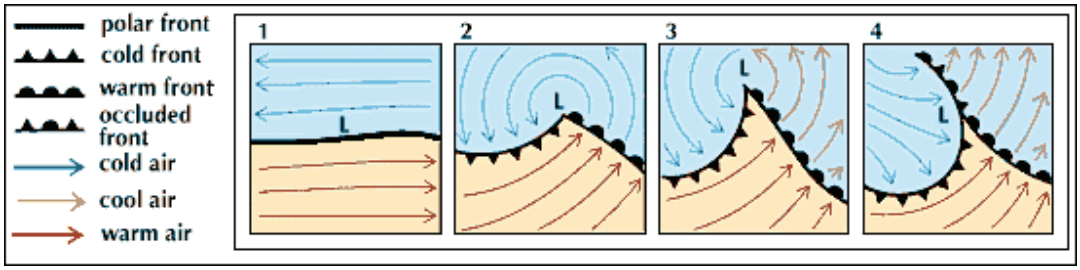
This arrangement of the Earth's wind and pressure belts varies somewhat with the time of the year. They shift northward during the Northern Hemisphere summer and southward during the Southern Hemisphere summer. Both the continuity of the pressure belts and the prevailing directions of the winds are also modified greatly by the differing rates at which the Earth's land and water surfaces exchange heat and moisture with the atmosphere.

Air Masses and Weather Fronts



Air that has acquired a fairly uniform temperature and humidity over a large area of the Earth's surface is called an air mass. Air masses are of four main types arctic (A) or antarctic (AA), polar (P), tropical (T), and equatorial (E). They are of either maritime (m) or continental (c) origin. In general, a maritime air mass is relatively moist and has a moderate temperature. A continental air mass is relatively dry and has either a very hot or very cold temperature.

Every winter, immense, cold continental polar (cP) or continental arctic (cA) air masses accumulate over northern Canada and Siberia. Temperatures may sink as low as -80º F (-62ºC). Cold waves occur when a cA air mass sweeps southward in the wake of winter storms. Milder maritime polar (mP) air masses accumulate over the North Pacific and North Atlantic oceans. Maritime tropical (mT) air masses move into the United States from over the Gulf of Mexico, the Caribbean Sea, and the tropical Atlantic Ocean. Maritime tropical air, because of its great moisture-holding capacity, produces heavy rains.

Weather fronts are sharp transition zones between different air masses. A cold front, which is the leading edge of a cold air mass, brings a quick drop in temperature and a rapid rise in pressure. It is often accompanied by thunderstorms in summer and snow flurries in winter. An advancing warm air mass tends to override the rear portion of the cold air mass ahead of it. The trailing edge of a retreating cold air mass along the ground is known as a warm front. Thickening and lowering cloud layers follow, usually with widespread, long-lasting precipitation.

A stationary front occurs when the boundary between a cold and a warm air mass does not move appreciably in any direction. Cloudiness and precipitation may then persist for many days on the cold side of the stationary front. An occluded front results when a cold front overtakes a warm front on the ground, lifting the warm air entirely aloft.

Weather fronts are formed as part of eastward-moving low-pressure centers known as wave cyclones or frontal cyclones. Wave cyclones form in the westerly wind belts along the polar fronts that separate polar and tropical air. A wave cyclone develops when a low-pressure area in the upper airflow approaches a stationary front on the ground. This lowers the pressure on the polar front, which then bends to form the typical horizontal wave consisting of a cold front following a warm front. The cold front swings around the equatorial side of the low as it overtakes the slower-moving warm front. As a cold front passes through an area in the Northern Hemisphere the wind generally shifts from the south and southwest to the northwest, in the Southern Hemisphere from the north and northwest to the southwest.

The stormy weather associated with a wave cyclone may affect an area of more than a million square miles. It usually reaches maximum intensity within two days. Storms in North America and Eurasia are usually steered by the upper airflow northeastward, respectively, into the Icelandic or Aleutian lows, semipermanent features of the low-pressure belt in the high latitudes of the Northern Hemisphere. The entire area of circulation is called a cyclone. In the Northern Hemisphere the circulation is counter-clockwise; in the Southern Hemisphere, clockwise.

Wave cyclones usually occur together. As a cyclone matures and moves on, a new one may form along the trailing cold front. When this occurs near an abundant supply of heat and moisture such as along the Atlantic coast of the United States, the secondary cyclone may exceed the primary one in suddenness, wind velocity, and amount of precipitation.

The Pacific Ocean, the Gulf of Mexico, and the Atlantic Ocean are the main sources of moisture for cyclones in the United States. Lows that enter the United States from these bodies of water, or that form over the western interior, may produce strong winds and heavy precipitation. Such storms occurring with a strong winter high may result in a blizzard, with bitterly cold temperatures and driving snow.

The anticyclone is the reverse of a cyclone. It is known as a high (high-pressure center). Highs are usually associated with dry, cool weather. The winds spiral outward around a high in a clockwise direction in the Northern Hemisphere and counterclockwise in the Southern Hemisphere. Highs usually originate in high latitudes and take a southeast course in the Northern Hemisphere. Extreme winter cold usually occurs in areas of high pressure, most notably in the semipermanent Siberian High. In North America, highs have carried subfreezing air as far south as the Gulf of Mexico and into Florida.

In summer the slow-moving oceanic anticyclones may influence inland areas in the central and eastern United States, producing cloudless skies, heat waves, and sometimes drought. In autumn, stagnating continental anticyclones may bring spells of summerlike weather (Indian summer). The light winds may lead to an accumulation of pollutants.