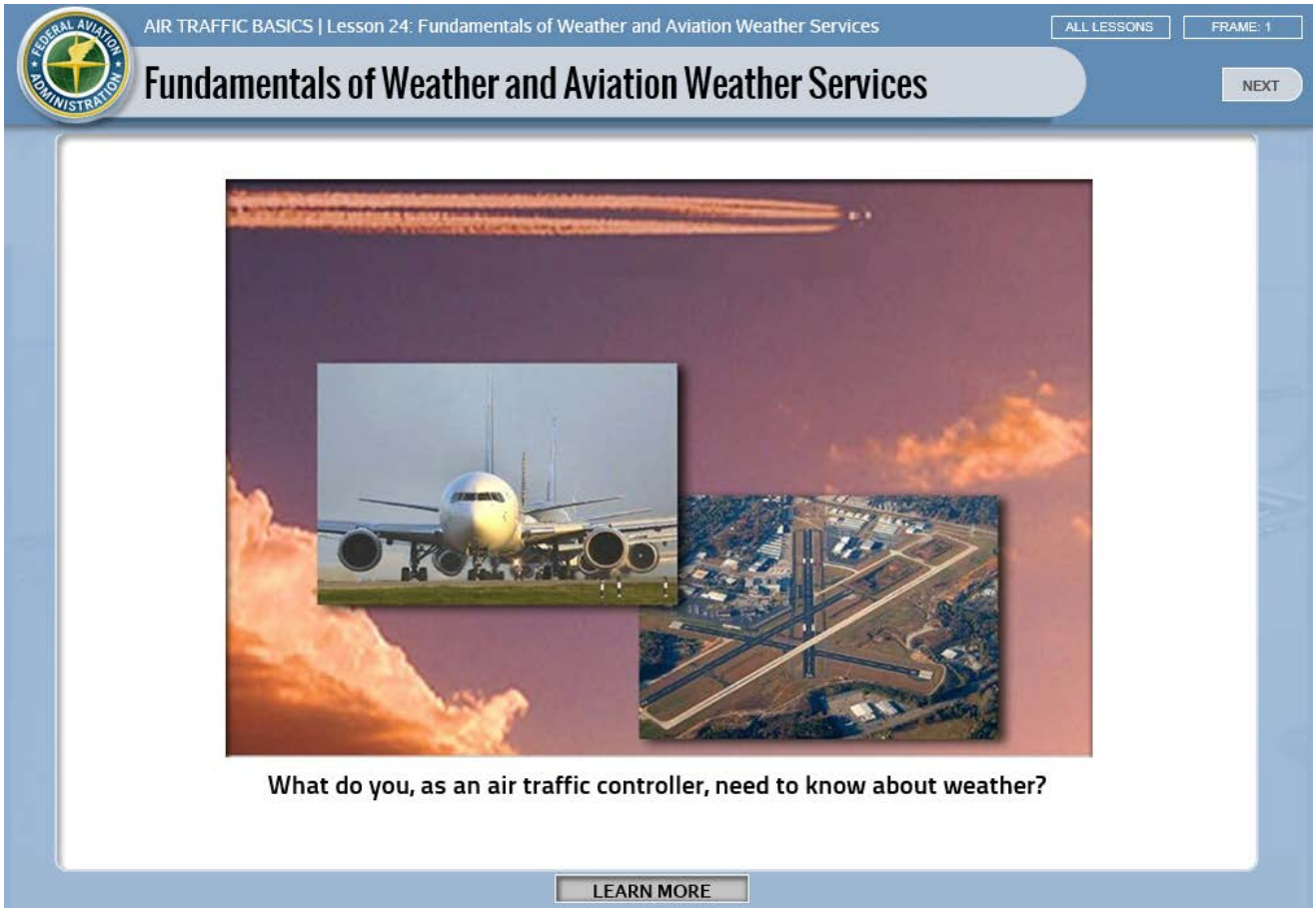
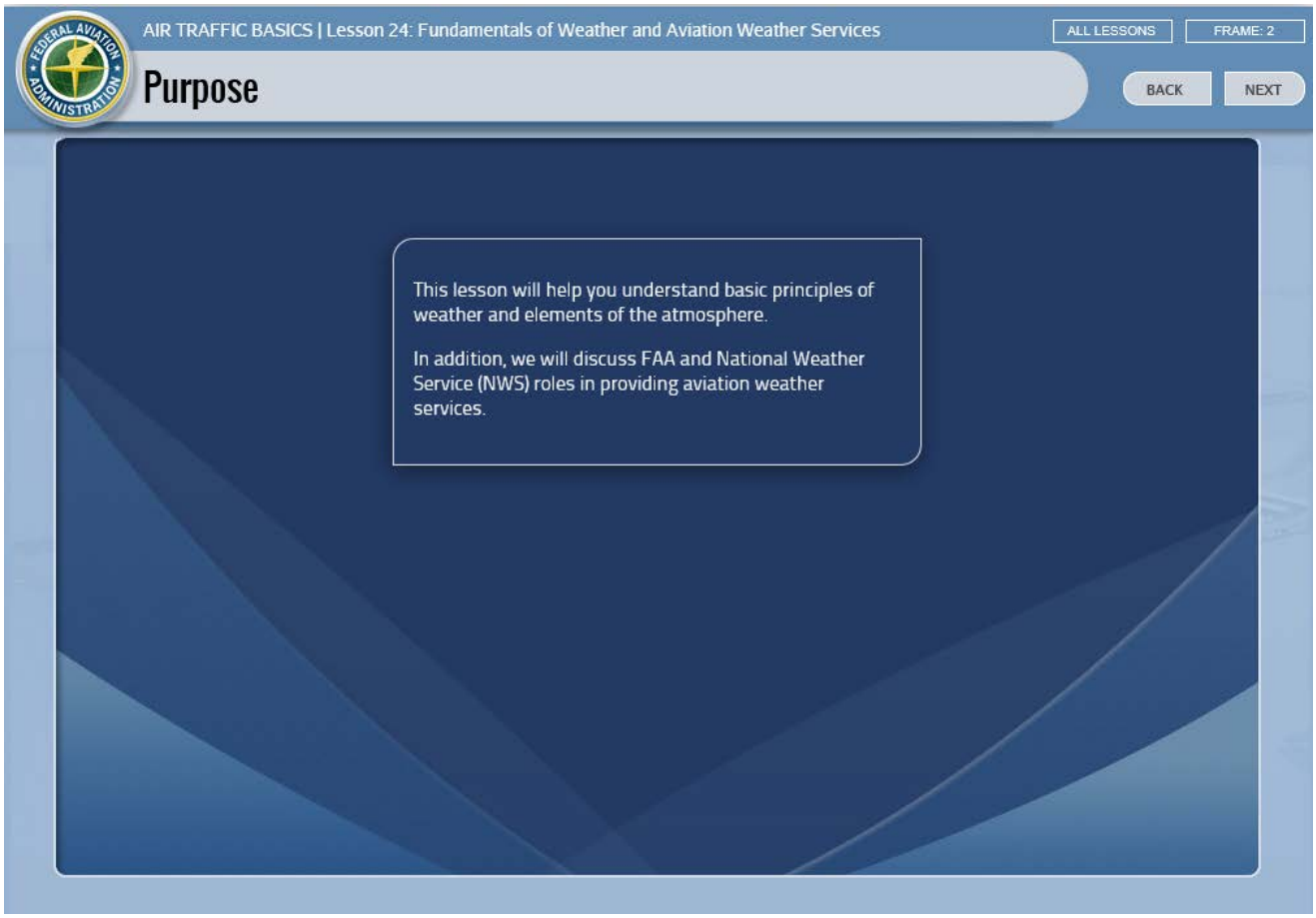
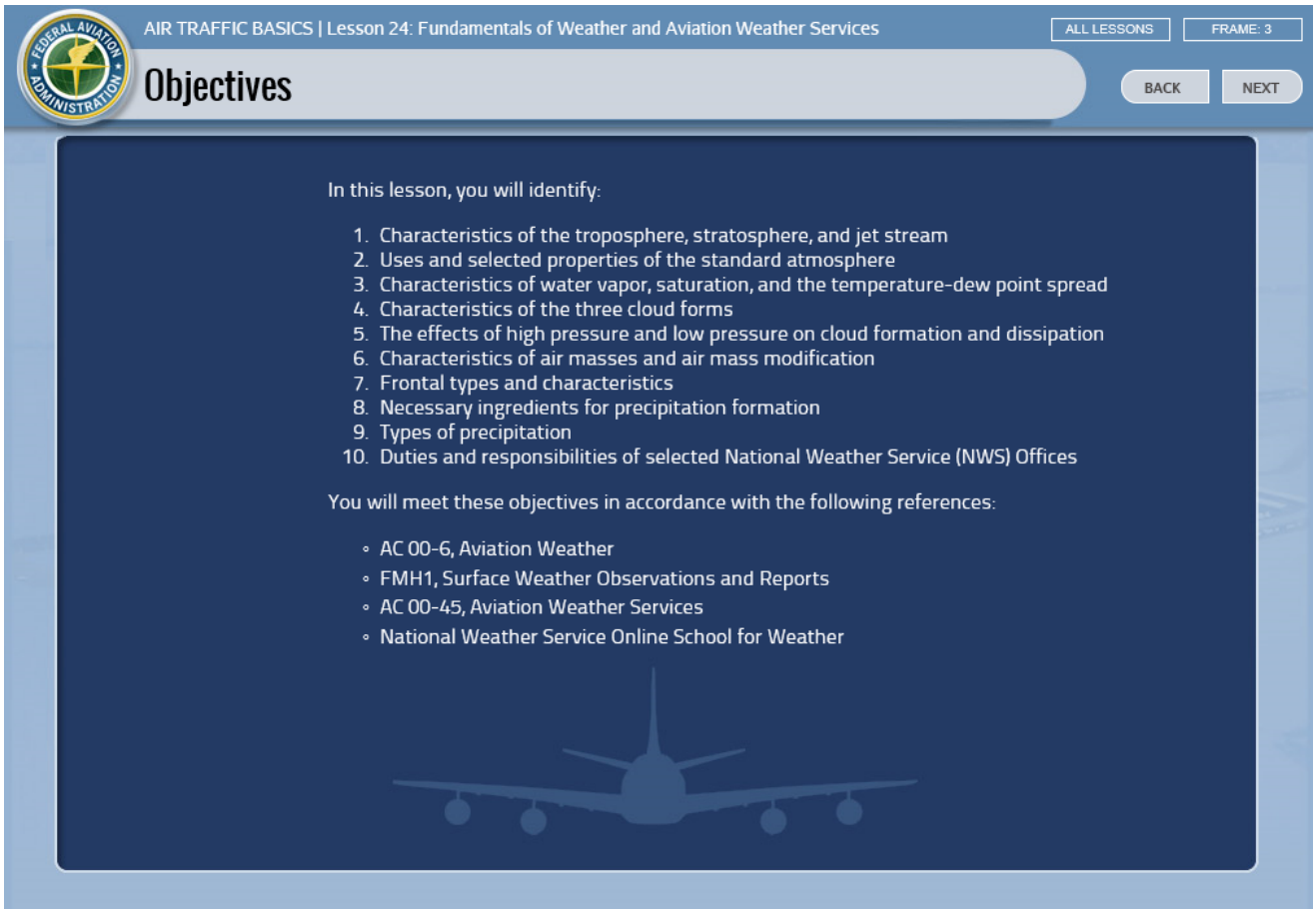
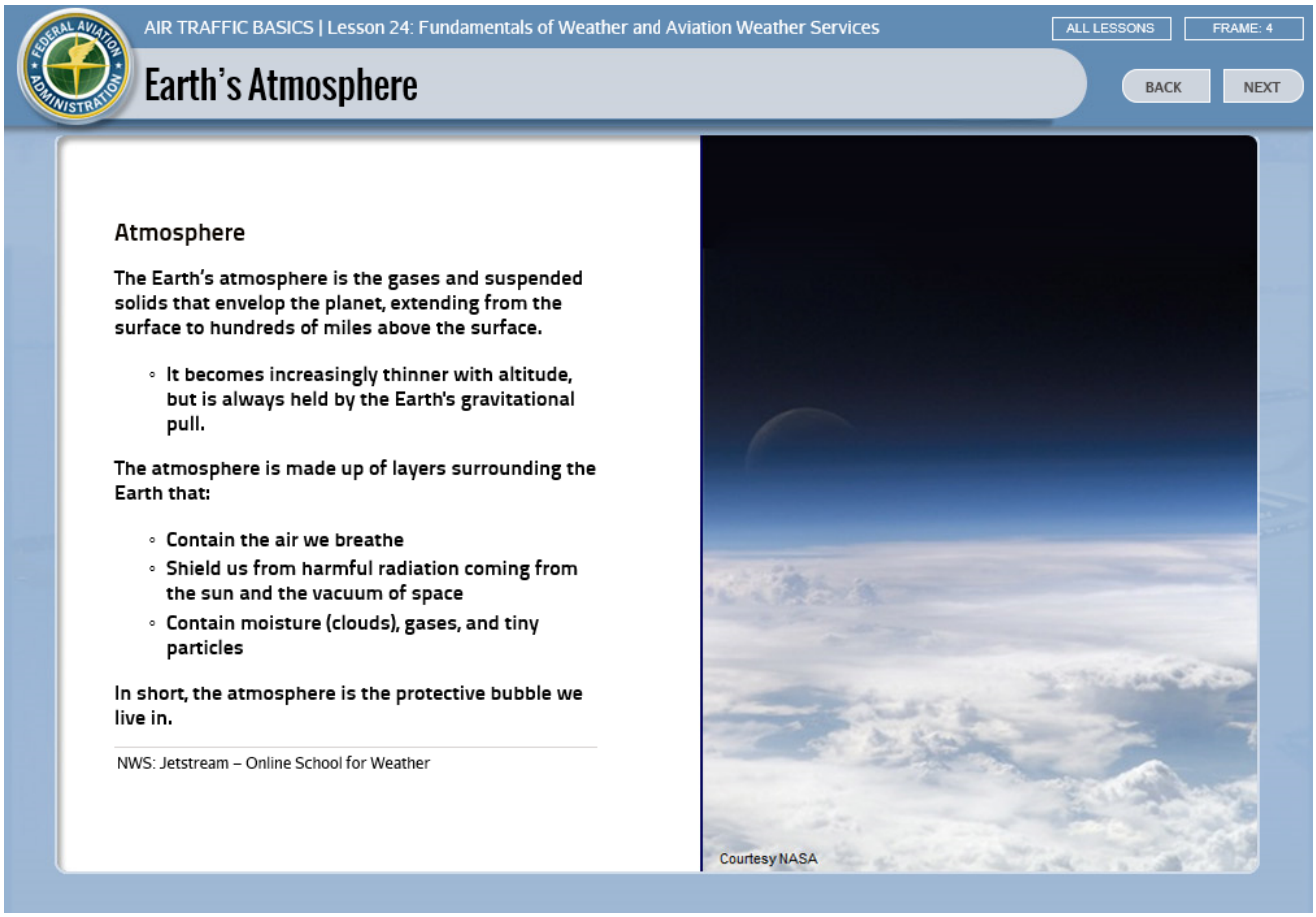


- Despite the development of advanced technologies such as radar and Global Positioning Systems (GPS), safety in flight is still subject to hazardous weather.
    - Thus, you must have a fundamental knowledge of weather to help pilots avoid hazardous weather.


AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services
ALL LESSONS
FRAME: 2
Purpose
BACK
NEXT
This lesson will help you understand basic principles of weather and elements of the atmosphere.
In addition, we will discuss FAA and National Weather Service (NWS) roles in providing aviation weather services.


AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services
ALL LESSONS
FRAME: 3
Objectives
BACK
NEXT
In this lesson, you will identify:
1. Characteristics of the troposphere, stratosphere, and jet stream
2. Uses and selected properties of the standard atmosphere
3. Characteristics of water vapor, saturation, and the temperature-dew point spread
4. Characteristics of the three cloud forms
5. The effects of high pressure and low pressure on cloud formation and dissipation
6. Characteristics of air masses and air mass modification
7. Frontal types and characteristics
8. Necessary ingredients for precipitation formation
9. Types of precipitation
10. Duties and responsibilities of selected National Weather Service (NWS) Offices
You will meet these objectives in accordance with the following references:
◦ AC 00-6, Aviation Weather
◦ FMH1, Surface Weather Observations and Reports
◦ AC 00-45, Aviation Weather Services
◦ National Weather Service Online School for Weather

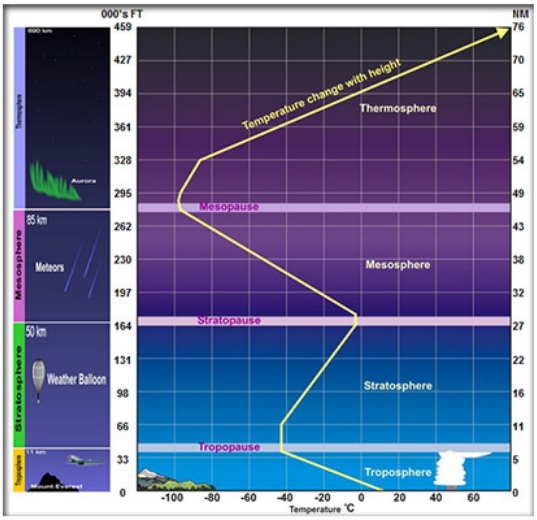

AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services
ALL LESSONS
FRAME: 4
Earth's Atmosphere
BACK
NEXT
Atmosphere
The Earth's atmosphere is the gases and suspended solids that envelop the planet, extending from the surface to hundreds of miles above the surface.
◦ It becomes increasingly thinner with altitude, but is always held by the Earth's gravitational pull.
The atmosphere is made up of layers surrounding the Earth that:
◦ Contain the air we breathe
◦ Shield us from harmful radiation coming from the sun and the vacuum of space
◦ Contain moisture (clouds), gases, and tiny particles
In short, the atmosphere is the protective bubble we live in.
NWS: Jetstream – Online School for Weather
Courtesy NASA

AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services

ALL LESSONS FRAME: 5

Earth's Atmosphere

BACK NEXT



Layers of the Atmosphere

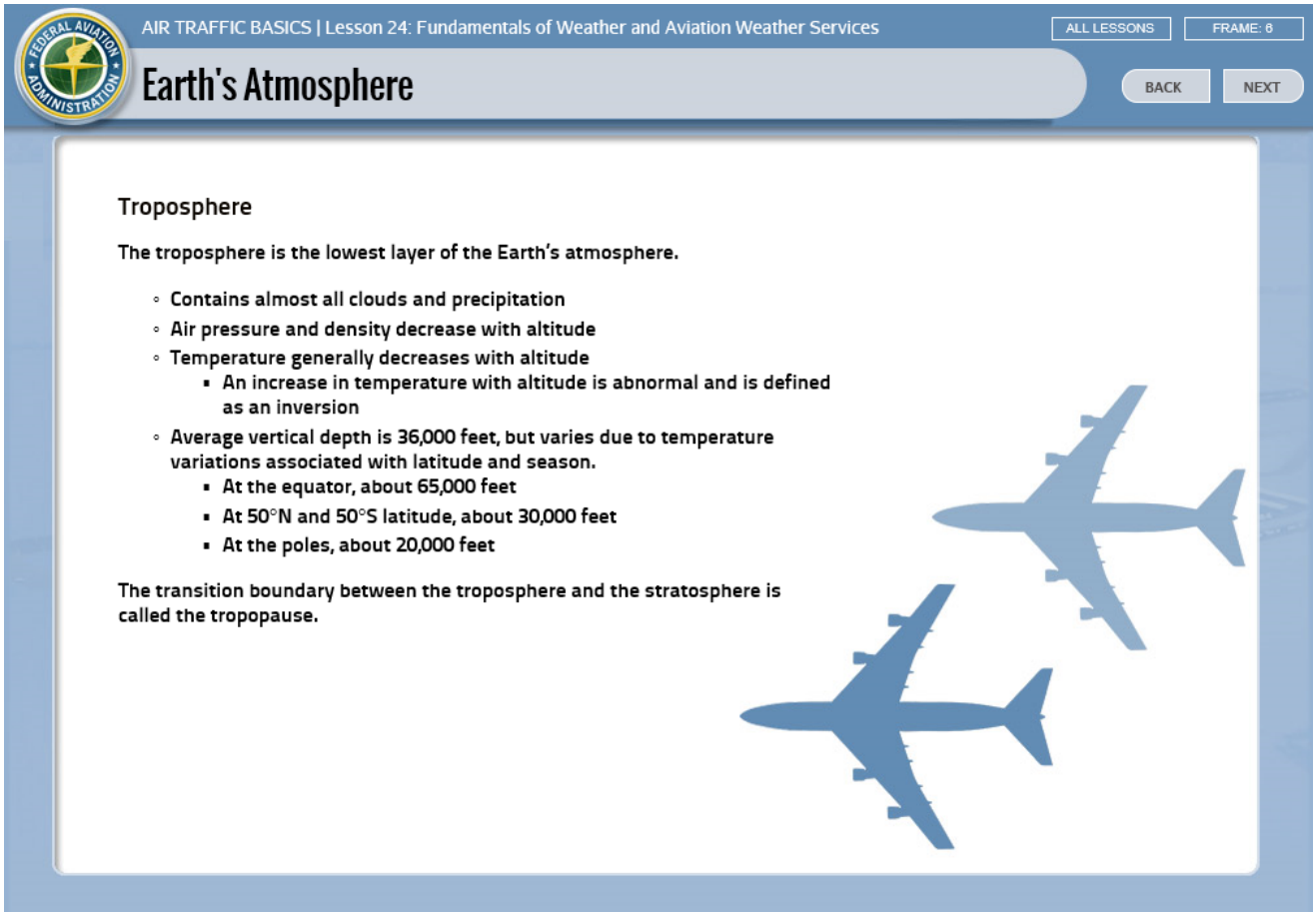
The Earth's atmosphere is subdivided into five layers:

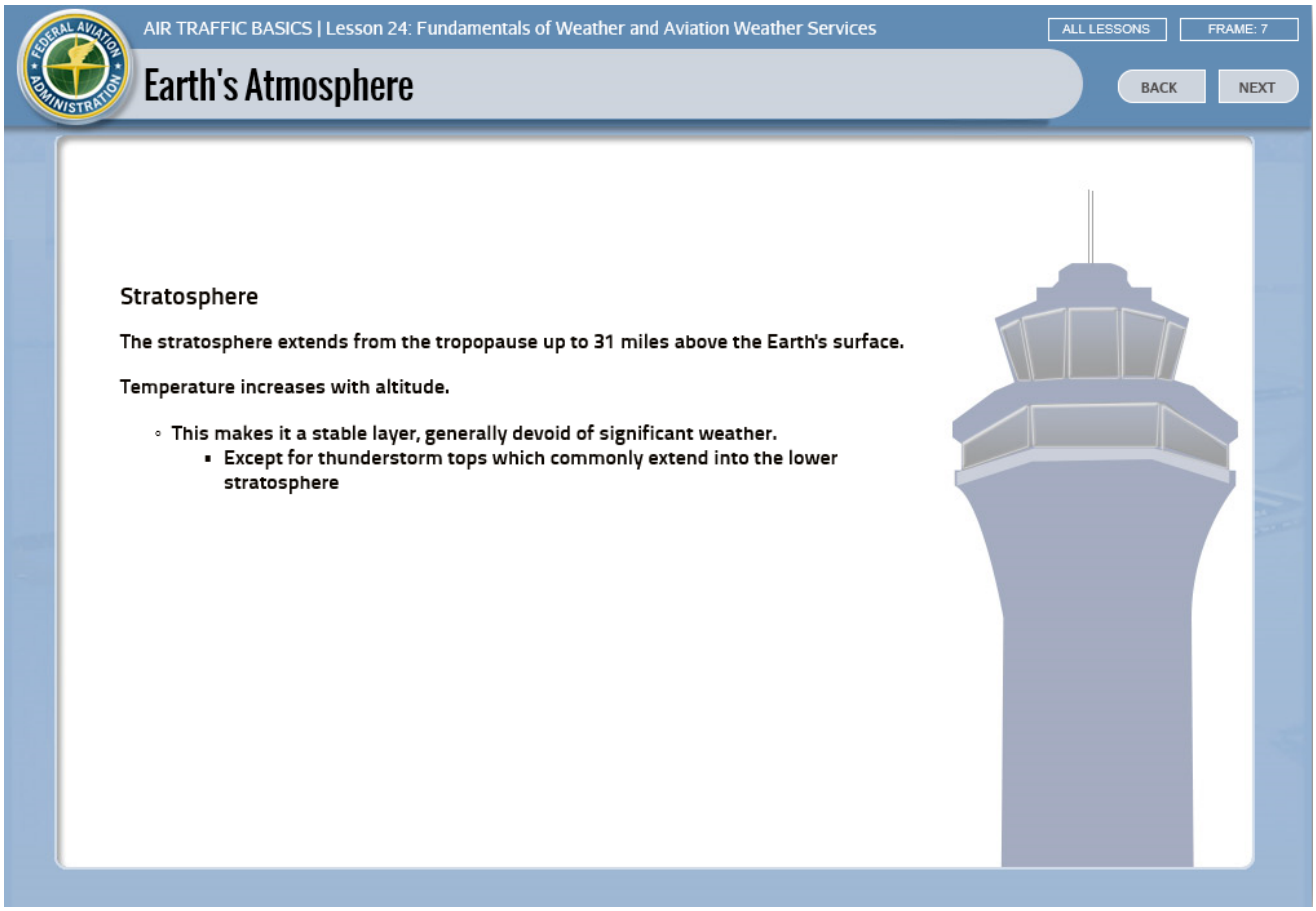
- **Troposphere**
- **Stratosphere**
- **Mesosphere**
- **Thermosphere**
- **Exosphere**

NOTE: The exosphere is not shown in the graphic on the left.

This lesson will emphasize the troposphere and lower stratosphere since this is where virtually all aircraft fly.

NWS: Jetstream – Online School for Weather


AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services
ALL LESSONS
FRAME: 6
Earth's Atmosphere
BACK
NEXT
Troposphere
The troposphere is the lowest layer of the Earth's atmosphere.
◦ Contains almost all clouds and precipitation
◦ Air pressure and density decrease with altitude
◦ Temperature generally decreases with altitude
▪ An increase in temperature with altitude is abnormal and is defined as an inversion
◦ Average vertical depth is 36,000 feet, but varies due to temperature variations associated with latitude and season.
▪ At the equator, about 65,000 feet
▪ At 50°N and 50°S latitude, about 30,000 feet
▪ At the poles, about 20,000 feet
The transition boundary between the troposphere and the stratosphere is called the tropopause.


AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services
ALL LESSONS
FRAME: 7
Earth's Atmosphere
BACK
NEXT
Stratosphere
The stratosphere extends from the tropopause up to 31 miles above the Earth's surface.
Temperature increases with altitude.
◦ This makes it a stable layer, generally devoid of significant weather.
▪ Except for thunderstorm tops which commonly extend into the lower stratosphere

AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services

ALL LESSONS FRAME: 8

Earth's Atmosphere

BACK NEXT

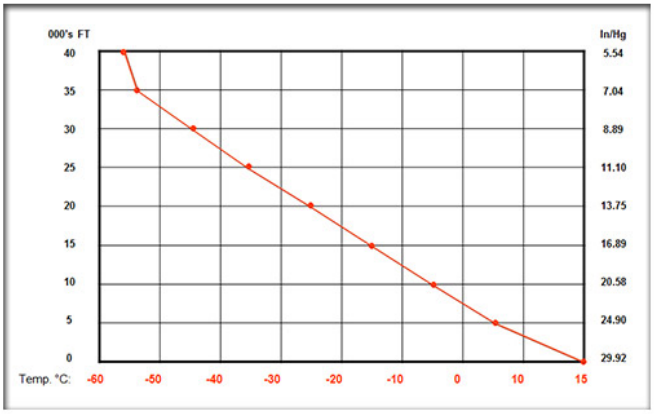
Standard Atmosphere

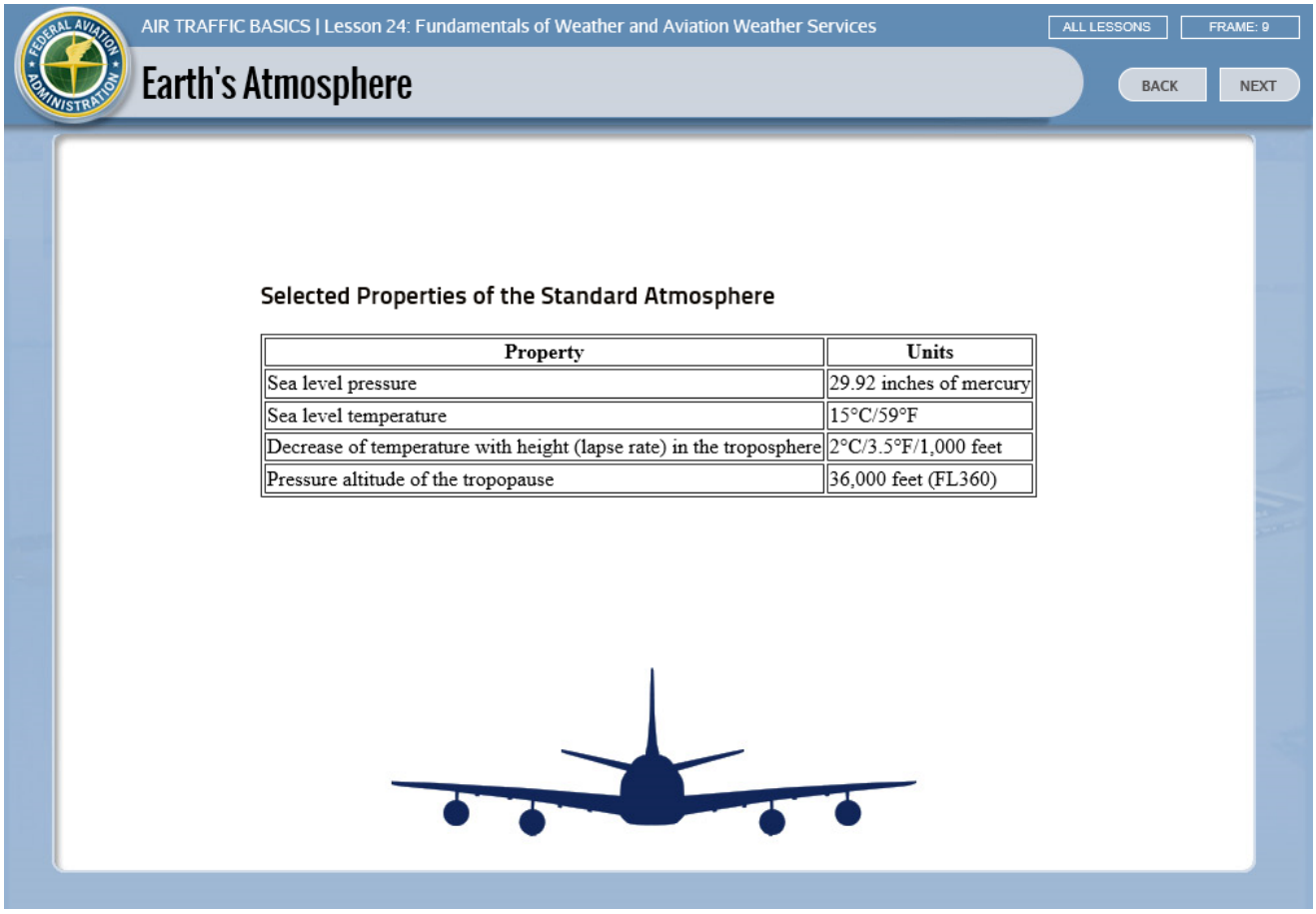
Standard atmosphere represents an average of conditions throughout the atmosphere for all latitudes, seasons, and altitudes.

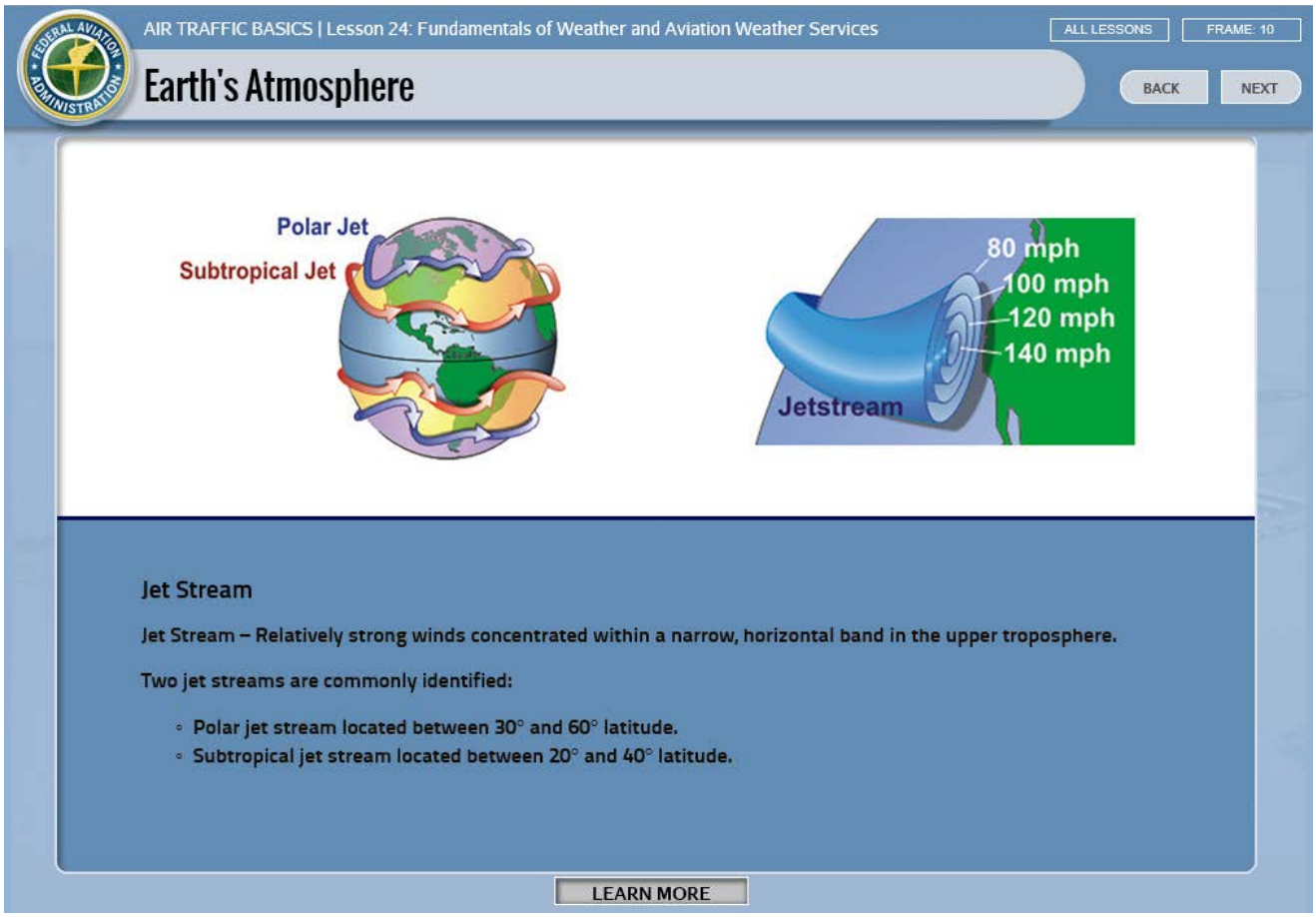
Standard atmosphere is used for:

- **Pressure altimeter calibrations**
- **Aircraft performance calculations**
- **Aircraft design**
- **Weather-related processes**

AC 00-6




AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services
ALL LESSONS
FRAME: 9
Earth's Atmosphere
BACK
NEXT
Selected Properties of the Standard Atmosphere
Property
Units
Sea level pressure
29.92 inches of mercury
Sea level temperature
15°C/59°F
Decrease of temperature with height (lapse rate) in the troposphere
2°C/3.5°F/1,000 feet
Pressure altitude of the tropopause
36,000 feet (FL360)



The jet stream flows from west to east, but the flow often shifts to the north and south due to weather systems and seasonal changes.

