Dew Point Climatology

For Southeast Minnesota, Northeast Iowa, and Western Wisconsin

WFO La Crosse Climatology Series #17

Mary-Beth Schreck
Dan Baumgardt

NWS La Crosse, WI

Objectives

- Become familiar with climatological hourly Td curves
- Understand how wind direction affects Td
- Become aware of the unique characteristics of KLSE and KRST

Data Methodology

- 1961-1995 Surface Hourly Observations
  - NCDC SAMSON CDROM 1960-1990
  - NCDC HUSWO CDROM 1990-1995
  - 1965-1972 removed due to station closures: 23 total years possible.
    - LSE (17)
      - No 62,63,80,81,85, 91. Removed June 78,82,95.
    - RST (20)
      - No 78, 80, 90
    - ALO (18)
      - No 73,74,80,81
    - EAU (19)
      - No 78-81
    - MSN: (23)
    - MCW: (17)
      - No 73,74,78-81

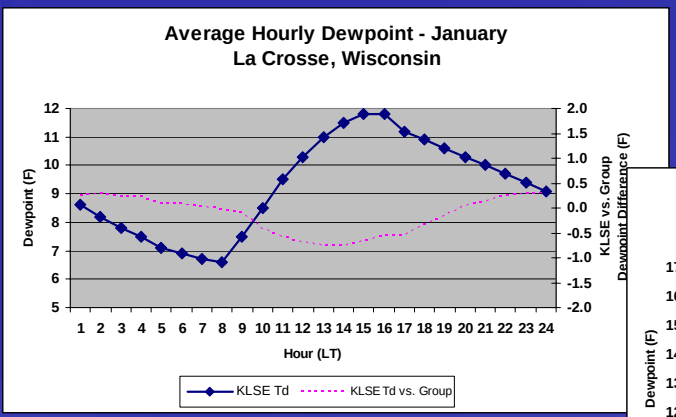
Data Methodology

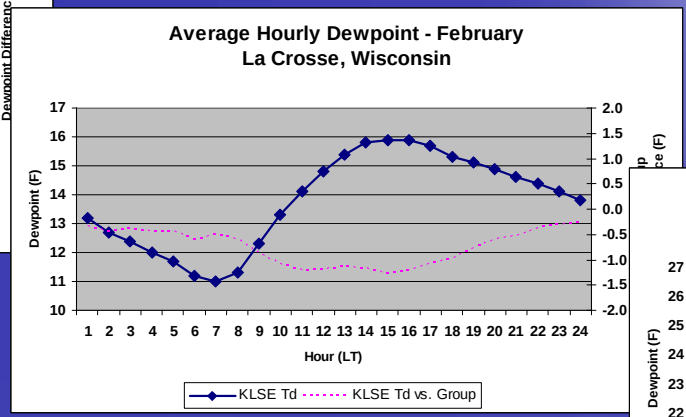
- Hourly dewpoint calculated over the period of record for every day of the year at each of the six sites. Also done hourly for every month.
- Average monthly dewpoint categorized by wind direction was calculated for each site by month.
- A group average was calculated by averaging the the data from each of the six sites.
- A 'perturbation' or anomaly (Td') was created by subtracting the site dewpoint (Td) from the group average (Td ave). Td' = Td ave - Td
  - This perturbation, or Td', is used to show where the dewpoint varies from the group average.
  - Shows local or site specific differences more clearly.

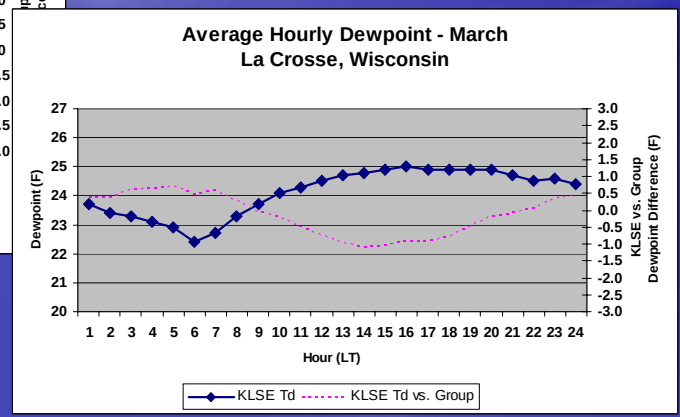
Synoptic vs. Local Signals

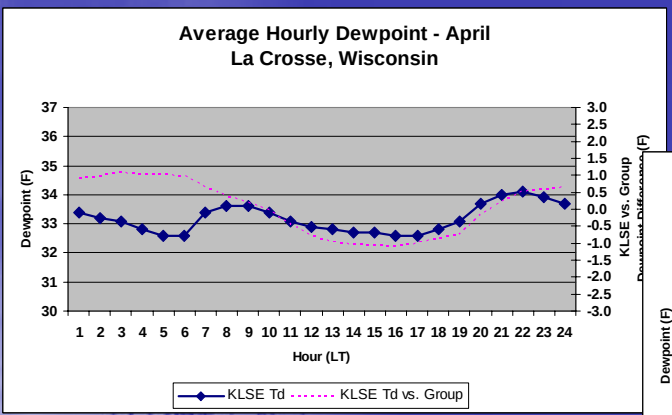
- All months – when there is a synoptic signal, it dominates
- Winter months – synoptic scale tends to have more influence
- Summer months – local signal has more influence
  - Exchange between soil moisture and water vapor in air
  - Crop coverage vs. moisture in air
  - River as moisture source

