



## CIVIL AIR PATROL

United States Air Force Auxiliary  
Maxwell Air Force Base, Alabama

Aerospace Dimensions

AIR  
ENVIRONMENT

MODULE 3

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# Chapter 1 - Air Circulation

After completing of this chapter, you should be able to:

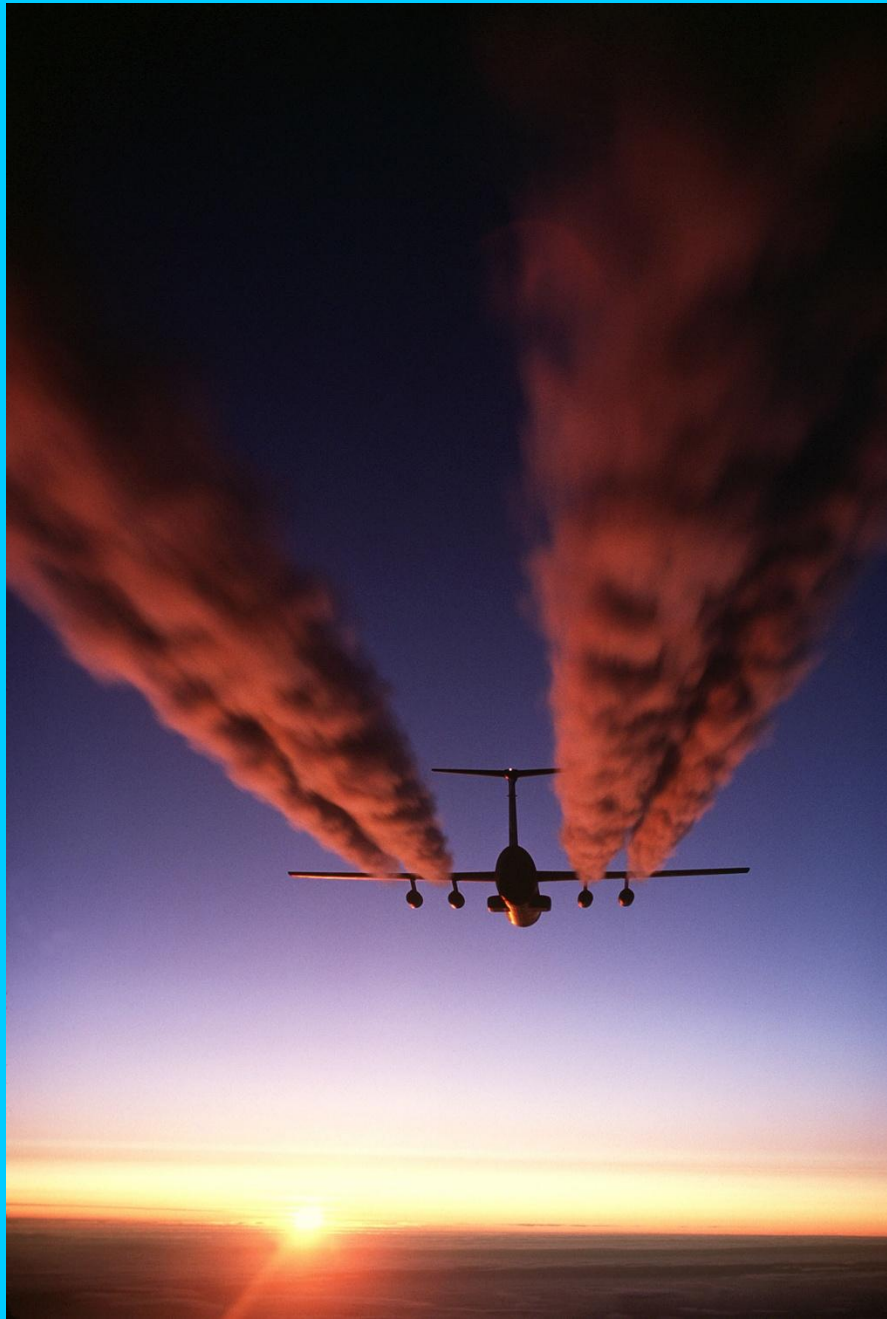
- Describe how the Sun heats the Earth.
- Describe the Earth's rotation and revolution, and its effect on the Earth's seasons.
- Explain the various theories of circulation.
- Describe Coriolis Force.
- Define the jet stream.and the control surfaces that create that motion.