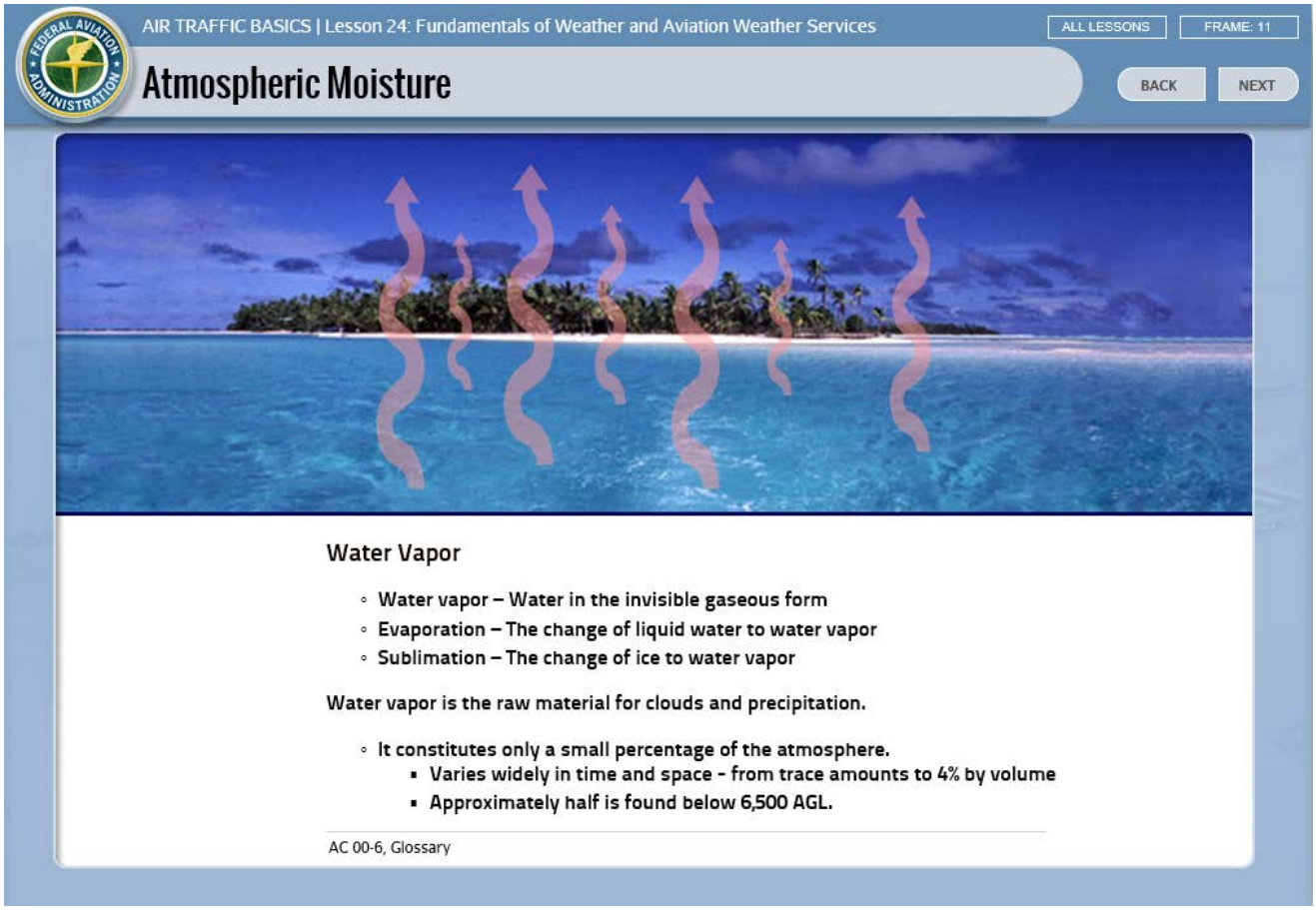
- Jet streams extend around the globe, but are segmented, splitting at times, and even disappearing altogether to appear somewhere else.
- They are associated with the boundaries between hot and cold air.
  - Since these boundaries are most pronounced during winter, that is when jet streams are strongest.

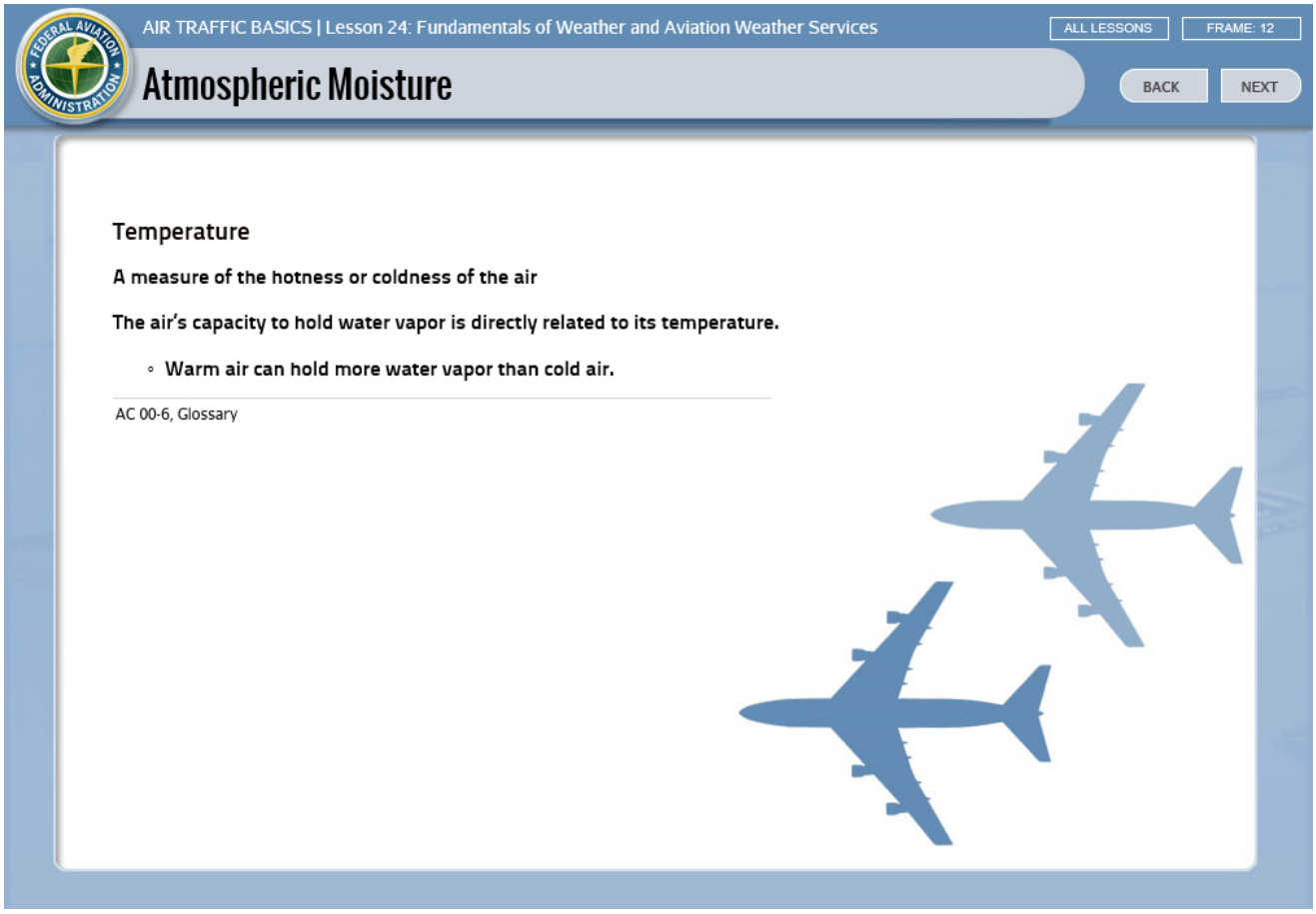
Jet streams often produce Clear Air Turbulence (CAT).

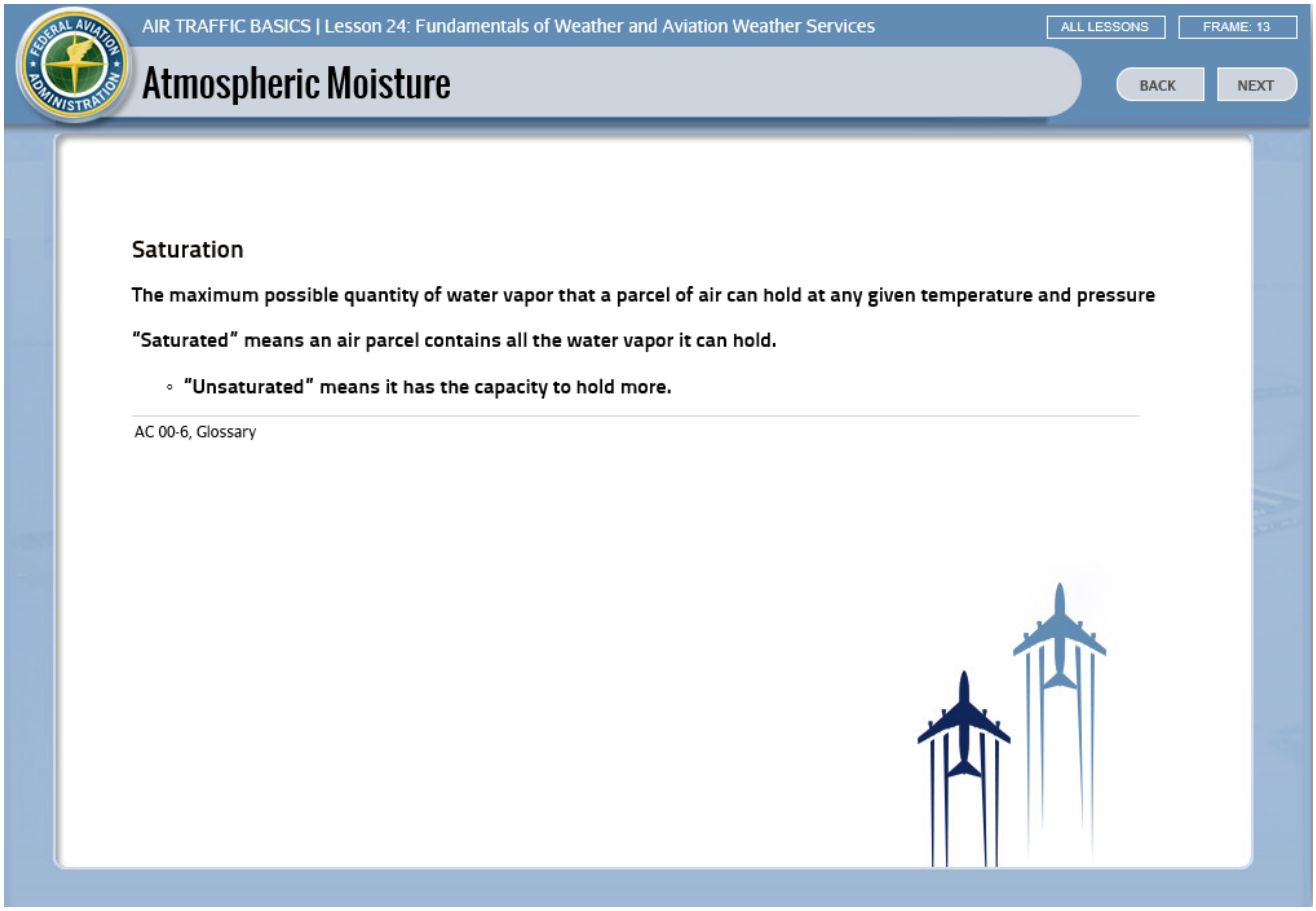
Jet streams make air traffic control separation more difficult.

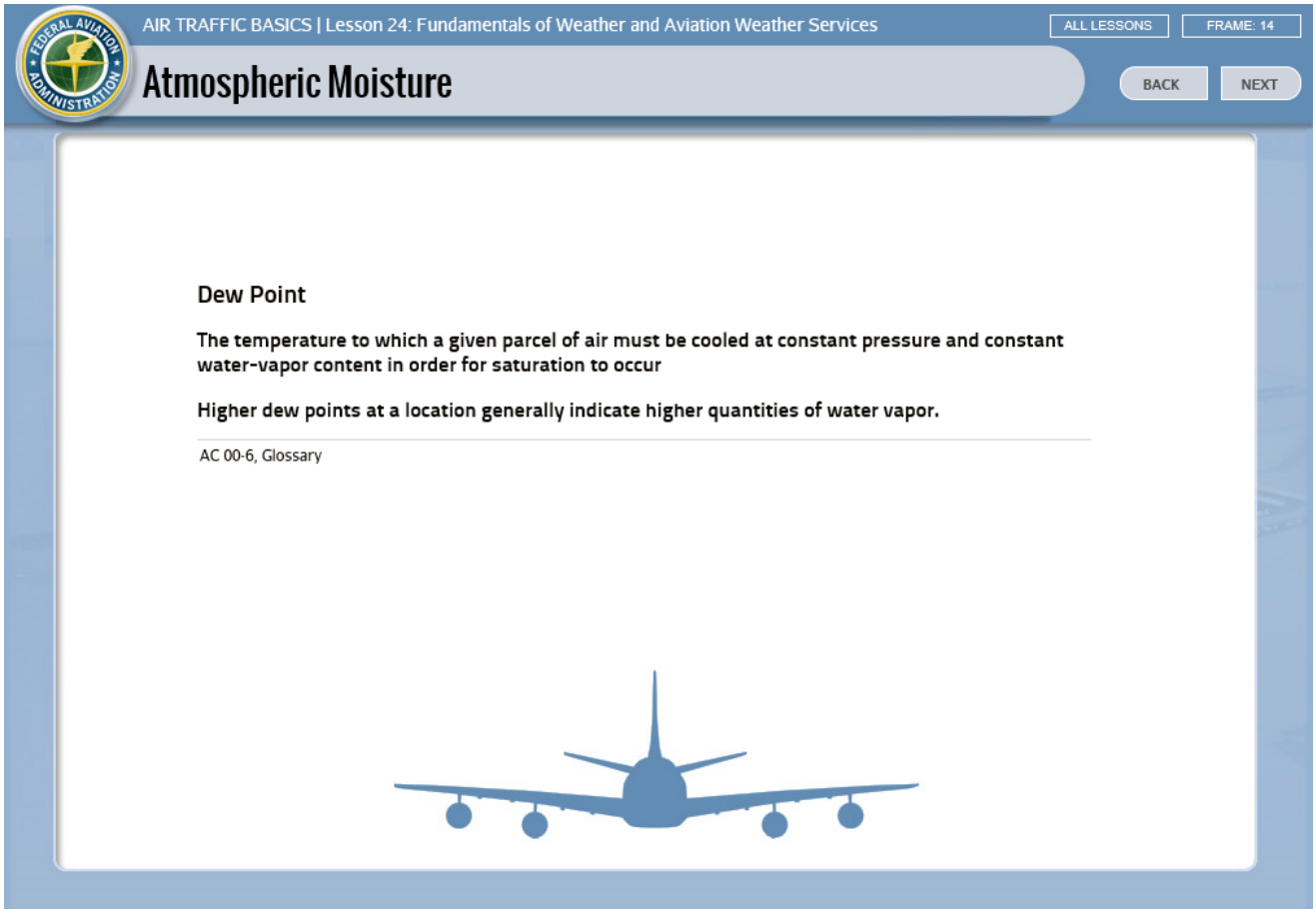
- They cause aircraft to move at different ground speeds

