Chapter 4: Humidity, Condensation and Clouds

- Circulation of water in the atmosphere
- Evaporation, condensation and saturation
- Humidity
- Dew and frost
- Fog
- Foggy weather
- Clouds

Circulation of Water in the Atmosphere

- Evaporation
- Condensation
- Precipitation
- Hydrologic cycle

• The total amount of water vapor stored in the atmosphere amounts to only one week’s supply of precipitation for the planet.

Evaporation, Condensation and Saturation

Saturation = number of water molecules escaping (evaporating) balances those returning (condensing).
Evaporation, Condensation and Saturation

- saturation
- condensation nuclei
  - In very clean air, about 10,000 condensation nuclei are typically found in one cubic centimeter of air, a volume approximately the size of your fingertip.

Humidity

Vapor Pressure

- actual vapor pressure
- saturation vapor pressure
  - “Saturation” describes a condition of equilibrium: liquid water is evaporating at exactly the same rate that water vapor is condensing.
  - When the general public uses the term “humidity”, they mean “relative humidity.”

Relative Humidity

- definition of relative humidity = \( RH = \frac{\text{water vapor content}}{\text{water vapor capacity}} \)
- saturation and supersaturation
- condensation
- relative humidity and temperature

**Figure 4.5**: Saturation vapor pressure increases with increasing temperature. At a temperature of 10°C, the saturation vapor pressure is about 12 mb, whereas at 30°C it is about 42 mb. The insert illustrates that the saturation vapor pressure over water is greater than the saturation vapor pressure over ice.

When the air is cool (morning), the relative humidity is high. When the air is warm (afternoon), the relative humidity is low. These conditions exist in clear weather when the air is calm or of constant wind speed.
Relative Humidity and Dew Point

- dew point temperature
- dew point depression and relative humidity

DEW POINT = The temperature to which air must be cooled (w/ no change in air pressure or moisture content) for saturation to occur.
- The dew point temperature is useful for forecasting heat index, precipitation probabilities, and the chance of frost.

Relative Humidity and Human Discomfort

- wet bulb temperature
- Heat index
  - “It’s not the heat, it’s the humidity” - both temperature and relative humidity contribute to warm-weather discomfort.

Measuring Humidity

- psychrometers
- hygrometers

Dew and Frost

- dew
- frost
- frost point and deposition
  - Frost is one of the few examples of deposition in nature.

Fog

- radiation fog
- advection fog
- upslope fog
- evaporation (mixing) fog

  - Fog is an extreme hazard to aircraft.

Foggy Weather

- coastal vs. interior areas
- hazard to aircraft
  - Some airports use fog-dispersal equipment.
Classification of Clouds

- major cloud types
- cloud appearance
- cloud base

- It’s easy to identify clouds, but it takes practice. The ability to identify clouds allows you to forecast many aspects of the weather using nothing but your eyes.

Cloud Identification

- high clouds
- middle clouds
- low clouds
- clouds with vertical development

High Clouds

- cirrus
- cirrocumulus
- cirrostratus
  - Cirrostratus clouds can sometimes be quite thick.

Middle Clouds

- altocumulus
- altostratus
  - Altocumulus clouds are very pretty, especially just after sunrise or just before sunset.

Low Clouds

- nimbostratus
- stratocumulus
- stratus
  - Marine stratocumulus is the most common cloud type in the world.
Clouds with Vertical Development

- cumulus
- cumulus congestus
- cumulonimbus

  • Not all cumulus clouds grow to be thunderstorms, but all thunderstorms start out as cumulus clouds.

Some Unusual Clouds

- lenticular clouds
- pileus
- mammatus clouds
- contrails

  • Several alleged ‘flying saucer’ reports have turned out to be lenticular clouds.