## Important Terms - Air Circulation

- **autumnal (fall) equinox** - when the sun's direct rays strike the equator resulting in day and night of equal length, usually on September 22nd or 23rd.
- **coriolis force** - deflects a freely moving object to the right in the Northern Hemisphere.
- **jet stream** - a strong wind that develops at 30,000 - 35,000 feet and moves as a winding road across the United States, generally from west to the east.
- **radiation** - the method by which the sun heats the Earth.
- **revolution** - the movement of the Earth revolving around the sun; it takes 365 days.

## Important Terms - Air Circulation

- **rotation** - the Earth rotates on its axis at an angle of 23.5 degrees while it revolves around the sun.
- **summer solstice** - when the sun is at its northernmost point from the equator in the Northern Hemisphere, the day is the longest, usually on June 21st or 22nd.
- **vernal (spring) equinox** - when the sun's direct rays strike the equator resulting in a day and night of equal length, usually on March 21st or 22nd.
- **Winter solstice** - when the sun is the farthest south of the equator and the Northern Hemisphere, the day is the shortest, usually on December 21st or 22nd.



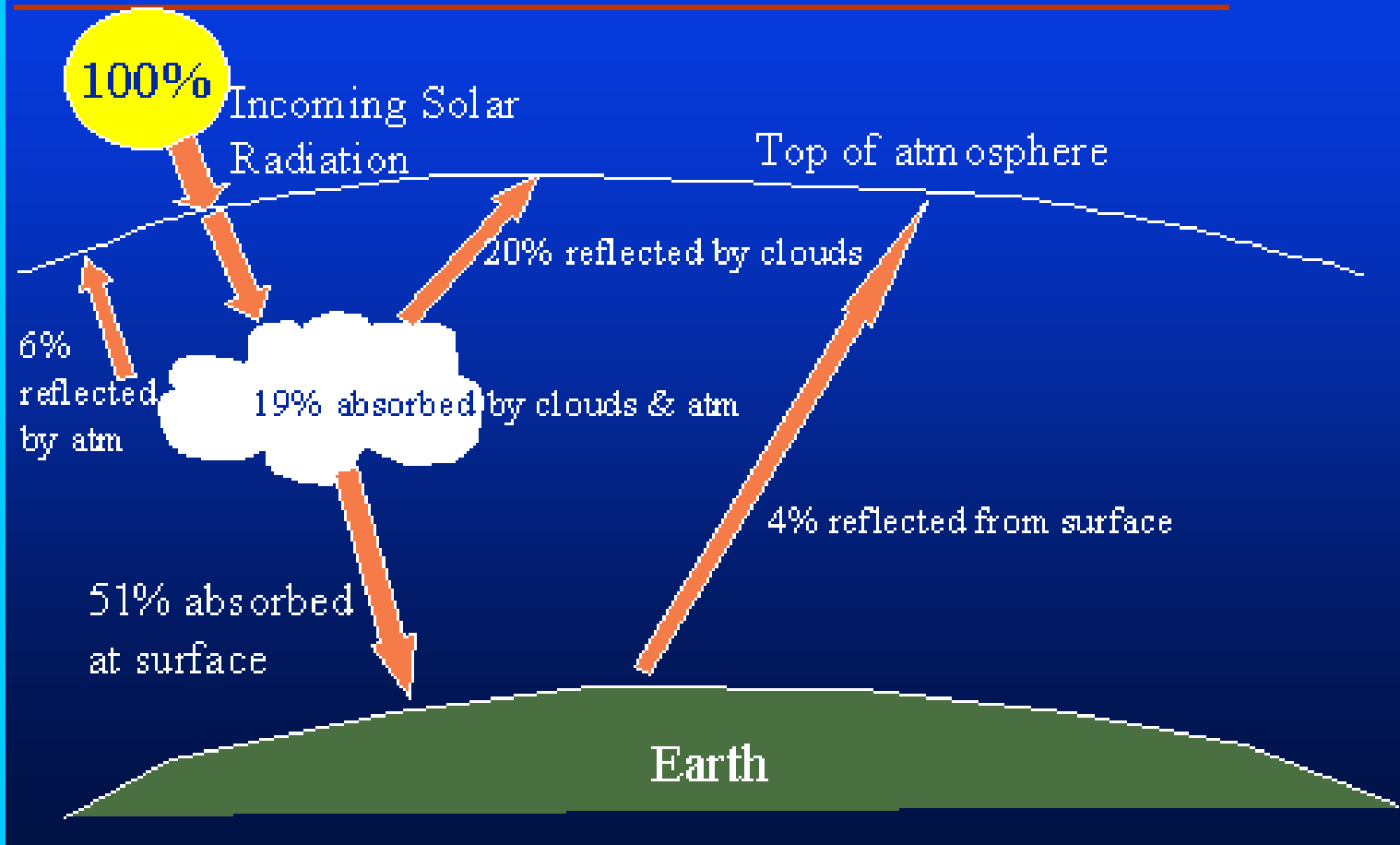




# SOLAR HEATING

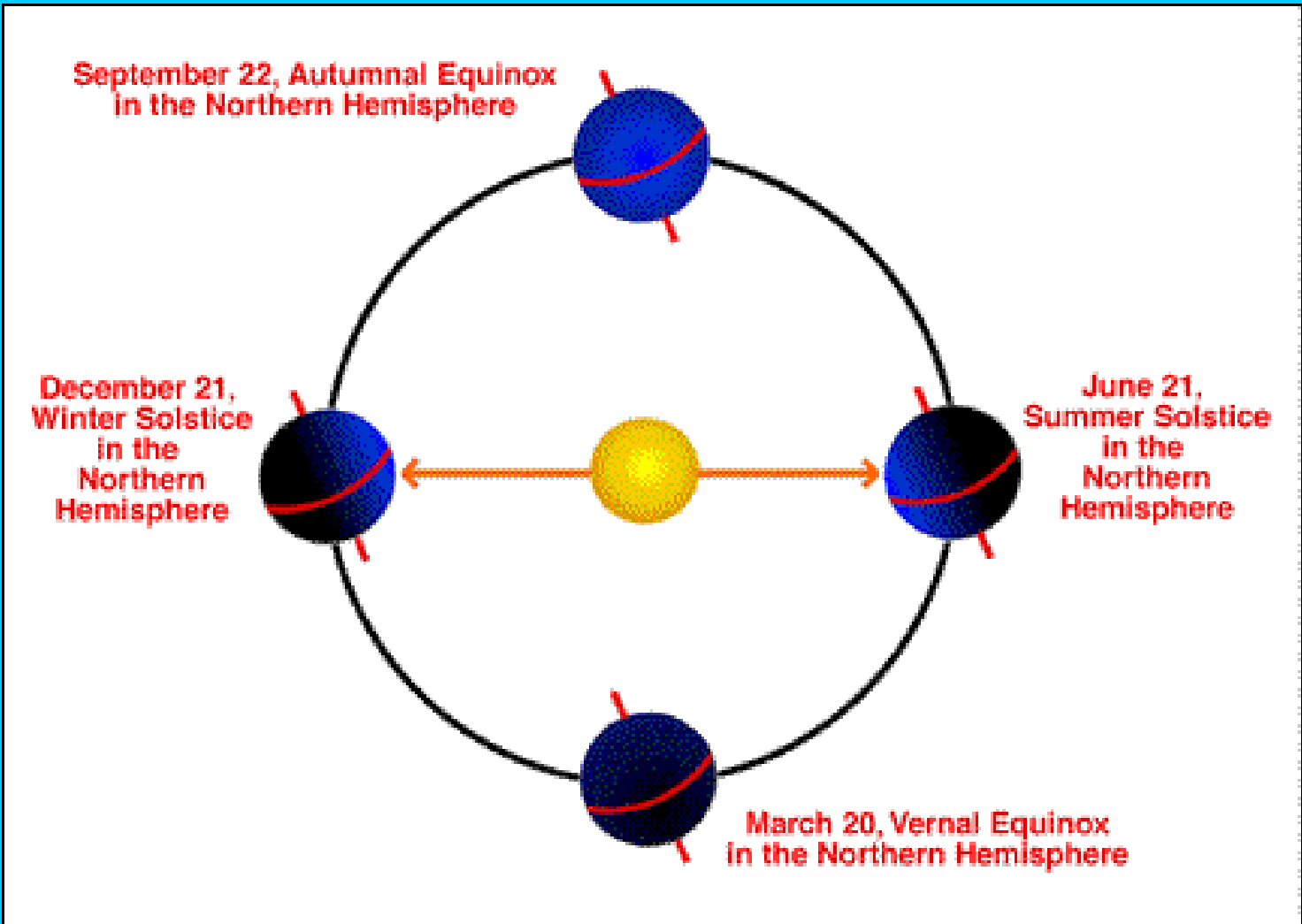
- The sun heats the Earth unevenly
- Some parts are hotter than others
- Unequal heating causes temperature and pressure differences
- These differences create movement of air
- Cooler temperatures means air of higher pressure
- Air of higher pressures flow to air of lower pressure

