LOCAL TEMPERATURES

Special environments may have significant differences in both temperature and other climatic elements over short distances. Some of the best known of these special environments are cities versus their surrounding rural areas, the sunny side of mountains versus the shady sides, valleys and canyons versus uplands, clearings versus the deep forest, coastlines versus places farther inland, and ground level versus the standard instrument height.

These temperature differences are not always present. Their magnitude and importance will vary from place to place and from time to time. Nevertheless, they can have considerable local importance—especially for campers and others who spend the bulk of their time exposed to the weather.

THE URBAN HEAT ISLAND: The central district of moderate to large cities will often display a distinct urban heat island effect. Under windless and rainless conditions (or near), the city center will be many degrees warmer than the outlying suburbs or the rural countryside. This is especially noticeable at night and in the winter. Precipitation of any kind diminishes this effect, and a strong wind will eliminate it completely.

This phenomenon is most evident in older cities that are heavily built-up, cities with few parks or lakes, and cities with few trees. Many newer cities do not meet these criteria, and the heat-island effect is less noticeable there than in places with older, denser settlements. Nevertheless, it is sometimes present.

In addition to the heat-island effect, cities world-wide tend to be cloudier, less sunny, much foggier, and rainier (both in amount and frequency). On the plus side, they are less windy, less humid, and homes cost less to heat in the cooler months.

THE OTHER SIDE OF THE MOUNTAIN: At any given time on any given day, the different slopes of a mountain may have different temperatures. This is entirely apart from the temperature differences brought upon by differences in elevation.

The sun changes both its compass direction and its angle above the horizon as the day progresses. In the summer months, it rises north of east, moves around the

horizon, will be due south at local noon, and sets north of west. During the winter months, it rises south of east, is still due south at local noon, and sets south of west.

This means that east-facing slopes will get the most direct rays of the sun at sunrise, when they are still cool (or cold) from the night's chill. If there is any dew or frost, the sun's energy will go to evaporating that before it gets around to raising the temperature of the ground and the air above it. Conversely, the west-facing slopes are already warmed when they get the most direct rays of the sun near sunset. All of the sun's energy can go to raising their temperatures even farther. These, and other factors, make west-facing slopes warmer then east-facing ones.

Similarly, south-facing slopes get the sun throughout the day, whereas north-facing ones may get direct sunlight only at sunrise and sunset, plus (depending upon the slope angle) during the middle of the day when the sun is high in the sky. A north slope would have to be extremely steep not to get the sun at all during midday.

The combination of these two factors makes southwestern-facing slopes the warmer, and northeast-facing slopes the cooler, as a general rule. There are exceptions, of course. In canyon country, where the canyon walls are very steep and occasionally overhanging, local twists and turns can create some unique situations. By and large, however, the generalization holds.

TEMPERATURE INVERSIONS: Despite the fact that temperatures generally drop as you go up the mountainside, campers have learned from experience that valley bottoms can be colder at night than campsites part way up the slope. This is because cold air is heavier than warm air. At night, the high slopes cool quickly, cooling the air in contact with them. This cold air flows down the slopes under the pull of gravity much like water does. Like water, it collects in the stream and river bottoms and continues to flow downstream. If the land levels off in a lake or flat meadow, the cold air may pool there.

This pooling of cold air in the valley bottoms is most noticeable on clear nights. It can easily be 20° to 30° cooler than the air part way up the slopes. This phenomenon is called a temperature inversion because it is just the opposite of the normal change in temperature with elevation. This pooling of cold air often creates valley fog. It is a common sight, in clear and windless weather, to see the valleys or

canyons full of morning fog while the uplands and peaks are clear and sunny.

Another good sign of a temperature inversion is when smoke from campfires or chimneys rises poorly and tends to spread out before getting very high. Temperature inversions tend to dissipate quickly once the sun comes up, and almost always disappear by noon.

CLEARINGS VERSUS THE DEEP FOREST: Other things being equal, temperatures will be more moderate in the deep forest than in clearings. That is, they will be a bit warmer at night and a bit cooler during the day. They may also be a bit warmer in the winter and a bit cooler in the summer, but this is less likely.

