The Meteorological Mystery of the Crushed Tanker



Under Pressure to Explain the Cause of the Crushed Tanker





The Atmosphere in Motion Atmospheric Pressure and Winds

Atmospheric Pressure in the Vertical



Air pressure is the weight of a column of air over a given location.

Measuring Air Pressure

Atmospheric Pressure is typically measured in millibars or inches of mercury.

Important Values:

-1013.2mb (standard sea level pressure)

-29.92 in of Hg (standard sea level pressure)







Altitude adjustments of air pressure



Why does air pressure change?

Air pressure changes because of

* altitude

* heating or cooling of the surface (what is the relationship?)

* changes in humidity (What is the relationship?)



HUMID AIR is lighter than dry air because water molecules (H_2O) are less massive than oxygen (O_2) and nitrogen (N_2) molecules. (This illustration exaggerates the amount of water in humid air.)

Pressure-Temp.- Volume Relationships



Boyles Law



Charles Law



Adiabatic Temperature Change



Why Does the Wind Blow?

- a. Temperature differencesb. Pressure differences
- c. Moisture differences
- d. All of the above

Why does the wind blow?

Wind is the result of horizontal differences in air pressure.



These pressure differences are a result of the differential heating of the Earth

Measuring the Wind

Wind speed is measured using an *anemometer*

- units are in knots

Wind direction is measured using wind vanes and is described as the direction it is coming from

(ex: a *northwest wind* is coming from the northwest blowing towards the southeast)



Planetary Circulations: Factors Influencing the Wind

Infrared Image

1715Z 25 MAR 2013



NCEPINWSINOAA

Three variables influence the circulation of air around the planet: the Pressure gradient force, the coriolis effect, and friction.

The Pressure Gradient Force



The **pressure gradient force** is the force which results when there is a difference in pressure across a surface.

The Pressure Gradient Force and Wind Speeds



Friction and Winds



Friction and Winds



Upper level winds flow parallel to the isobars. These are called *Geostrophic Winds*.

How does Earth's rotation influence planetary winds?



The Coriolis Effect and the Earth's Rotation



The direction in which the wind blows is a result of the pressure differences but this is also influenced by the Earth's rotation.





B

Global Wind Systems



The Coriolis Effect

Latitude and the Coriolis Effect



Rate of Rotation and the Coriolis Effect Jupiter's Atmosphere





Microscale Wind Systems



Both Land and Sea Breezes are a result of the differential heating of the Earth's surface causing pressure differences resulting in the wind to blow

It is 3pm in the afternoon and a fire has broken out on this mountain side. You are a smoke jumper assigned to set the fire line to stop the progression of this fire. You will be dropped in by helicopter. At which location will you tell the pilot to drop you to set this fire line?

B

Microscale Wind Systems



(a) Valley breeze



(b) Mountain breeze

What is a *monsoon* and how do they occur?

Rising, heated air Heavy causes low precip. pressure along mountain front Moist onshore flow of air 500 Km







Regional Wind Systems: Santa Ana's



Santa Ana winds occur each fall in the western United States when strong, dry desert winds blow from the northeast, picking up speed as they lose altitude and are squeezed through narrow mountain passes and canyons on their way to the Pacific Ocean. The winds are powered by high pressure systems over the Great Basin, the vast expanse of desert that covers much of Nevada, Utah and southern Idaho.

Chinook Winds



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Very strong, potentially damaging winds downwind of the Rockies are called Chinook winds. As moist, cool air descends off the mountains, it rapidly warms and loses moisture as the air is compressed. As the air accelerates away from the mountains and into the Plains it can get extremely windy, with gusts in excess of 100 mph on occasion.

Current Surface

Locating Pressure Systems

LT RAIN/DRIZZLE MOD/HVY RAIN FRZ RAIN/SLEET LT SNOW/FLUR MOD/HVY SNOW



FOG

09 Feb 2001 18:45 GMT / 09 Feb 2001 01:45 PM EST

weathercom

Pressure Systems



At the surface, winds tend to flow counterclockwise and inward towards a center of low pressure.

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Department of Atmospheric Sciences University of Illinois at Urbana-Champaign

Isobars

1004 mb

000 mb

996 mb

Upper Level Pressure/Wind Systems









Atmospheric-Oceanic Interactions and Planetary Circulations





Fig.6 Normally, the trade winds and strong equatorial currents flow toward the west. At the same time, an intense Peruvian current causes up welling of cold water along the west coast of South America.



Fig.14 Upon the advent of an ENSO event, the pressure over the eastern and western Pacific flip-flops. This causes the trade winds to diminish, leading to an eastward movement of warm water along the equator. As a result, the surface waters of the central and eastern Pacific warm, with far-reaching consequences to weather patterns.

El Nino and it's Effects on North American Weather



El Niño



Figure 5. Typical Sea Surface Temperatures During La Niña Conditions

La Nina events typically are opposite of El Nino events.

La Nina and it's Effects on North American Weather



La Niña

La Nina and it's Effects on Missouri Weather



With more intrusions of cold air plowing into warm, wet air under an active storm pattern, La Niña can create more frequent occurrences of severe weather and tornado days. Shown below are the total days between February and April during which at least one tornado occurs.



This Concludes The Atmosphere in Motion