# Earth's Energy Balance



# ROTATION AND REVOLUTION

- The Earth revolves around the sun in 365 days.
- The Earth is rotating on its axis at an angle of 23.5 degrees.
- The Earth's rotation effects the length of day
- In the Northern Hemisphere, the Earth rotates in a counterclockwise direction



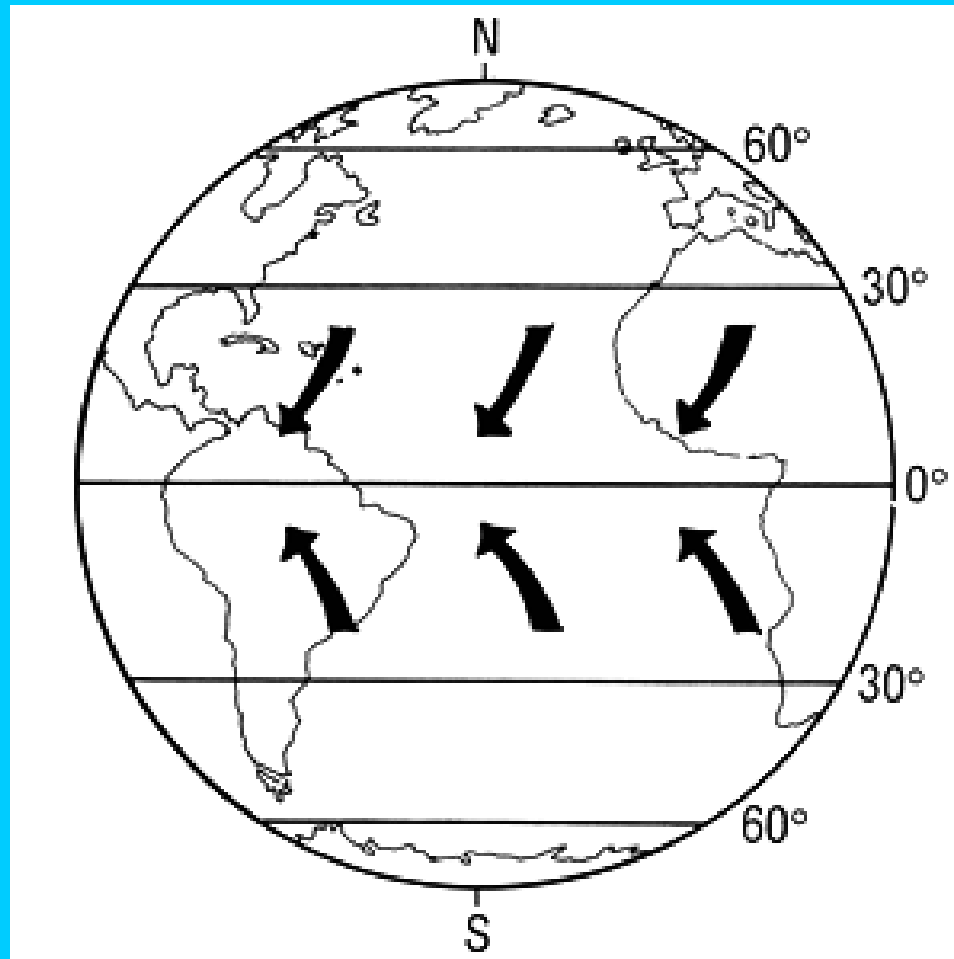
# CIRCULATION

- Refers to the global movement of air.
- Warm air rises from the Equator as it moves towards the poles.
- Cold air sinks at the poles as it moves towards the Equator

# World Ocean



# GLOBAL CIRCULATION



# Chapter 2 - Weather Elements

After completing of this chapter, you should be able to:

- Define wind.
- Describe the Beaufort Scale.
- Define heat.
- Explain what temperature is and how it can be expressed.
- Describe what wind chill is and what it does.
- Describe how a microburst can affect a plane.

## Important Terms - Weather Elements

- **atmospheric pressure** - the weight of all the atmosphere's gases and the molecules on the Earth's surface
- **Beaufort Scale** - a scale for estimating wind speed, on land or sea
- **heat** - the total energy of all molecules within a substance.
- **temperature** - a measure of molecular motion expressed on a man-made scale.
- **wind** - a body of air in motion.

# Admiral Sir Francis Beaufort, K.C.B.

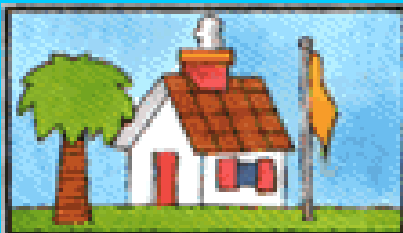
The Beaufort Scale has been around since 1805. It is not a scale for wind speed but a measure of force. The original scale was intended for ships at sea but was “modified” for modern meteorological uses



Admiral Beaufort

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# A Tool You Can Use!