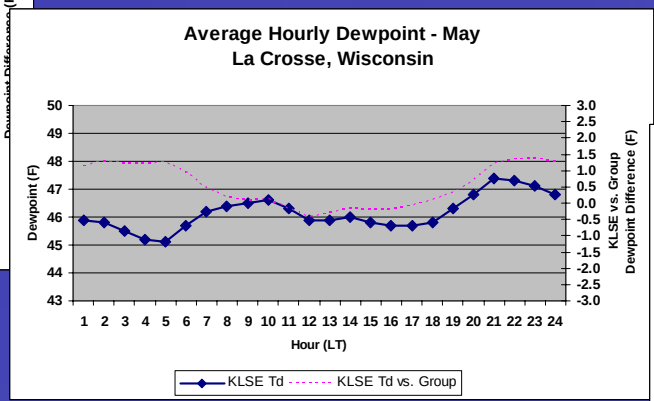
January - June

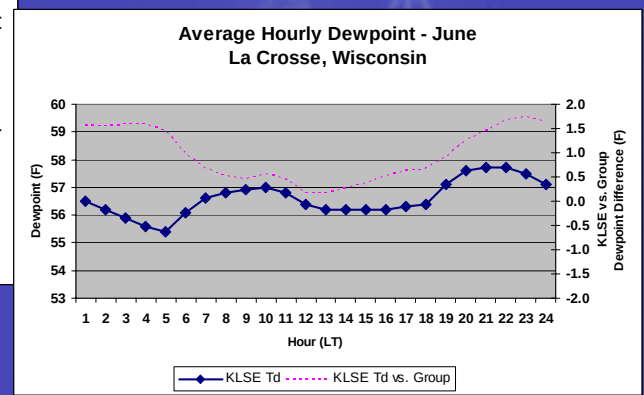




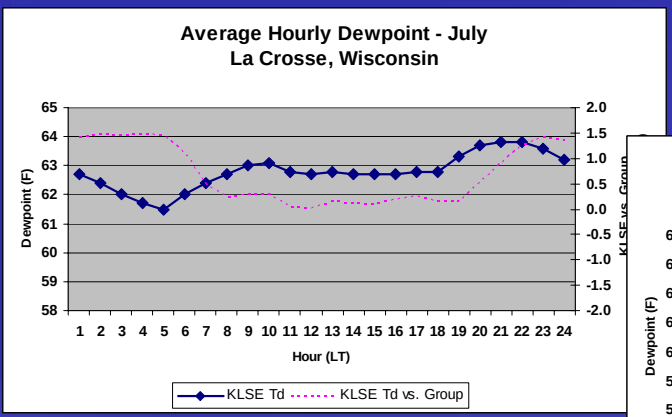


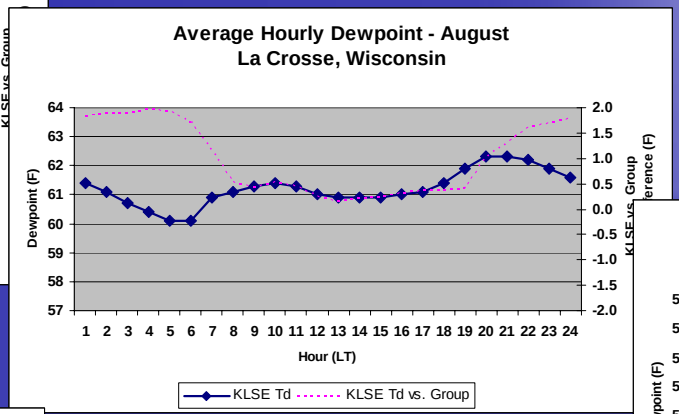


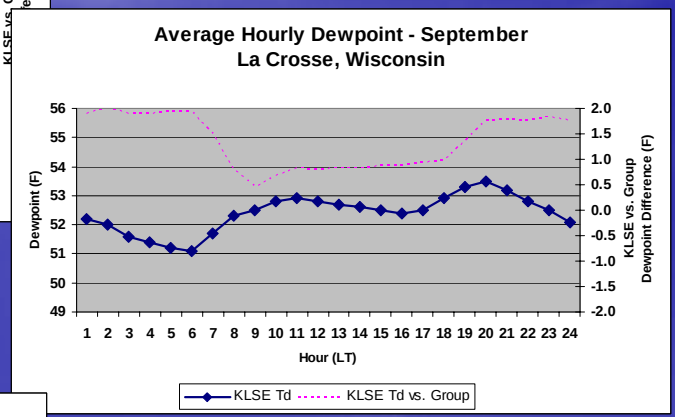


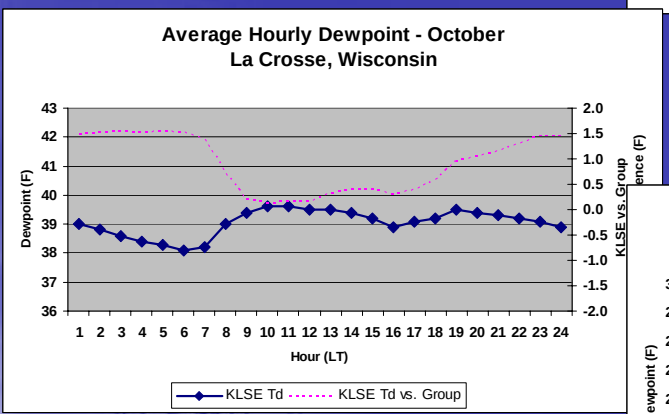


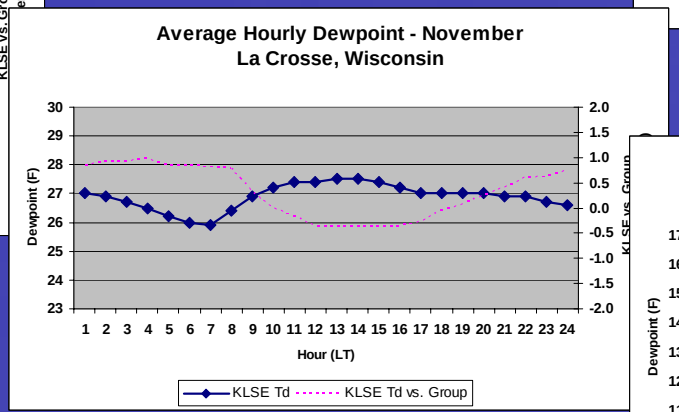
July - December

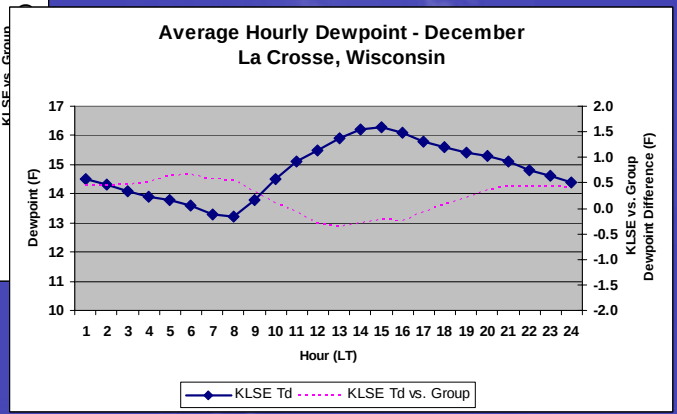








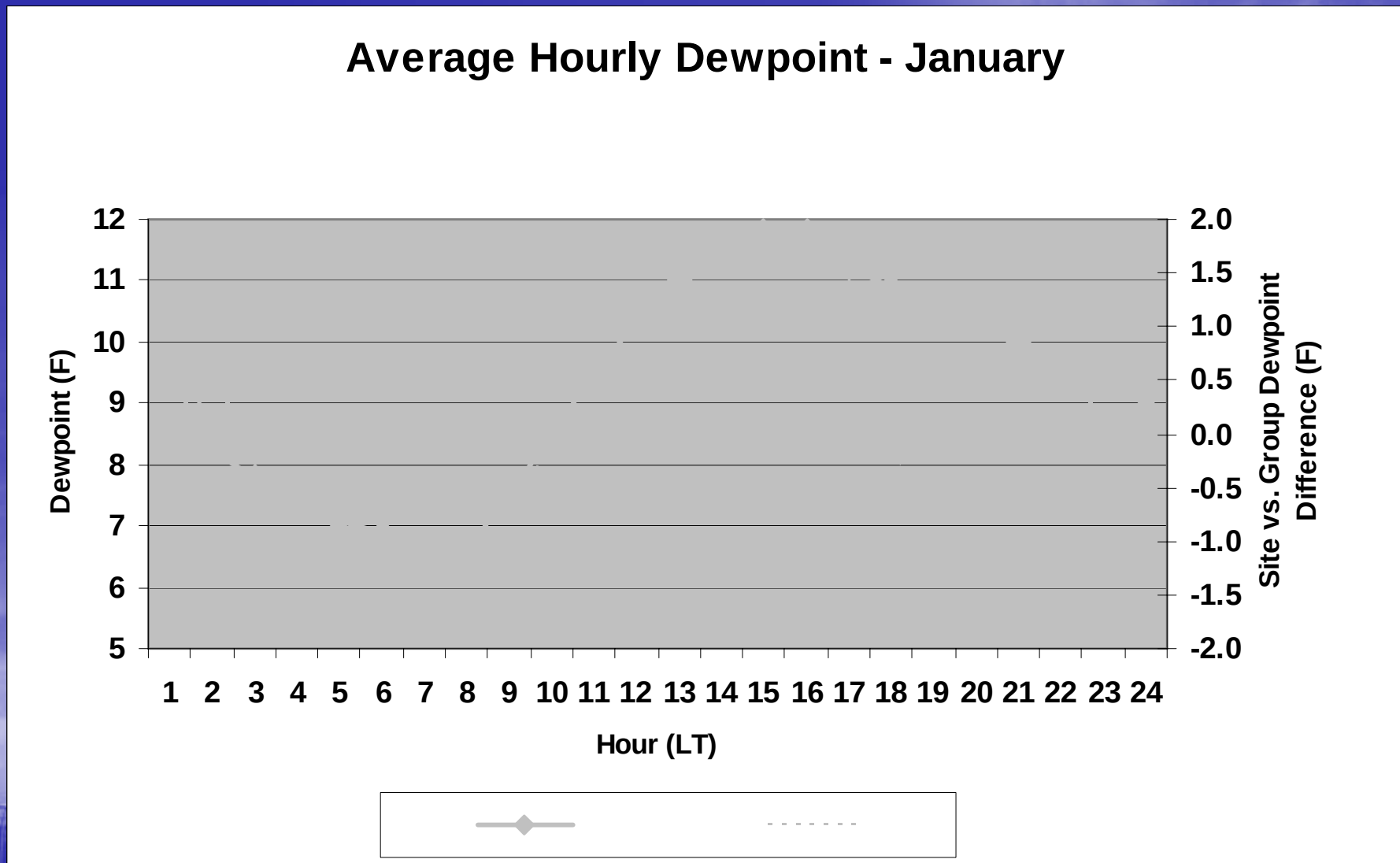




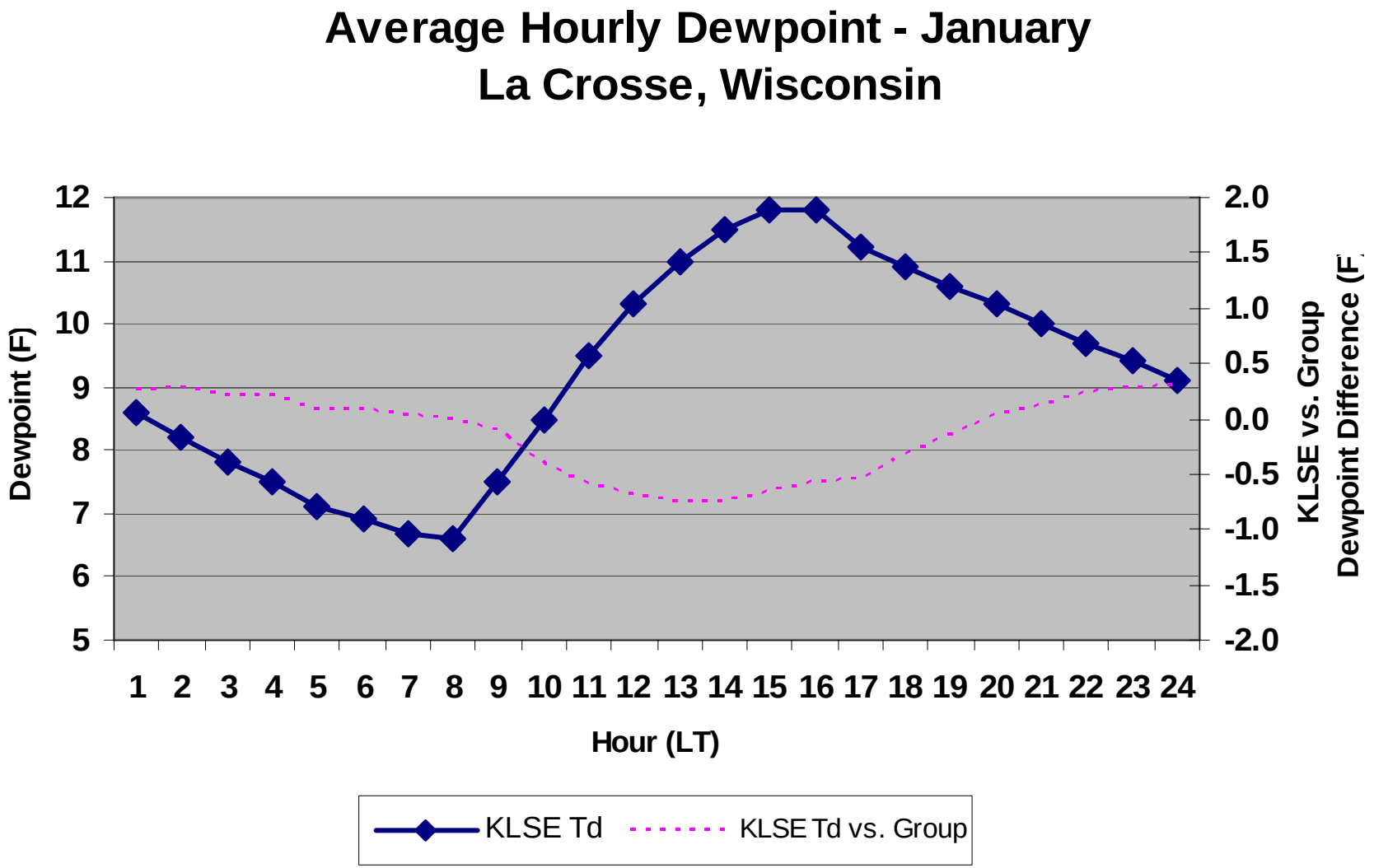
The Big Picture (All Sites): Hourly Dew Points

