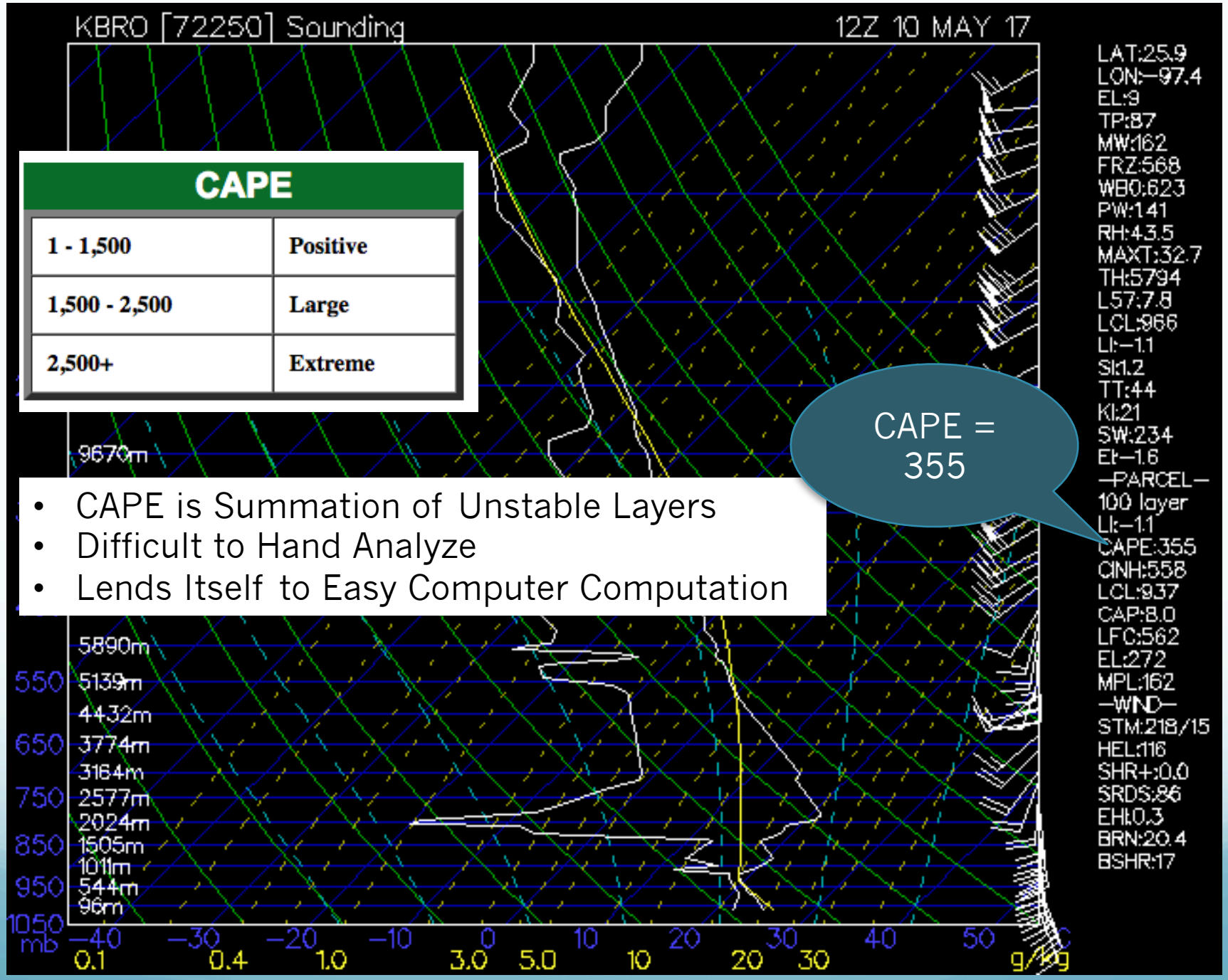
Lifted Index Example:
Assume the Following Surface Conditions As Before, But Temperature at 500 mb = -5 C

Is our Atmosphere Profile Stable or Unstable? Follow Parcel Lapse Rate to 500 mb = 2 C

Compare that to the 500 mb Actual Temp LI = (Actual – Parcel) = -7

500 mb Lifted Index

- Crude Measure for Stability
- Works Best In Late Spring, Summer
- Doesn't Consider Full Potential Energy of Atmosphere
- The Convective Available Potential Energy (CAPE) is a Better Index, But
  - Difficult to Hand Analyze
  - Usually Given With The Sounding



