

JULY 2014

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WORLDWIDE PARAGLIDING AND PARAMOTORING MAGAZINE. FOR FREE.



CLOUDS

A DANGEROUS, HEAVENLY, THREATENING LANDSCAPE

WHO'S SCARED OF THE NASTY CLOUD?



Clouds crown the thermals and the fabulous earthly landscape, and also represent danger. But when?

*By Sascha Burkhardt
Translation Ruth Jessop*

The cumulonimbus is the most feared cloud by all who fly. From paragliders to Boeing 777s, you don't fly in a cu-nim. The reasons for the crash of the MD83 in Mali in July 2014 are not yet officially known, but it is known that the pilots found themselves in front of a very active storm cell and announced a change of flight path. The forces in a cumulonimbus are such that even a commercial airliner can suffer structural damage, to the point of breaking up.

One of the most commonly known cases of a plane breaking up in a CB is the story of the Lockheed Electra which broke up in a storm in December 1971 above the Peruvian tropical rain forest. A 17 year old passenger, Juliane Koepcke, survived the fall of 3000 metres attached to her seat which acted as a parachute.

In her memoirs, she also suggested the theory that strong updraughts could have slowed down her fall. In any case, the story of her ten day long walk out, on her own, through the jungle has made her famous the world over.

<https://www.youtube.com/watch?v=ZQU4f-KiyEA>

Front cover: Our photographer having a morning flight at sunrise in September 2013, between two cloud layers... It's the day after a chilly night and rain.

A peaceful aerology... Banks of mist form at ground level. A lot higher, the altocumulus gives a unique relief to this unexpected pastoral landscape in the sky near Paris... The only risk to watch out for: Always have a landing option within reach.

Photo: Franck Simonnet
Motor Fresh Breeze Simonini Sportix



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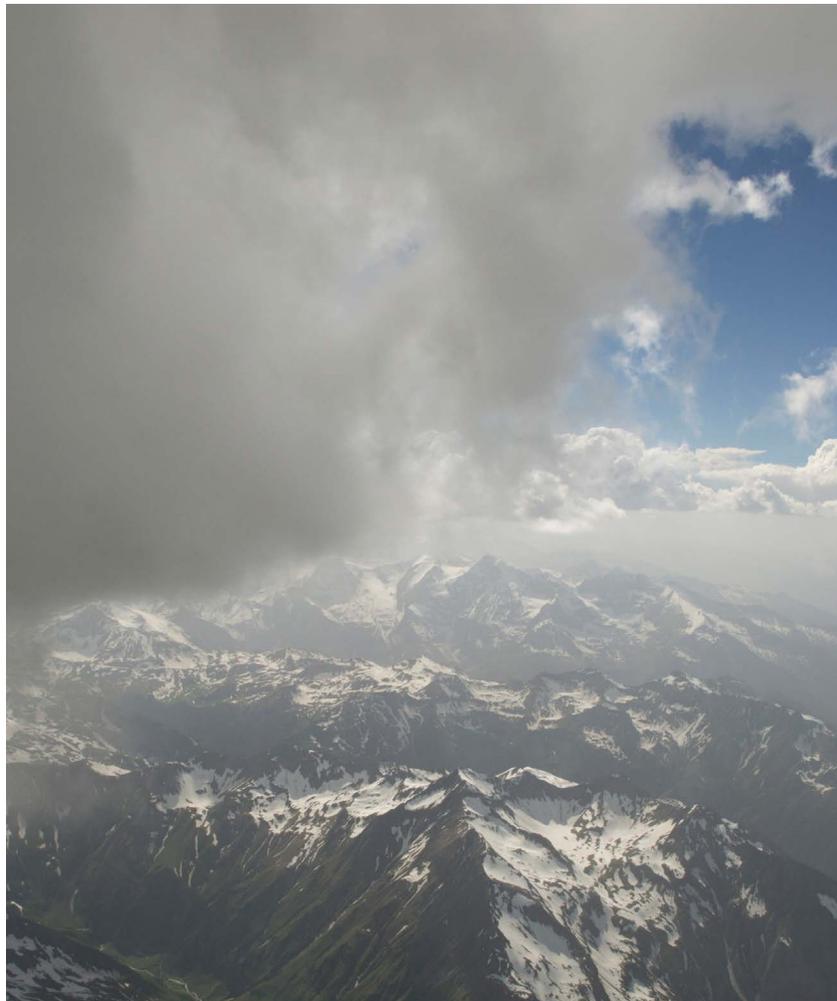
10TH ANNIVERSARY