- Larger variation over 24 hours during the Winter months than Summer months

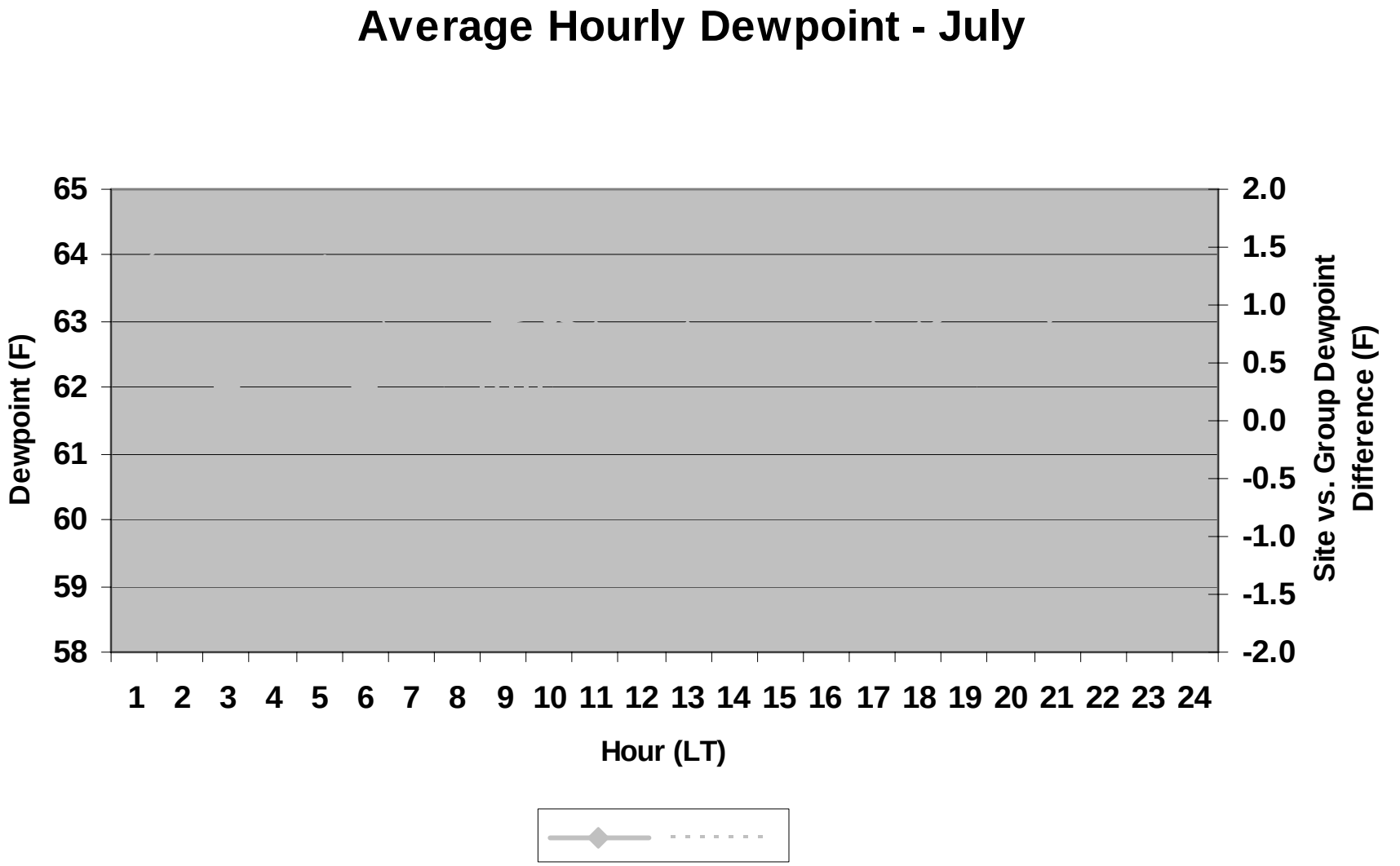
Exercise - January



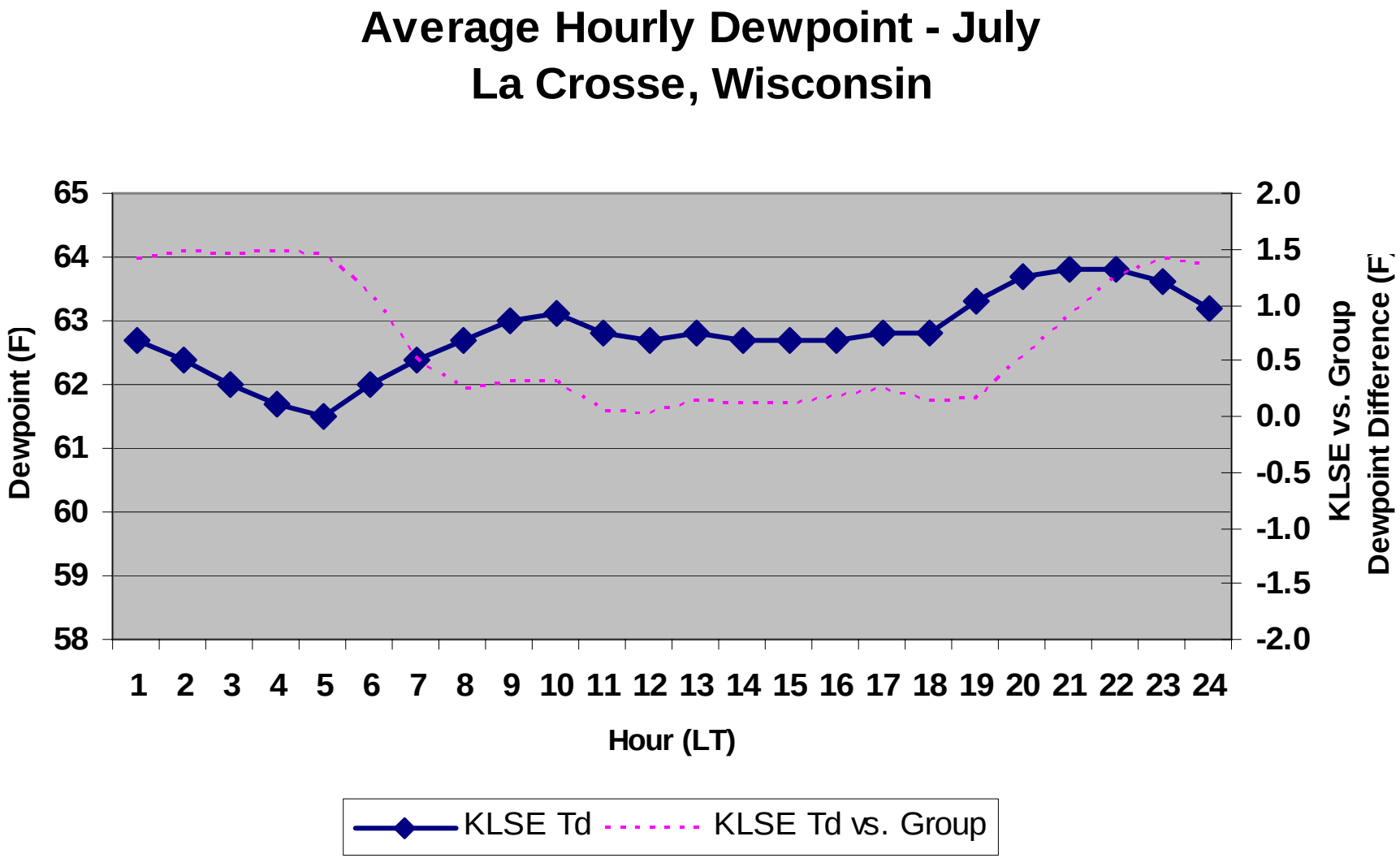
January – Td variation 6°F



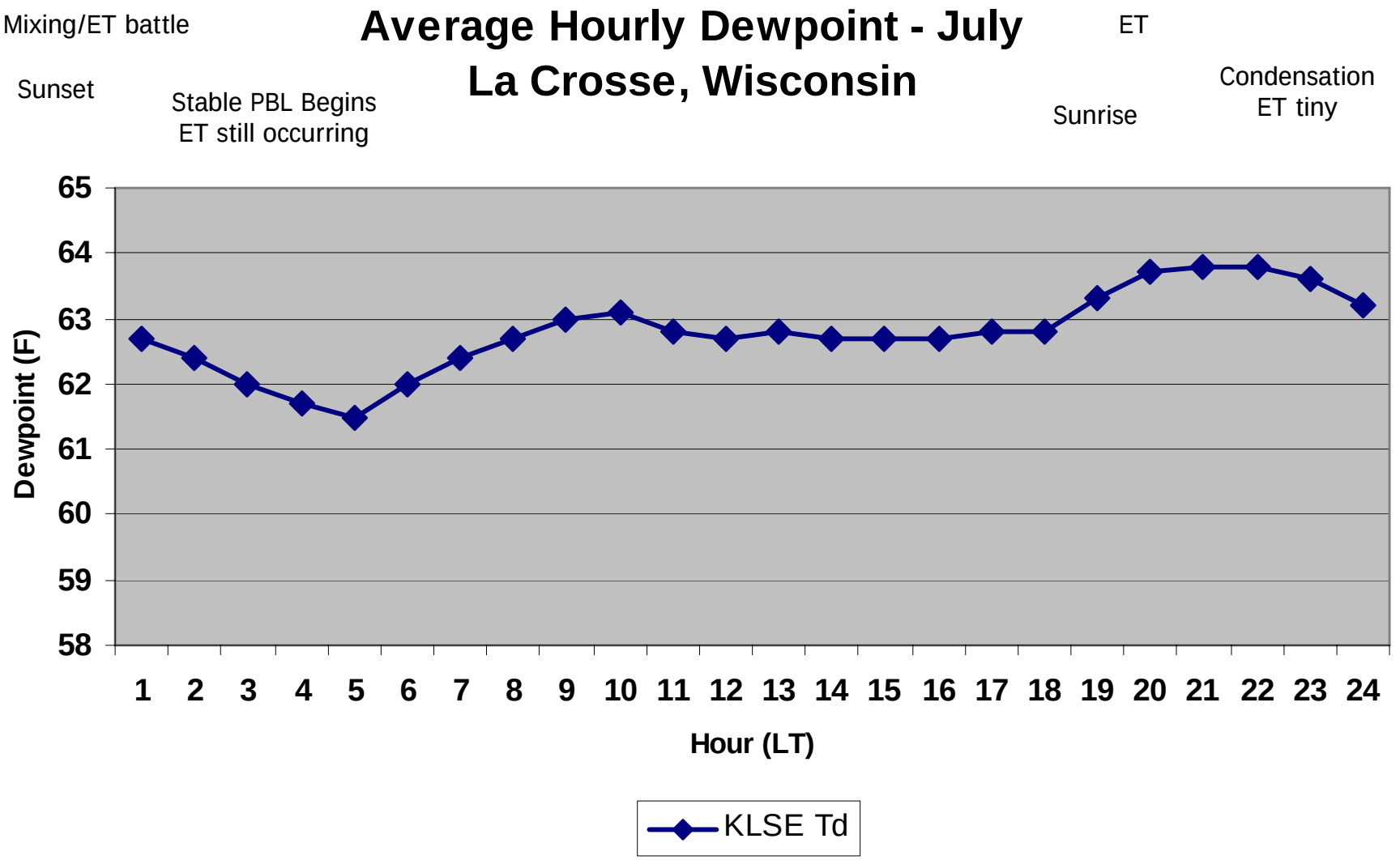
Exercise - July



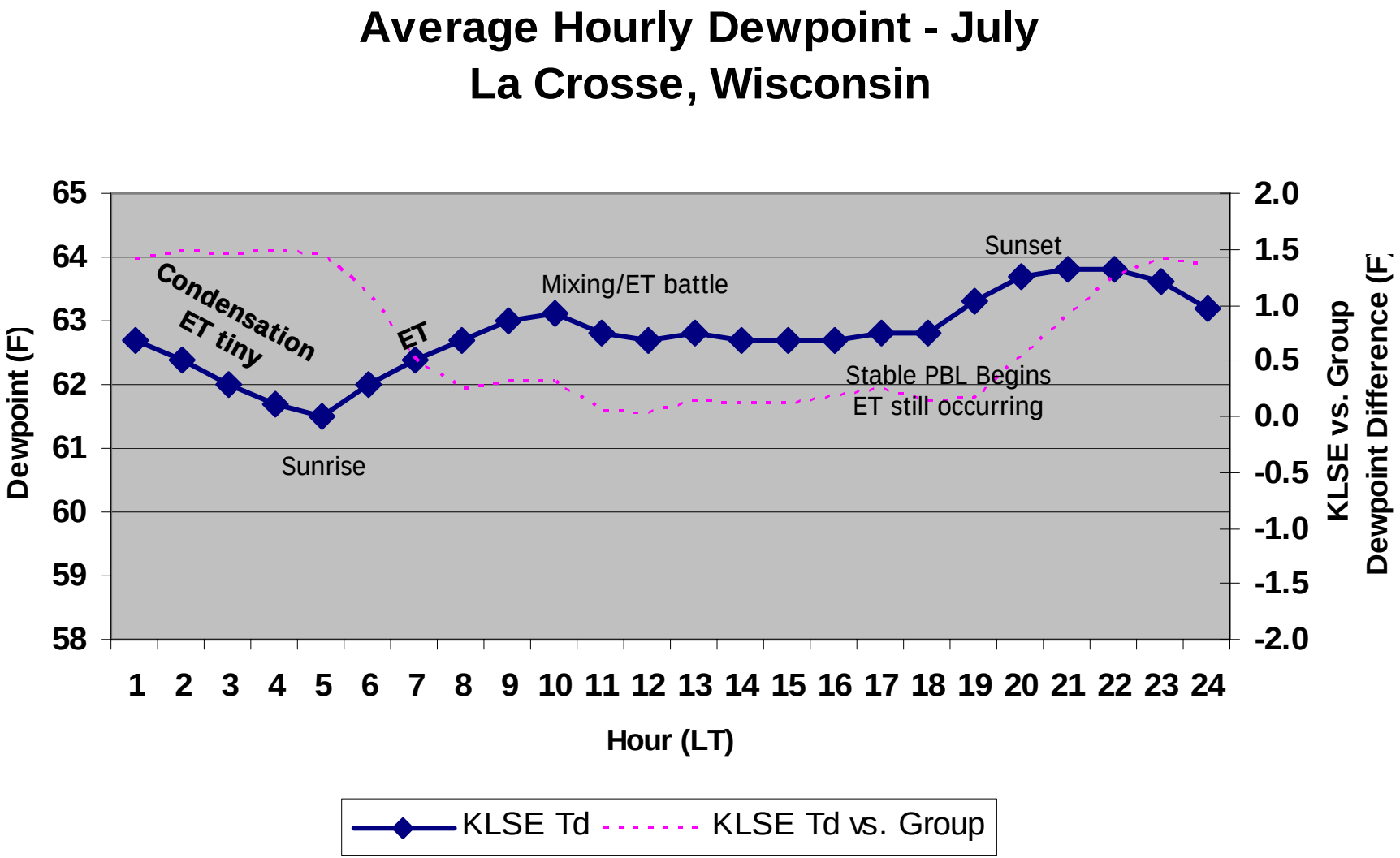
July – Td variation 3º F



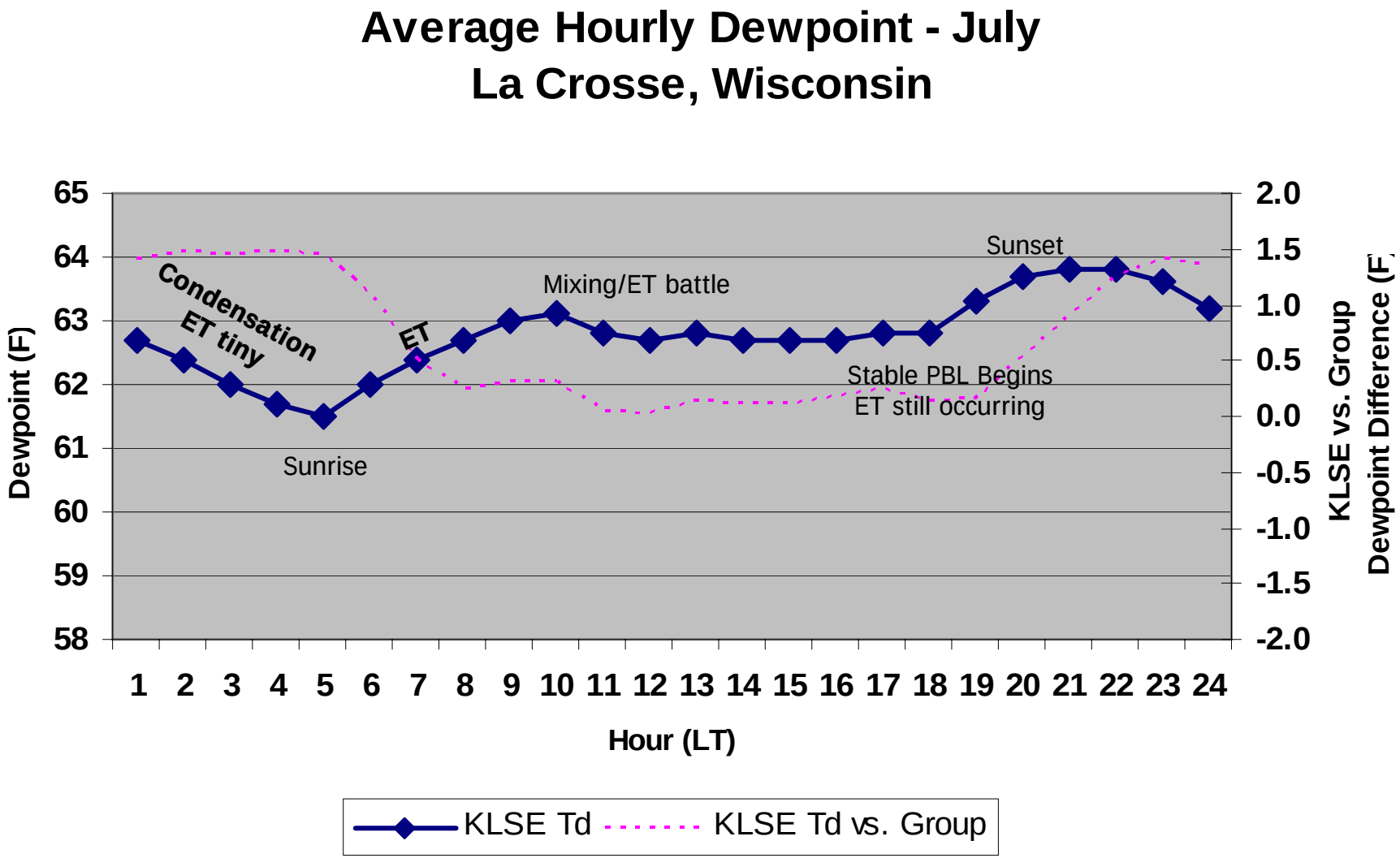
Exercise: Labeling



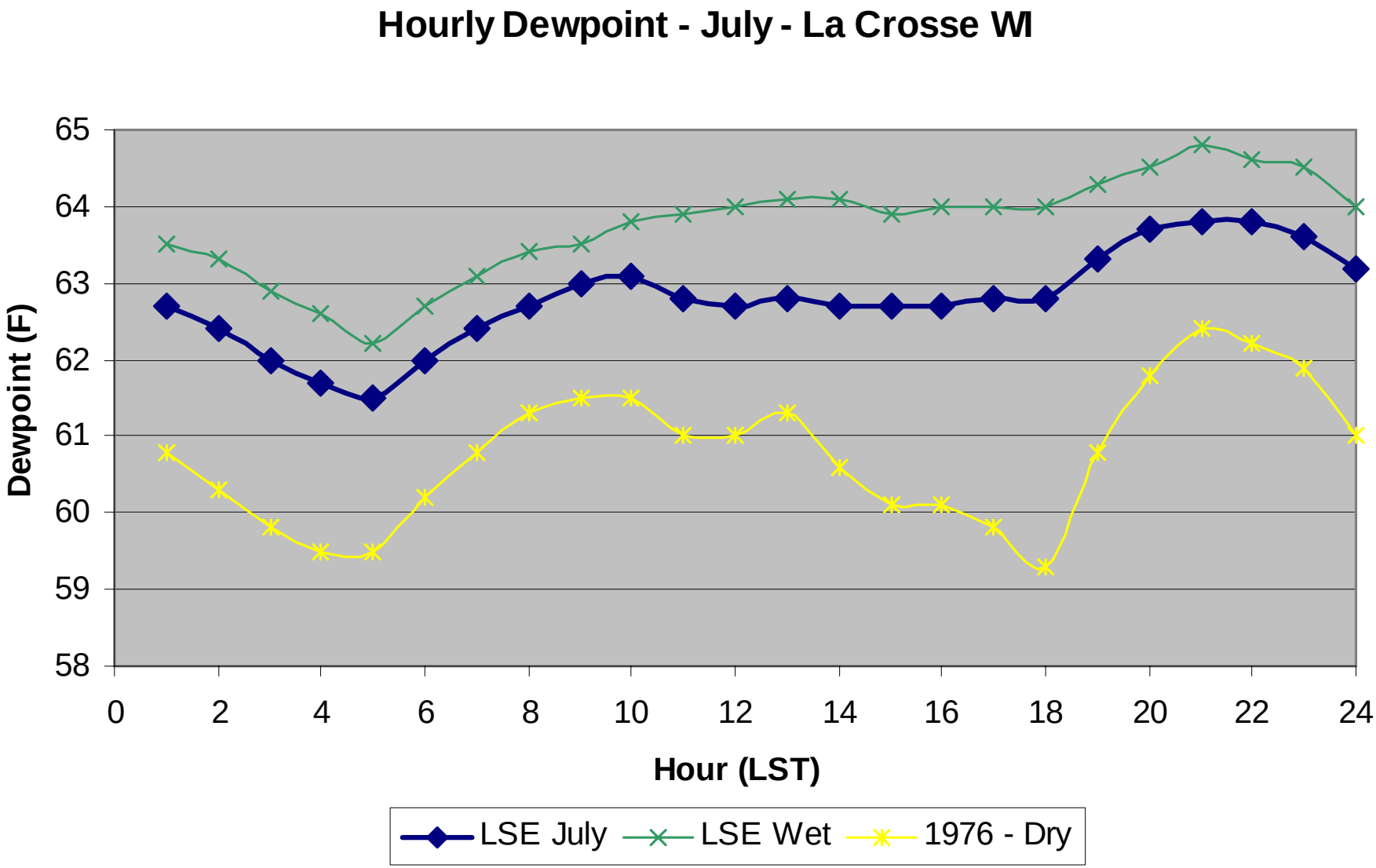
July – Daily Cycle



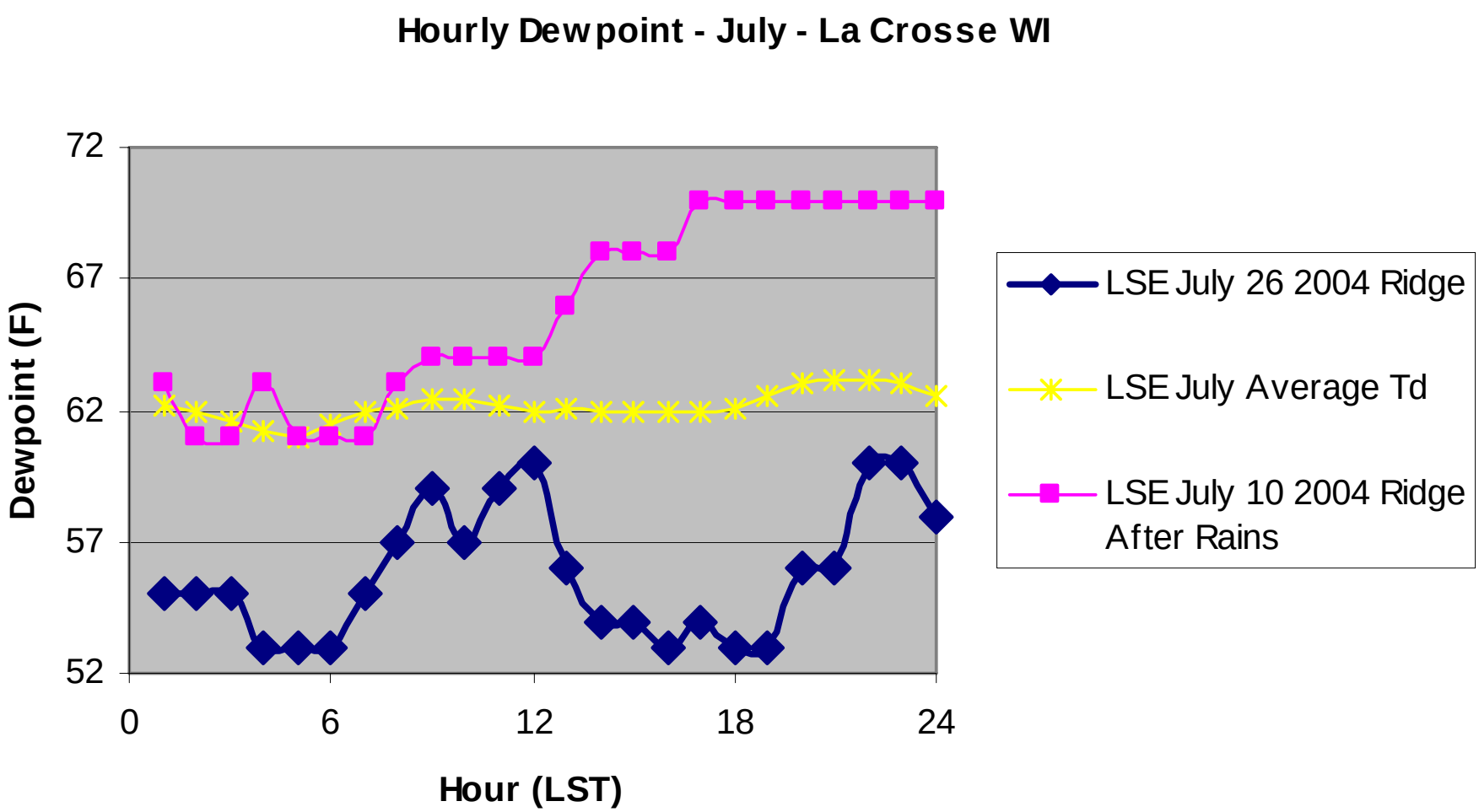
Exercise – Wet and Dry



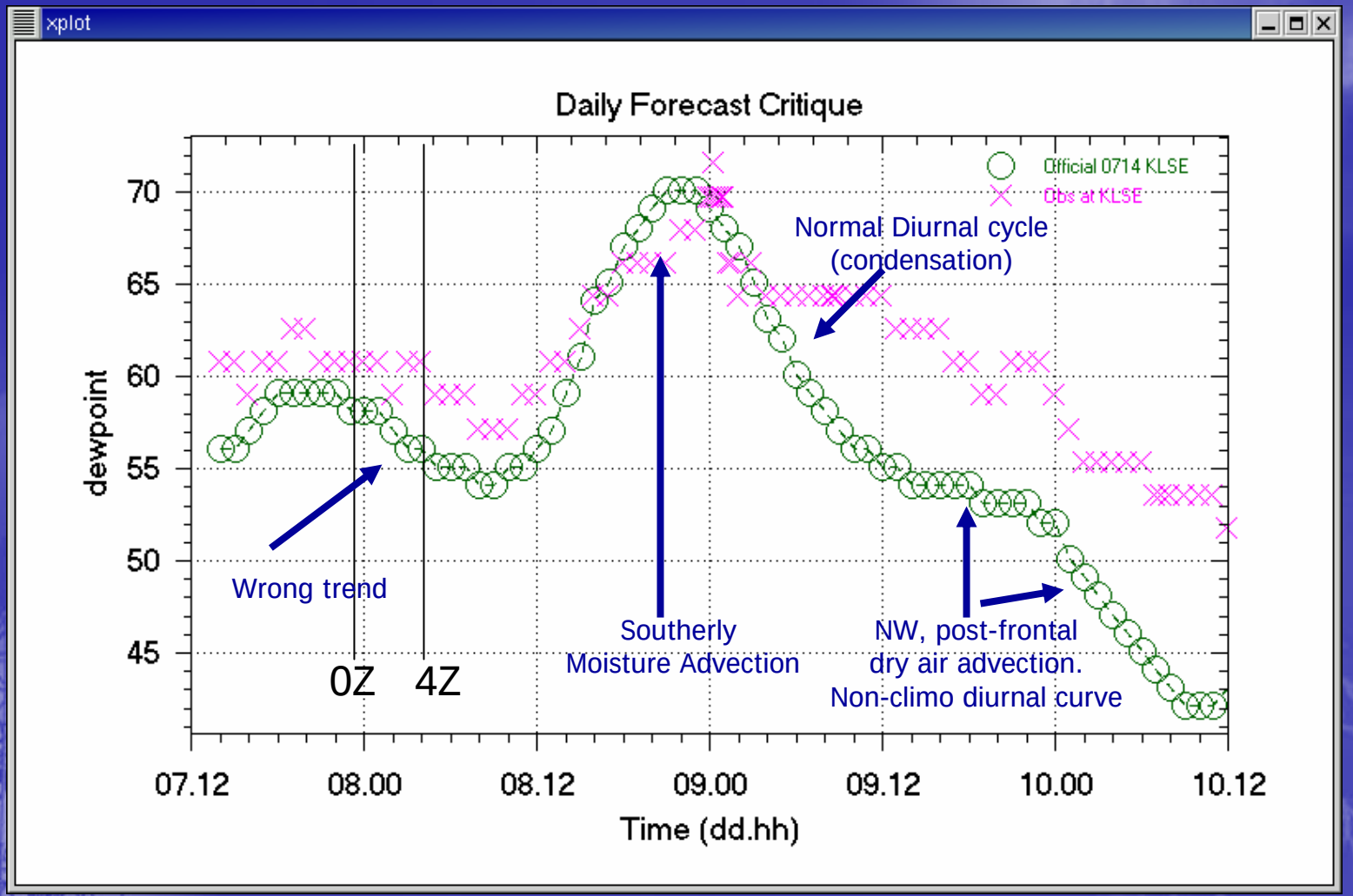
Answers: Wet and Dry Years



Real Life Example – July 2004



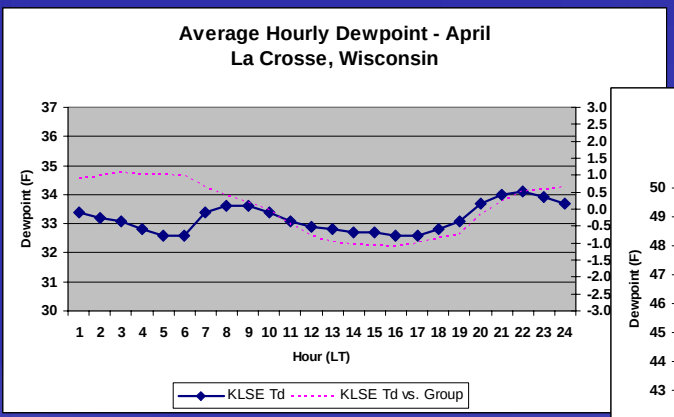
ARX Forecast Trends

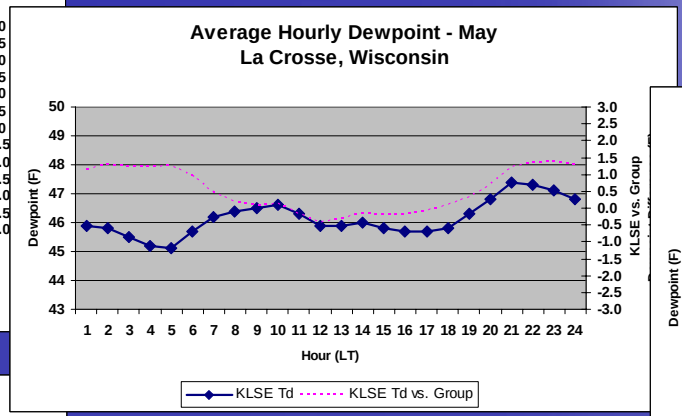


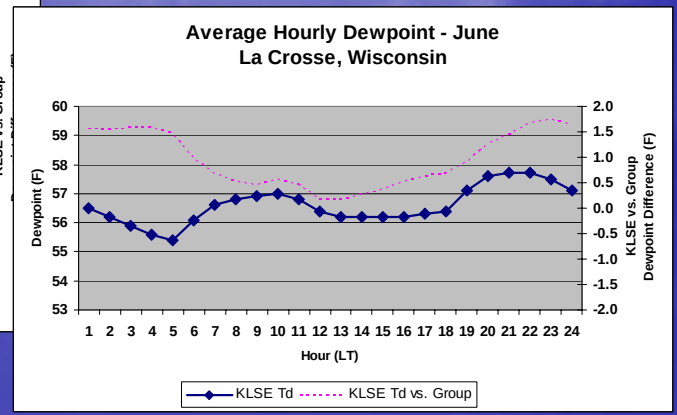
