# Weather 101

## Fundamental Meteorology for Turf Managers

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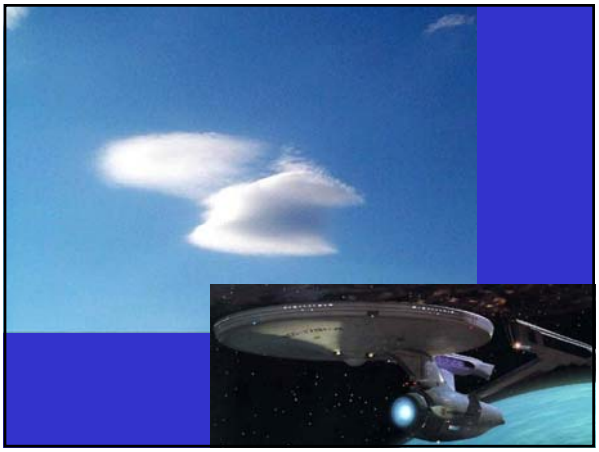
SportsTurf Managers Association

## Do Baseballs Really Fly Farther at Coors Field?

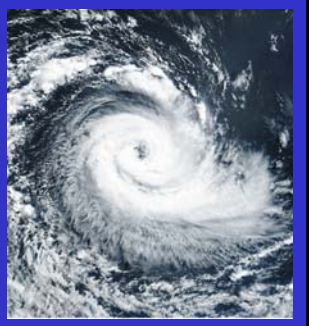


## Learning Objectives

- Water
- Temperature
- Pressure
- Fronts
- Forecasting
- Lightning and Safety

# Water

- One of the Earth's greatest power sources
- One of the Earth's biggest recycling programs
  - 91,000 cubic miles is recycled every year
  - Great Lakes = 5500
  - Earth averages 41 inches rain per year



## Water's Changes of State

Ice melting absorbs heat

Evaporation absorbs heat

Anyone syringe their turf?


## Water's Changes of State

Freezing releases heat

## HUMIDITY
### Water in the Atmosphere

Absolute Humidity:

- The actual amount of water vapor in the air at a given time.

Water Vapor Capacity:
(also called Saturation Mixing Ratio)

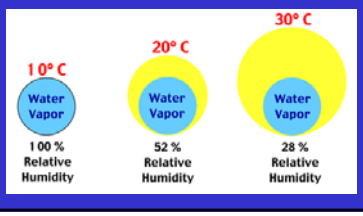
- Maximum amount of water vapor that air can hold at a given temperature.

**TABLE 4-1** Saturation mixing ratio (at sea-level pressure)

| Temperature °C (°F) | Saturation mixing ratio g/kg |
|---|---|
| −40 (−40) | 0.1 |
| −30 (−22) | 0.3 |
| −20 (−4) | 0.75 |
| −10 (14) | 2 |
| 0 (32) | 3.5 |
| 5 (41) | 5 |
| 10 (50) | 7 |
| 15 (59) | 10 |
| 20 (68) | 14 |
| 25 (77) | 20 |
| 30 (86) | 26.5 |
| 35 (95) | 35 |
| 40 (104) | 47 |

## Relative Humidity:

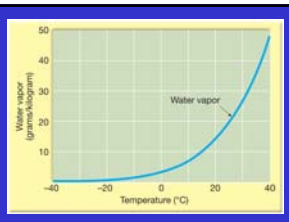
- A percentage of the actual amount of water compared to amount air can hold at a given temperature
- Indicates how near air is to saturation NOT actual amount of air in the air




Which situation has more moisture in the air?

32°F can hold 3.5g/kg

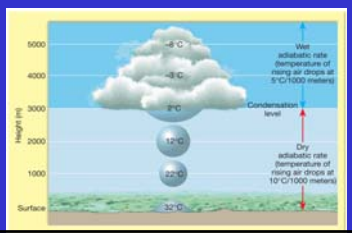
104°F can hold 47g/kg
10%*47=4.7g/kg

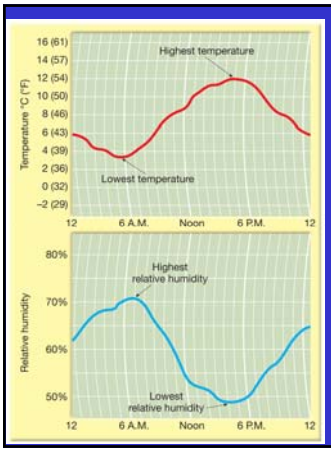




As air cools, its ability to hold water decreases

So, as air rises, it cools

Car windshield ex.




Relative Humidity changes with Temperature

So, is that our best measure of moisture?