Photo: Mike Hollingshead / www.extremeinstantly.com

Inside this one, you would probably still go up even without a wing.

A photo taken by a test pilot on our editorial team at nearly 5000 metres in June, still going up, but not too much...



Without a doubt, there are strong updraughts in a cu-nim. One hears of peaks of 80 m/s going up. Shear layers and turbulence are the result. The energy released in a cumulonimbus is phenomenal and is equivalent to the output of several nuclear power stations.

However, around the periphery of the storm, the conditions can be pleasant: Wide smooth lift of 1-2 m/s lulling us into believing it is a 'friendly' cu-nim – which encourages some pilots to play with fire. Yet the trap can quickly close. The biggest risk comes from two cumulonimbus joining together.



A beautiful cu-nim above the Eastern Pyrenees. Photo: Sascha Burkhardt



FILM: MIRACLE IN THE STORM

Ewa's story has been made into an interesting 52 minute long documentary which retraces (with reconstructions that are sometimes a bit theatrical) this German pilot's incredible adventure.

Free Aero asked her what she thought of the film. 'Apart from a few small errors in the detail, it's a good documentary'.

You can watch it here: <https://www.youtube.com/watch?v=7LvJHhmzxbc>



Niviuk: An illustration of landing a bit late...

THE TRAP IN MANILLA 2007

The best known case in the paragliding world was the drama which unfolded in Manilla in 2007. It happened fifteen days before the World Championship, in the middle of the Australian summer during an open competition.

Two cu-nims joined together trapping several pilots whilst others like David Dagault and Chrigel Maurer flying a few hundred metres from them, carried on without experiencing any real problems.

The Chinese pilot He Zhongpin died when he was struck by lightening in the storm. The Belgian pilot Christophe Gaber was also sucked up.

After trying in vain to get down by B lining, followed by a cascade of incidents, he had to throw his Rogallo reserve but still continued to go up to 2700 metres, before eventually coming down unharmed.

The most well known pilot in the cu-nim was the German pilot Ewa Wisnierska, who was remarkably lucky to survive after being sucked up to 10 000 metres.

The tales of her adventure were told all around the world, and recounted to the general public by the press. She was propelled by air rising at 20m/s, despite her attempts to escape by spiralling at the limit of blacking out.

It confirmed what should be clearly understood: In such an updraft, no fast decent technique is going to get you out of there!

Ewa found herself surrounded by lightning and hail stones the size of melons.

At 4000 metres, she informed the German team captain of her dire situation by radio. The turbulence increased and the wing kept turning into a rag. Ewa stalled it to get rid of the cravats.

She tried to fly in a straight line to get out of the cloud, but her GPS confirmed that it was impossible to stay on course. Finally, she lost consciousness and slumped asymmetrically in her harness, provoking a trajectory in wide circles, as shown by the tracklog on her GPS.

The recording on her vario showed a maximum altitude of 9964 metres, the soundings for that day gave a temperature of -50° at that height...



Sucked up on the same day by the cu-nim that Ewa was in, Christophe Gaber had no visibility, he could hardly even see his wing and continued to go up...under his reserve! How brave in such a desperate situation to think of taking a 'selfie' to record what hell looks like...