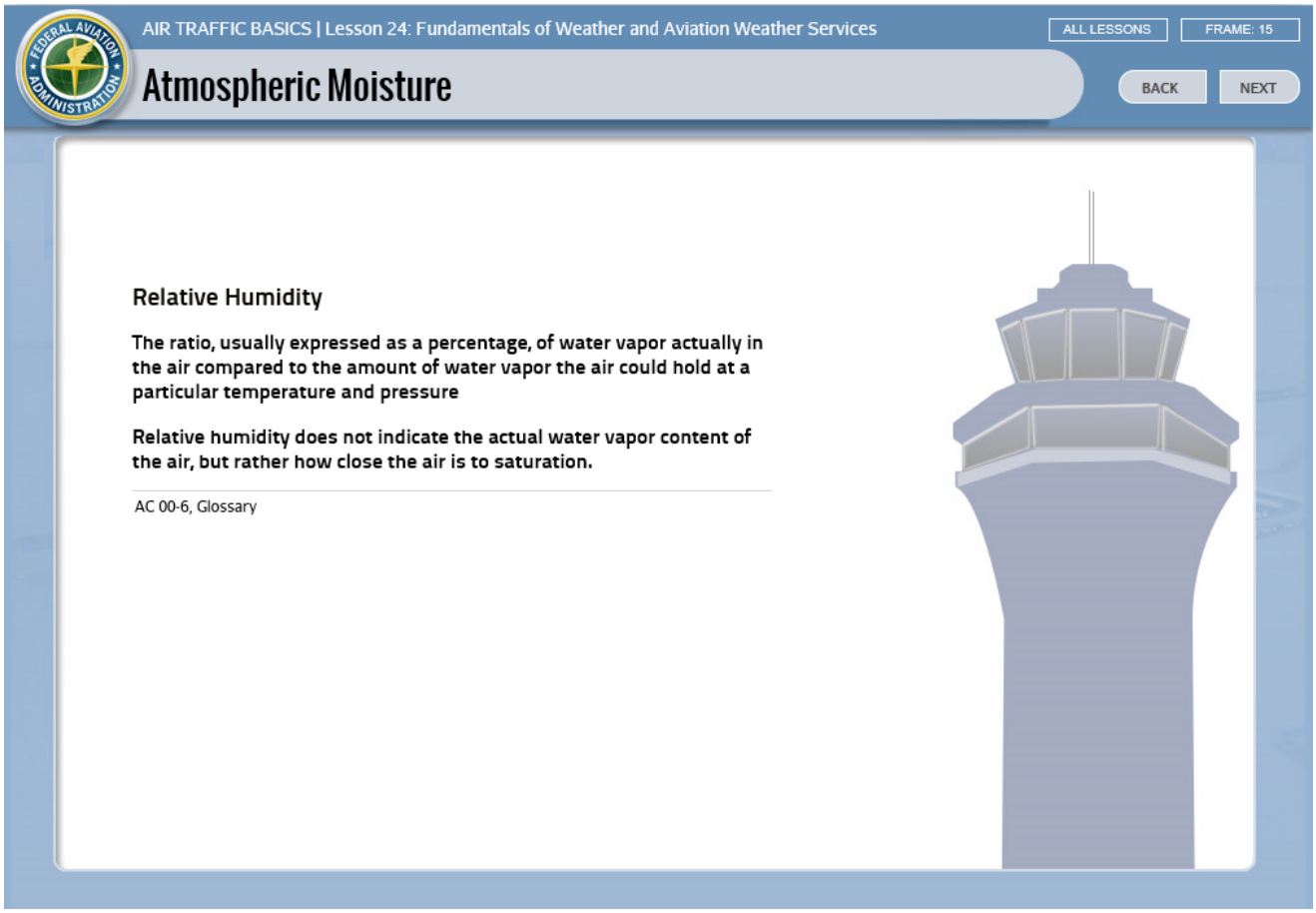
NWS: Jetstream – Online School for Weather, AMS Glossary of Meteorology


AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services
ALL LESSONS
FRAME: 11
Atmospheric Moisture
BACK
NEXT
Water Vapor
◦ Water vapor – Water in the invisible gaseous form
◦ Evaporation – The change of liquid water to water vapor
◦ Sublimation – The change of ice to water vapor
Water vapor is the raw material for clouds and precipitation.
◦ It constitutes only a small percentage of the atmosphere.
▪ Varies widely in time and space - from trace amounts to 4% by volume
▪ Approximately half is found below 6,500 AGL.
AC 00-6, Glossary


AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services
ALL LESSONS
FRAME: 12
Atmospheric Moisture
BACK
NEXT
Temperature
A measure of the hotness or coldness of the air
The air's capacity to hold water vapor is directly related to its temperature.
Warm air can hold more water vapor than cold air.
AC 00-6, Glossary


AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services
ALL LESSONS
FRAME: 13
Atmospheric Moisture
BACK
NEXT
Saturation
The maximum possible quantity of water vapor that a parcel of air can hold at any given temperature and pressure
"Saturated" means an air parcel contains all the water vapor it can hold.
"Unsaturated" means it has the capacity to hold more.
AC 00-6, Glossary


AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services
ALL LESSONS
FRAME: 14
Atmospheric Moisture
BACK
NEXT
Dew Point
The temperature to which a given parcel of air must be cooled at constant pressure and constant water-vapor content in order for saturation to occur
Higher dew points at a location generally indicate higher quantities of water vapor.
AC 00-6, Glossary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ALL LESSONS
FRAME: 15
Atmospheric Moisture
BACK
NEXT
Relative Humidity
The ratio, usually expressed as a percentage, of water vapor actually in the air compared to the amount of water vapor the air could hold at a particular temperature and pressure
Relative humidity does not indicate the actual water vapor content of the air, but rather how close the air is to saturation.
AC 00-6, Glossary

AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services

ALL LESSONS FRAME: 16

Atmospheric Moisture

BACK NEXT

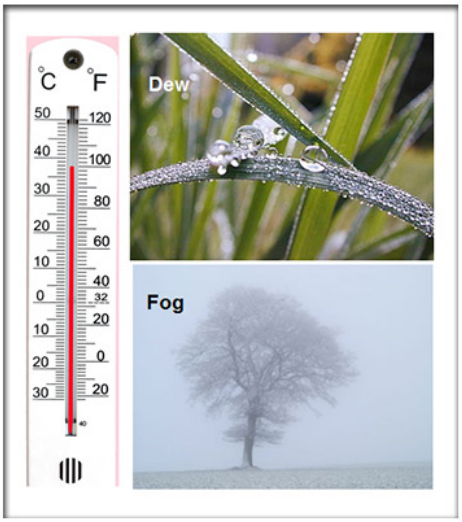
Temperature – Dew Point Spread

Condensation – The change of water vapor to liquid water

Temperature minus Dew Point equals "Spread."

- **When the spread is greater than zero, air is unsaturated.**
- **When the spread decreases to zero, air becomes saturated and condensation will form dew, fog, or clouds.**

FMH-1, Glossary; AC 00-6, chap. 5, Glossary



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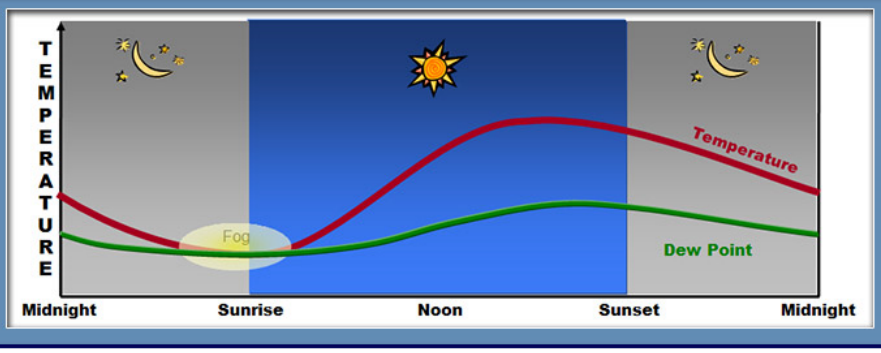
ALL LESSONS FRAME: 17

Atmospheric Moisture

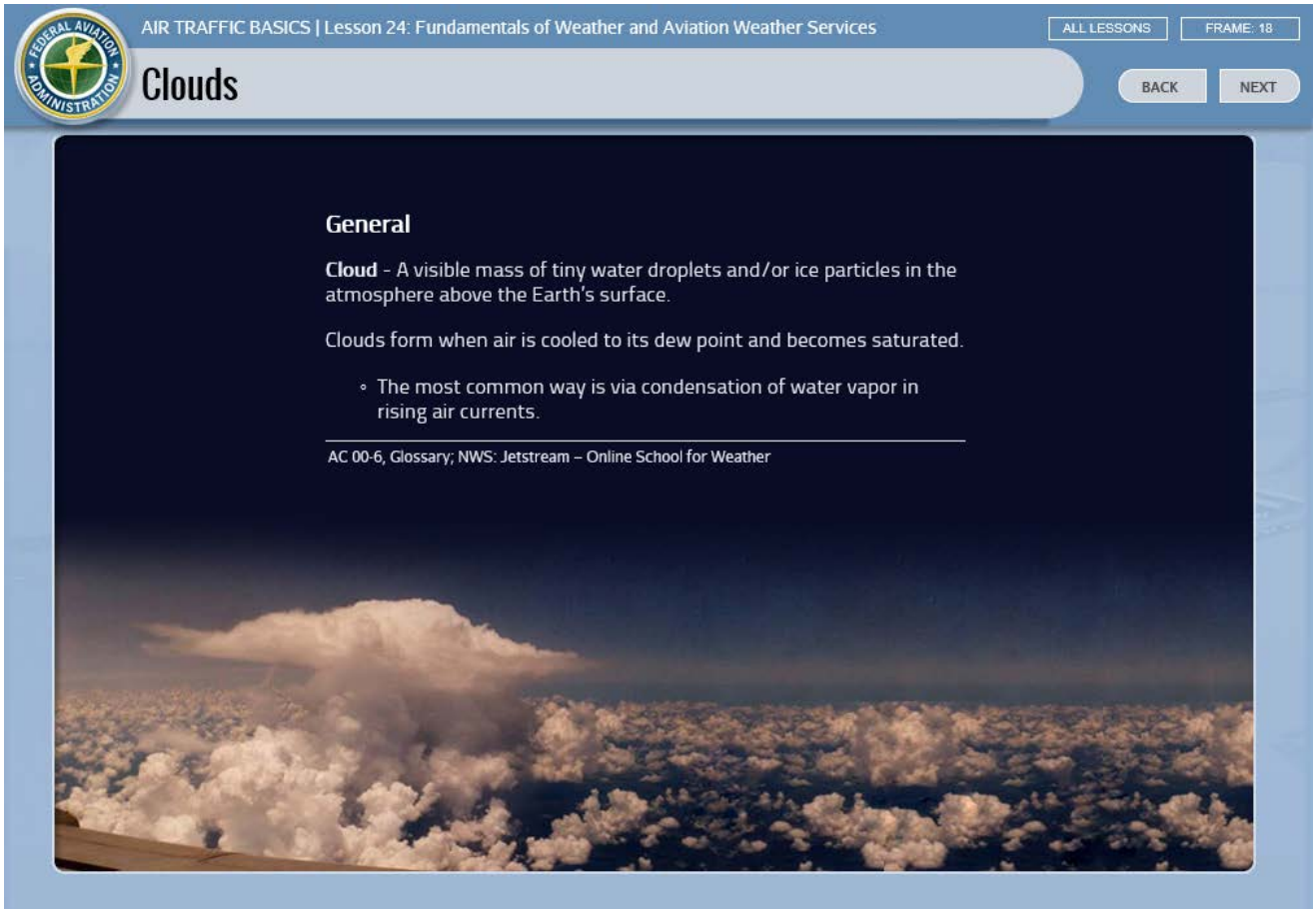
BACK NEXT



Temperature-Dew Point Spread Example

During a typical 24-hour period over land, the surface air temperature increases during the day and decreases at night, while the dew point changes more slowly.

- When the temperature-dew point spread decreases, relative humidity increases.
- When the temperature-dew point spread decreases to zero, the air becomes saturated, and condensation will form dew or fog.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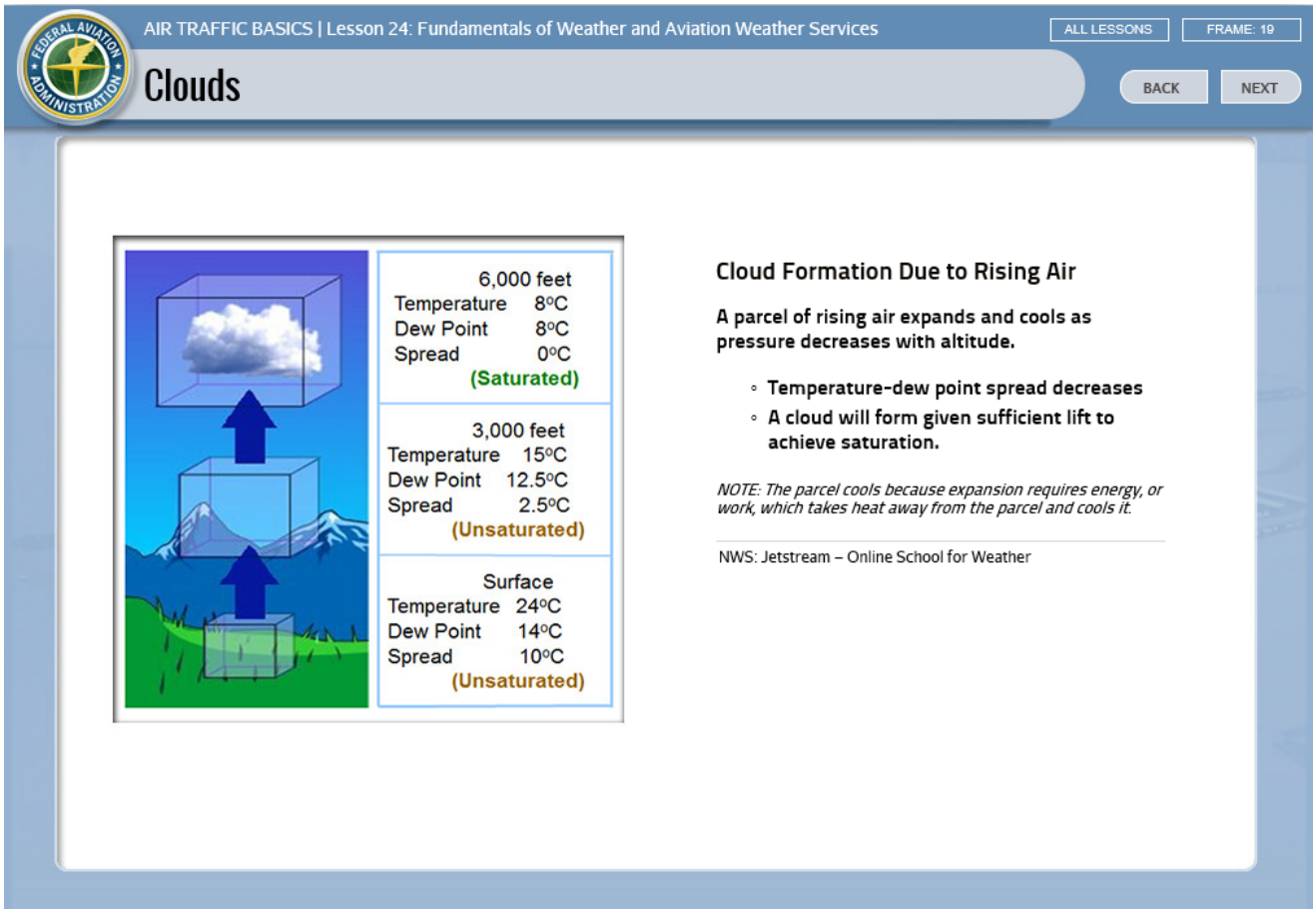
ALL LESSONS
FRAME: 18
Clouds
BACK
NEXT
General
Cloud - A visible mass of tiny water droplets and/or ice particles in the atmosphere above the Earth's surface.
Clouds form when air is cooled to its dew point and becomes saturated.
◦ The most common way is via condensation of water vapor in rising air currents.
AC 00-6, Glossary; NWS: Jetstream – Online School for Weather


AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services
ALL LESSONS
FRAME: 19
Clouds
BACK
NEXT
6,000 feet
Temperature 8°C
Dew Point 8°C
Spread 0°C
(Saturated)
3,000 feet
Temperature 15°C
Dew Point 12.5°C
Spread 2.5°C
(Unsaturated)
Surface
Temperature 24°C
Dew Point 14°C
Spread 10°C
(Unsaturated)
Cloud Formation Due to Rising Air
A parcel of rising air expands and cools as pressure decreases with altitude.
◦ Temperature-dew point spread decreases
◦ A cloud will form given sufficient lift to achieve saturation.
NOTE: The parcel cools because expansion requires energy, or work, which takes heat away from the parcel and cools it.
NWS: Jetstream – Online School for Weather

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ALL LESSONS FRAME: 20

Clouds

BACK NEXT

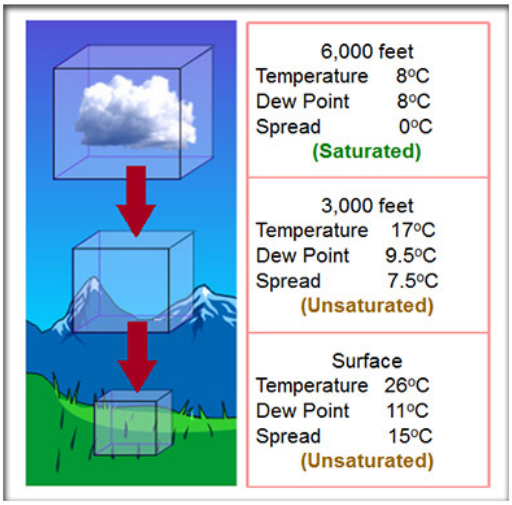
Cloud Dissipation Due to Sinking Air

A parcel of sinking air warms as it encounters increasing pressure and is compressed.