The Big Picture (All Sites): Hourly Dew Points

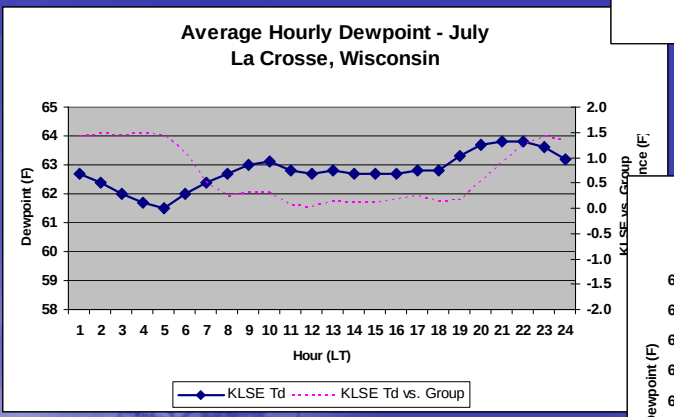
- Larger variation over 24 hours during the Winter months than Summer months
- Td rises during evening hours from April through October; 9 to 10 pm peak
  - Vegetation related

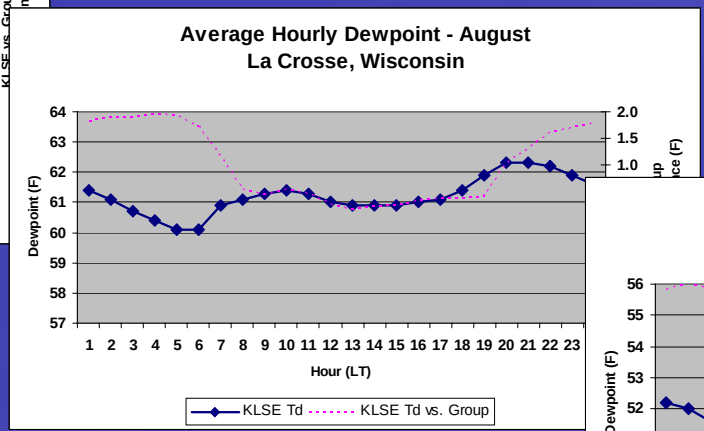
Evening Td Rises

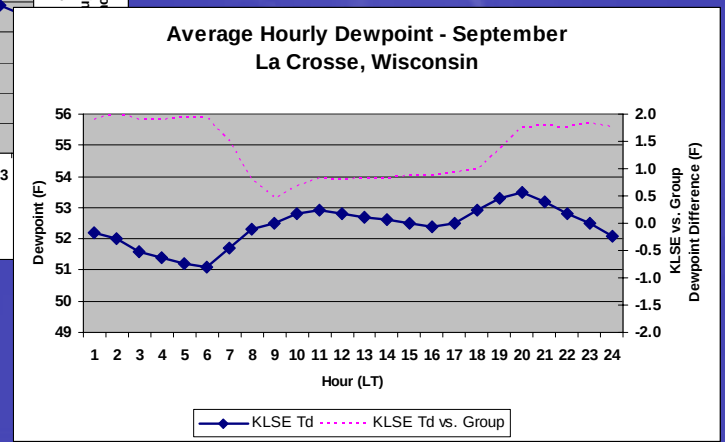








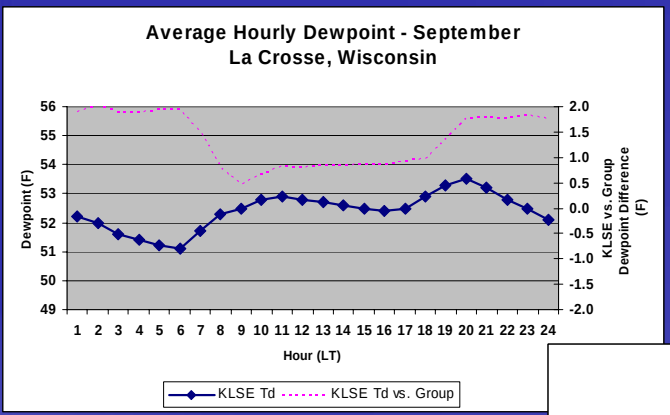


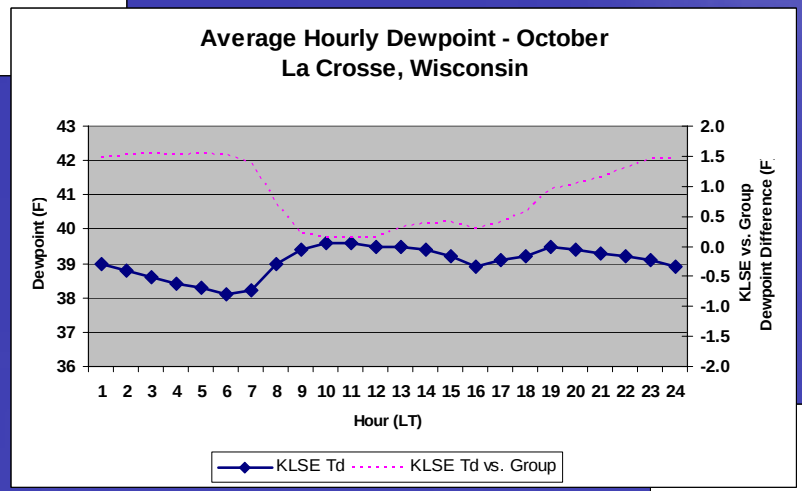


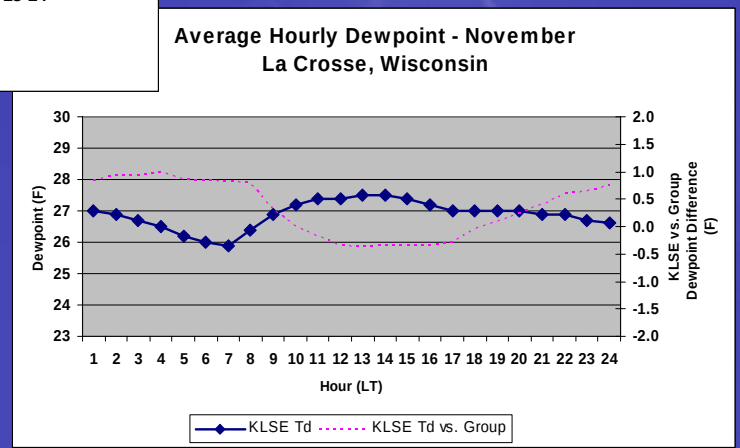
The Big Picture (All Sites): Hourly Dew Points

- Larger variation over 24 hours during the Winter months than Summer months
- Td rises during evening hours from April through October; 9 to 10 pm peak
  - Vegetation related
- Transition from 2 Td peaks to 1 in October
  - Growing season ending

