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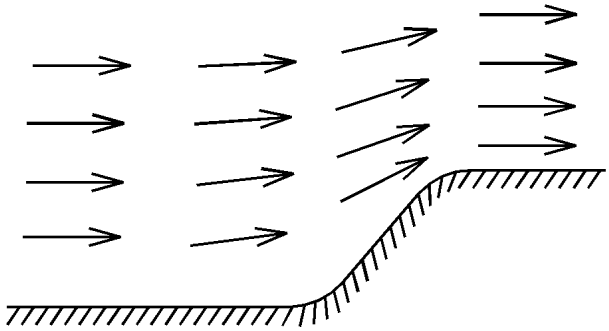
Venturi, Rotor, and Turbulence Behind the Ridge

N.B. Airflow over hills can be very complicated. This article only addresses a few of the most basic hazards with a view to helping pilots keep themselves safe. Novice pilots, or those unfamiliar with hill soaring in geostrophic winds are strongly advised to seek advice from coaches or experienced pilots.

Some pilots and coaches are very concerned at the present time. We are finding that some pilots who have obtained their BHPA Hill Club Pilot ratings abroad, or by initially training on the winch and then "converting" do not seem to have a practical understanding of rotor, venturi or turbulence behind the hill. If any of the stuff below seems seems unfamiliar or you have not been shown where it is likely to occur on actual hills then get an experienced pilot or coach to help you. These elements are a fundamental and essential part of hill soaring safety.

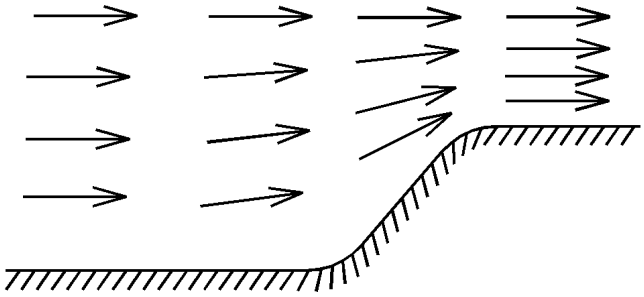
Venturi

Let's have a look at what is going on on the edge of a ridge. The following diagram shows a fairly "standard" interpretation of what happens when moving air encounters a ridge. Air in the diagram seems to be moving up nicely so perhaps we can expect good soaring in front of the ridge.



However, we know that there will be some speeding up of the air over the corner of the ridge where we might be launching. The venturi effect. Many pilots persist in calling this effect "compression", a very misleading term suggesting the air is squashed. An important point is that the air moves faster instead of being compressed so please try and use the correct term.

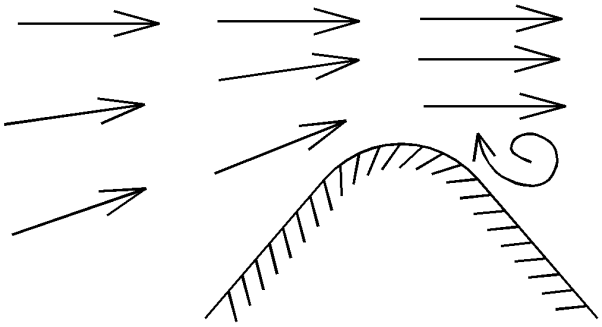
Sometimes venturi is made worse by stable air conditions. When air is stable its buoyancy reduces as it rises and it does not easily produce thermals. The result of wind against a ridge in stable conditions can be a bit like this.



The air does not “want” to rise over the edge so will produce less lift in front of the ridge and higher winds over the top. This worsens the venturi effect on the edge of the hill and can make life very difficult.

Rotor

We also need to be wary of rotor.