- **Temperature-dew point spread increases**
- **A cloud will quickly dissipate due to sinking air.**

NOTE: The parcel warms because the surrounding atmosphere does work compressing the parcel which adds heat to the parcel and warms it.

NWS: Jetstream – Online School for Weather



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ALL LESSONS FRAME: 21

Clouds

BACK NEXT

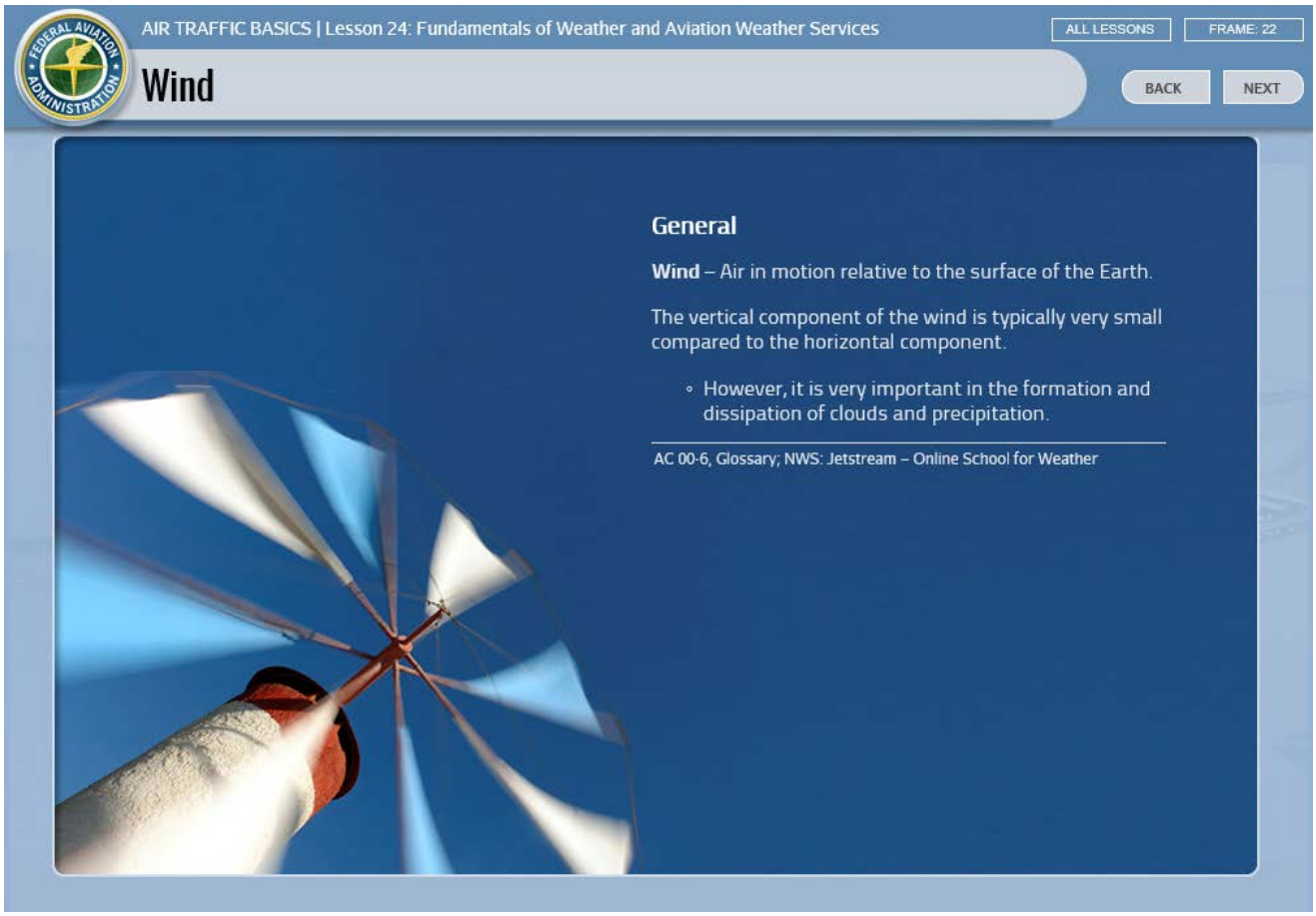
Cirriform		- High-level clouds which form above 20,000 feet - Usually composed of ice crystals - Typically thin and white in appearance - Contains no significant icing
Cumuliform		- Resembles white fluffy cotton balls or heaps - Indicates upward vertical motion or thermal uplift of air - Tops can reach over 60,000 feet - May produce icing, turbulence, and other hazards
Stratiform		- "Stratus" is Latin for "layer" or "blanket" - Consists of a featureless low layer that can cover sky - Often produces widespread IFR weather - Little or no turbulence, but can produce icing

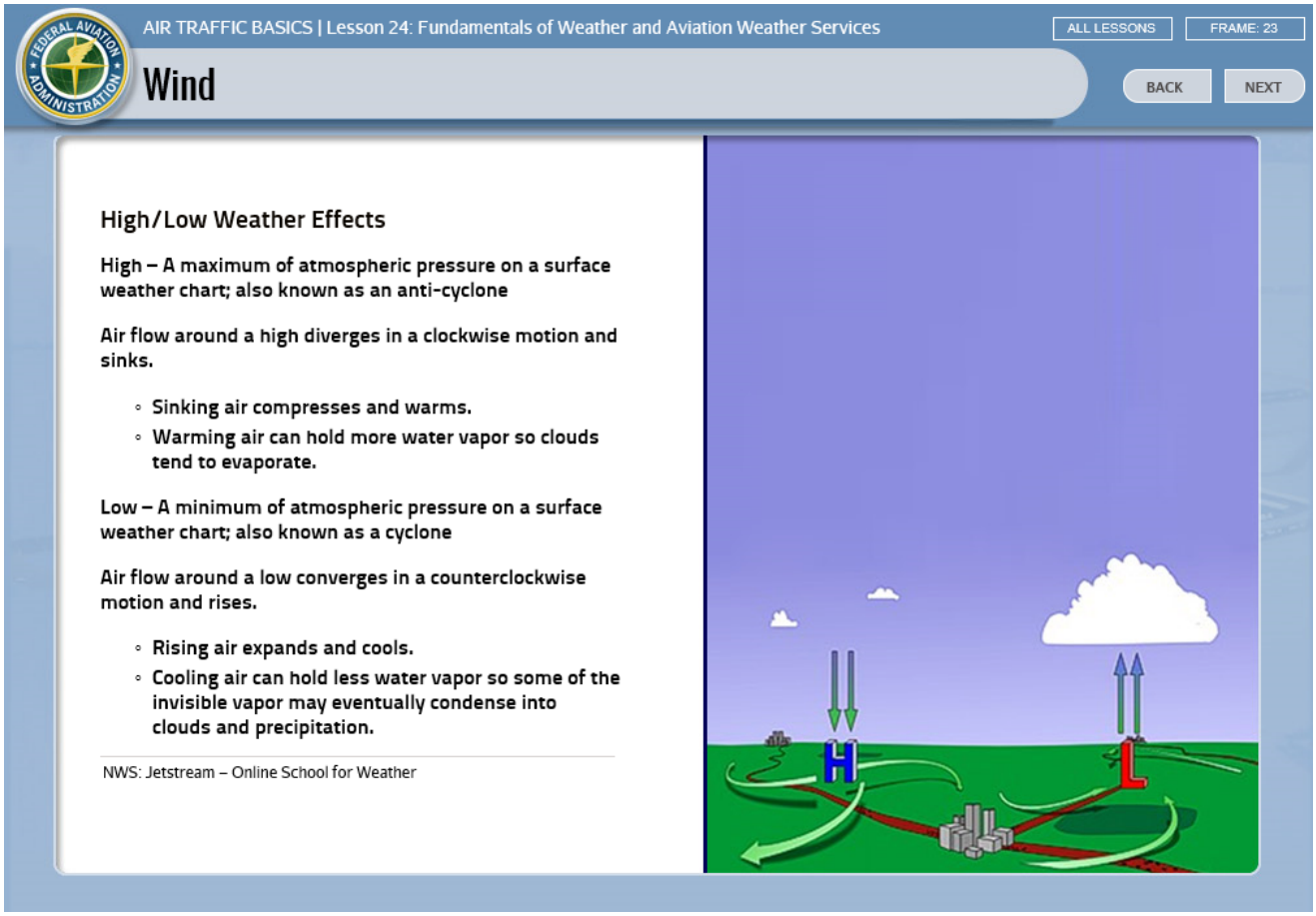
Three Cloud Forms

In addition to Cirrus, Cumulus, and Stratus, the prefix "nimbo" or the suffix "nimbus" means raincloud.

- **Stratiform clouds from which rain is falling are nimbostratus.**
- **Cumuliform clouds which produce precipitation are cumulonimbus.**

NWS: Jetstream – Online School for Weather, AC 00-6, Chap. 7


AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services
ALL LESSONS
FRAME: 22
Wind
BACK
NEXT
General
Wind – Air in motion relative to the surface of the Earth.
The vertical component of the wind is typically very small compared to the horizontal component.
◦ However, it is very important in the formation and dissipation of clouds and precipitation.
AC 00-6, Glossary; NWS: Jetstream – Online School for Weather


AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services
ALL LESSONS
FRAME: 23
Wind
BACK
NEXT
High/Low Weather Effects
High – A maximum of atmospheric pressure on a surface weather chart; also known as an anti-cyclone
Air flow around a high diverges in a clockwise motion and sinks.
◦ Sinking air compresses and warms.
◦ Warming air can hold more water vapor so clouds tend to evaporate.
Low – A minimum of atmospheric pressure on a surface weather chart; also known as a cyclone
Air flow around a low converges in a counterclockwise motion and rises.
◦ Rising air expands and cools.
◦ Cooling air can hold less water vapor so some of the invisible vapor may eventually condense into clouds and precipitation.
NWS: Jetstream – Online School for Weather
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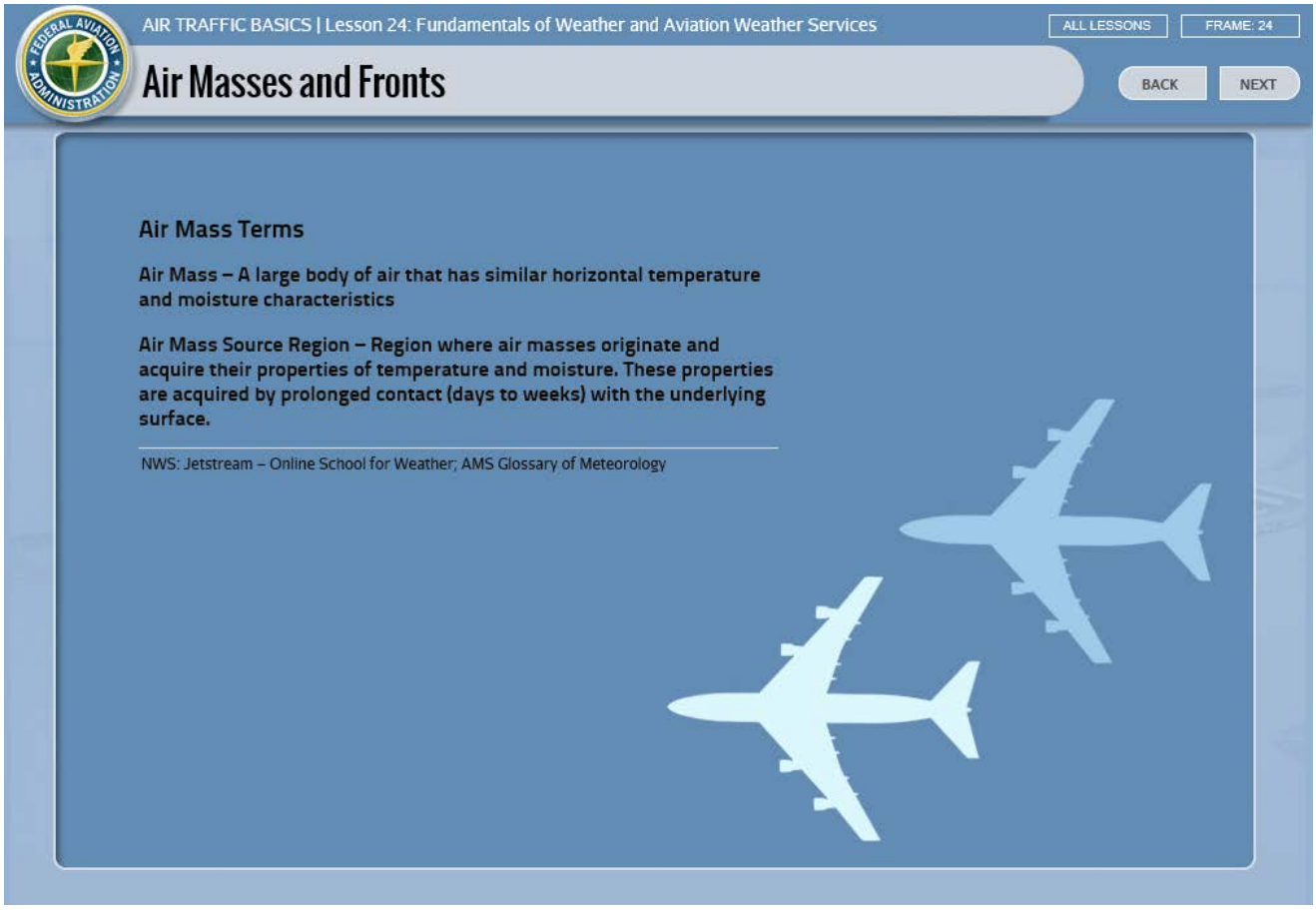

AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services
ALL LESSONS
FRAME: 24
Air Masses and Fronts
BACK
NEXT
Air Mass Terms
Air Mass – A large body of air that has similar horizontal temperature and moisture characteristics
Air Mass Source Region – Region where air masses originate and acquire their properties of temperature and moisture. These properties are acquired by prolonged contact (days to weeks) with the underlying surface.
NWS: Jetstream – Online School for Weather; AMS Glossary of Meteorology

AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services

ALL LESSONS FRAME: 25

Air Masses and Fronts

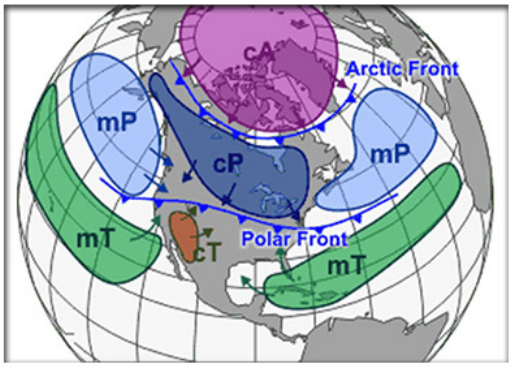
BACK NEXT

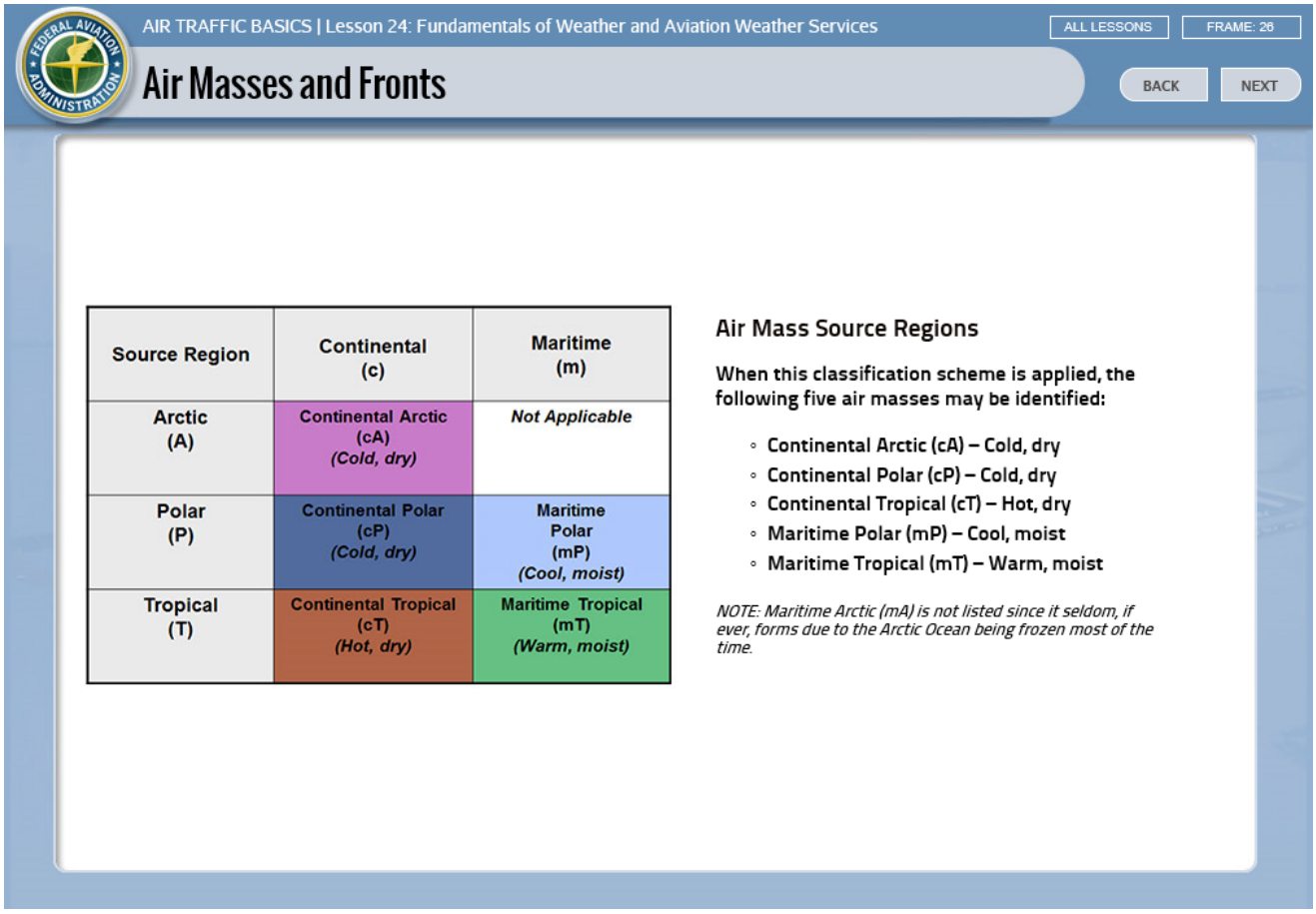
Air Mass Classification

Air masses are classified according to the temperature and moisture properties of their source regions.