## Dew Point
or Dew Point Temperature

- The temperature at which condensation occurs
  - When air is cooled to the dewpoint condensation occurs
  - Grass, glass, etc.
- Better indicator of how moist the air is

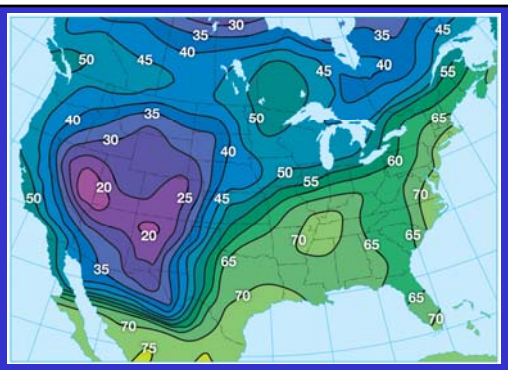
**TABLE 4–2** Dew-point thresholds

| Dew-point temperature | |
|---|---|
| ≤ 10°F | Significant snowfall is inhibited. |
| ≥ 55°F | Minimum for severe thunderstorms to form. |
| ≥ 65°F | Considered humid by most people. |
| ≥ 70°F | Typical of the rainy tropics. |
| ≥ 75°F | Considered oppressive by most. |

So:

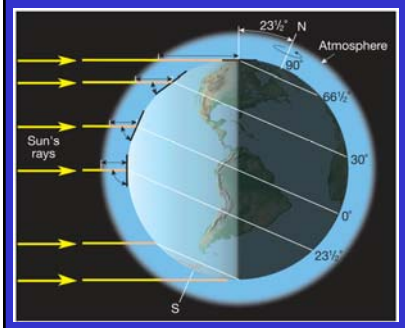
High dew point temps = moist air

Low dew point temps = dry air



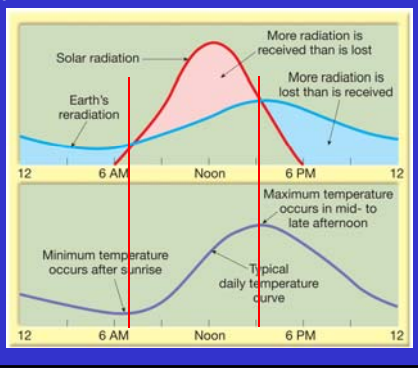
Dew Point Temperatures
September 15, 2005

## Temperature




- The Earth receives the sun's energy unevenly
- Energy is:
  - Absorbed
  - Reradiated
  - Transferred

At what time of day do we record the coolest temperatures? The Warmest?




Minimum daily temperature occurs near sunrise, causing early morning...

...Winter Frost

... or Summer Fog

...the air was cooled to the dew point

## How can understanding dewpoint and temperature benefit turf managers?

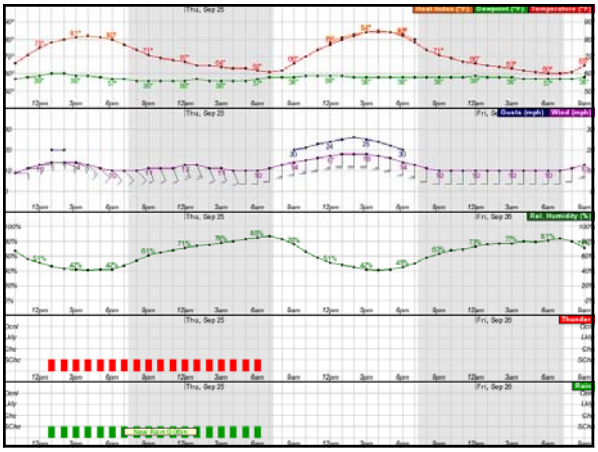
Predicting Frost or Dew

- Scheduling
  - Maintenance (minimize labor downtime)
  - Early morning ball games or practices

Planning pesticide applications

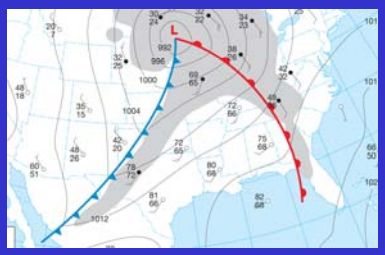
- Fungicides, weed and feeds, etc.

