CUMULUS SPREAD OUT

The ruin of many a good day

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THE EXASPERATING FEATURE of most spread out days is that they share many fair weather indicators, so it can be hard to distinguish between good and bad days.

Cases of spread out Spread out is due mainly to excessive moisture in the atmosphere but it is strongly influenced by the development of an inversion. The problem is caused by very slow evaporation of older masses of cloud.

- In a dry atmosphere thermals carry moisture up from low level to form clouds. When the thermal ends evaporation into the surrounding dry air disperses the cloud and cooling makes the sink stronger. Thus scattered cumulus are often separated by areas of strong sink in clear air.
- If the air aloft is already moist it takes much longer for evaporation to dissolve the decaying patches of cloud. The sky begins to fill up with bits of cloud at many levels. Sink is weaker under an overcast of spread out stratocu but this is offset by a lack of sunshine to set off fresh thermals.

An early warning It is often a bad sign if cumulus start to form soon after the sun has risen. It means that the air is so moist that little heat is needed to form cloud which almost always has a low base. Tall cu with a low cloudbase often precedes spread out.

Figure 1 shows a temperature sounding on a day of extensive spread out. The tephigram shows some factors which nearly always produce a spread out layer soon after convection starts:

- A marked inversion (this day at 832 mb, nearly 5300 msl). Above this level the temperature rose some 6.5° in just over 700 feet.

- The separation between dew point and air temperature was less than 2°C nearly all the way from 2000 to 5300 feet and was only 0.7° at the base of the inversion.

- The condensation level (marked CL) was low, near 955 mb or about 1500 feet. This suggests a cloud depth of some 3800 feet. Anything more than 2000 feet depth of cloud favours persistent spread out. An inversion at 7000–8000 feet with a big depth of cloud under it tends to give so much spread out that cross–country flying is nearly impossible. On this occasion very little surface heating was needed to start convection. The extra energy from release of latent heat is shown by the shaded area. The larger this shaded area the more energy is available for forming cloud. If the shaded area grows wider with height the early morning cu tend to shoot up like rockets until they hit the inversion. The first clouds may not have the energy to go so far; these tend to slow down and become tilted over if there is a stronger wind aloft.

Figure 2 shows a sounding made at the same time to illustrate the difference which often occurs over a distance of 300 or 400 miles.

- The air was much drier, the separation between air temperature and dew point was at least 10°C between 1000 and 5000 feet.

- The inversion (which was just below 5000 feet asl) was much less marked; the temperature only rose 1° in the next 900 feet. Much more heat was needed to start convection and the condensation level was much higher than in Figure 1.

Since the air was drier at the surface the condensation level was much higher, being nearly 4000 feet asl. Much heat was needed before any thermals reached this level so cumulus formed much later. The depth of cloud was much smaller too. The small shaded area above CL on Figure 2 shows very little extra energy was released by condensation.

Critical factors These two soundings show up the difference between widely scattered cu and a total spread out. Scattered cu exist in a dry atmosphere with more than 5°C separation between air temperature and dew point under a weak inversion. Spread out is likely with a very marked inversion, 2° or less separation between dew point and air temperature with a cloud depth of at least 2000 feet. The inversion is important because it concentrates all the lifted moisture at much the same level just under the inversion. If the inversion is destroyed the moisture is spread out over greater depth and a complete layer of cloud takes longer to form.

The development of spread out Figure 3 illustrates a typical sequence of events from early morning to midday. Time runs from left to right. Letters mark stages of development.

A shows lots of scruffy bits of cu which form soon after sunrise. This early appearance shows little heat is needed to start convection and suggests the air is too moist, thus giving a low cloudbase.

B shows columns of cu rocketing up in the moist unstable air. These have not yet enough energy to reach the inversion so they slow down and become tilted over by the wind.

C At this stage the cu have become stronger and their ascent pushes up some of the moist air aloft. This results in lenticular cloud caps called pileus. They are smooth because they are not part of a bubbly cumulus; they are rather like bow waves ahead of a blunt nosed barge. The pileus tend to stay in the moist zone and the cumulus may build through them. Pileus are a reliable sign of spread out later on but they do not appear on every occasion.

D shows the cumulus big enough to carry moisture up to the inversion where it spread out horizontally.