- Temperature properties
  - Arctic (A) - An extremely deep cold air mass which develops mostly in winter over arctic surfaces of ice and snow
  - Polar (P) - A relatively shallow cool to cold air mass which develops over high latitudes
  - Tropical (T) - A warm to hot air mass which develops over low latitudes
- Moisture properties
  - Continental (c) - A dry air mass which develops over land
  - Maritime (m) - A moist air mass which develops over water

AMS Glossary of Meteorology

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ALL LESSONS
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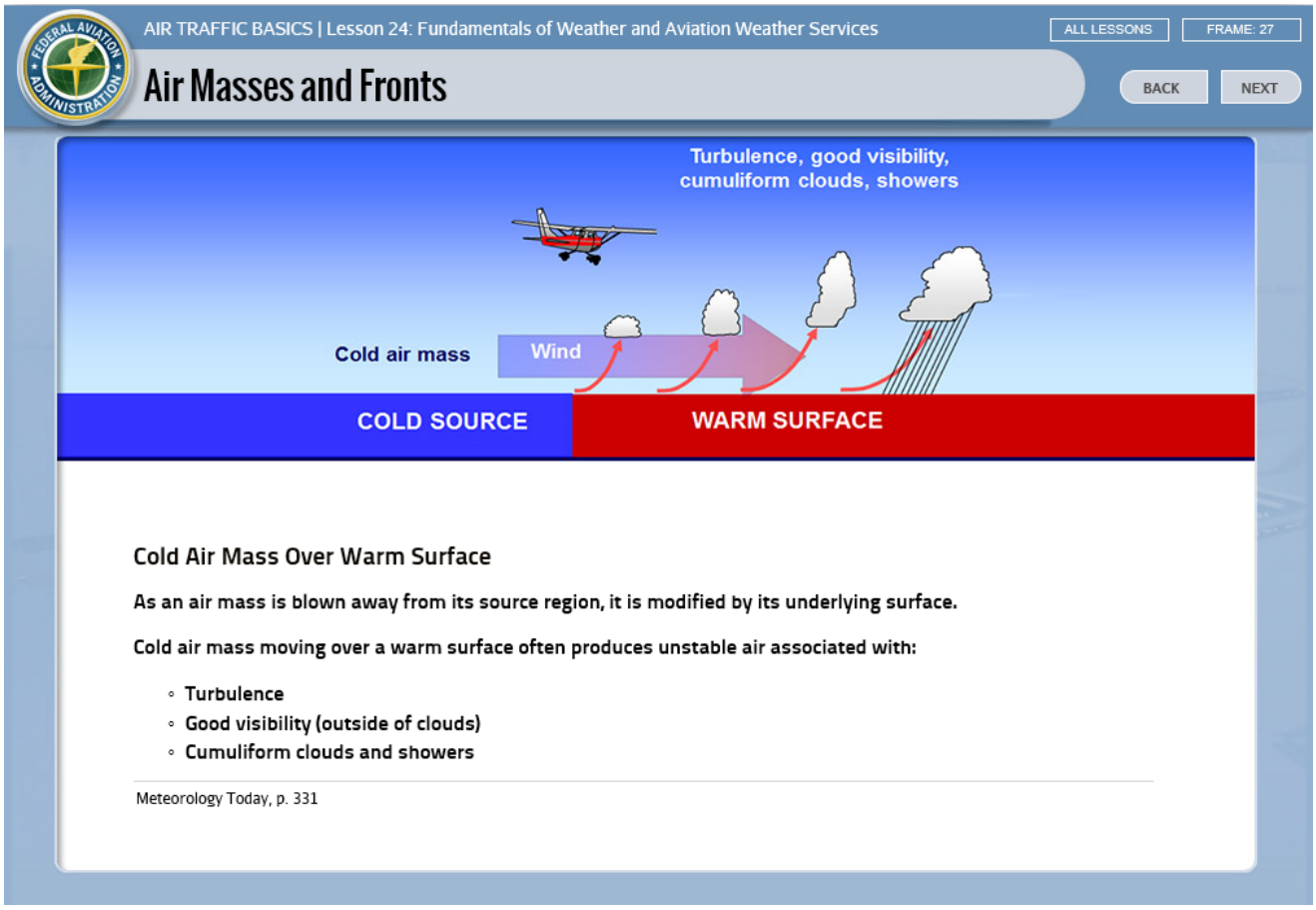
Air Masses and Fronts
BACK
NEXT
Source Region
Continental (c)
Maritime (m)
Arctic (A)
Continental Arctic (cA) (Cold, dry)
Not Applicable
Polar (P)
Continental Polar (cP) (Cold, dry)
Maritime Polar (mP) (Cool, moist)
Tropical (T)
Continental Tropical (cT) (Hot, dry)
Maritime Tropical (mT) (Warm, moist)
Air Mass Source Regions
When this classification scheme is applied, the following five air masses may be identified:
◦ Continental Arctic (cA) – Cold, dry
◦ Continental Polar (cP) – Cold, dry
◦ Continental Tropical (cT) – Hot, dry
◦ Maritime Polar (mP) – Cool, moist
◦ Maritime Tropical (mT) – Warm, moist
NOTE: Maritime Arctic (mA) is not listed since it seldom, if ever, forms due to the Arctic Ocean being frozen most of the time.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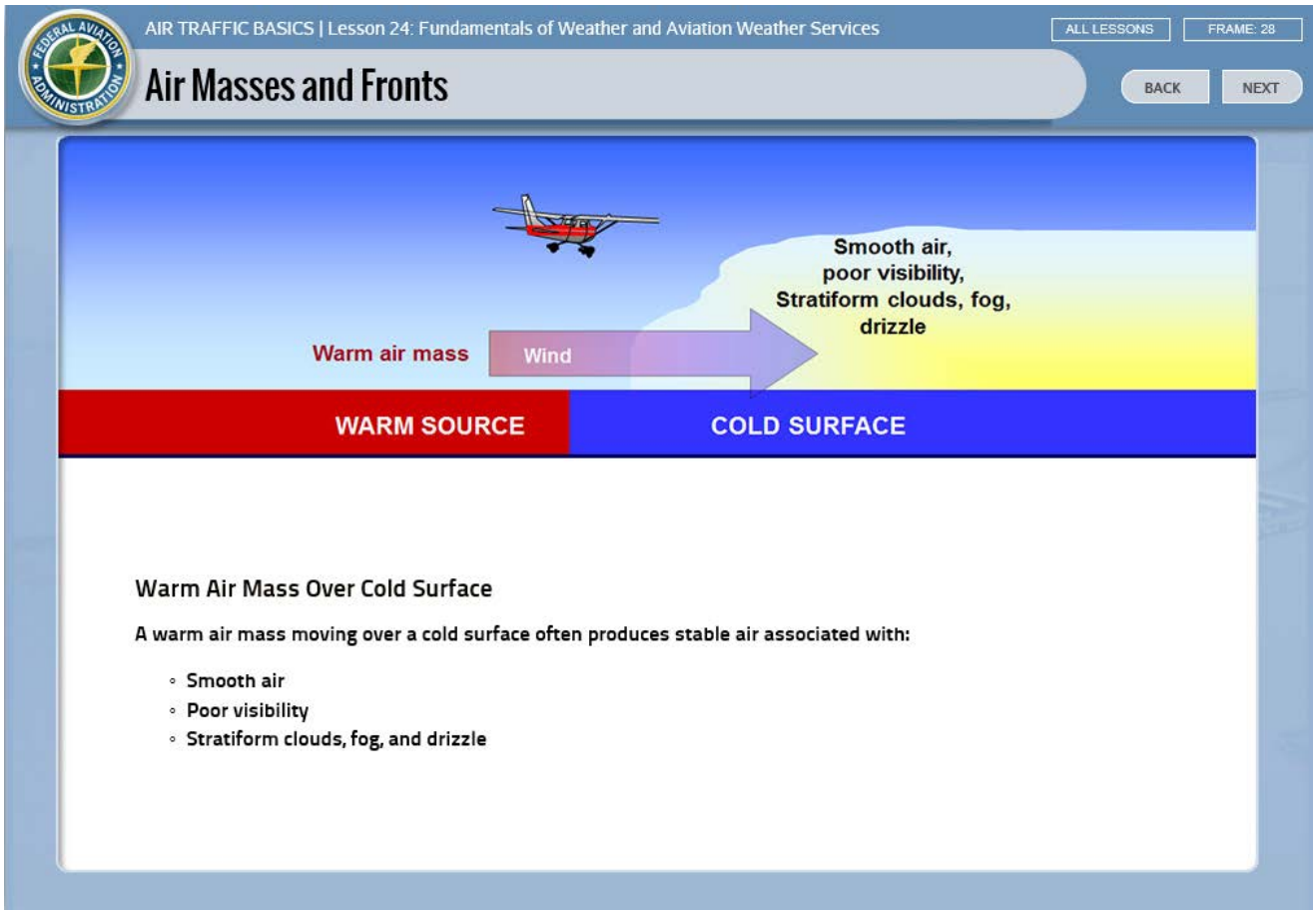
ALL LESSONS
FRAME: 27
Air Masses and Fronts
BACK
NEXT
Turbulence, good visibility,
cumuliform clouds, showers
Cold air mass
Wind
COLD SOURCE
WARM SURFACE
Cold Air Mass Over Warm Surface
As an air mass is blown away from its source region, it is modified by its underlying surface.
Cold air mass moving over a warm surface often produces unstable air associated with:
◦ Turbulence
◦ Good visibility (outside of clouds)
◦ Cumuliform clouds and showers
Meteorology Today, p. 331


AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services
ALL LESSONS
FRAME: 28
Air Masses and Fronts
BACK
NEXT
Smooth air,
poor visibility,
Stratiform clouds, fog,
drizzle
Warm air mass
Wind
WARM SOURCE
COLD SURFACE
Warm Air Mass Over Cold Surface
A warm air mass moving over a cold surface often produces stable air associated with:
◦ Smooth air
◦ Poor visibility
◦ Stratiform clouds, fog, and drizzle

AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services

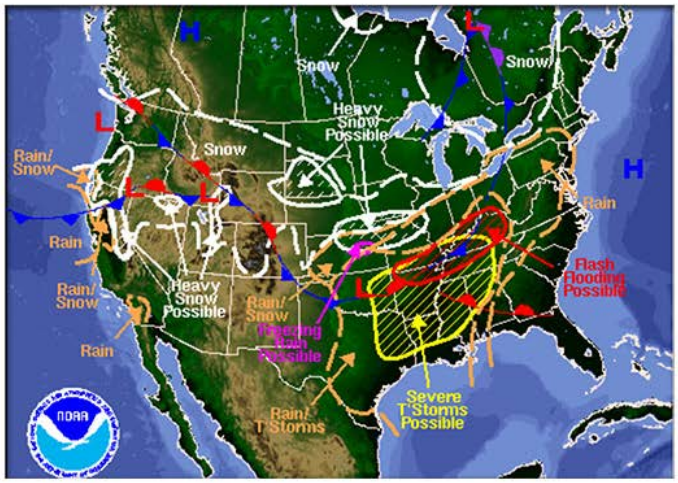
ALL LESSONS FRAME: 29

Air Masses and Fronts

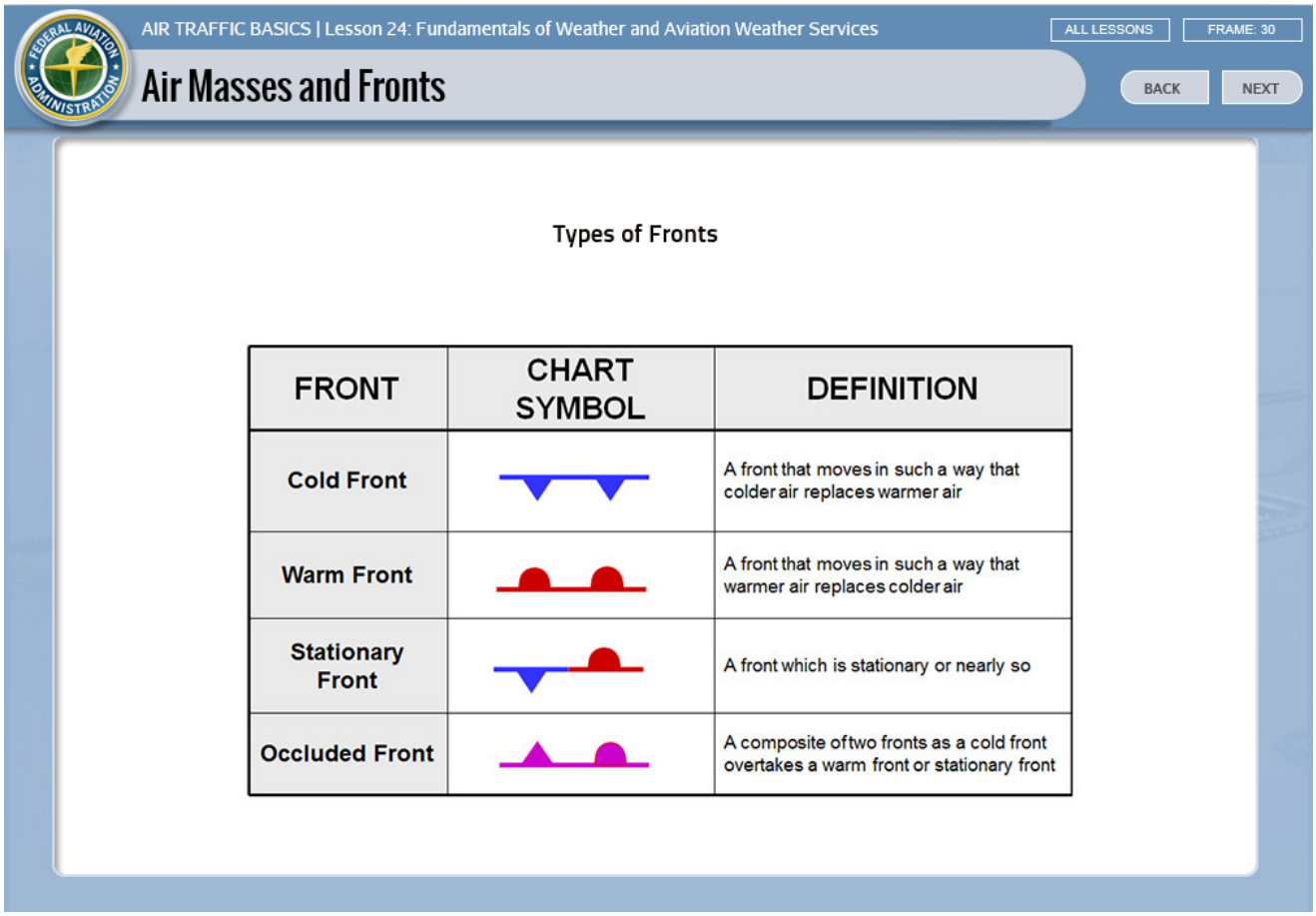
BACK NEXT

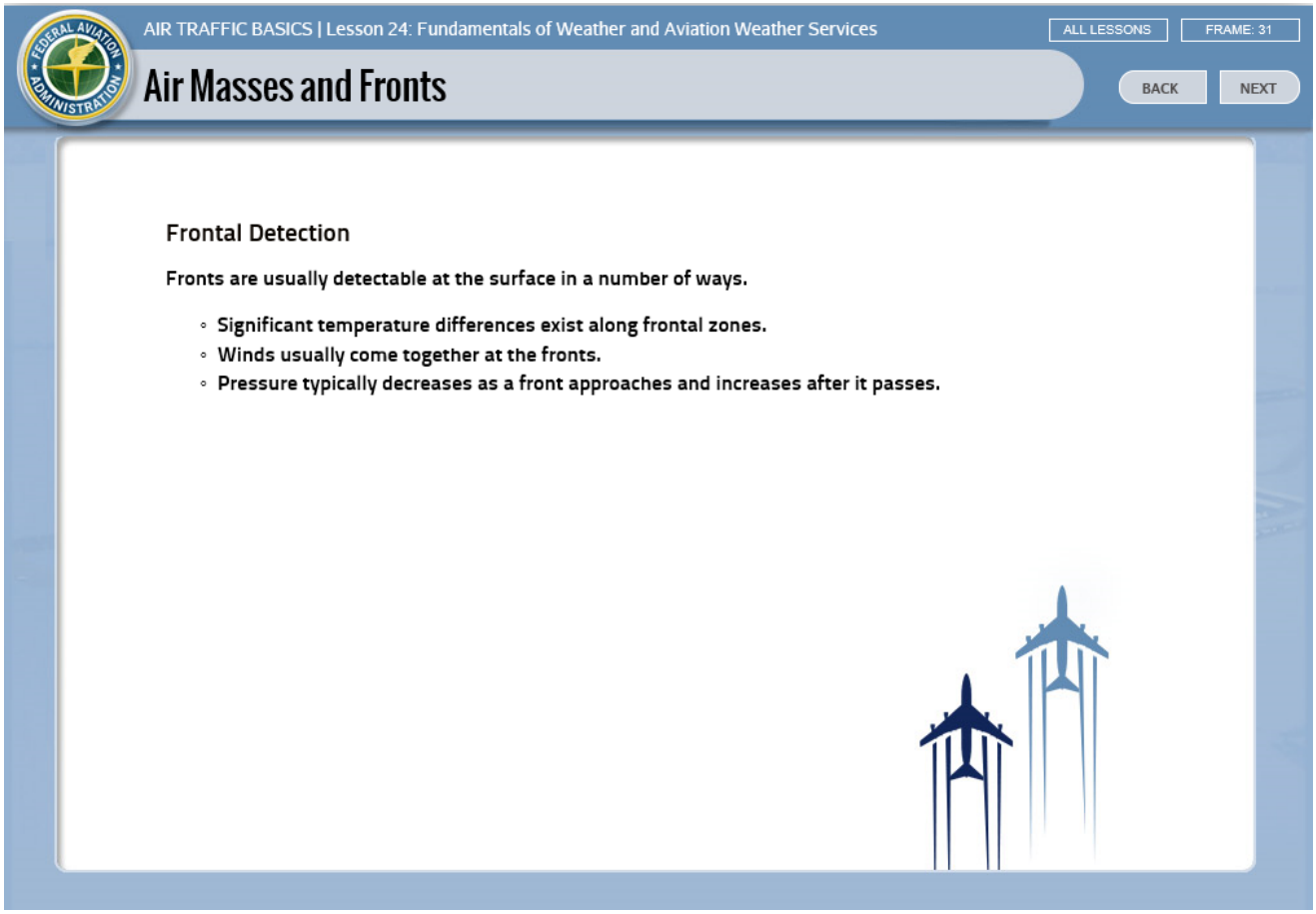
Fronts

Front – A boundary or transition zone between two air masses of different density, and thus, (usually) of different temperature.