Then she was spat back down at more than 30 m/s and woke up at 6900 metres. The temperature was still -25°, and she still had no visibility. It was raining and hailing, and she was shaking with cold, but the air was a bit calmer, and the paraglider flew on its own in a straight line...

Then the white world which enveloped her began to break up, and she saw the sun and the cumulus around her. Ewa descended in wide turns, crossed back through a cloud and finally saw the ground from an altitude of 1800 m. 'It was like Apollo 13', she said later.

She landed near a farm and stayed lying on the ground to heat herself up. This was fortuitous, because if Ewa had walked around immediately, the very cold blood in her extremities would have gone to her core, which could have been dangerous.

The German pilot had unheard of luck in all respects because, according to the specialists, if she hadn't fallen unconscious at high altitude, allowing her body to go into a type of hibernation and thus function at a minimum, she wouldn't have survived...



Pilots are used to flying relatively near to over developing clouds. Without valleys to channel the flow of air, the influence of the suction is more localised.



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Bild: Thomas Ulrich / Location: Azores Islands

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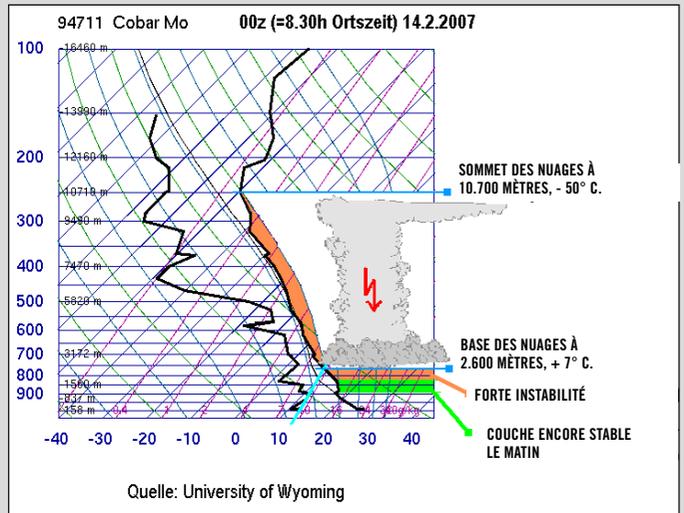
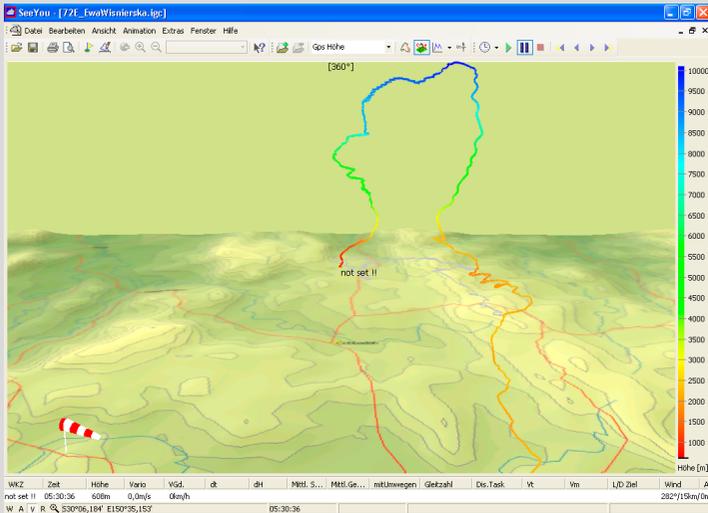
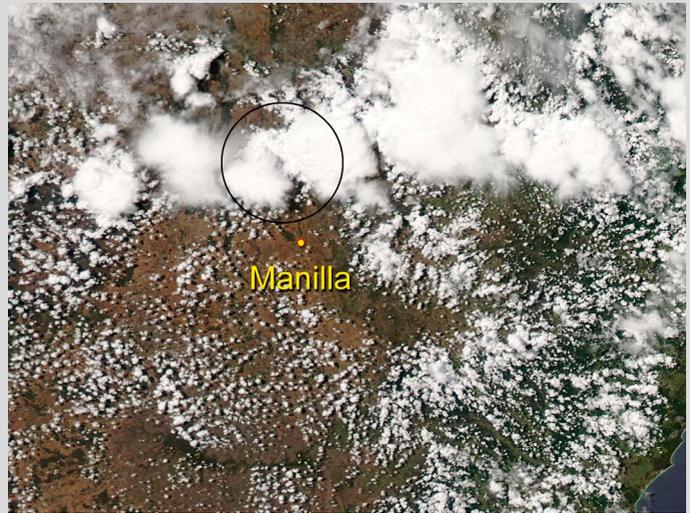