Transition from 2 peaks to 1



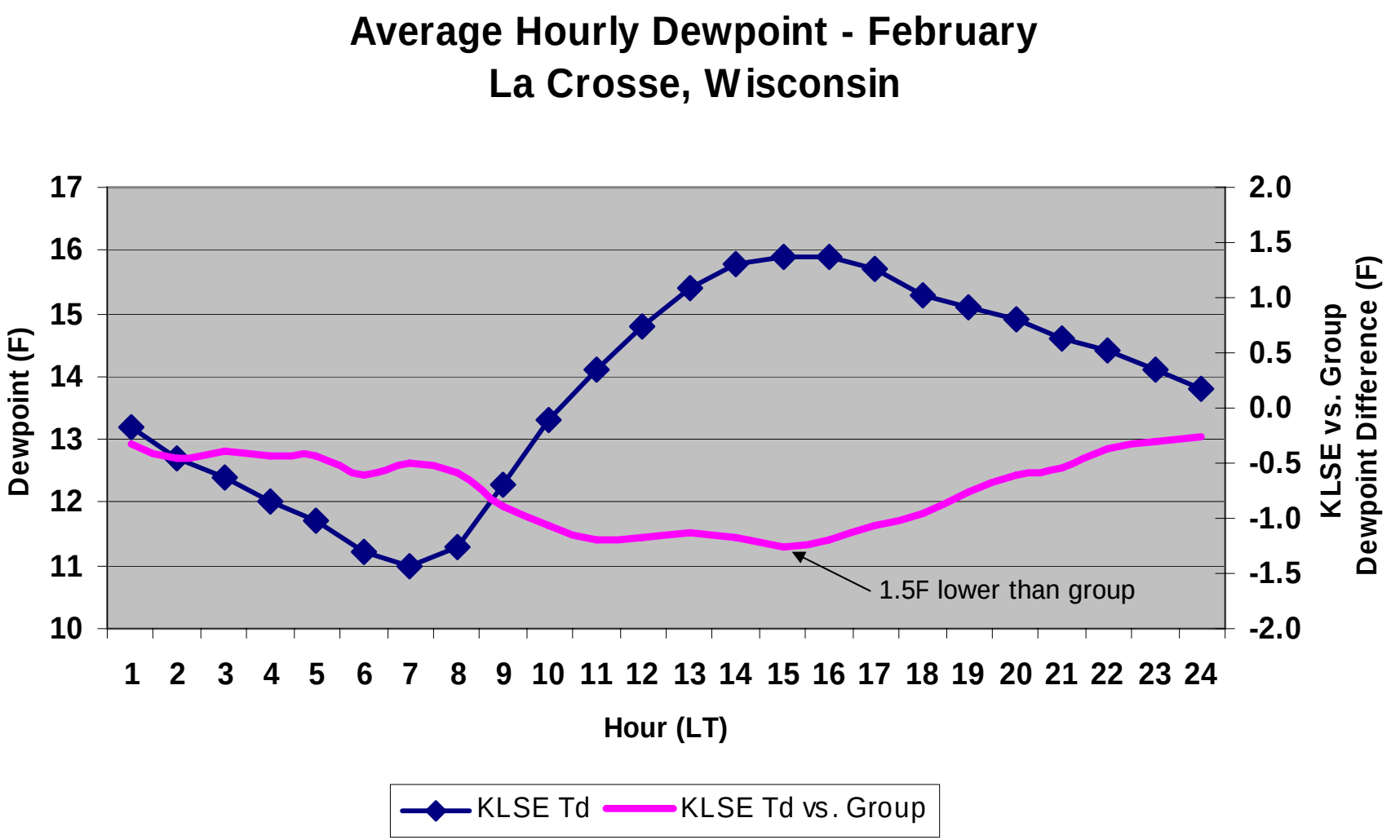




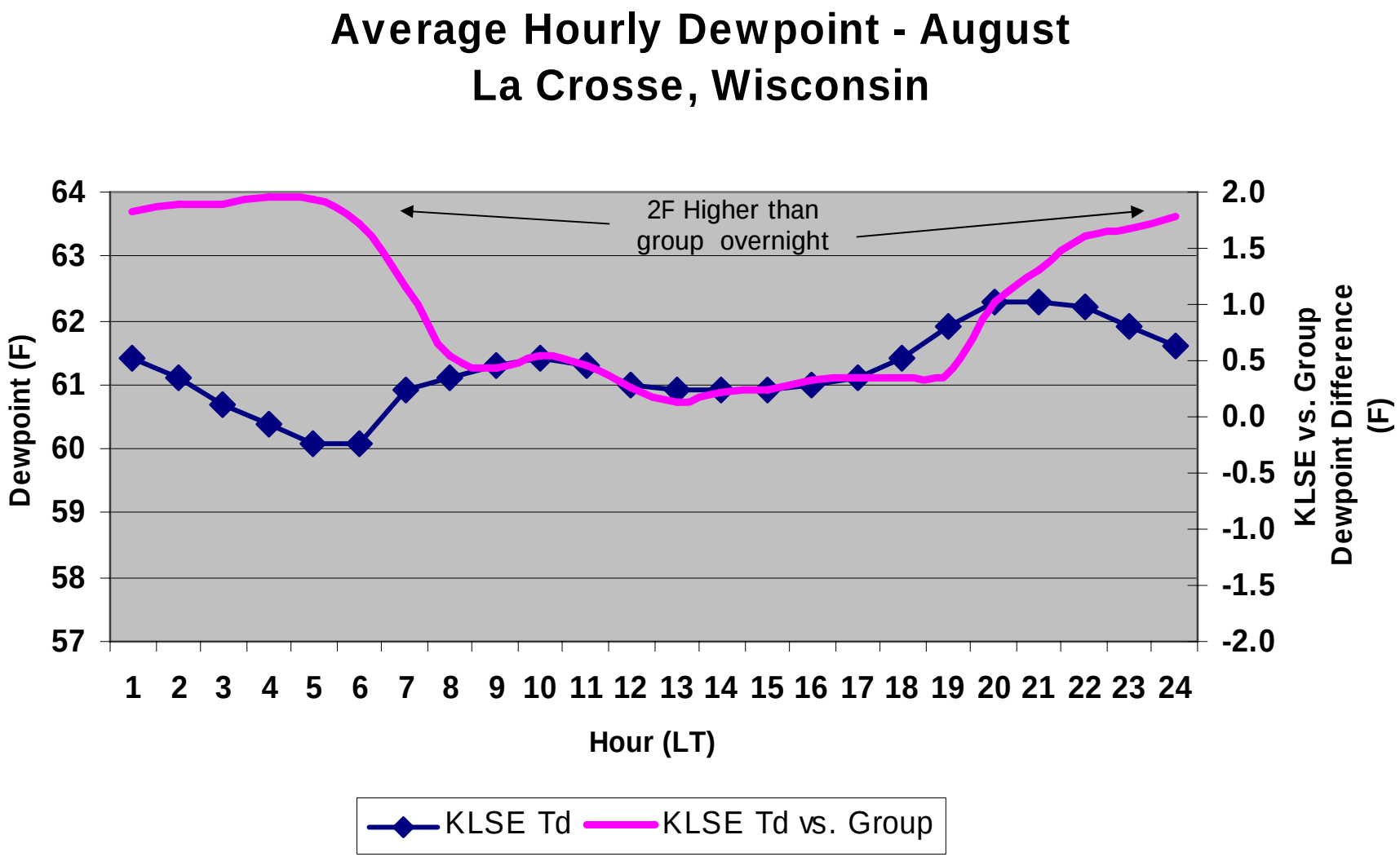
Unique to KLSE: Hourly

- Td is lower than the group in winter months; higher than group in summer months
  - Especially at night
  - Important for fog development
  - Highest perturbation is in Aug/Sept

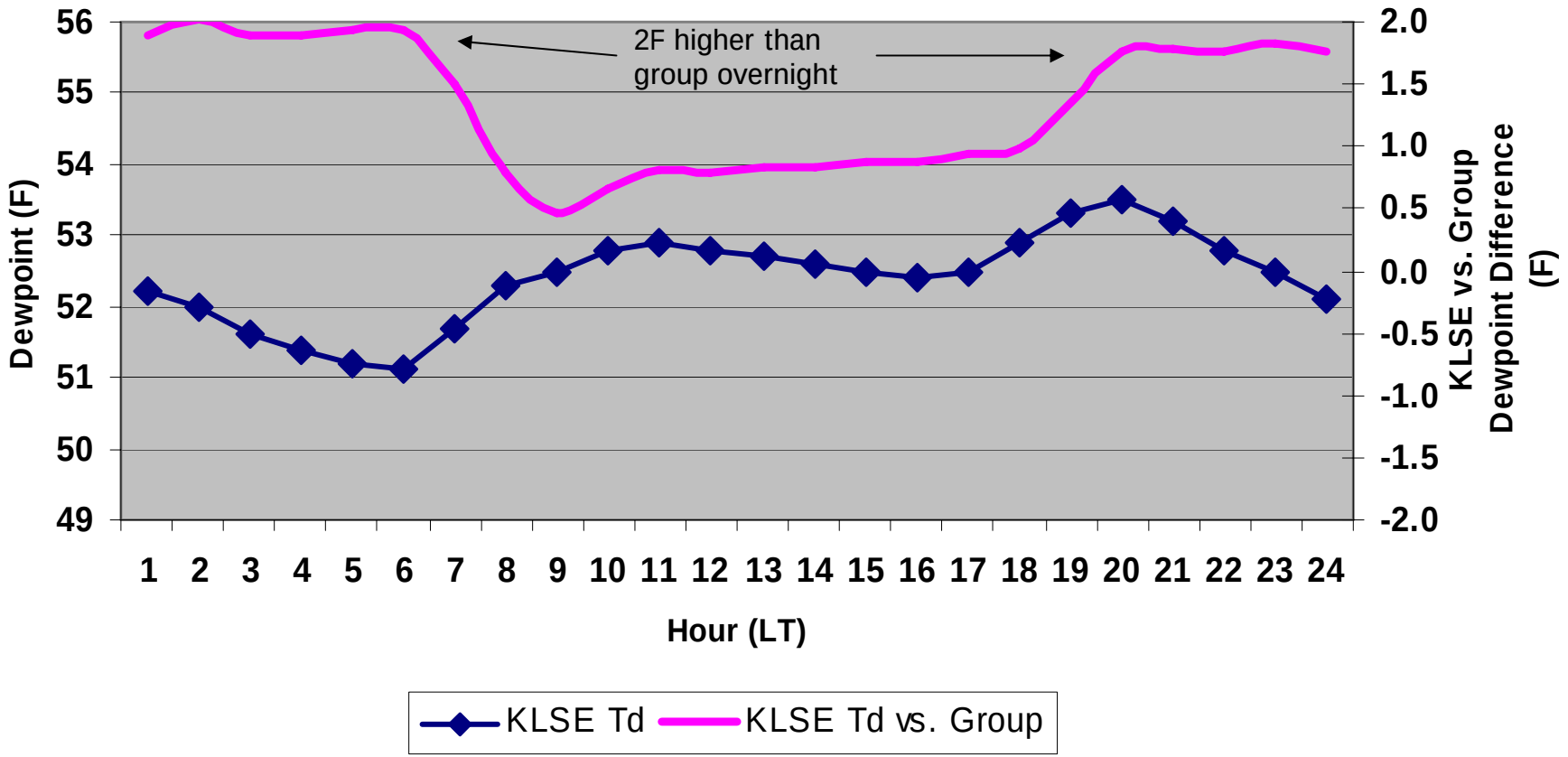
Td Lower Than Group in Winter



Td Higher Than Group in Summer



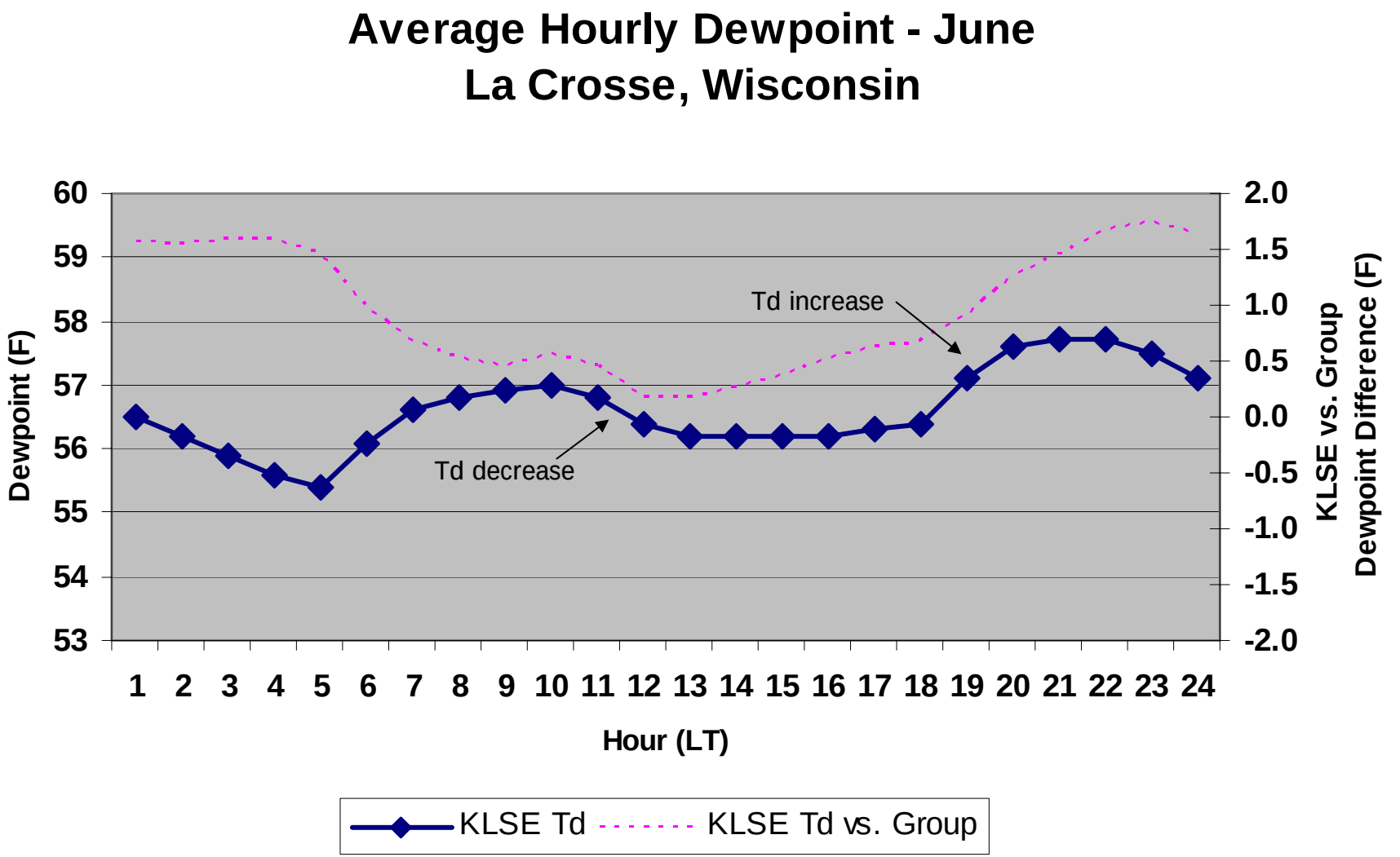
Aug. and Sept. biggest anomaly



Unique to KLSE: Hourly

- Td is lower than the group in winter months; higher than group in summer months
  - Especially at night
  - Important for fog development
  - Highest perturbation is in Aug/Sept
- In green months, Td actually decreases during afternoon, then rises again