NWS: Jetstream – Online School for Weather; AC 00-6, Glossary


AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services
ALL LESSONS
FRAME: 30
Air Masses and Fronts
BACK
NEXT
Types of Fronts
FRONT
CHART SYMBOL
DEFINITION
Cold Front
A front that moves in such a way that colder air replaces warmer air
Warm Front
A front that moves in such a way that warmer air replaces colder air
Stationary Front
A front which is stationary or nearly so
Occluded Front
A composite of two fronts as a cold front overtakes a warm front or stationary front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Air Masses and Fronts
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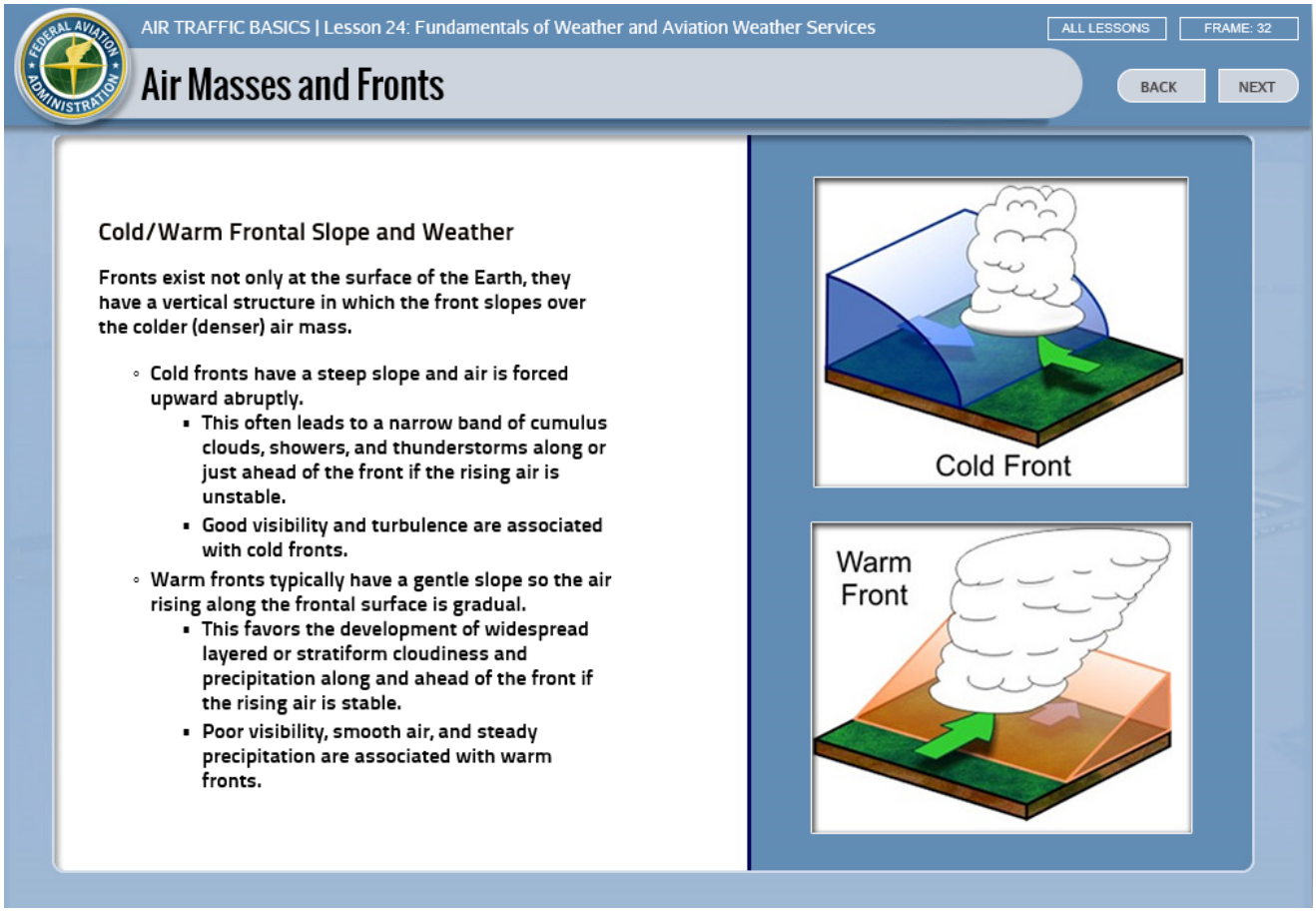
Frontal Detection
Fronts are usually detectable at the surface in a number of ways.
◦ Significant temperature differences exist along frontal zones.
◦ Winds usually come together at the fronts.
◦ Pressure typically decreases as a front approaches and increases after it passes.


AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services
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Air Masses and Fronts
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Cold/Warm Frontal Slope and Weather
Fronts exist not only at the surface of the Earth, they have a vertical structure in which the front slopes over the colder (denser) air mass.
◦ Cold fronts have a steep slope and air is forced upward abruptly.
▪ This often leads to a narrow band of cumulus clouds, showers, and thunderstorms along or just ahead of the front if the rising air is unstable.
▪ Good visibility and turbulence are associated with cold fronts.
◦ Warm fronts typically have a gentle slope so the air rising along the frontal surface is gradual.
▪ This favors the development of widespread layered or stratiform cloudiness and precipitation along and ahead of the front if the rising air is stable.
▪ Poor visibility, smooth air, and steady precipitation are associated with warm fronts.
Cold Front
Warm Front

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ALL LESSONS FRAME: 33

Air Masses and Fronts

BACK NEXT

Occluded Front

Cold fronts typically move faster than warm fronts, so in time they "catch up" to warm fronts.

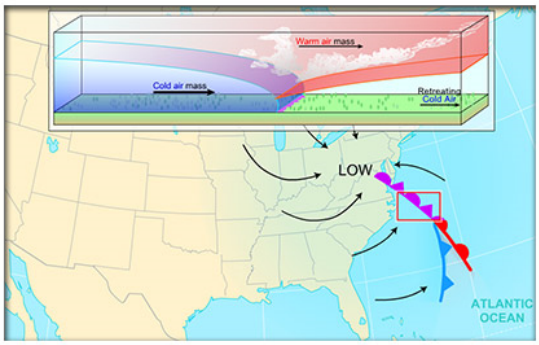
- As the two fronts merge, an occluded front forms.

At the occluded front, the cold air undercuts the retreating cold air mass associated with the warm front, further lifting the already rising warm air.

- Combining the effects of both a cold and warm front, clouds and precipitation can occur both ahead of, and in the areas of frontal lift of an occluded front.

A stationary front is a boundary between two different air masses, neither of which is strong enough to replace the other.

- A wide variety of weather can be found along a stationary front, but it is usually clouds and prolonged precipitation.



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Precipitation

BACK NEXT

General

Precipitation - Any of the forms of water particles, whether liquid or solid, that fall from the atmosphere and reach the ground

AC 00-6, Glossary

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ALL LESSONS FRAME: 35

Precipitation

BACK NEXT

Precipitation Formation

Precipitation formation requires the following three ingredients:

- **Water vapor**
  - **The primary sources in the U.S. are the Atlantic and Pacific Oceans, the Gulf of Mexico, and the Great Lakes.**
    - **Winds transport this water vapor inland.**
- **Sufficient lift to condense the water vapor into clouds**
  - **Converging winds around surface lows**
  - **Fronts**
- **A growth process that allows water particles to grow large and heavy enough to fall as precipitation**

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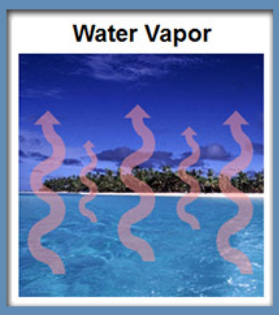

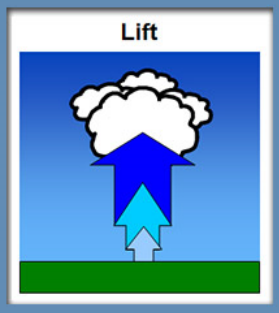

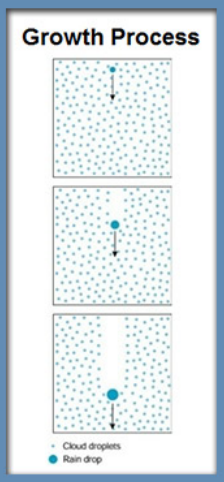

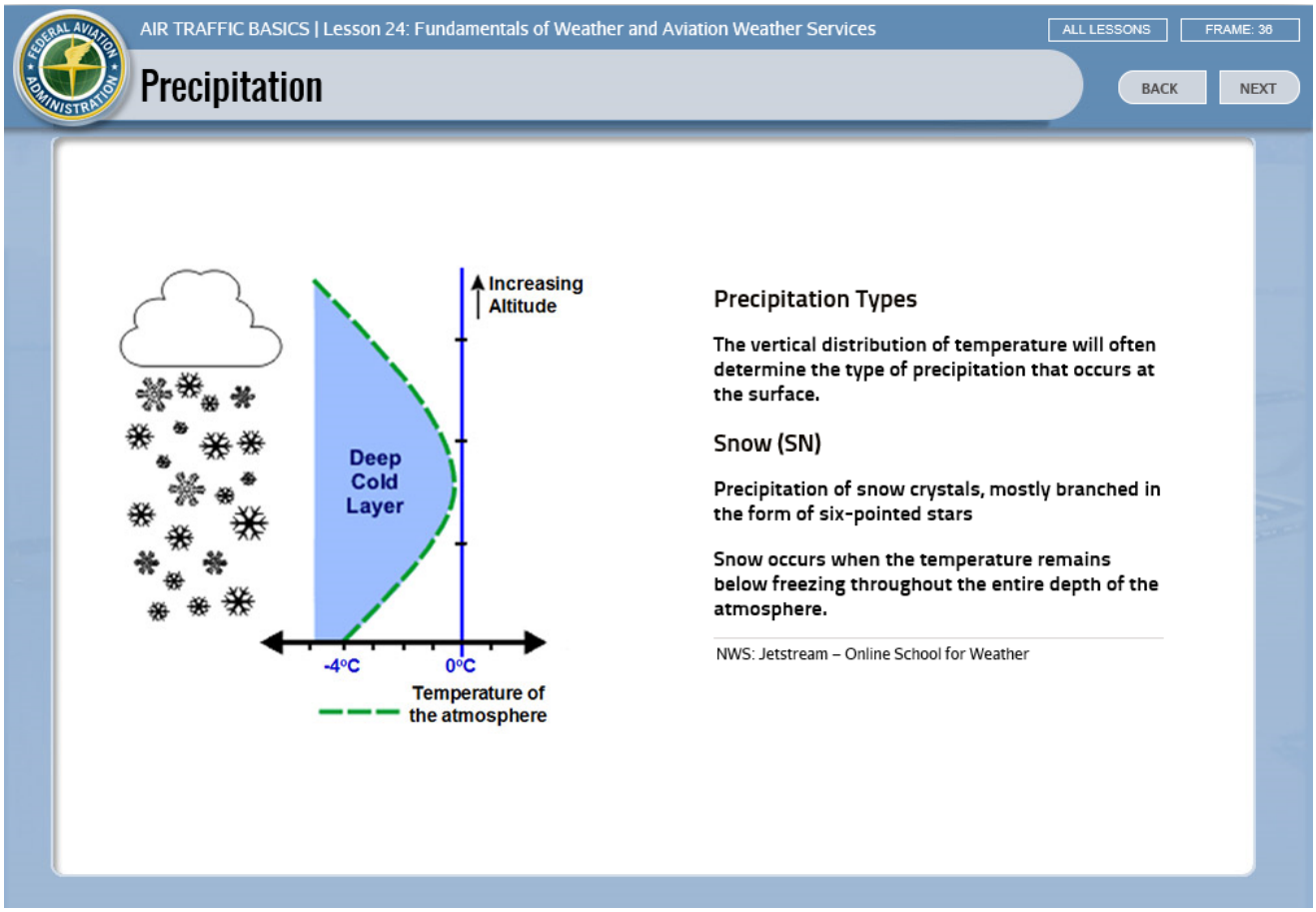
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Precipitation
BACK
NEXT
Increasing Altitude
Deep Cold Layer
-4°C
0°C
Temperature of the atmosphere
Precipitation Types
The vertical distribution of temperature will often determine the type of precipitation that occurs at the surface.
Snow (SN)
Precipitation of snow crystals, mostly branched in the form of six-pointed stars
Snow occurs when the temperature remains below freezing throughout the entire depth of the atmosphere.
NWS: Jetstream – Online School for Weather

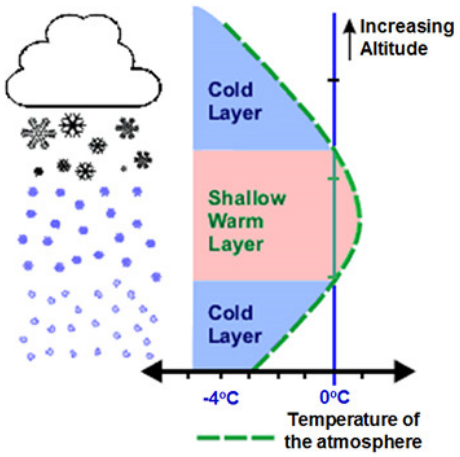
Precipitation

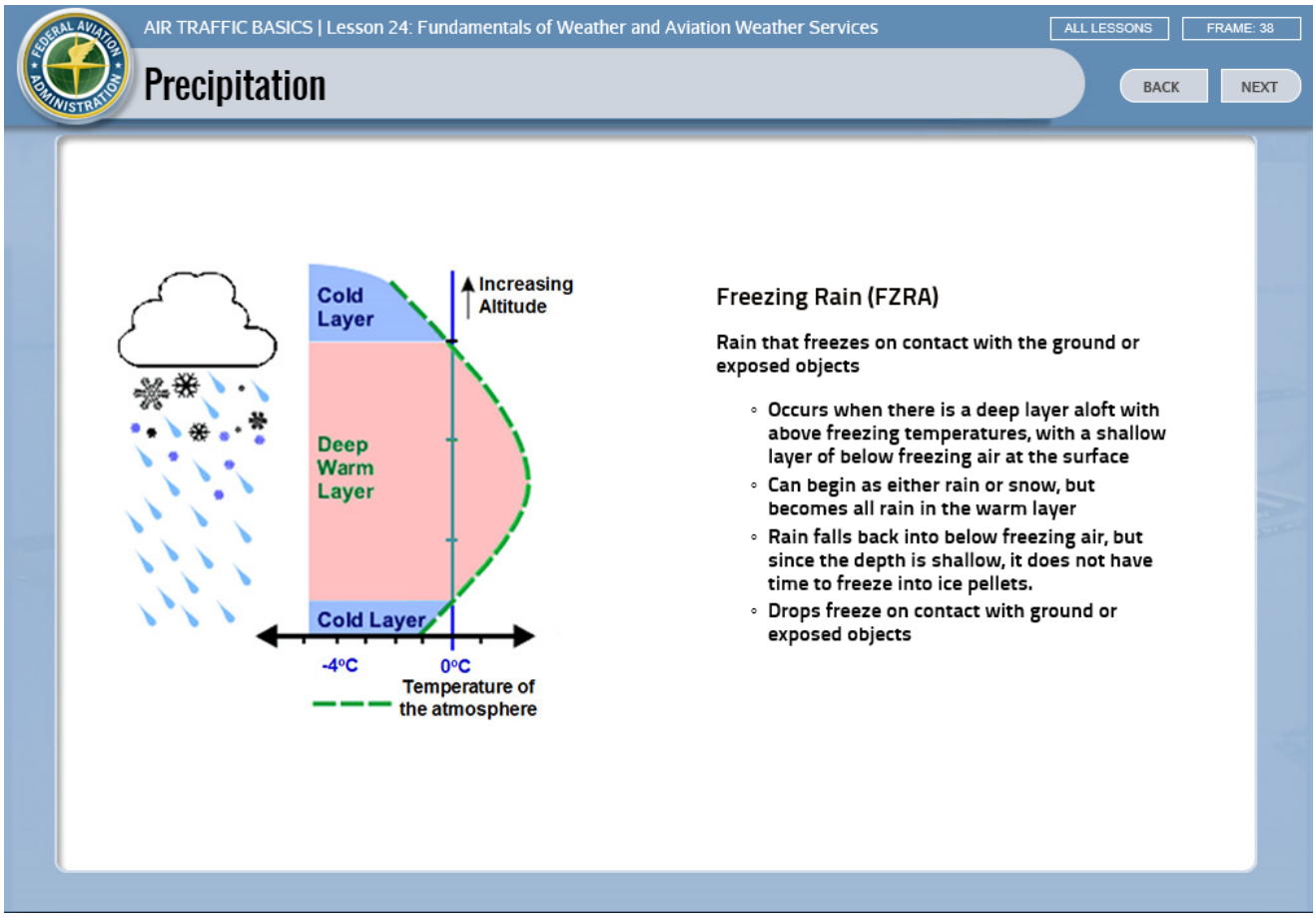
Ice Pellets (PL)

Precipitation of transparent or translucent pellets of ice, which are round or irregular, rarely conical, and which have a diameter of 0.2 inch (5 mm), or less; sometimes called "sleet"

Ice pellets occur when there is a shallow layer aloft with above freezing temperatures, with a deep layer of below freezing air based at the surface.

