Local winds are best defined as

1. Intro & General Winds This module, which describes general and local winds, is part of the S-290 Intermediate Wildland Fire Behavior course. The module is divided into five sections. Each section can be accessed from the tabs above or from the Quick Start option on the home page. Section 1 provides an introduction and description of the general winds. Local daytime winds are described in Section 2. Section 3 shows the critical winds of the fire weather and their effects on fire behaviour. Land influences on wind and guidelines for estimating wind speeds by land and fuels are described in Section 4. Section 5 offers a series of review exercises that allow you to apply your knowledge and also provides a summary of the overall content. After completing this module, you will be able to: Describe the effects of the wind on the behavior of wildland fire. Describe the general winds around high pressure and low pressure systems. Describe the cause and effect of local winds (slope/valley wind and land wind/sea breeze) on the fiery behaviour of wild terrain. Describe typical daytime slopes and wind patterns in the valley and identify time patterns on a topographic map. Describe critical winds and their impact on wild fire behavior. Identify three ways in which topography can change wind direction and speed. Describe the general, local and 20-foot winds from the middle of the flame, as well as their relationship with each other. Adjust wind speeds according to topographic location and calculate average flame wind speeds for the three main fuel types. Wind is the critical factor of the weather that affects the behavior of the fire. It is the most difficult to predict, varying significantly both in time and in space. This variability, especially in complex terrain, can pose safety and fire control problems, leading to fire deaths. When fires become large, it is often due to an unusual or unforeseen wind situation. Wind is the horizontal movement of the air relative to the Earth's surface. This movement of air results from small and large temperature differences, as well as from the rotation of the Earth. The direction of the wind is defined as the direction from which the wind blows. It is usually described using an 8-point compass (N, NE, E, SE, S, S, W, NW) Remember that winds are named depending on the direction from which it blows. If you're facing in the wind, name the wind from that direction. Question 1 North Wind refers to which of the following? Select the best answer. A. A wind blowing north b. A wind blowing south c. A wind originating in Polar Feedback The correct answer is b. Question 2 What are western winds? Select the best answer. A. Winds blow from west to east b. Winds blow from east to west c. Trade winds Feedback The correct answer is a. Click to view the animation in a new window Air movement, or wind, takes place on a range of scales, from large-scale systems influenced by heat transfer from equator at poles, at small eddies or swirls that appear around obstacles or barriers. Click to view the animation in a new window The air is a fluid, similar to the water flowing in a stream. Just as the water in a stream will spill over obstacles and barriers, would be the rocks, the moving air will spill over the barriers and around them, would be a mountain. Therefore, the terrain can greatly influence the winds in a location. Wind affects wildfire in several ways: Wind can take away moisture-laden air, accelerating drying of wildland fuels. Once a fire ignites, the wind helps to burn by increasing the supply of oxygen. The wind increases the spread of fire by transporting heat and burning new fuels through a process called spotting. As the fire burns, the wind bends the flames closer to unburned fuels, preheating the fuel ahead of the fire front. Wind influences the direction of fire propagation and the transport of smoke. The wind affects the time of residence of the fire front. The stronger the wind, the shorter the stay time in a particular location. Because of the curvature of the Earth, the tropics receive more heat than the poles. Weather systems mix warmer tropical air with cooler polar air in an attempt to maintain a global energy balance. Click to view the animation in a new window This heat transfer from the tropics to the poles sets pressure highs and minimums, leading to large-scale winds. Remember that the weight of the atmosphere on an area, called pressure, varies both over time and depending on the location as the air masses move across the continent. These pressure differences can be illustrated in the same way that land differences are shown on a topographic map. On the topographic map, the outline lines mark areas with ridges and display valleys with equal elevation. On a pressure map, constant pressure lines, called isobars, delineate pressure ridges and troughs in the atmosphere and provide a way of observing pressure changes, called pressure gradient, on an area. Similarly, the tighter contours on a topographic map indicate steeper terrain, tighter lines of constant pressure indicate a stronger pressure gradient. The closer the isobars, the stronger the pressure gradient and the faster the resulting winds. The further away the isobars, the weaker the pressure gradient, and the weaker the resulting winds. Large or general winds are also affected by the Earth's rotation. The earth rotates from west to east. The effect of this rotation, called the Coriolis force, makes us the horizontal movement of large-scale air diverted to the right in the northern hemisphere and to the left in the southern hemisphere. Click to view the animation in a new window. The combination of the Coriolis force with the pressure gradients resulting from the transfer of heat to the pole leads to prevailing winds in different latitudes of each hemisphere. These prevailing winds are: are: commercial winds between