SKYWATCH

Unhelpful clouds and areas to avoid

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from *SAILPLANE & GLIDING*

THE ARTICLE IN THE LAST ISSUE was concerned with describing thermals and suggesting where to find the best lift. Now we will describe unhelpful clouds and some areas to avoid if you want to keep clear of strong sink.

One of the most common kinds of development is the spreading out of cumulus to form an almost total layer of stratocu. It frequently happens on days which would otherwise provide magnificent soaring conditions. Figure 1 shows three stages in the spreadout process.

A illustrates an unstable airmass with relatively dry air aloft and no inversion. Here the cumulus tops are very irregular, some high, some low. Each tower displaces some of the dry air aloft and brings it down amongst the cumuli. This reduces the humidity in the cumulus layer and as a result clouds tend to evaporate more readily once the thermals inside have ended. In these conditions clouds remain well broken, a fair amount of sun reaches the ground and thermals are evenly distributed.

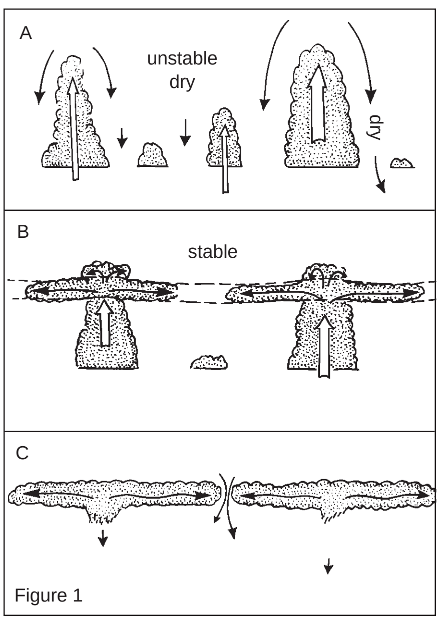

Figure 1

B shows what happens when the cloud tops are limited by a moist inversion. The inversion checks the growth of the cumuli so that all the cloud tops are much the same level. The up–currents are diverted sideways when they reach the inversion and the moisture they bring up from below is spread out horizontally. If the air in and above the inversion layer is very dry, the cloud usually evaporates before forming a complete layer.

When strong thermals bump into the inversion they produce turbulence which draws dry air down from aloft. This reduces the humidity under the inversion and may prevent the spreadout from becoming total. Over the oceans weaker but more prolonged convection gradually brings up so much moisture to the inversion layer that eventually the flattened cumuli join up to form a huge area of stratocu. This kind of cloud layer is very common over the sea and coasts on the eastern side of large anticyclones.

C shows how the spreading layer of stratocu cuts off further heating so that the thermals die out overland. The stratocu often forms large cells of 50–100 km diameter. Narrow cracks separate the cells. A line of sink can come down through long lived cracks.

How old fronts cause spreadout
Active fronts have a great depth of cloud; when the front weakens and dies it is usually because some major system has made the air subside over a large area. For example, the development of a ridge or new anticyclone usually weakens a front so much that nothing is left except a band of very moist air tucked underneath the subsidence inversion. The analysts at major Met centres usually drop such fronts from their charts so you will not find them on the TV or press weather maps.

Sometimes you can guess where they should be by mentally extending the fronts which are shown. These dead fronts are a menace to good soaring. The invisible moisture is just what is needed to encourage the growth of a stratocu layer a few hours after the first cu have formed.

Cycling Over the sea one sees little sign of a cyclic change in these stratocu layers but over land the cloud layer often breaks up when there are no more thermals to maintain a supply of moisture. Then the sun comes through again, more thermals develop, and the new gaps are quickly filled in. The length of these cycles seems unpredictable; it may be only an hour but too often the spreadout lasts till sunset.

When stratocu become self supporting
A layer of stratocu formed by cumulus spreadout does not always break up when there are no longer thermals underneath. If the layer becomes thick enough a new process takes over which can keep the layer intact for several days.

All objects radiate heat; at night the ground cools by radiating heat away into space. Clouds radiate heat too; the base radiates heat back to the ground (which is why the ground does not cool so much on a cloudy night). The tops of cloud radiate heat away into space and become cooler in the process. The cloud top cools more by night than by day but even on a summer afternoon the top loses heat.

Cooling the cloud top has two results: first it makes the inversion stronger and second it makes the cloud slightly unstable. This is because the temperature hardly alters at cloudbase but the cloud top becomes steadily cooler. The process is illustrated in Figure 2.