1 1-3 mph



2 4-7 mph



3 8-12 mph



4 13-18 mph



5 19-24 mph



6 25-31 mph



7 32-38 mph



8 39-46 mph



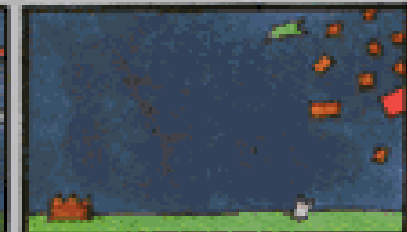
9 47-54 mph



10 55-63 mph



11 64-72 mph



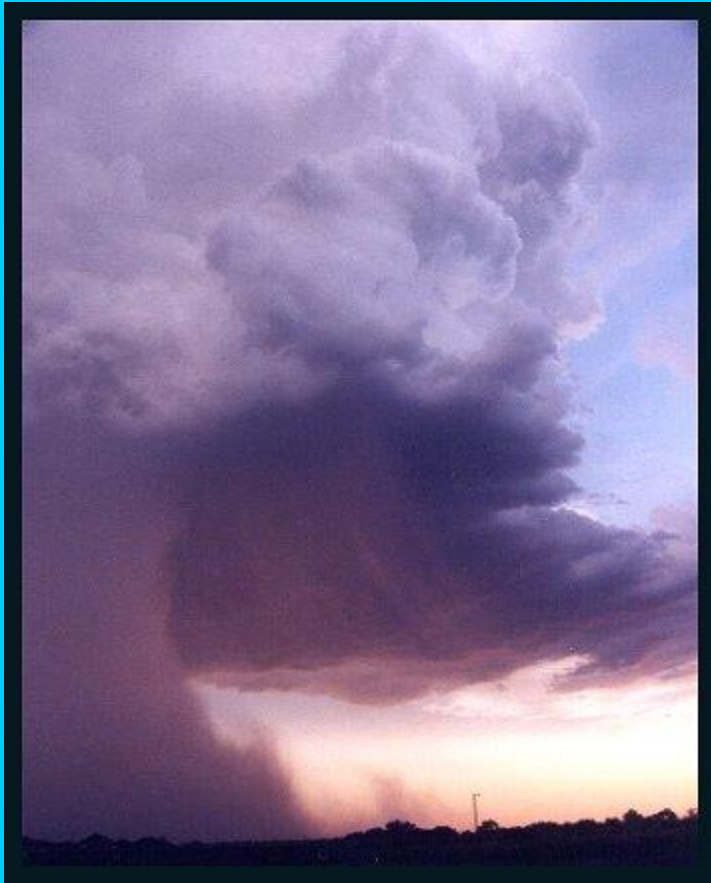
12 73+ mph

# A Tool You Can Use!

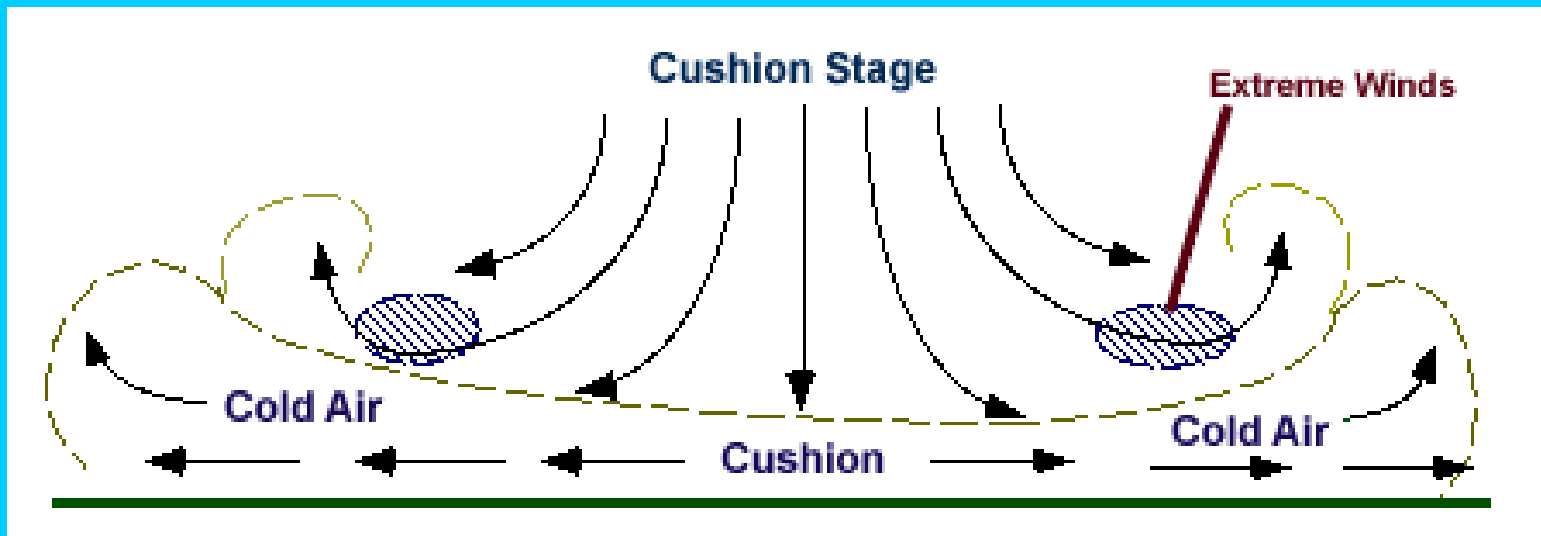
		AIR TEMPERATURE (° FAHRENHEIT)														
		35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35
WIND SPEED (MPH)	4	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35
	5	32	27	22	16	11	6	0	-5	-10	-15	-21	-26	-31	-36	-42
	10	22	16	10	3	-3	-9	-15	-22	-27	-34	-40	-46	-52	-58	-64
	15	16	9	2	-5	-11	-18	-25	-31	-38	-45	-51	-58	-65	-72	-78
	20	12	4	-3	-10	-17	-24	-31	-39	-46	-53	-60	-67	-74	-81	-88
	25	8	1	-7	-15	-22	-29	-36	-44	-51	-59	-66	-74	-81	-88	-96
	30	6	-2	-10	-18	-25	-33	-41	-49	-56	-64	-71	-79	-86	-93	-101
	35	4	-4	-12	-20	-27	-35	-43	-52	-58	-67	-74	-82	-89	-97	-105
	40	3	-5	-13	-21	-29	-37	-45	-53	-60	-69	-76	-84	-92	-100	-107
45	2	-6	-14	-22	-30	-38	-46	-54	-62	-70	-78	-85	-93	-102	-109	

