

VFR Flight in Mountainous Terrain.

By Andrew Graham, Kamloops FIC

Many mountainous areas of the western reaches of our country have very dramatic elevation changes over relatively short distances, which can pose challenges to VFR pilots of any skill level, especially those who are used to operating in terrain with less 'vertical variety'. There are many unique issues pilots must keep in mind when flying VFR through the mountains.

Aviation weather in the mountains

When weather hits the mountains, a number of phenomena can occur that usually wouldn't without the large elevation increases. Two such phenomena are A) differences in local conditions between valleys, and B) lee wave turbulence. Both of these are caused by the nature of the upper airflow across BC.

Orographic lift is a very important factor in mountainous terrain. In BC, the mountains and valleys run along a generally north-south or northwest-southeast orientation, while the upper airflow from the Pacific provides weather systems generally from the west or southwest. This means that these systems are often perfectly situated to maximize the effects of orographic lift, which is the upward forcing of the moist air against terrain. As it is forced up into cooler parts of the atmosphere, the air cools, clouds form, and eventually precipitation begins. This is a very powerful effect: when moist marine air hits BC's Coastal Mountain range it can be forced upward 8 to 10 thousand feet in very short order.

This kind of lift is greater by many factors than that associated with daytime heating and can be active 24 hours a day (this is where western BC gets its rain forests!), and is seen right across the province. The western slopes of all the mountain ranges see much more precipitation than the eastern slopes. These upslope areas are not just areas of greater precipitation: they can work as a trigger, much like daytime heating only stronger, kicking off convective activity. The leeward side of the mountains see descending air, sometimes descending faster than the maximum climb capabilities of some small aircraft, warming and the absorbing visible water vapour, thus they see less cloud and much less precipitation. So being aware of these large-scale patterns and how they interact with mountainous geography can aide in deciding which route to take through the mountains. It's easy to see how flying from the east it often appears to be much better until penetrating past the highest point in a mountain range. Seeing VFR skies to the west from Kamloops, Kelowna or Penticton is not a reliable indicator of what conditions are like in the Coquihalla or Manning Park areas.

Lee wave turbulence along the eastern flank of the Rocky Mountains and the Coastal Range is fairly well understood by pilots. The turbulence associated with lee waves is usually well above the mountain tops and normally well above most general aviation traffic. However, the lower levels are also greatly affected and can be all the way to the surface.

In reality, any of the valleys throughout BC, AB and YT will experience turbulence when the flow aloft is strong enough and its direction crosses the line of the ridges. Since the valleys turn and the ridges are irregular and there is usually another ridge on the far side of the valley, the winds can be extremely erratic and difficult to predict. What is usually certain is that there will be significant mechanical turbulence somewhere in the valley. The difficulty in predicting this hazard is that there may be no METAR site in the valley or no clear indication of winds aloft at the particular location.

Considering the overall flow pattern and how it interacts with your preferred route can help you avoid unpleasant flying conditions in mountainous terrain.

Choosing your VFR route

Knowing the geography of your route is critical for any flight, and is especially so when planning a VFR route through high mountains; unlike most of the country, the west has vertical slabs of rock rising thousands of feet above the valley floors below. Considering this fact pilots must keep a few things in mind when preparing for their flight:

When checking METAR information, be aware of the fact that weather reporting sites are always in valley floors. This means that even if two METARs along your route are calling ceilings of 4500 feet, which would be decent VFR in any other part of the country, in BC, AB, and YT the intervening terrain might very well be in cloud, preventing a direct VFR route between the two sites. For example, Hope, BC (CYHE) has an elevation of 128' ASL, while the peaks immediately surrounding hope rise up to between 4500 and 5500' ASL, and therefore in cloud.

Be sure you are following your planned route. Be familiar with the waypoints and geographical features along your route. Too many pilots have found themselves in dodgy situations after taking a wrong turn up a wrong valley. For example, if ceilings are being called along your route such that the surrounding high terrain is 'capped-off', your aircraft is basically flying in a tunnel; if you then take a wrong turn up a 'hanging valley' (a valley than ends in a ridge or peak), the tunnel's floor begins rising, very quickly leaving you with very few options.

Also, good airmanship requires pilots to always keep an emergency landing site in mind as they make their way to their destination. However, this can be significantly more difficult in mountainous terrain than in flatter areas of the country. Keep this in mind when researching your route; following lower elevations will afford you farmland and dry riverbanks to use in a

pinch, and when in doubt, plan to keep a highway beneath you! Also, know where RCOs are located so that you may avail yourselves of current and forecast weather information enroute and the ability to amend your flight plan if necessary, because of unexpected weather or other circumstances.

Nav Canada – the company that provides air navigation services for Canadian civil airspace - operates seven Flight Information Centres across the country. Each one is staffed 24 hours a day with operators that are quite knowledgeable about local weather in their respective areas of responsibility. My colleagues and I at the Kamloops FIC have several hundred years of combined experience helping pilots navigate the complexities of Western Canada's mountainous terrain. When coupled with our knowledge of Western North American geography, meteorology, weather product interpretation, and aviation practises and procedures, this experience can be invaluable in helping to make your next flight a safe, efficient, and enjoyable one.

Don't hesitate to call 1-866-WXBRIEF (1-866-992-7433); we're always open!

Happy flying!