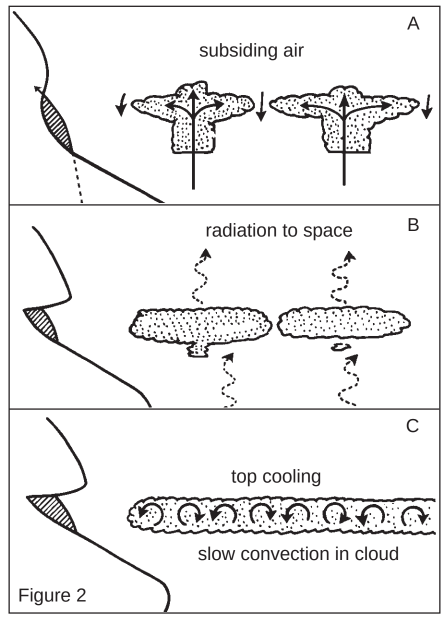

Figure 2

A is the early stage before a complete cloud cover had developed. The curve on the left represents the temperature with a gentle inversion at cloud top. The shaded bit shows where the cloud fits in.

B shows almost total cover of stratocu with the top radiating heat away to space. The cloudbase also radiates heat but this downward radiation is more or less balanced by upward radiation from the ground. Cloud top cooling has made the inversion sharper.

C shows the final stage when the layer of stratocu has become unstable. The new instability is very slight but it does produce a gentle stirring through the whole cloud layer. This keeps taking moist air up to the inversion to maintain the cloud cover. Most stratocu layers have a billowy top showing the result of this convective stirring. This internal convection maintains the cloud layer without any help from thermals rising from the surface. Flight above such a layer is usually very smooth but it becomes slightly turbulent if you let down into it.

Early morning signs of spreadout

Many potentially good soaring days start with cloudless skies and very good visibility. The signs of spreadout are:

- Unusually early appearance of the first cumulus clouds. This shows that very little heat is needed to set off thermals.

- The cu tops go shooting up quickly instead of growing gradually. This shows the air is particularly unstable, at least in the lower layers.

- The rising cu form narrow towers, the tops are well rounded but the bases do not stay flat for long. This suggests that although there is lots of energy available it is badly distributed. On good days the cu grow less rapidly and have broader longer lasting bases.

- Little lenticular caps (pileus clouds) appear over the cu tops and are soon absorbed into the rising towers. Pileus are produced by air pushed up ahead of a rising thermal. They may even show up above a blue thermal. They are a good indication of very moist air aloft, air which needs little lifting to reach its condensation level.

- If clear visibility allows you to see developments over hilly regions, watch how things go over the mountains. Spreadout often develops first over mountains. The layer of clag extends over the plains a few hours later.

Coping with spreadout I have never been successful on a spreadout day; it is my usual excuse for landing out. However, the better pilots keep going for astonishing distances but they often make large diversions from the direct track. If the cloud cover is not total, one can:

- Try the sunny edge. There is often good lift under the boundary clouds where the slanting rays of sun warm the ground under the edge of the cloud sheet.

- While following this edge divert to any little puffs just off the main sheet. Surprising good lift occurs under the rather scruffy bits of cloud within a mile of the main edge.

- If the route goes anywhere near a coastline of estuary try diverting nearer the sea. Approaching the coast is rather like going back in time; one finds conditions as they were earlier in the day before the spreadout developed.

- Take any opportunity for a cloud climb. Strong thermals take cu tops well through the inversion and you may come out into dazzling blue skies several hundred feet above the cloud layer. This doesn't last long of course but such a climb can add many minutes to the glide.

- When down below the cloud sheet look out for any darker patches, especially if there are cloud fragments below the main base. In the very unstable air below spreadout one may encounter unsuspected thermals. These are easier to work higher up so it pays to take any lift available while still fairly high.

Staying out of sink Avoiding sink is almost as important as finding good lift. If on a particular day most clouds give their best lift on the upwind and/or sunny side, then it is worth making a diversion to avoid the opposite end. Some pundits make a habit of curving round the dud bits when approaching a good looking cloud. Thus they get round Murphy's law which says that the direct track to the next lift shall always pass through sink.

Here are some items to look for:

- Look at the cloudbase, especially at the downwind end of a cloud. Rapid decay [can take place in minutes] at the downwind end of a bank of cumulus. See if the base has become ragged with hanging straggly bits.

- If you see tendrils hanging down compare their level with the general cloudbase. Tendrils which go well down below the main base are usually good signs. Bad signs are tendrils which start far above the main base. These are just the remnants of a dying cu; see Figure 3. A shows tendrils below the main base;

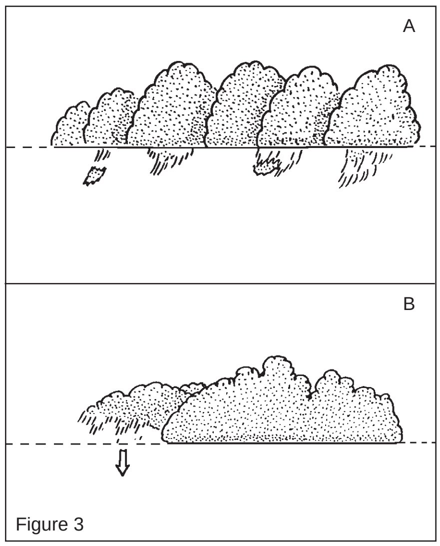

Figure 3

these are usually a good sign of lift. Sea breeze fronts and other convergence lines often look like this. B shows tendrils formed from a decaying cloud; they are mostly above the main cloudbase and almost invariably indicate sink.