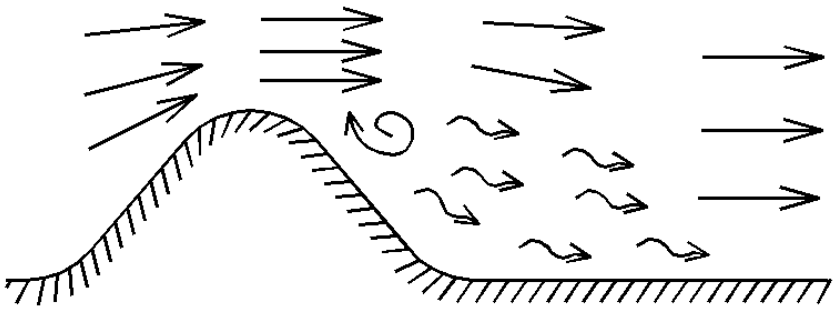


Rotor is a form of turbulence behind an edge where the air rolls back up the hillside making things very unpleasant indeed. Try taking a walk along the back of an edge when the wind is strong and see if you can feel the rotor directly. Stable conditions will worsen rotor in a similar manner to venturi.

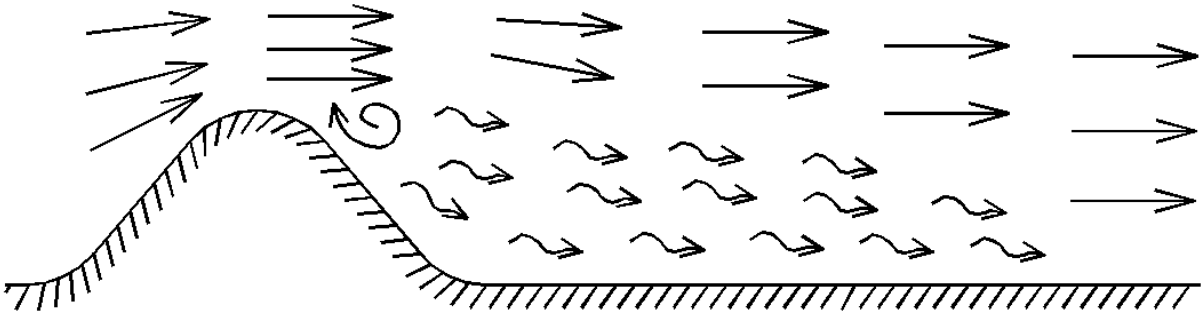
Rotor is not only found behind horizontal edges, it also occurs behind sloping or vertical corners. This is particularly important to think about when flying a ridge with the wind blowing at an angle to the main slope. An example of a sloping edge is the western edge of the landslip on Mam Tor (between the landslip and the south face). The stronger and more easterly the wind is the greater the hazard of rotor as you fly across this edge. If you are flying to Windy Knoll from the SE face of Mam Tor you should think about your height above this edge and what the wind is doing before crossing it.

Turbulence Behind The Ridge

We can expect turbulence immediately behind any obstruction including the ridge we are soaring.



The stronger the wind the further behind the hill we can expect turbulence.

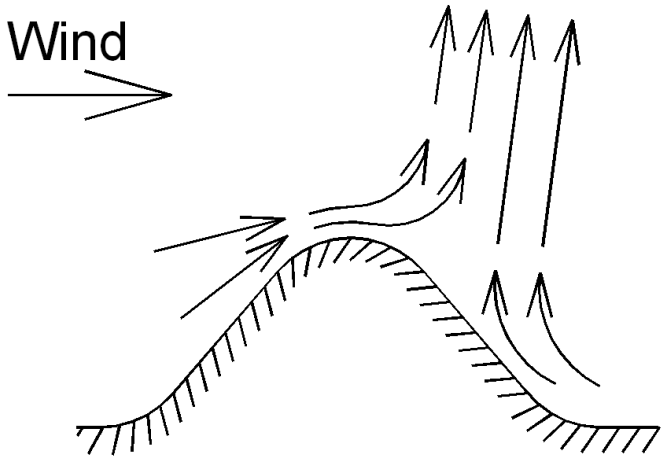


We are told that, depending on the wind strength, we can expect turbulence behind the hill to be significant up to a distance of about 4 times the height of the hill. This is not something I have investigated!

If we find ourselves being blown back the best thing to do is usually to get as high as we can and fly as far as possible downwind to land. As well as getting us away from potential rotor our high groundspeed flying downwind quickly gets us away from the hillside giving us good ground clearance if anything nasty does happen.

Venturi In Light Winds

Just because the wind is light it doesn't mean we will not have problems on edges.



A leeside thermal can draw a lot of air over an edge creating just as bad venturi as a strong geostrophic wind.