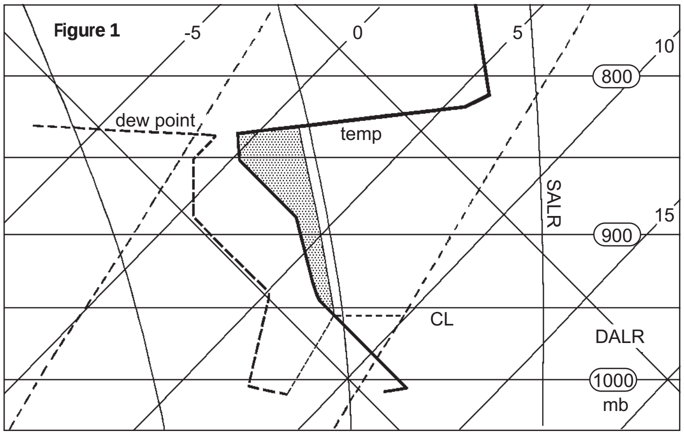

Figure 1

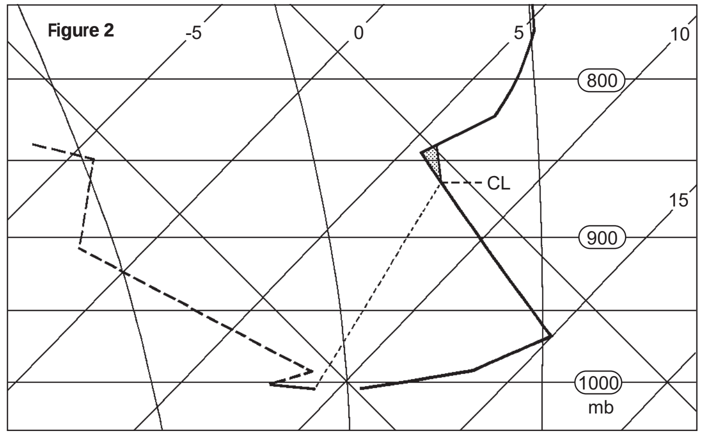

Figure 2

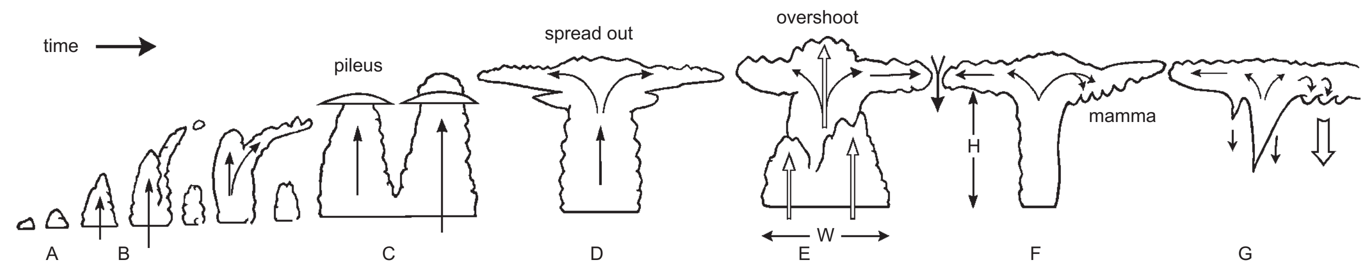

Figure 3

E shows a cu top overshooting the inversion and pushing a dome into the warmer and usually very dry air aloft. At this stage there is usually lots of lift under the cloud and climbs can be made which bring you out into clear air above the inversion. The lift of such a cu which has its width "W" equal or greater than its height "H" is usually at least 15 minutes and may be longer if there is a steady feed of new thermals into the cloudbase.

F shows the column of cumulus narrowing. The chimney carrying moisture upwards is no longer supported by buttresses of younger cells as at E. At this stage the overshooting top probably starts to collapse. The descending air sinks down and appears on the underside of the cloud sheet like a set of upside–down cumuli. These are termed mammatus clouds. Mammatus is an indication of the collapse of powerful cu which have overshot the inversion and are now falling back. Mamma usually have a short life; they change their shape and size rapidly. Thunderstorms often produce an area of mamma on the inactive side. It is often a good idea to avoid the region underneath mammatus cloud as the sink can come down a long way beneath them.

G shows the final stage when the cumulus chimney has thinned out and begun to decay rapidly. There is often an anxious period when flying to a narrowing chimney like F, wondering if it will last long enough to get you further or if this vital stepping stone is suffering from terminal starvation and is about to dwindle into a useless inverted cone of dead air.