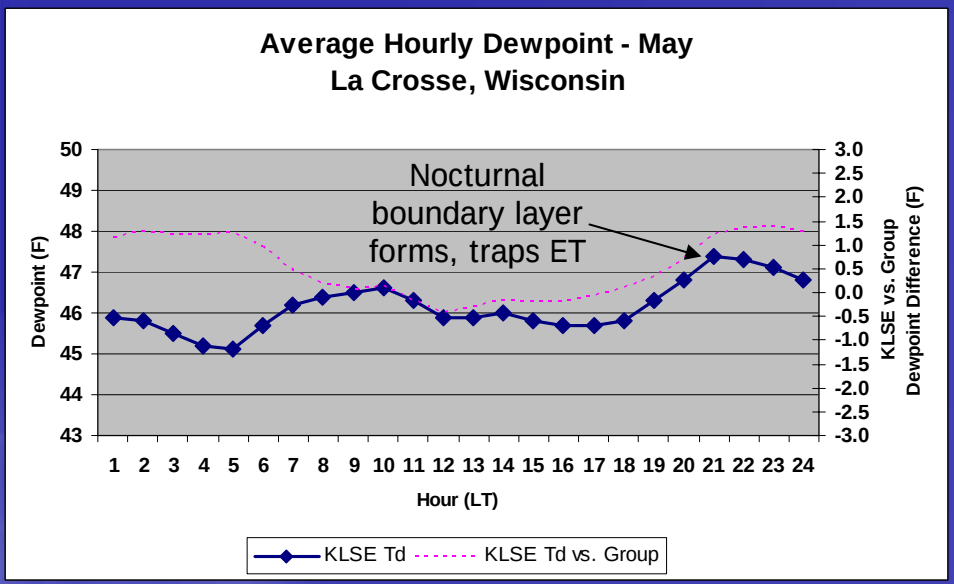
Td Decreases in Afternoon

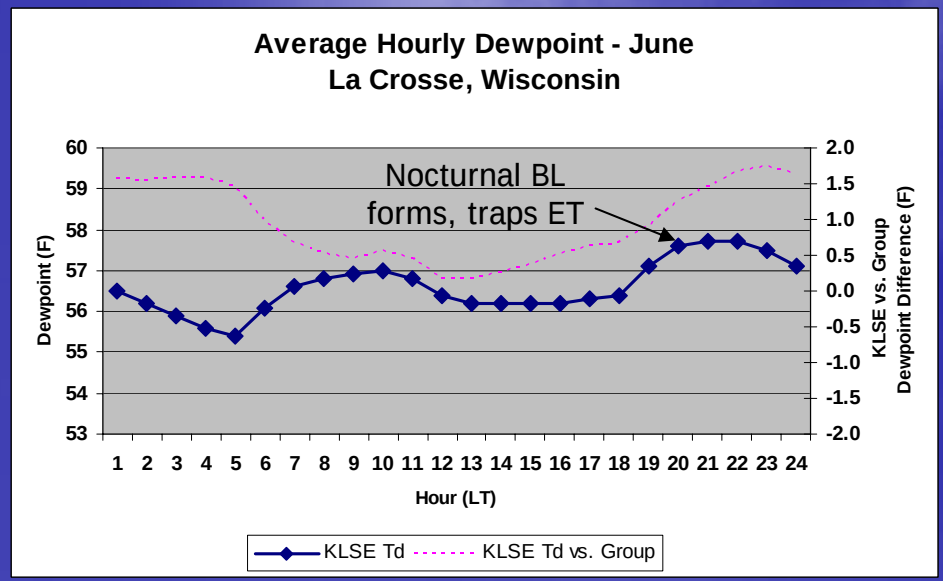


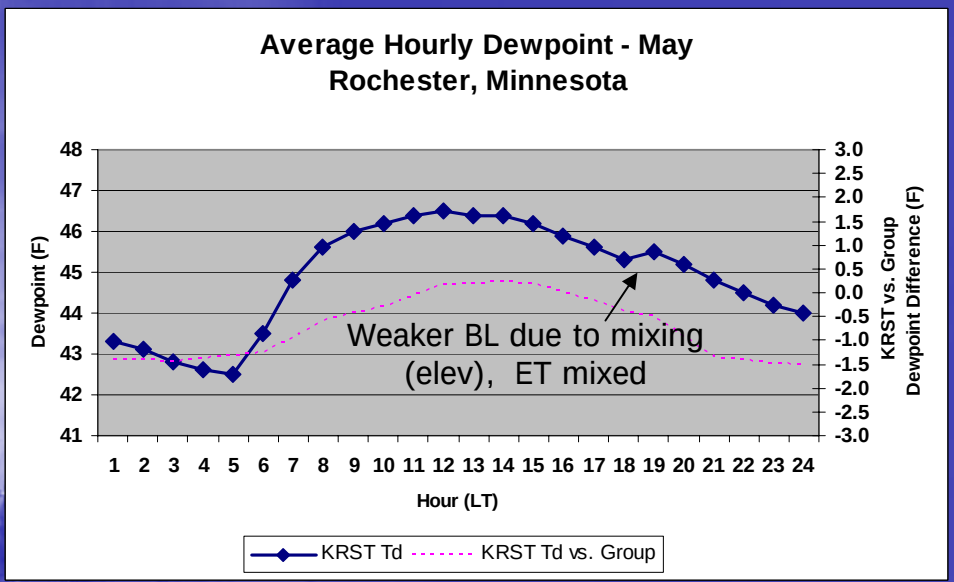
Unique to KRST: Hourly

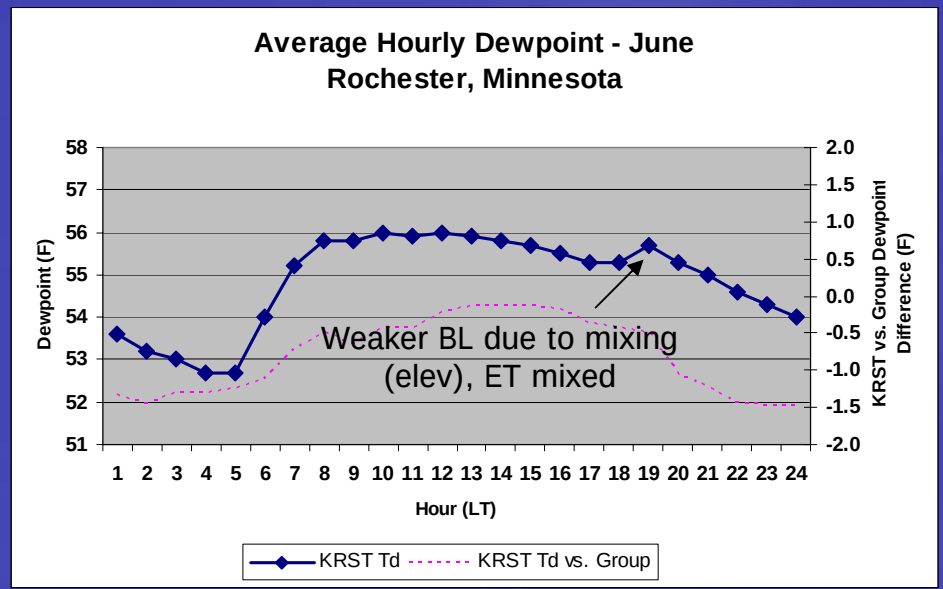
- Later impact from growing season

Growing Season





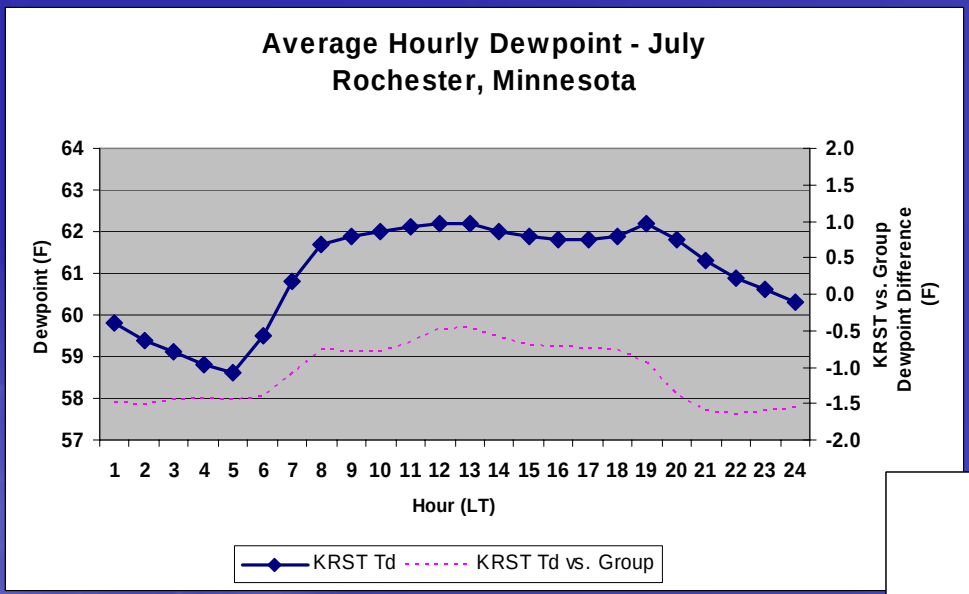


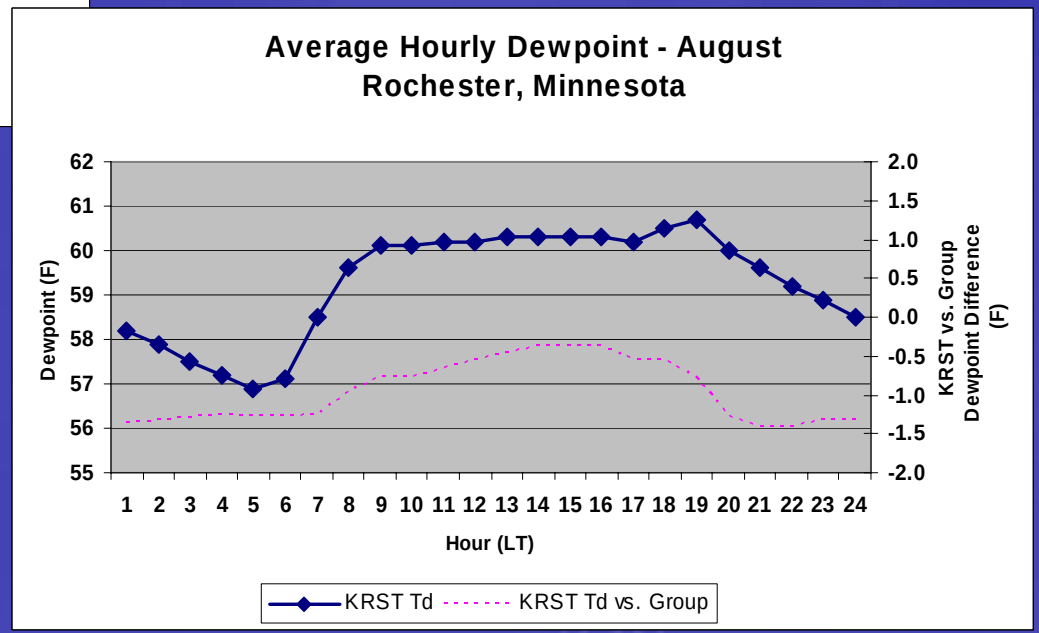


Unique to KRST: Hourly

- Later impact from growing season
- July and August are the only months with the evening Td higher than the daytime
  - Mixing vs. Evapotranspiration
  - Crop canopy coverage most extensive

KRST Evening Td Higher Than Afternoon

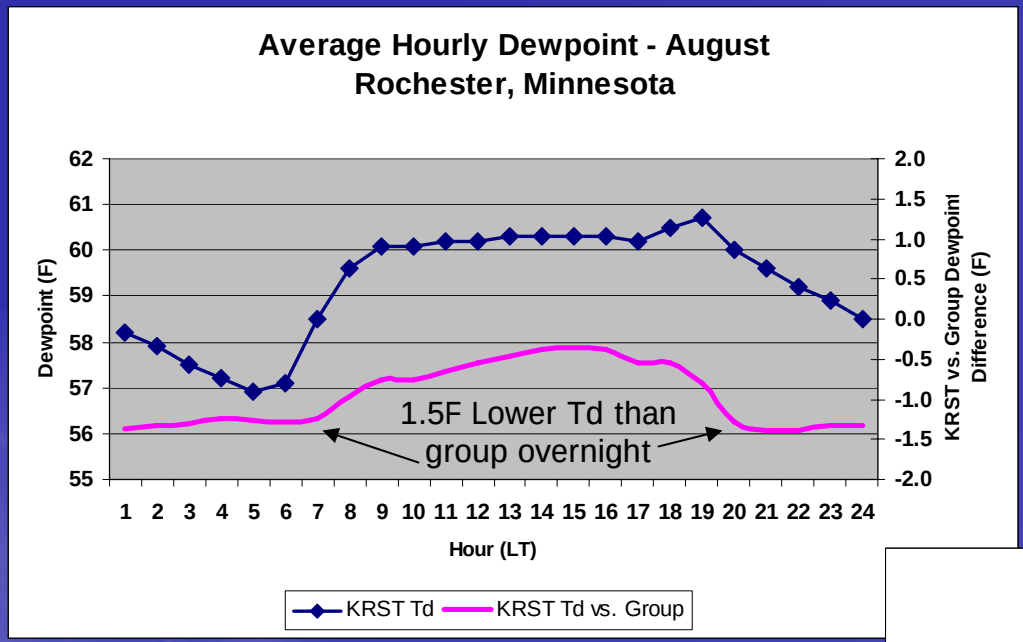


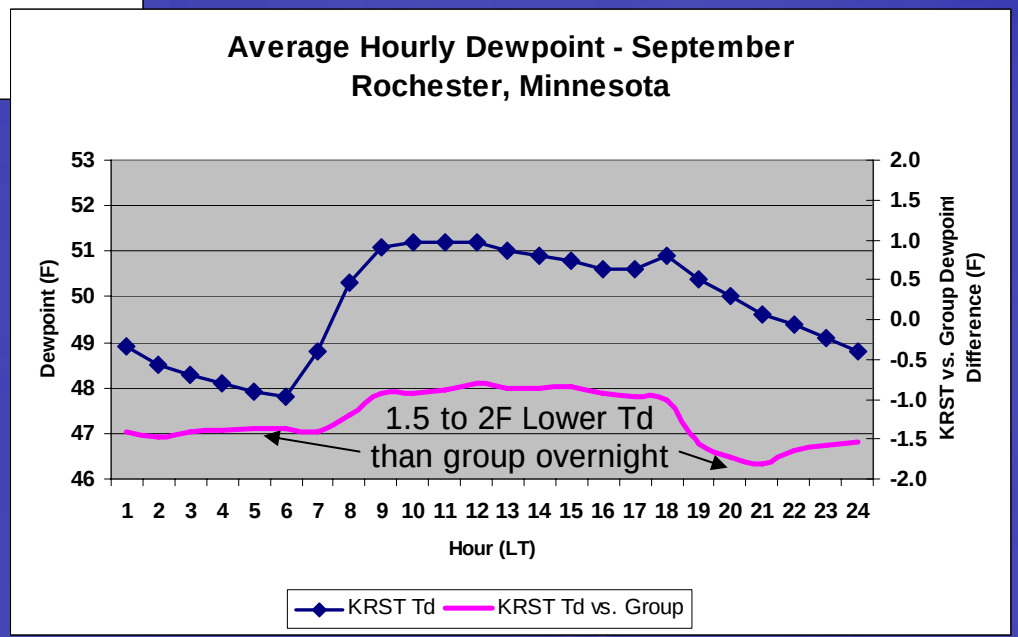


Unique to KRST: Hourly

- Later impact from growing season
- July and August are the only months with the evening Td higher than the daytime
  - Mixing vs. Evapotranspiration
  - Crop canopy coverage most extensive
- Lower Td than group in Aug. and Sept.
  - Harder to fog at KRST