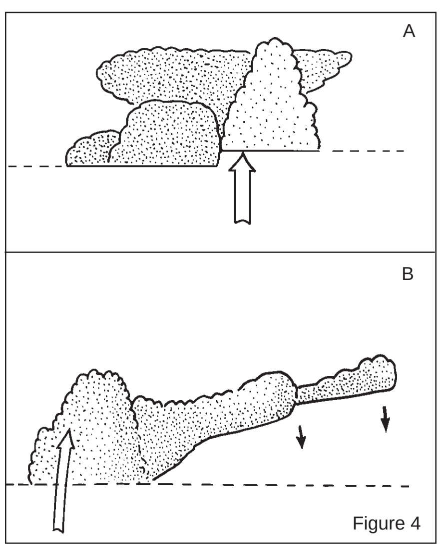

Figure 4

Figure 4 shows two kinds of cloud step. A is the kind which has its best lift close to the step and under the higher base. Steps like this are caused by the conjunction of moister and drier patches of air. Dry air gives a higher cloudbase and better lift.

In B the steps have been caused by the cloud top being blown sideways by stronger winds aloft. When this happens the displaced top loses its lift and one must go to the main base to find the active thermals. This sounds confusing but one can usually spot the difference in a step due to drier air and a step caused by the cloud top being blown sideways.

Clouds with tails Horizontal tails to a cumulus cloud often show which end is subsiding. Figure 5A is a diagram of a cloud showing where a succession of cells were building the right hand side but descent of air was suppressing the left side. Figure 5B has a much shorter tail on the left where the cloud is dying. In the middle and towards the right there is a nice flat base with little tendrils suggesting lift.

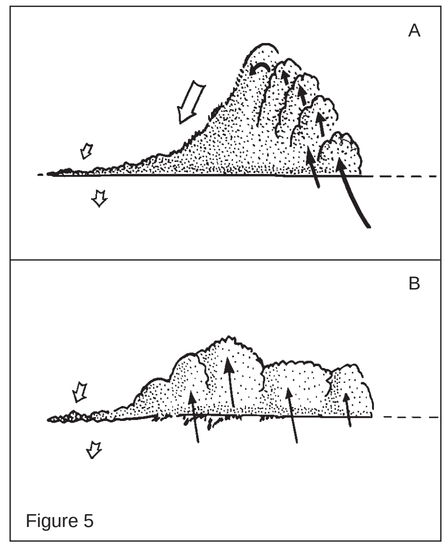

Figure 5

Sloping (not horizontal) cloud tails can be an indication of cloud formed in rather strong winds when a narrow thermal is torn away from the surface before it is big enough to produce a decent sized cumulus.

Blue holes It is apt to be disconcerting when one discovers that all the clouds ahead have vanished, leaving a great blue hole. There may be several reasons for such a gap:

- The area ahead may be low lying and too damp for thermals. Broader parts of the Severn or Thames valleys are examples of such dead areas. They are particularly bad after a wet spell.

- Sea air may have moved in from the coast.

- There may be a boundary between the moist cumulus–filled air and much drier air which has a condensation level too high for cu. In this case it should still be soarable in the blue.

- The inversion may have come down below the condensation level. There will prob-

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ably be thermals in the blue but the lift will be weaker since the depth of convection is less. If the tops of cumuli have been getting steadily lower it probably means the inversion has been coming down.

- The area may have been under fog in the early morning and the temperature has been slow to rise. It is risky to head out into such an area. Thermals form much later in areas which have been under fog at dawn.

- There may be a local area of unusually strong subsidence aloft inhibiting thermals. This is rather uncommon and is described in the next paragraph.

Localized subsidence Subsidence, the slow descent of air from aloft, is common when anticyclones and ridges are developing. The process is important because it produces a stable layer or inversion a few thousand feet above the surface. It is usually assumed that anticyclonic subsidence is seldom more than 3000 feet/day. I believe subsidence can behave like sink between clouds. Sink is usually very gentle when averaged over a wide area but one may encounter small regions of much stronger sink. In the same way anticyclonic subsidence is normally far too gradual to be noticed by an aircraft but there may be places where it is concentrated into a small area and then the sink is much more powerful.

"Double Eagle", the first helium filled balloon to cross the Atlantic, encountered something of this sort when still west of Ireland. The crew saw a large circular hole in the solid stratocu sheet below. When the balloon (which had been above 20,000 feet) passed over this blue hole it began a descent which could not be checked till it was down to 4000 feet. They lost 15,000 feet in under an hour despite dropping ballast.