Spread out and fronts

Official charts usually drop a front when it has become too weak to produce rain and the associated cloud band becomes narrow. These systems are said to be "frontolyzed" (frontolysis is the process of frontal decay). They may be inactive as regards most kinds of weather but they still have the capacity to produce a band of spread out.

One can sometimes estimate where they may be by drawing a line extending the official front out towards the ridge or high covering the task area. These old fronts are often too narrow to be picked up by early morning soundings which are 300 km apart. Lulled into a false sense of security by the two or three soundings which show dry air, one can easily agree to a route which crosses the old (and temporarily invisible) frontal zone. Although the day dawns clear the development of cumulus soon results in a belt of stratocu forming along the previously invisible line of the old front. This development tends to happen after the task has been set and before any satellite picture is available to show what is happening. It does not always need an old front; a weak trough may trigger off a wide band of spread out.

Going round or pushing through?

An active cloud edge offers the chance of a fairly fast diversion round the spread out; unfortunately it does not often go far enough though it may take you to a rift which heads in the direction you want to go. The active edge is often a good place to take a climb under one of the stronger cu.

Lift under the gloom The soundings on spread out days are almost always very unstable beneath the inversion and need little extra heat to set off more thermals. These are apt to be much weaker than those formed under a sunny sky. The weakness is sometimes compensated for by the thermals being larger and much smoother. Sink does not entirely vanish but is often much less than between scattered cumulus. As a result one can go quite long distances under an unwelcoming sky. On such days it can be extremely encouraging to hear another pilot ahead announcing good lift. (It is almost the only reason to leave the radio on at weekends when nine out of ten calls are just idle chatter.)

Even feeble scraps of tired looking cu seem to offer lift under the cloud sheet. Under a sunny sky such scraps nearly always mean the thermal has expired but under a strato cu sheet any feature is worth exploring; sometimes they mark an essential bit of lift. Darker patches in the overcast may also reveal where weak lift has gone up into the cloud sheet to form a deeper cu with a top penetrating the inversion.

If you have a choice in the matter it is seldom worth pushing out under a solid grey sheet of cloud unless you can see some brighter patches ahead. Hazy days make life even more difficult since the bright and dark patches cannot be distinguished soon enough to pick a good track.

Using satellite pictures from the previous day

On many days the satellite pictures shown on TV the previous day give warning of spread out to come. Northwesterly winds give us most of our good cross–country days but these winds have often had a long sea track round the perimeter of an Atlantic high. The sea is often warm enough to produce lots of cu which spread out under the anticyclonic inversion. The afternoon pictures may show if the cover is well broken or almost continuous.

A continuous sheet of cloud off Ireland or the west coast of Scotland often indicates cu spread out over England the next day when the wind is northwesterly. The cloud sheet may disperse over the cold land during the night but it will usually form again a few hours after cu have developed.

On days when the air is moving slowly from the west an area of spread out over Ireland during the afternoon gives warning that the same may occur over England the next day. (Since moisture is a major reason for spread out Ireland seems to suffer from it even more than England.) For Europeans the arrival of spread out over England is a warning of problems for them the next day. However, a long land track often dries up the air enough to break up a stratocu sheet. The North Sea coasts from the Low Countries round to Denmark suffer from stratocu at least as much as the UK but the cloud sheet usually breaks up over Eastern Europe.

Shelter effect The stratocu sheet often breaks up on crossing high ground if the cloud top is not more than 2000 feet above the hills. Once it breaks the sun warms the air enough to maintain good breaks on the lee side. Thus areas downwind of the Highlands of Scotland, the Pennines and the Welsh mountains can have good soaring when places near the Cheshire Gap and windward coastal areas remain almost overcast all day. The wind direction can be critical; if the wind veers bringing the flow down the North Sea the east coast areas and especially East Anglia lose almost all their sunshine.

Diurnal changes When there is strong convection maintaining the cloud sheet overland there is often a region of descending air just off shore. As a result the Irish Sea and adjacent coasts become almost cloud free during the afternoon; so does much of the English Channel. I have never discovered how to predict this, nor been able to exploit it.

The four o'clock slot Even though the stratocumulus sheet cuts out much of the sun's energy the cloudbase does seem to rise through the day. A stage is reached when the base of cu goes up to the main stratocu layer and then good breaks develop. The process is aided by an approaching ridge bringing the base of the inversion down and making the cloud thinner. This often seems to happen about four o'clock. The latter part of the day then becomes good enough for short cross–countries. However, for this to happen it is usually necessary for the contest director to have scrubbed that day's task. •