KRST Fog Season

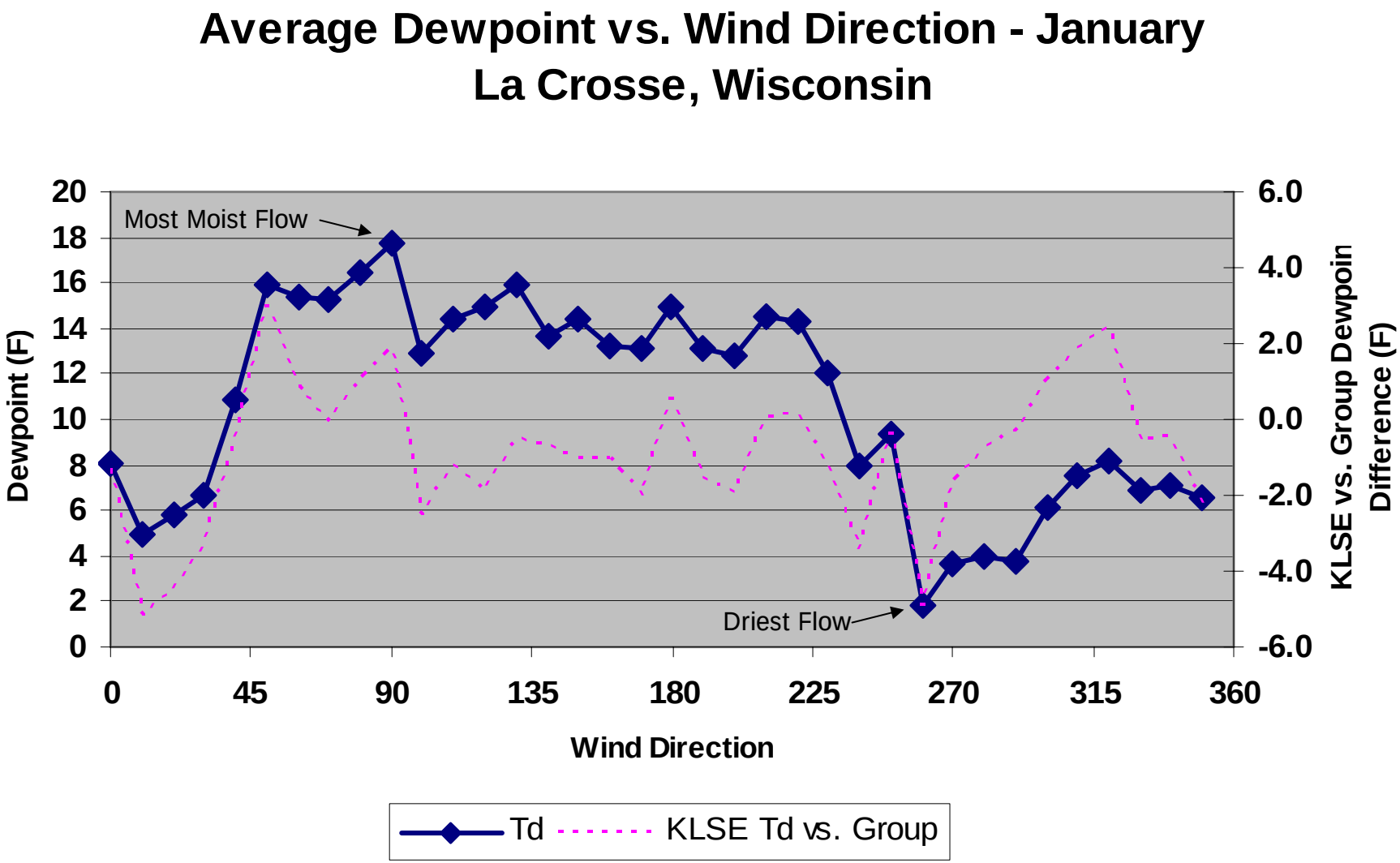




The Big Picture (All Sites): Td vs. Wind Direction

- W to NW directions are driest Nov – Feb
- E wind yields highest Td Nov - Feb

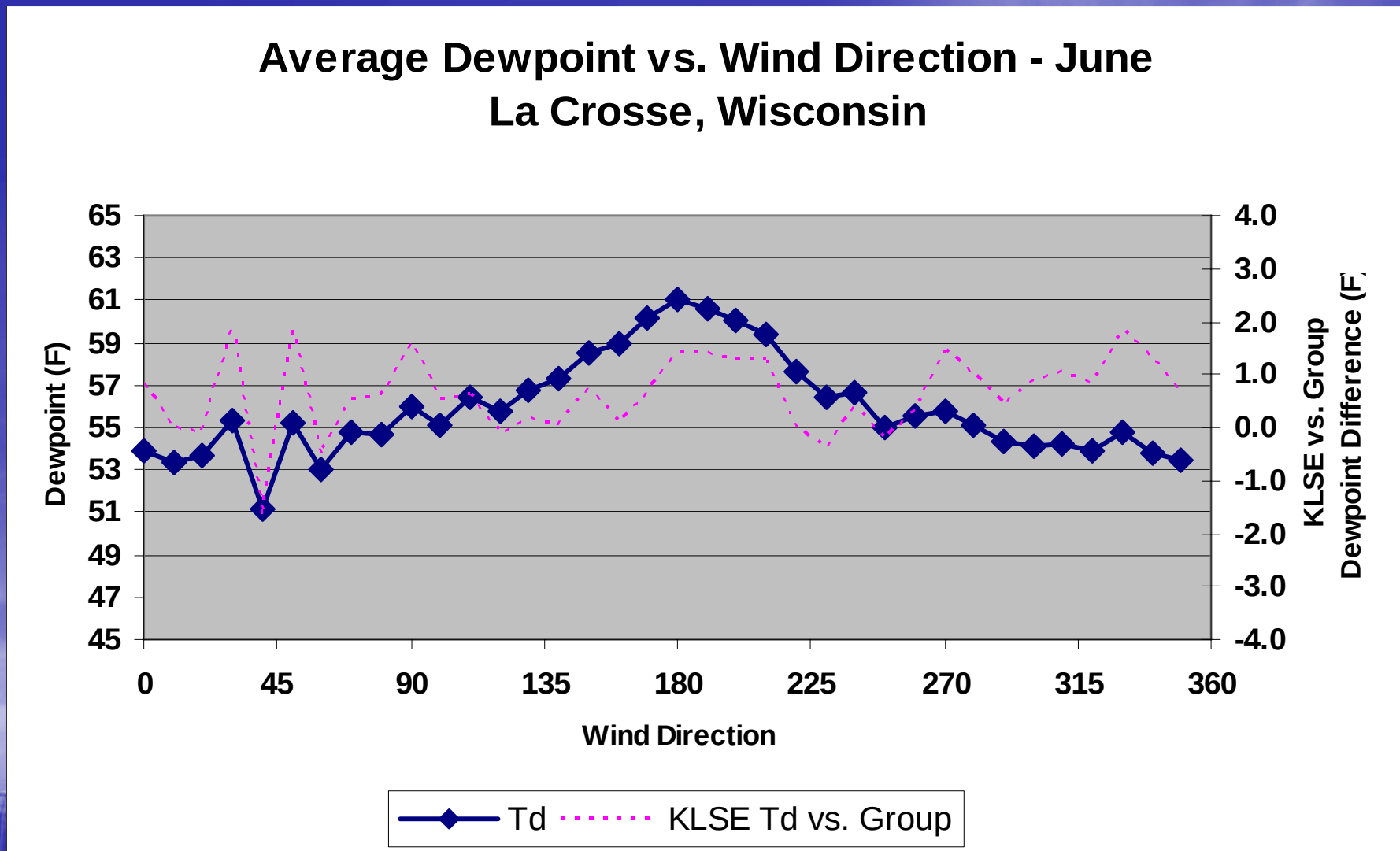
W to NW Winds Driest; E Winds Most Moist



The Big Picture (All Sites): Td vs. Wind Direction

- W to NW directions are driest Nov – Feb
- E wind yields highest Td Nov - Feb
- Highest Dew points are confined to Southerly Jun – Aug

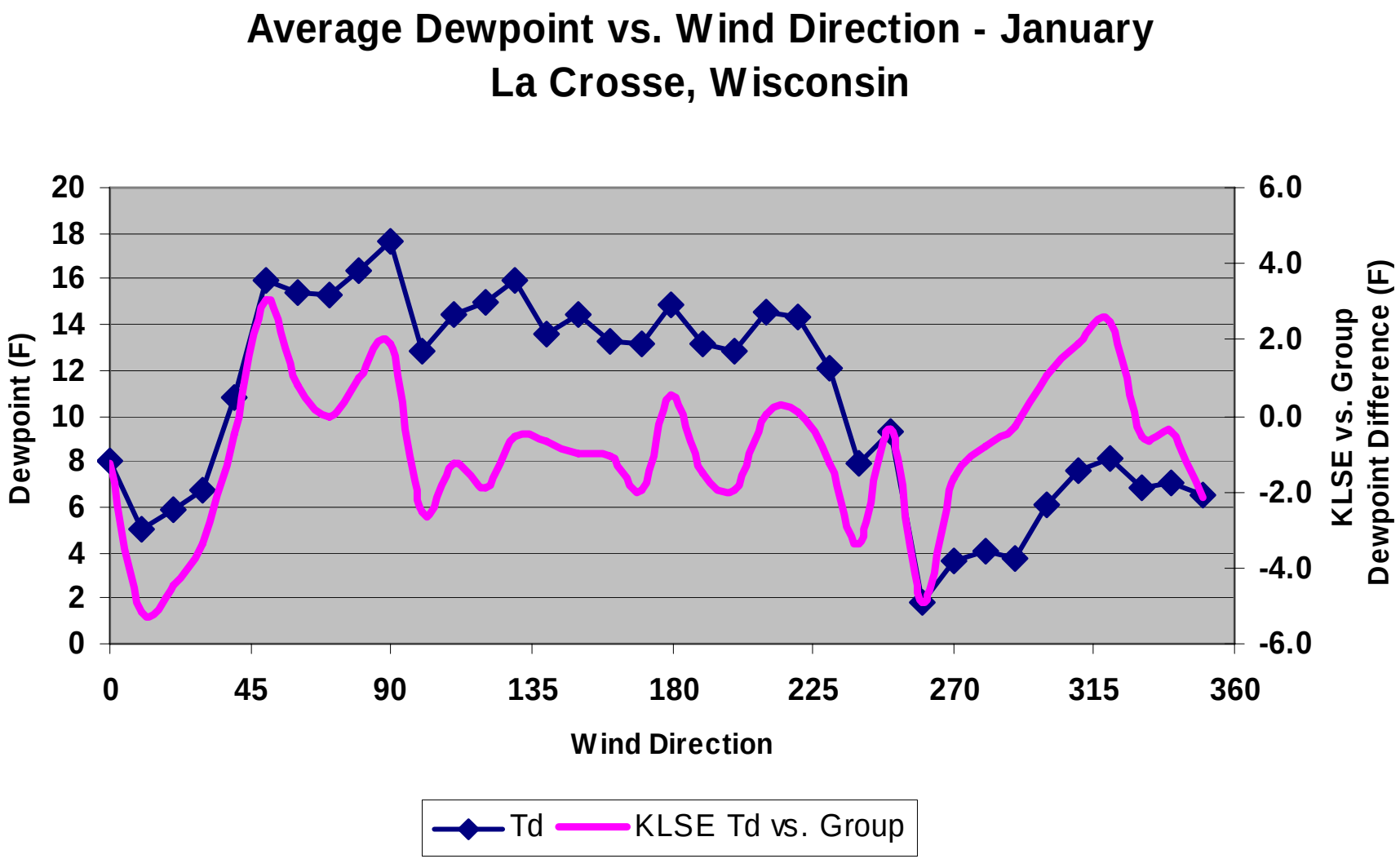
Highest Td confined to around 180º



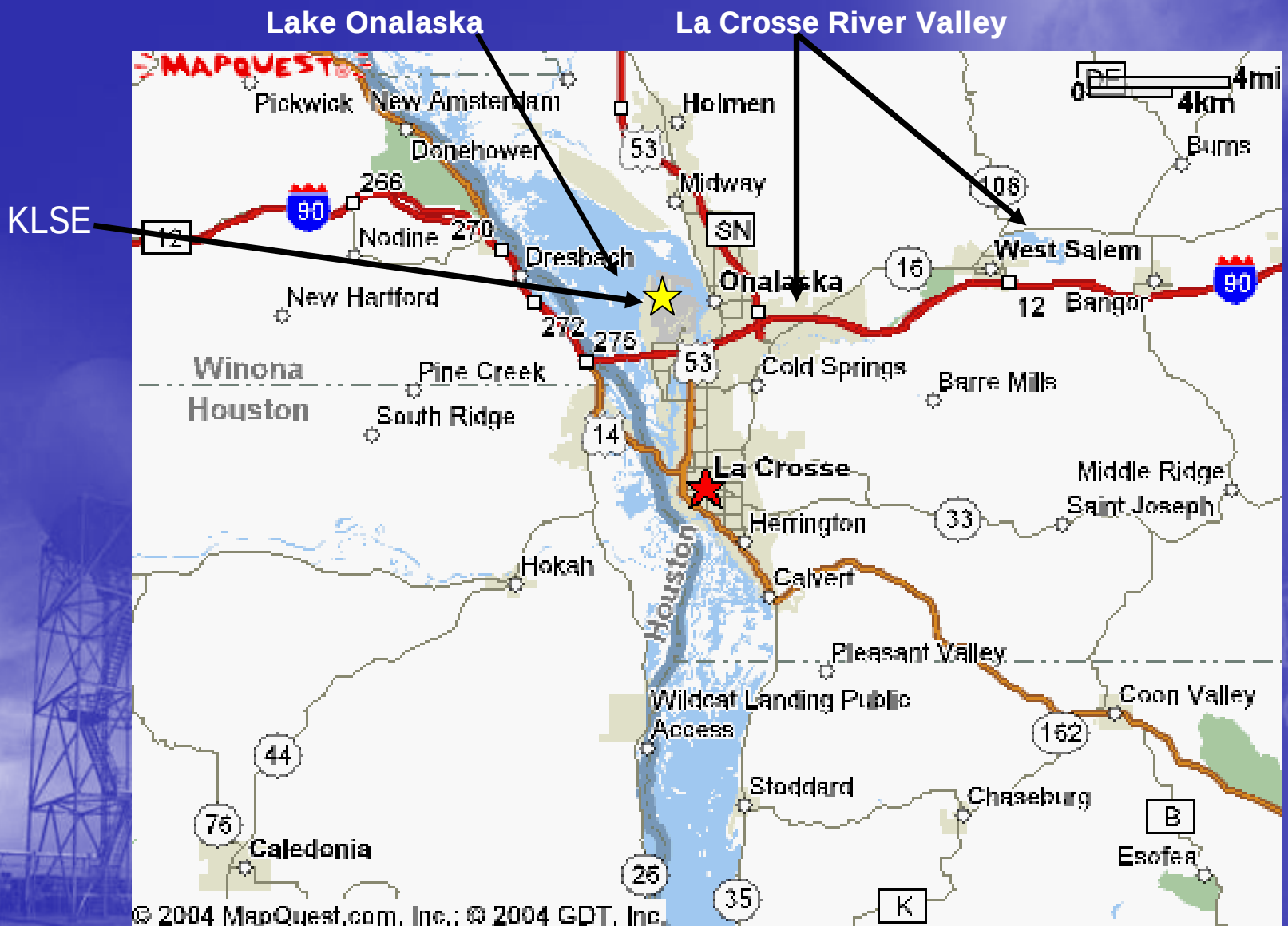
Unique to KLSE: Td vs. Wind Direction

- Moist anomaly for NW winds compared to group in Dec. and Jan.
  - Lake Onalaska and Mississippi River influence?