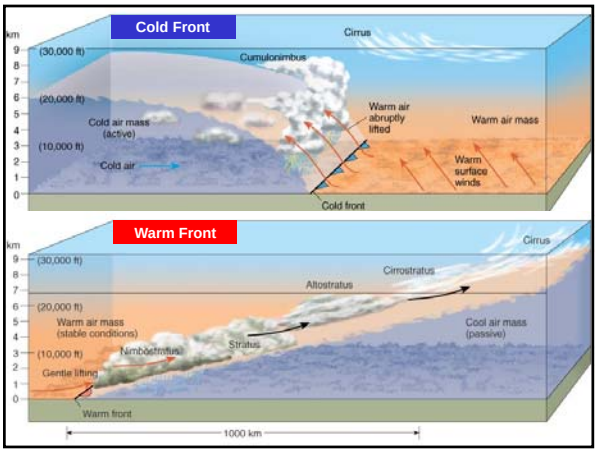
Calibrate sunrise, sunset, temperature and dewpoint forecasts with actual results



## Fronts

- Narrow boundary zones separating relatively warm and cold air

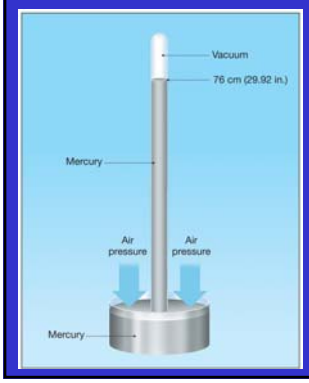




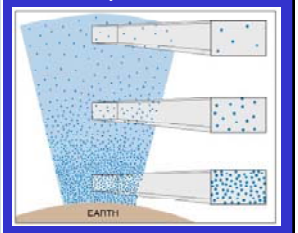
## Warm Front Precipitation
(~2-3 day window)

## Thunderstorm Development along a Cold Front
(window of hours to days)

## Pressure

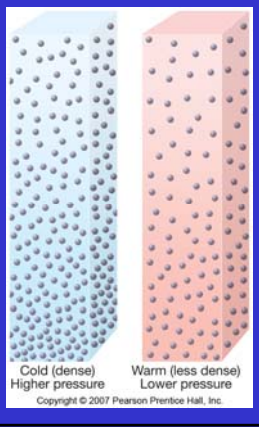



- Total weight of the atmosphere




## Pressure Changes with Temperature

- High Pressure
  - Stable Air
- Low Pressure
  - Unstable Air

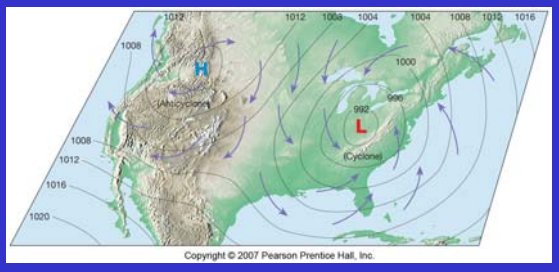



## Associated Weather...

...with
Low Pressure
(rising air)

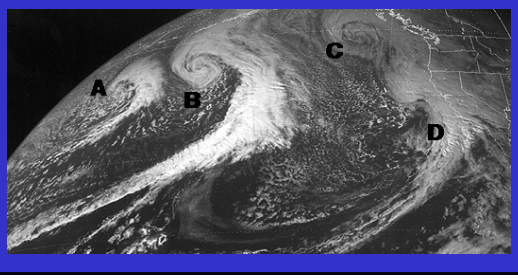
...with
High Pressure
(descending air)

## Surface High and Low Pressure Systems



# Mid-Latitude Cyclones

- Key for the Earth's Transfer of Energy
  - Earth's Eggbeater
  - Continental in size



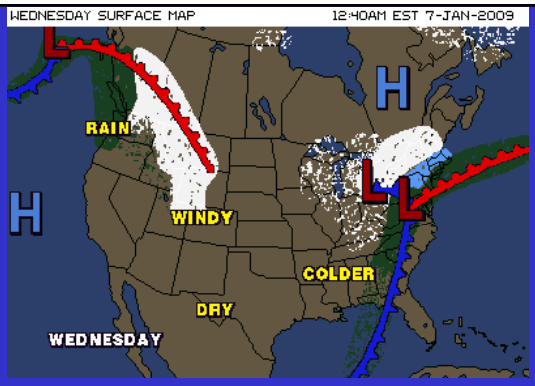

## Mid-Latitude Cyclones

Follow general patterns

- Travel West to East
- Exhibit similar weather conditions
  - Wind
  - Clouds
  - Precipitation