the equator and 30° latitude, westerly winds between about 30° and 60° latitude, and polar easterbetween about 60° latitude and pole. Question 1 Which of the following general winds affects a large part of the North American land surface? Select the best answer. A. South-east commercial winds b. Northeast commercial winds c. Westerlies d. Easterlies Feedback The correct answer is c. The prevailing general winds over most of North America are westerlies, blowing from west to east, between about 30° and 60° latitude. In the heralds are powerful air currents called jet streams. These air currents can be hundreds of miles wide, thousands of meters deep and can extend into hemispheres. Jet stream winds are indicated by blue and green shading on this land of upper atmosphere winds. Jet streams are usually located at altitudes between 30,000 and 40,000 meters. Wind speed in the jet stream can exceed 180 mph. Due to the effectiveness of the jet stream to steering storms, it is also referred to as the storm track. The location and power of jet streams vary by season and day to day in a season. In winter, the north and center of the U.S. are affected by the polar jet. This polar jet tends to move north over the southern and central portions of Canada in summer. The southern United States (around 30° latitude) may be affected by a subtropical stream of water in winter and spring. During these months, it is not uncommon to see both a polar jet stream near the U.S.-Canada border and a subtropical jet stream over the southern US. Large-scale waves are common in the overall wind flow. The flow flows around low and high pressure areas, making wave-like patterns around the globe. Meteorologists often refer to a low pressure area as a trough, and a high-pressure area as a ridge. A gutter is an elongated area of relatively low pressure. When viewed from above as a weather map, the direction of winds around a trough is cyclonic or counterclockwise in the northern hemisphere. (In the southern hemisphere, the flow around a trough will be clockwise.) A ridge is a relatively high pressure zone. The direction of winds around a ridge is anticyclonic or clockwise in the northern hemisphere (counterclockwise in the southern hemisphere). Due to the effects of friction on the Earth's surface, air is diverted from high pressure areas to low pressure zones. On the surface, the air in a high-pressure cell differs from the centre, moving clockwise (for the northern hemisphere) towards the low hemisphere. The air in a low-pressure cell converges in the center of the low level, counterclockwise in the northern hemisphere. Remember that the directions on which air flows around the maximums and lows will be reversed in the southern hemisphere. The air in high and low pressure areas is constantly in vertical motion. Air in high-pressure cell sinks. On the surface, this sinking air deviates from the center of the high pressure to the center of a low-pressure cell. In the center of the low-pressure cell, the air rises. When it reaches the top of the low pressure area, it will swerve and move towards the top of the high pressure cell. Click to view the animation in a new window. Based on the ideal gas law presented in Unit 6, the air that sinks at high pressure will compress and heat up. The air rising in low pressure expands and cools. The rule on the right is useful to remember the vertical and horizontal movement in maximums and minimums. Looking at the right hand: the wavy fingers and thumb up represent the counterclockwise flow and the movement of the air upwards at a low level. The wavy fingers and the thumb down represent the movement of air down into a high pressure cell. In the southern hemisphere, the same process can be applied, in this case looking at the left hand. The same vertical movements associated with maximums and minimums can be observed in a smoke and gas failure associated with a fire. Smoke feathers act as a low pressure cell on a small scale, with the entry air converging in the center and growing upwards from the surface. On either side of the feathers are areas of low-scale high pressure, where the air sinking differs towards fire. Click to view the animation in a new window. Water vapor images illustrate the movement of air around high and low pressure systems over North America. The colors orange, red and gray indicate the smallest amounts of water vapour, while white, blue and green indicate larger quantities. Clockwise and counterclockwise movement can be observed in the global flow. Looking at this image of water vapor taken from the satellite, can you identify any high and low pressure areas? Question 1 A high-pressure region is located _____. Select the best answer. A. Over Central U.S. B. Off the east coast of the United States off the Pacific coast of Northwest & Canada d. I don't see any region high pressure feedback The correct answer is b, off the east coast of the U.S. Clockwise circulation indicates a high-pressure region, in this case moving northeast. In this example we see larger amounts of water vapour moving north ward from the warm waters of the Gulf Stream. Winds around a high flow clockwise and outwards from the high pressure zone. High pressure signals down vertical motion, usually meaning sunny skies. Question 2 A region of low pressure is located _____. the best answer. A. Off the Pacific Coast of Northwest & Canada b. Over the northern plains the states c. Over Texas panhandle d. I don't see any region low pressure feedback the correct answer is one. Counterclockwise traffic off the coast of the Pacific Northwest and British Columbia indicates an area of low pressure moving southeast. Winds flow counterclockwise around low low pressure in the northern hemisphere. Close to the surface, the air converges in areas of low pressure, which leads to vertical lifting and the formation of clouds and possibly precipitation. Precipitation.