MANILLA, THE TRAP

The photo montage above and the satellite photo on the right show the situation just before the fusion of the two storm cells. The cumulonimbus on the right had been growing all morning and had produced lots of rain. The pilots approached this cloud to use the updraft, before going round it and heading north. The pilots were initially pushed by the southerly wind then, once they had passed the cloud, they met a northerly wind, because the cloud was sucking up the air around it. There were still patches of sunlight on the ground.

The pilots thought they had got out of it once they had passed this cu-nim. In fact the second cloud in front of them (on the left) spread out very quickly. It seems as if a storm cell formed in 30 to 45 minutes in the middle. The pilots found themselves sucked up by this developing cell. Christophe Champetier

Below left: The IGC tracklog of Ewa's flight. Below right: The sounding for that morning showed a little bit of stability in the lower layers which would rapidly disappear. Higher up, it was very unstable which indicated a risk of storms.



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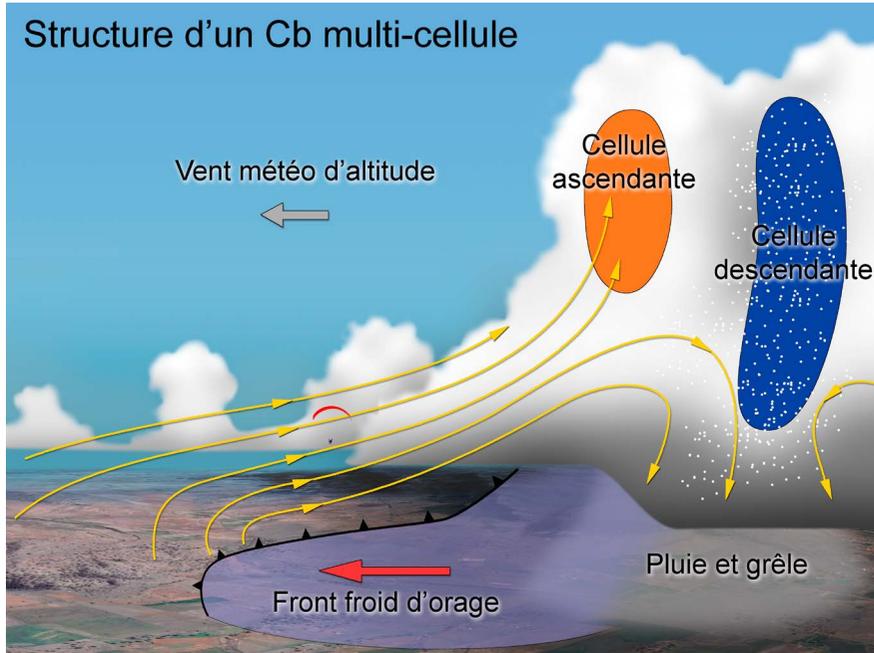
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WHY CAN CU-NIMS BE TREACHEROUS?

Christophe Champetier, former journalist with THERMIK and Aériale, explains how a multi-cell storm works with the help of a diagram...

"The convection cells form and dissipate along a line. When a cell is in the dissipating phase (in blue in the diagram), it disintegrates releasing rain, hail and cold air created by evaporation. The high level of instability accelerates this cold air downwards.