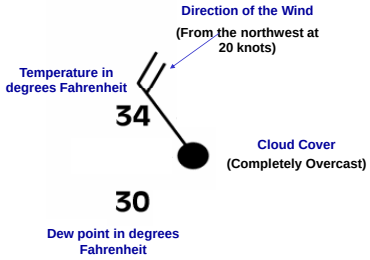

# Forecasting Weather

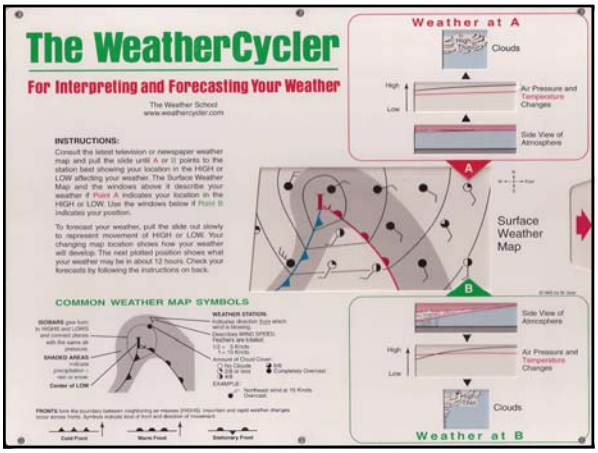
- Traditional methods match established patterns from patterns of the past
  - Utilizes "rules of thumb"
- Computers play key role in accuracy and lengthening the lead time of forecasts
  - Many models are put into use
- Human approach is still needed
  - Still requires a 'feel' to make it all work

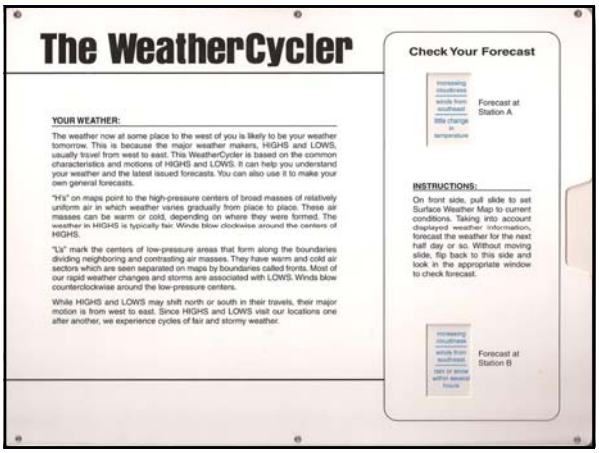


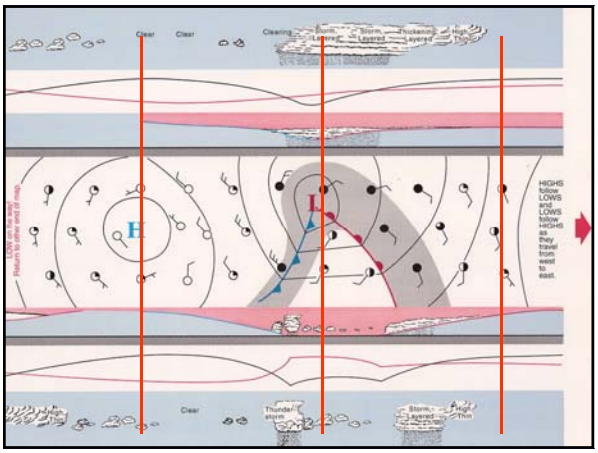

Weather Map Showing Middle-latitude Cyclone

## Let's review the station model

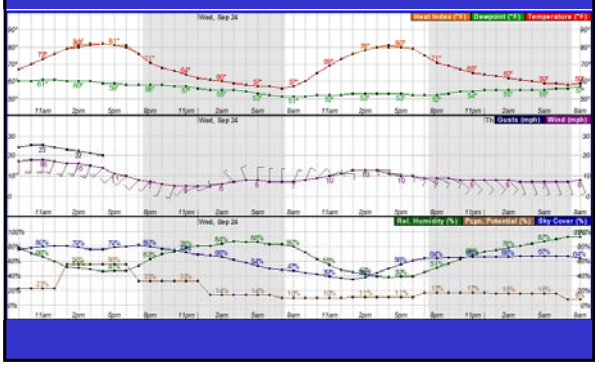





## Interpreting Weather Information





## Thunderstorm and Lightning Safety

- No place outside is safe near a thunderstorm
- Lightning can strike long distances, even outside of rain and cloud cover
- 45% of lightning casualties occurred on open fields (includes Sports Fields)
- Obey the 30/30 rule
  - Get Indoors
  - If thunder occurs 30 seconds or less after lightning
  - Wait 30 minutes after the last thunder



## Weather Resources

Free Websites
Current weather:
http://weather.gov (National Weather Service)
http://weather.com (The Weather Channel)
http://www.crh.noaa.gov/oax
http://www.spc.noaa.gov/
http://www.rap.ucar.edu/weather

Professional Weather Services:
Customized Online Access, Lightning Monitors, Alerts, Online Consulting, Mobile Access
DTN Meteorlogix www.dtnmeteorlogix.com
Custom Weather www.myforecast.com