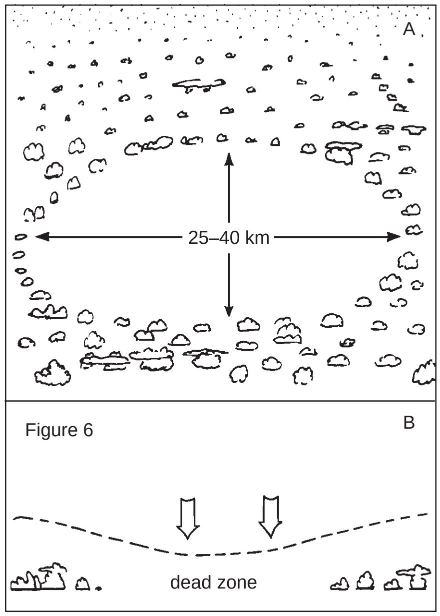

Figure 6

A similar kind of subsidence may occur overland too producing a blue hole in the field of cumulus. Figure 6A is a sketch from high up looking down on such a blue hole. 6B shows a cross–section. If you arrive at the edge of a big blue hole ringed with cumuli think twice before pressing on into the gap. Flying round the perimeter under lots of active clouds is quicker than heading out into the dead bit where you may become stuck low down in very weak lift.

Since one rarely knows just what has produced a blue hole it frequently pays to divert round it if at all possible. I have known an expert detour round three sides of a square rather than head out to an almost certain field landing in the blue.

Closing thoughts Drawing lines on maps is a most valuable aid to navigation but one should not feel bound to fly rigidly along these lines. I suspect that one reason for the failure of many early cross–country flights is that the pilot felt impelled to stick to the direct line. It is much more important to follow lines of energy and divert to the good looking clouds and avoid the decaying bits. Try to stay high and take any strong lift you fly through even if you do not need a climb just then.

Look at the cloudbase rather than the top as you approach it. The nicely domed top of a cumulus may be offset from the place the next thermal enters the cloudbase. The lift you hope to find may not yet have produced its own dome. If you are already high look at the shadows on the ground. If the cloud shadow looks full of holes you are more likely to find sink than lift underneath it.

Experts who hurtle round triangles at speeds in excess of 100 km/h know when they can safely ignore these kindergarten rules. They can nearly always retrieve an error by scraping up again from a low point. Speed is a secondary consideration on early cross countries and for these it pays to fly a winding track following the energy and staying high as long as possible. •

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† DON HILL

Our good friend and long time member of the Vancouver Soaring Association lost his life in a gliding accident near Invermere BC on June 3. Don had a Gold C with 2 Diamonds. Don's cheerful personality and his willingness to share his aviation experience will be missed by all of us.

Joe Gegenbauer

Coming Events

Aug 16-22, **SAC western instructor course**, hosted by Cu Nim. Course director Mike Apps (403) 436-9003.

Aug 17-21, **Beginner's cross–country clinic**, Rockton, ON. Paul Thompson (416) 387-4222

Oct 2-4, **SAC Board meeting**, Kingston, ON

Oct 3-12, **Cowley fall wave camp**, Cowley, AB

5-7 Mar 1993, **SAC AGM**, London, ON

INCIDENTS & ACCIDENTS

27 May – SOSA, LS–4, C–GMZZ. Struck power lines on off–field landing. Serious injuries to pilot. Glider a write–off.

3 June – Vancouver, DG–400, C–FADG. Flew into mountainside at Invermere. Fatal.

7 June – Regina, DG–300, C–FEQH. Trailer rolled during transport, wing damage.

10 June – Champlain, Pirat, C–FCUM. Rudder cable broke at takeoff, major wing and tail damage.

13 June – Base Borden, 2–33, C–GCSY. Undershot runway, gear damage.

14 June – SOSA, G103, C–GGLA. Rear canopy damaged when opened on takeoff roll.

25 June – Air Sailing, Ka6E, C–FOLO. Groundlooped on crosswind off–field landing. Possible write–off.

6 July – SOSA, Citabria, C–GKXJ. Groundloop on landing. Bent prop and blown tire.

NATIONAL CFI SEMINAR SLATED FOR 1993

The Soaring Association of Canada and the Ontario Soaring Association are planning to co–sponsor a CFI Seminar on Safety and Instruction in 1993, possibly in conjunction with the SAC AGM. Provincial Associations have been asked to assist in funding CFI delegates to the seminar through their safety programs. More information will follow at a later date.

AWARD FOR BEST AUTHOR

SAC is offering a worthwhile prize beginning this year for the best article to appear in *free flight* written by a SAC member. The Board will judge the crop of stories and choose a winner.