KLSE NW to N moist wind anomaly



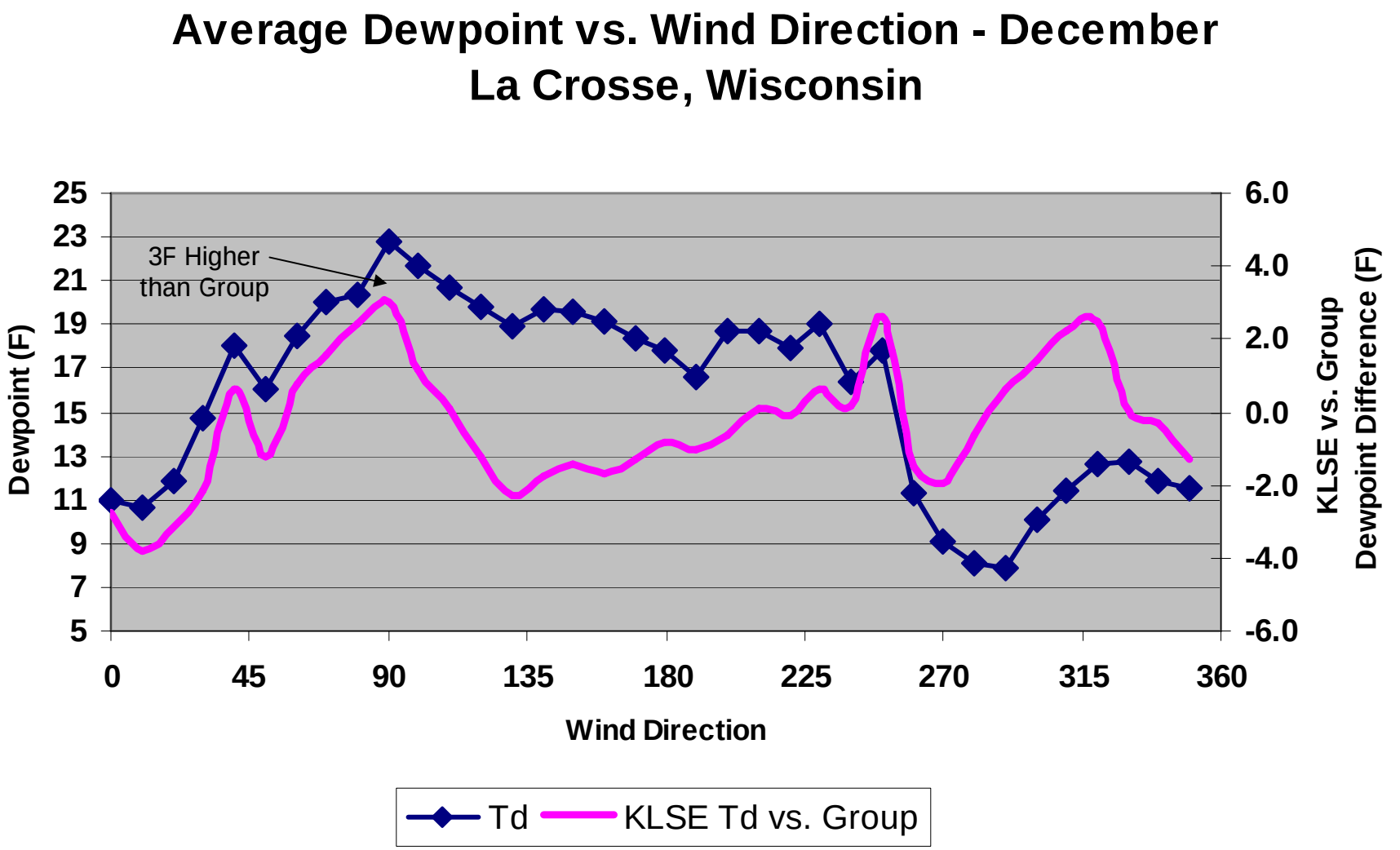
La Crosse Geography



Unique to KLSE: Td vs. Wind Direction

- Moist anomaly for NW winds compared to group in Dec. and Jan.
  - Lake Onalaska and Mississippi River influence?
- Higher Td than group with E winds in Winter

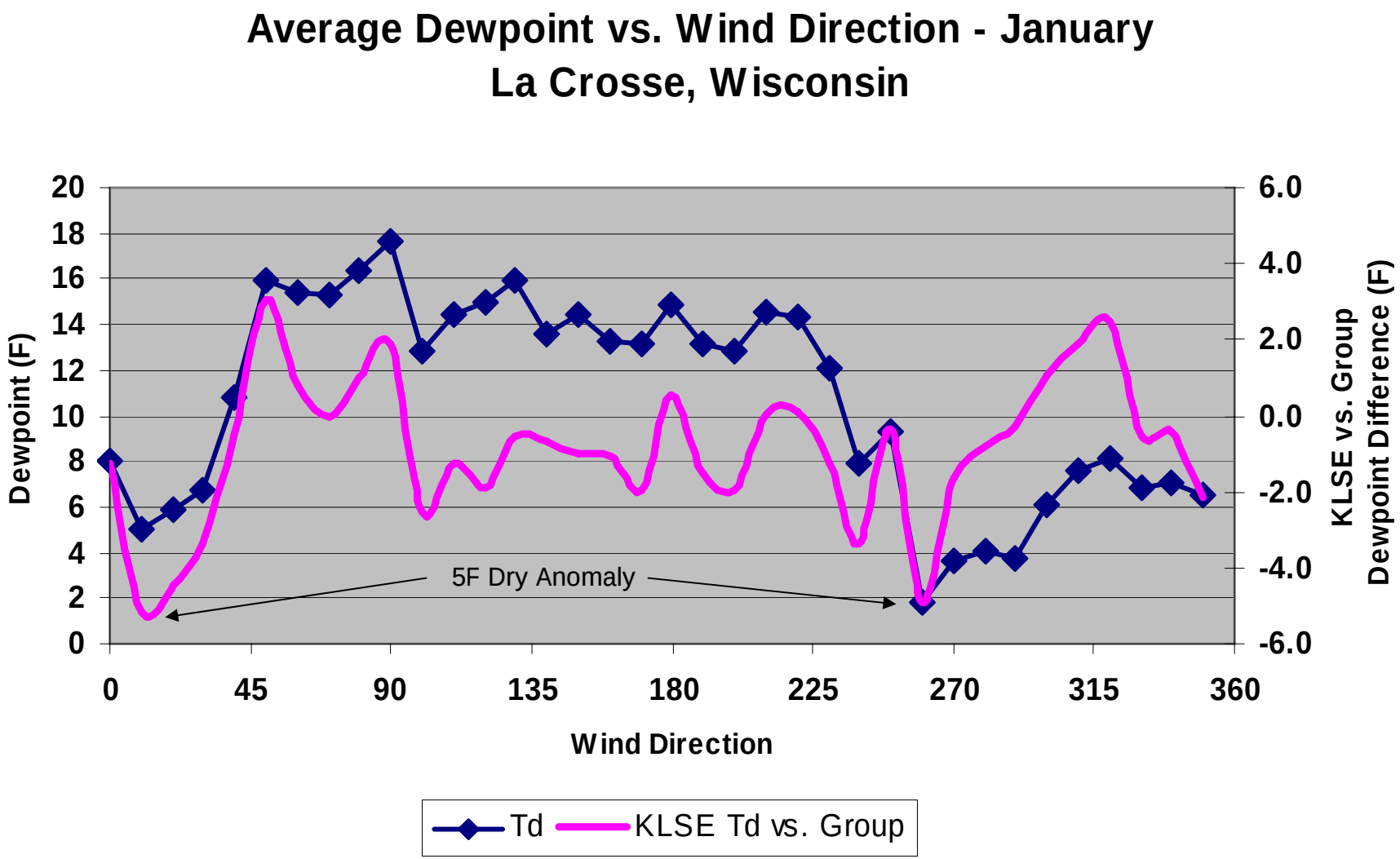
E Wind Anomaly at KLSE



Unique to KLSE: Td vs. Wind Direction

- Moist anomaly for NW winds compared to group in Dec. and Jan.
  - Lake Onalaska and Mississippi River influence?
- Higher Td than group with E winds in Winter
- Very dry anomaly at 20^{o} and 260^{o} (~ -5^{o}F) in Winter
  - Bluffs?

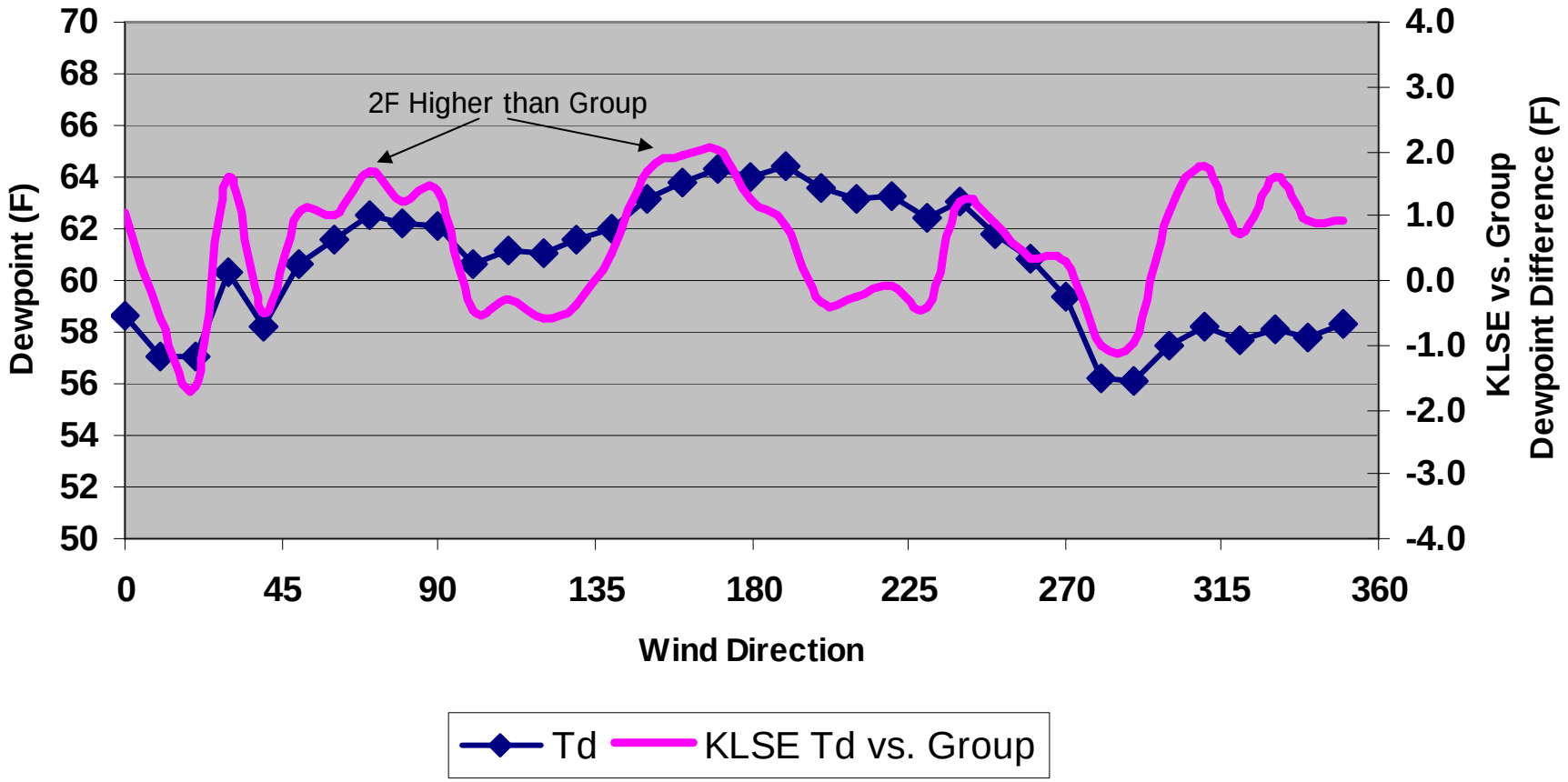
Very dry anomaly ~ 20º and 260º



Unique to KLSE: Td vs. Wind Direction

- Moist anomaly for NW winds compared to group in Dec. and Jan.
  - Lake Onalaska and Mississippi River influence?
- Higher Td than group with E winds in Winter
- Very dry anomaly at 20° and 260° (~ -5°F) in Winter
  - Bluffs?
- SE to S and NE to E Td moist anomaly during warm months
  - La Crosse River valley influence?

NE to E and SE to S Warm Anomaly



Conclusions - Winter

- Synoptic signal typically dominates
- Larger Td variation in 24 hours than in Summer (average ~ 6-7 F, versus 2-3F)
- W to NW winds are driest; E winds correspond with higher Td
- KLSE
  - Td lower than group in dry months
  - NW to N wind: higher Td, river influence?
  - E winds even higher than rest of group

Conclusions - Summer

- More local signal is seen
- Complex diurnal behavior seen (e.g., sunrise, afternoon mixing, early evening rise, overnight condensation).
- Smaller Td swings over 24 hours
- Td decreases slightly during afternoon; rises during evening
- KLSE
  - Td higher than group in summer months
  - Biggest nighttime moist anomaly during peak fog months (Aug. and Sept.)
  - Td decrease more evident during afternoon; rises during evening
  - SE to S and NE to E Td moist anomaly during warm months