- As snow falls into the shallow warm layer, the snowflakes partially melt.
- As the precipitation re-enters air that is below freezing, it re-freezes into ice pellets.

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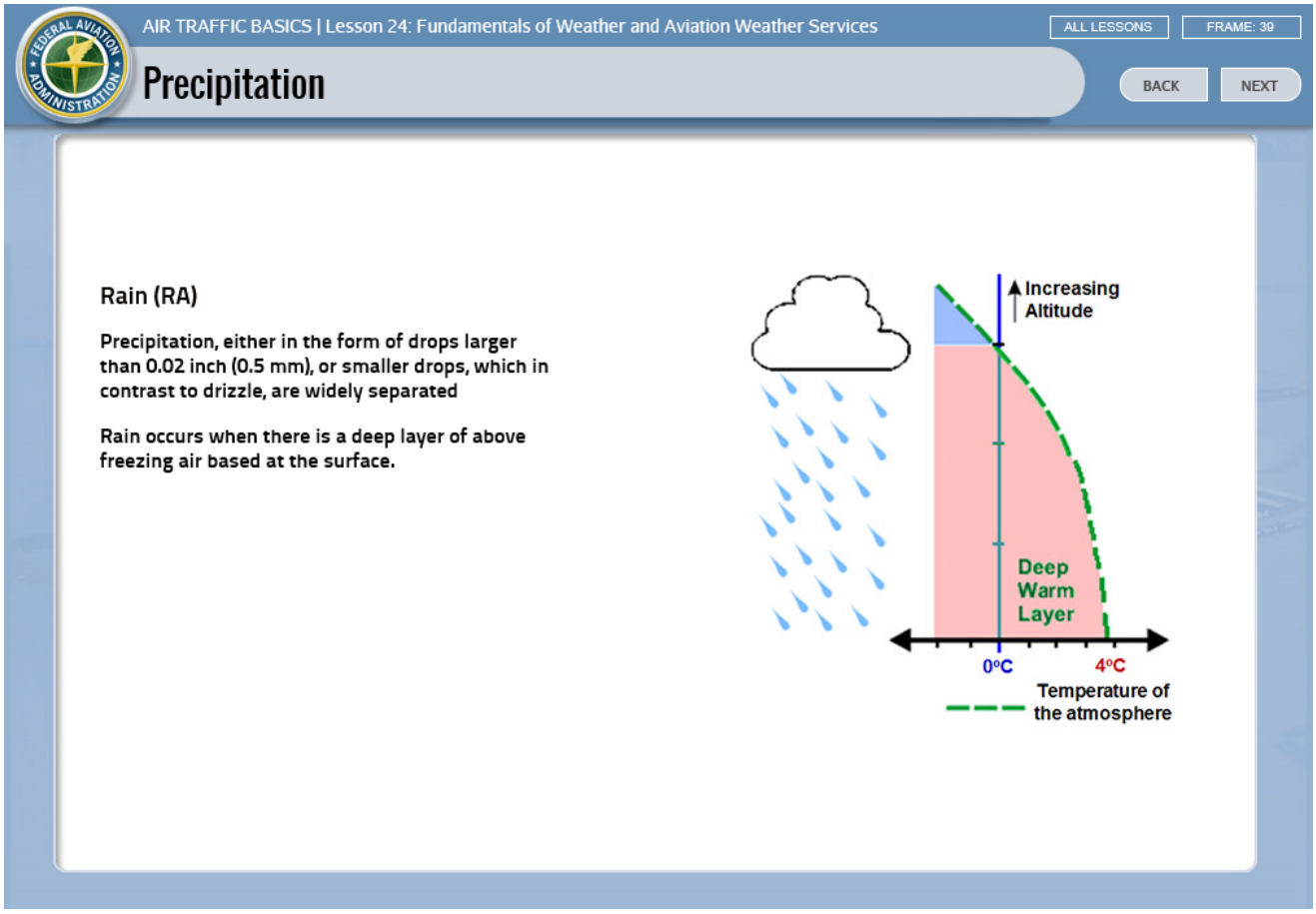
Precipitation
BACK
NEXT
Cold Layer
Increasing Altitude
Deep Warm Layer
Cold Layer
-4°C
0°C
Temperature of the atmosphere
Freezing Rain (FZRA)
Rain that freezes on contact with the ground or exposed objects
◦ Occurs when there is a deep layer aloft with above freezing temperatures, with a shallow layer of below freezing air at the surface
◦ Can begin as either rain or snow, but becomes all rain in the warm layer
◦ Rain falls back into below freezing air, but since the depth is shallow, it does not have time to freeze into ice pellets.
◦ Drops freeze on contact with ground or exposed objects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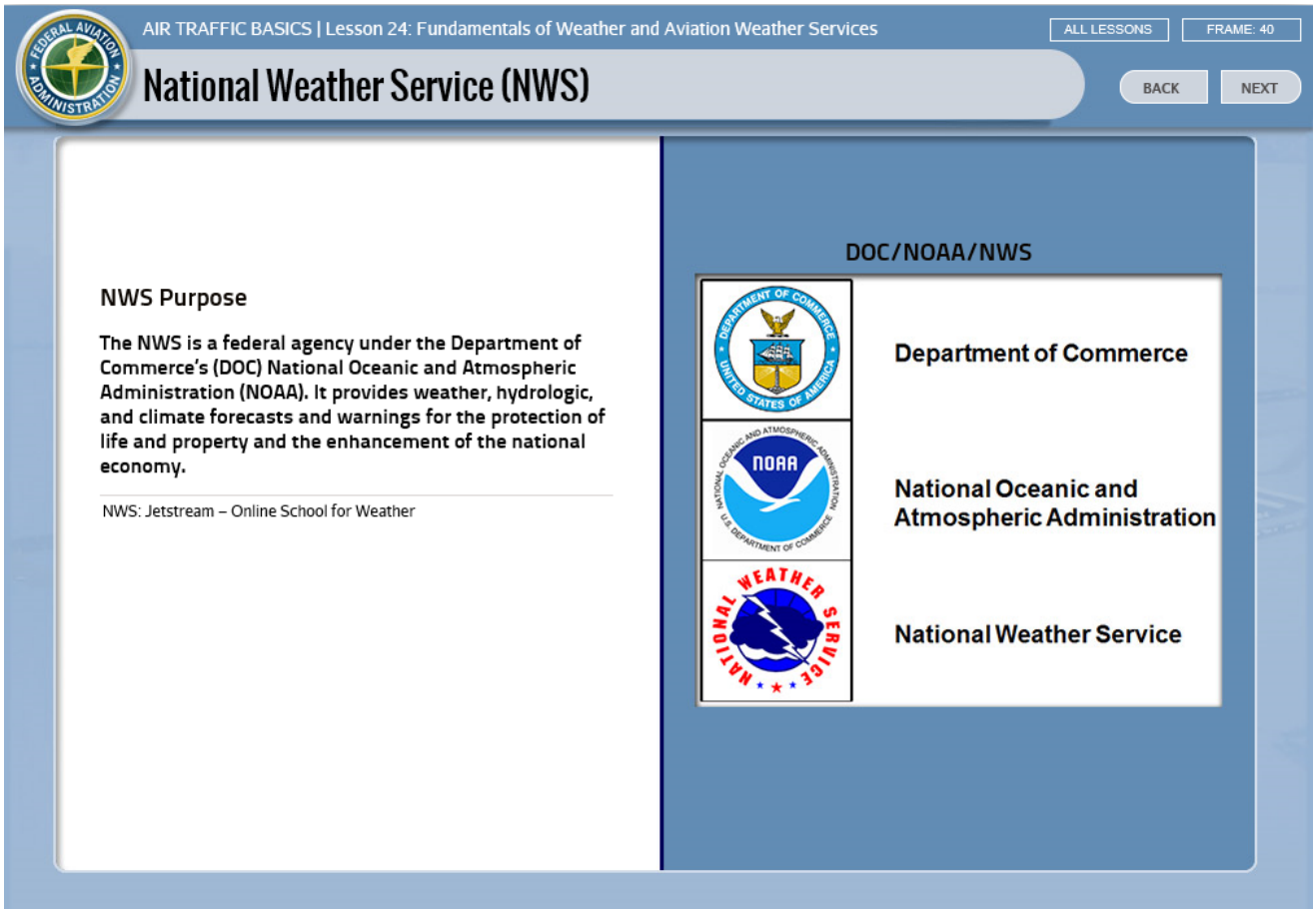
Precipitation
BACK
NEXT
Rain (RA)
Precipitation, either in the form of drops larger than 0.02 inch (0.5 mm), or smaller drops, which in contrast to drizzle, are widely separated
Rain occurs when there is a deep layer of above freezing air based at the surface.
Increasing Altitude
Deep Warm Layer
0°C
4°C
Temperature of the atmosphere


AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services
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FRAME: 40
National Weather Service (NWS)
BACK
NEXT
NWS Purpose
The NWS is a federal agency under the Department of Commerce's (DOC) National Oceanic and Atmospheric Administration (NOAA). It provides weather, hydrologic, and climate forecasts and warnings for the protection of life and property and the enhancement of the national economy.
NWS: Jetstream – Online School for Weather
DOC/NOAA/NWS
Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service

AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services

ALL LESSONS FRAME: 41

National Weather Service (NWS)

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Meteorological Watch Office (MWO)

United States NWS offices

- Meteorological Watch offices
  - Aviation Weather Center (SFO, SLC, CHI, BOS, DFW, MIA)
  - Alaska Aviation Weather Unit
  - Weather Forecast Office Honolulu
- Weather Forecast offices
  - There are 122 across the U.S.

These NWS offices issue several aviation weather products

- AIRMETS
- SIGMETS
- CONVECTIVE SIGMETS
- TAFs

NOTE: These products will be covered in detail in later lessons

AMS Glossary of Meteorology; AC 00-45, section 1

AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services

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National Weather Service (NWS)

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Center Weather Service Unit (CWSU)

Center Weather Service Units (CWSUs) are NWS offices located in every Air Route Traffic Control Center (ARTCC), providing meteorological consultation, forecasts, and advice to ARTCCs and other FAA facilities regarding weather impact on their:

- **Missions**
- **Equipment outages and repairs**
- **Staffing**

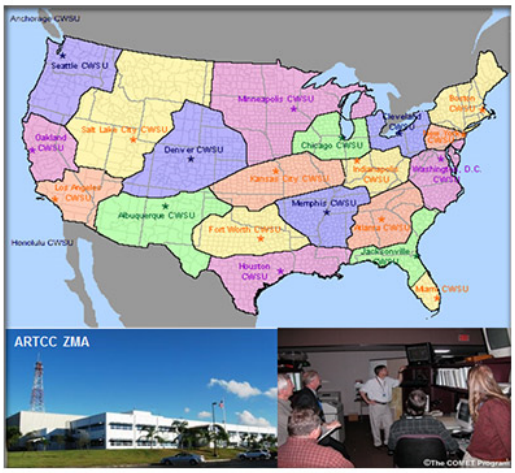
The Center Weather Coordinator (CWC) is staffed by controllers and is the designated interface between CWSU meteorologists and:

- **ARTCC controllers**
- **FAA facilities within the ARTCC area of responsibility**

CWSUs issue:

- **Center Weather Advisories (CWAs)**
- **Meteorological Impact Statements (MISs)**

NOTE: CWA and MIS will be covered later.



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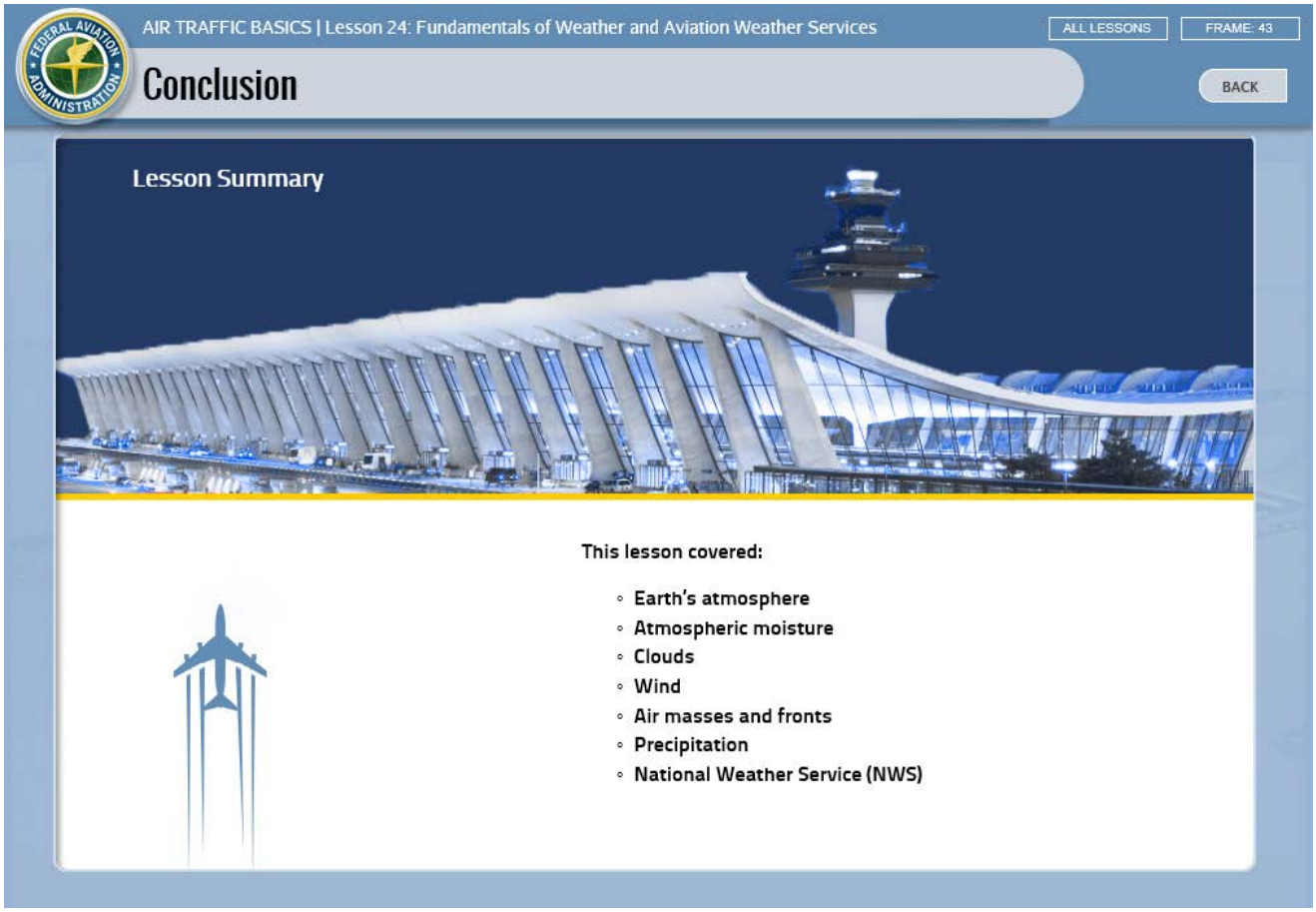
AIR TRAFFIC BASICS | Lesson 24: Fundamentals of Weather and Aviation Weather Services
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Conclusion
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Lesson Summary
This lesson covered:
Earth's atmosphere
Atmospheric moisture
Clouds
Wind
Air masses and fronts
Precipitation
National Weather Service (NWS)