In the woods, sunshine gets diffused over a larger volume of space during the daylight hours, leading the temperatures to rise more slowly and not get as high. At night, the heavy vegetation cover acts as a sort of blanket, and keeps temperatures from dropping as rapidly or as far. These phenomena only apply under fairly clear conditions with little wind. Otherwise, you won‘t even notice them.

LAKE SHORES VERSUS INLAND: It is a common belief that coastal areas are cooler and wetter than lands farther away from the water. There is some truth in this, but plenty of places where it doesn’t apply.

First of all, this phenomenon only applies when the wind is off the water, and only when the water body is pretty good size. The distance that the wind blows across open water is called its “fetch”. The fetch has to be fairly long for the water to have much effect on air temperature. Small reservoirs and lakes have only a small fetch.

Secondly, the lake effect only extends inland about one-twentieth of the fetch under even ideal conditions. That’s not very far. If you spend much time around lakes, you will note that the vegetation very close to the shoreline (not the stuff with its roots in the lake) is essentially the same as the vegetation farther inland. This suggests that there is not much of a lake effect.

True, you will be cooler on a boat out on one of the lakes than you will be sitting on the nearby shore, but this is because your body is getting less heat radiation from the cool lake surface than it would from the hot land surface. The air

temperatures at both of these sites will be very similar, especially if there is a wind blowing (and there usually is).

SHOE TEMPERATURES VERSUS HAT TEMPERATURES: Earlier in this section, I mentioned that official temperatures are taken in instrument shelters about five feet above the ground. There are a number of reasons for this, including simple convenience. Another reason is that temperatures change drastically as you get closer to the surface. The temperature at five feet above the ground is representative of a considerable thickness of air. The temperature at ground level represents only a narrow band of at most a few inches.

The air close to the ground will be much hotter in the summer and much colder in the winter than the air at standard instrument height. During a desert summer, there are plenty of places where the air close to the ground may reach as high as 180°F. Similarly, during the cooler months in the mountains, hard frost may form on the surface of the ground when the thermometer at five feet may show that temperatures never got below the low forties.

Hikers should be aware of these differences, and pick their footwear with these conditions in mind. Similarly, campers who sleep on the ground in tents should use a good insulating pad beneath their sleeping bags. Closed-cell foam pads give the best insulation against both heat and cold, while air mattresses give the least.

SHORT-TERM TEMPERATURE CHANGES

In addition to the relatively rapid increase in temperature following sunrise in the summer months, there are a number of other short-term temperature changes.

COLD FRONTS AND WARM FRONTS: Frontal systems move along the jet streams (there are several jet streams) like beads on a string. The jet streams itself moves poleward and equatorward with the changes in the seasons. When one passes over a particular destination, abrupt changes in the weather due to the passage of frontal systems may occur.

When the mass of air that moves across an area is from a cooler region, the change in temperature is relatively abrupt, and we speak of the passage of a cold

front. When the mass of air that moves across an area is from a warmer region, the change in temperature is gradual, and we speak of the passage as a warm front.

COOLING RAIN: Afternoon thundershowers are common during the summer months throughout much of the world. Because the raindrops originate at very high elevations, they are much cooler than the air near the ground. They can thus bring on a pleasant drop in temperatures of from twenty to thirty degrees. The cooling is short-lived, however, and temperatures will very quickly climb back almost to their pre-storm levels.

CHINOOKS: The ***chinook*** (from a Salish Indian word, meaning "snow eater") is a strong, warm, downslope wind common to the eastern slopes of the Rocky Mountains. It often sets in following a winter storm. During the ***chinook***, temperatures will rise many tens of degrees in as many minutes. The combination of increasing temperatures, high winds, and very low humidities tend to both melt and evaporate large quantities of snow—sometimes as much as a foot or more per hour.

While most common along the eastern slopes of the Rockies, ***chinook*** winds can also be found on the leeward slopes of other mountain ranges in the Southwest. They do not occur on the windward slopes. Similar gravity winds with a multitude of local names (***foehn, mistral, bora, Santa Ana***, etc.) occur throughout the world.

SUMMARY

Throughout the world, air temperatures change from time to time and from one place to another. Some of these changes are regular, such as the change from day to night, from summer to winter, from north to south (in the cooler months), and from low elevations to high elevations. Other changes in air temperature are more complex, and less predictable.