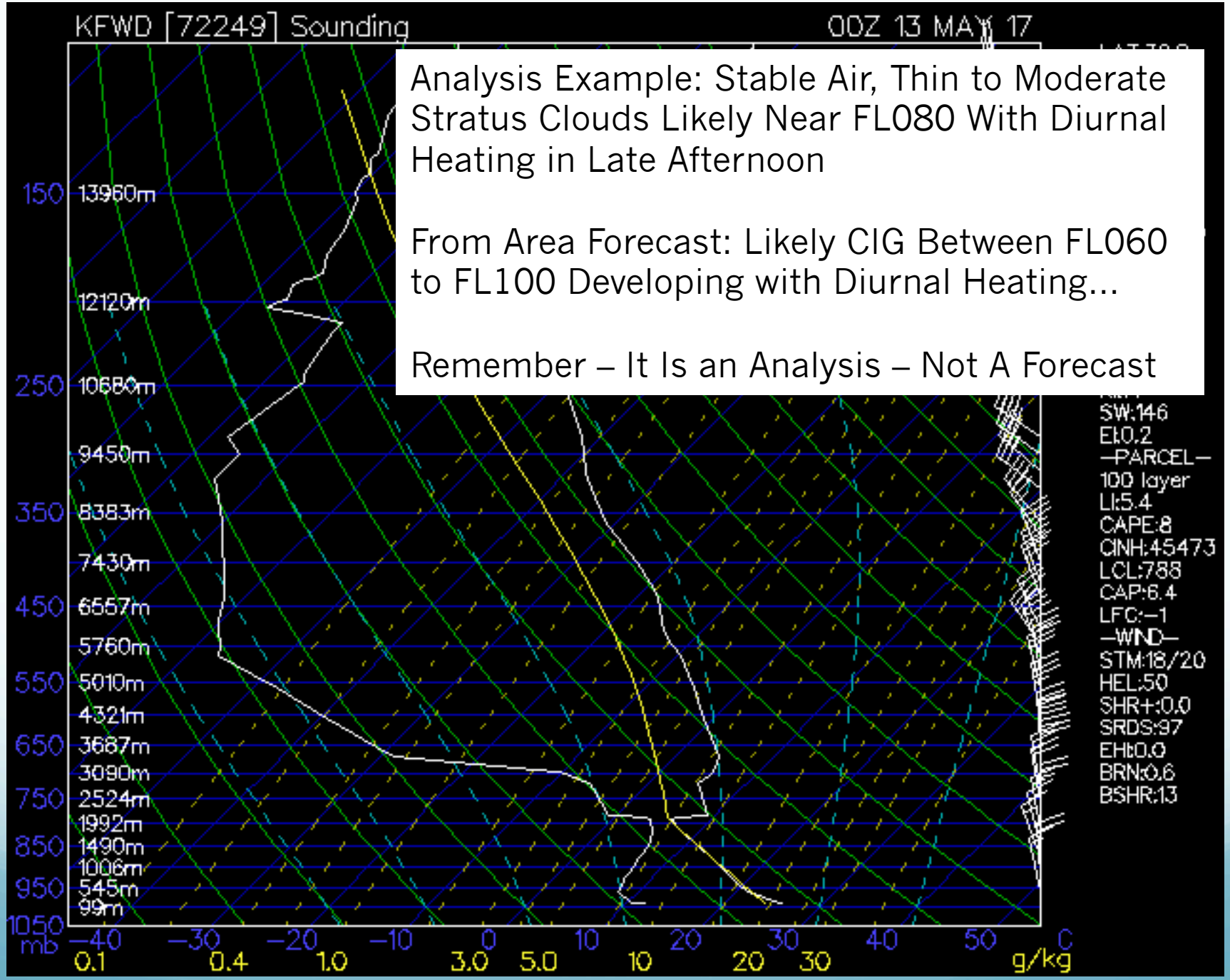
CAPE	
1 - 1,500	Positive
1,500 - 2,500	Large
2,500+	Extreme

CAPE = 355

- CAPE is Summation of Unstable Layers
- Difficult to Hand Analyze
- Lends Itself to Easy Computer Computation

Resources

- Jeff Haby
  http://www.theweatherprediction.com/thermo/skewt/
- Unisys
  http://weather.unisys.com/upper_air/skew/
- NOAA's Storm Prediction Center
  http://www.spc.noaa.gov/exper/soundings/


KFWD [72249] Sounding
00Z 13 MAY 17
Analysis Example: Stable Air, Thin to Moderate Stratus Clouds Likely Near FL080 With Diurnal Heating in Late Afternoon
From Area Forecast: Likely CIG Between FL060 to FL100 Developing with Diurnal Heating...
Remember – It Is an Analysis – Not A Forecast
150 13960m
12120m
250 10680m
9450m
350 8383m
7430m
450 6557m
5760m
550 5010m
4321m
650 3687m
3090m
750 2524m
1992m
850 1490m
1006m
950 545m
99m
1050 mb
−40 −30 −20 −10 0 10 20 30 40 50 C
0.1 0.4 1.0 3.0 5.0 10 20 30 g/kg
SW:146
EI:0.2
—PARCEL—
100 layer
LI:5.4
CAPE:8
CINH:45473
LCL:788
CAP:6.4
LFC:—1
—WIND—
STM:18/20
HEL:50
SHR+:0.0
SRDS:97
EHI:0.0
BRN:0.6
BSHR:13

Future of Upper Air

- Soundings from Radisondes Being Replaced by Satellite Data
- Occasionally I Use For Examining
  - Stability
  - Inversions
  - Correlation With Satellite Data
- Impress Someone
- Yes, I Still Have My Slide Rule!

Conclusion

- And If You Liked This…
- Perhaps ‘How to Use Flags to Semaphore a METAR’, or perhaps
- Morse Code Q Codes, e.g. QNH