Cold
  Very cold
  Bitter cold
  Extreme cold

# MICROBURSTS



A microburst is a dangerous phenomenon for aircraft. The sudden updraft and downdraft will adversely affect the lift of the plane and could cause a pilot to over-correct for these changes.



**Wet microburst**

Dry air enters thunderstorm.

Rain evaporates, cooling the dry air.

Cooled, heavier air plunges down.

Heavy rain often hides the microburst.

The diagram shows a cross-section of a wet microburst. At the top, a grey arrow points right, labeled 'Dry air enters thunderstorm.' Below this, a layer of pinkish clouds is shown with rain falling through it. Text says 'Rain evaporates, cooling the dry air.' Below the clouds, blue arrows point downwards, labeled 'Cooled, heavier air plunges down.' At the bottom, a brown ground surface is shown with heavy rain falling. Text at the bottom says 'Heavy rain often hides the microburst.'

**Dry microburst**

Air below a shower or thunderstorm is very dry.

Rain evaporates into dry air, cooling it.

Cooled, heavier air plunges down.

The only sign might be dust kicked up by the wind.

The diagram shows a cross-section of a dry microburst. At the top, a grey arrow points right, labeled 'Air below a shower or thunderstorm is very dry.' Below this, a layer of pinkish clouds is shown with rain falling through it. Text says 'Rain evaporates into dry air, cooling it.' Below the clouds, blue arrows point downwards, labeled 'Cooled, heavier air plunges down.' At the bottom, a brown ground surface is shown with dust being kicked up by the wind. Text at the bottom says 'The only sign might be dust kicked up by the wind.'

# Formula's for Conversion

## **Temperature Conversion Formulas**

$$\text{Fahrenheit } ^\circ\text{F} = 1.8^\circ\text{C} + 32$$

$$\text{Centigrade } ^\circ\text{C} = (^\circ\text{F} - 32) / 1.8$$

# Pressure Measurement Devices

