opposed to the general wind direction aloft, with a fluctuating thin zone of calm between. Very often, when the air is moist, the presence of upslope air motion on either the windward or leeward mountain sides is betrayed by clouds or fog which form by adiabatic expansion and cooling of the air.

Inasmuch as abrupt transition during flight in an airplane or glider from a zone of head winds to a zone of calm or tail winds leads to sudden decrease of lift, and drop in altitude, such regions are decidedly unsafe for landings. It may therefore be said that the conflicting eddies, strong descending currents, variable calm zones, and turbulent air in the neighborhood of mountains present to the unwary pilot serious hazards from which it is best to steer clear by maintaining an adequate altitude above the mountain.

Flow of stable air over a cliff facing to leeward is like a waterfall in character, but more complicated because numerous eddies are formed which at times produce ascending motions and conflicting, choppy currents, in a most dangerous combination.

Strong winds yield so much turbulence at the ground that adiabatic lapse rates are quickly established in a layer near the surface. Under adiabatic and super-adiabatic conditions, and especially with strong winds, turbulence near mountains becomes vastly intensified compared with the conditions previously cited. The turbulent zone then extends to more than several thousand feet above the mountain tops. Exceedingly violent and confused turbulence, in which it is impossible to maintain control of an airplane, results. This holds true for a considerable number of miles downstream from the mountain. Along the leeward side, powerful currents rush down the slope, making the neighborhood hazardous for any aerial operations.

Within mountain passes, the wind is greatly strengthened in regions where the pass narrows, and the atmospheric pressure drops due to the Bernoulli effect, which is the basis of the Venturi meter. Pressure differences thus produced create very turbulent winds which now and then sweep down into the pass in irregular fashion. The descending currents associated with these winds jeopardize the lives of occupants of any aircraft in the vicinity.

On leeward sides of mountains, the scouring action of the descending currents passing over cirques or other recesses has the effect of gradually reducing the atmospheric pressure. Finally, in a most abrupt manner, overwhelmingly strong winds burst into the hollows, in an action that strives to fill up the pressure deficiency. Following this the local wind dies down, but the process is repeated in successive cycles. The recurring winds become very turbulent during their passage over rough terrain. By their force in the stage when they first suddenly intrude on the scene, these powerful blasts of air are capable of crashing to the earth any airplane caught in their path or of rendering it unmaneuverable through the force of the turbulent motions.

Another phenomenon of possibly even greater energy is manifested when a cold front at the leading edge of a relatively unstable, cold air mass reaches the crest of a mountain ridge under the impetus of a steep pressure gradient. Strong winds urge the air mass onward to overshoot the leeward valley. If warm, moist air fills this valley, the overrunning of the cold air in surges temporarily creates a super-adiabatic lapse rate and great instability in a restricted area. The cold air then plunges downward into the valley, warming adiabatically as it descends until temperature equality with its surrounding air is achieved. The warm, moist valley air thus displaced ascends in large bodies and cools adiabatically until condensation of the water vapor occurs. Towering cumulus and then cumulonimbus clouds rapidly develop in great swirling masses as the latent energy of condensation becomes available as motive power for the vigorous convection.

In addition, the cold air mass behind the front spills over into the valley. Rollers of cold air thus rush down the lee mountain slope from the ridge at an accelerated velocity until adiabatic heating and surface friction slow them down and cause dissipation.

Severe thunderstorms, sometimes accompanied by hail and often bearing icing conditions, derive from the clouds. Intense lightning flashes attend the energetic convection within them.

The turbulence associated with these phenomena is likely to be of even greater intensity than that found in convection with line squalls, and can be considered truly mighty. Fortunately, it is only short-lived, for the filling of the valley with cold air spells an end to the temperature contrasts which made the occurrence possible in such strength.

However, the winds that stem from the tremendous surges of cold air into the valley carry with them for a considerable time the eddies and turbulent motions acquired during their recent history. This is likewise true of any moderate or strong wind that has travelled for a long distance over rugged terrain, since the eddy energy is not degraded into heat for some time so long as adiabatic and super-adiabatic lapse rates prevail.

An illustration of this may be found in the cases of the foehn or chinook which is a warm, dry, rather turbulent wind which blows down the slopes on the lee side of a mountain ridge under certain circumstances. The chinook is produced when a stable air mass (that is,

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