When it arrives at ground level, the cold bubble spreads out in a front, called a gust front. It reinforces the instability in front of the cloud, and mechanically lifts the hot air from the ground. The front is a very turbulent zone and the winds at ground level can be very violent (storm gusts). Higher up, the lifting air creates a large area of rising air in front of the cloud, and forms a current coming back towards the cu-nim (here in yellow).

This air flow creates a new convective cell (in orange). This image is simplified and on a very large scale; these phenomena aren't easy to see whilst flying. In Manila, the pilots apparently noticed a current of air at about 2000m travelling towards the cumulonimbus.

Near these big clouds, it is sometimes difficult to find good thermals. The shade limits the convection and unless you are at the front of the storm, the thermals can be fairly weak in the lower layers. It becomes tempting to approach the clouds to look for the best lifting thermals.

Pilots are perhaps drawn by the conditions higher up at cloud base. The air there goes up gently and the zone is calm because the air flow is very wide. But the updraught suddenly becomes strong in the convergence zone near the storm cell. No doubt this is what trapped the pilots."

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A nice congestus: Over development is perhaps not far away.

WHY?

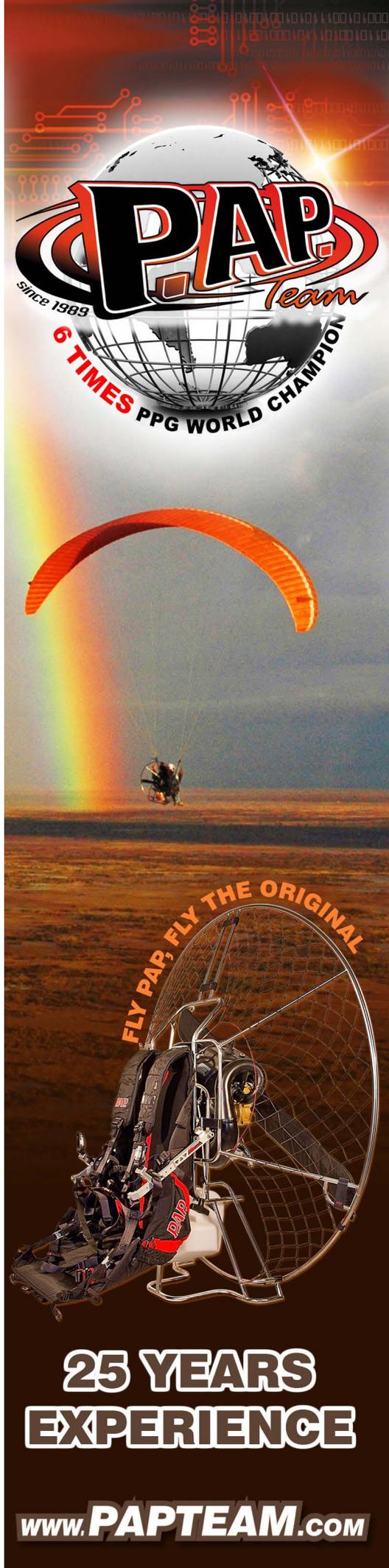
How could this tragedy have happened? The weather forecast certainly predicted possible storms during the day. But at the same time, Manilla is known as a safe site in this respect.

The flat terrain doesn't channel the wind from storms, so it is, in principal, easier to keep away than in high mountains where the strong winds channelled by the relief suck in the air from afar in the valleys.

But evidently in this immense plain, the pilots no doubt underestimated the cloud development.

Contrary to what they were used to in the Alps, here, for several days, they had been able to fly relatively near to clouds where it was already raining, without experiencing particularly strong rising air or winds.

Another reason explains the surprise effect: As it got bigger, a second storm cell trapped the competition pilots...



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BUT WHERE IS THE LIMIT?

There is no doubt about it; everything about this type of accident tells us: Never play with cu-nims or with developing congestus.
 But the question that every pilot asks themselves is: Where is the limit? How do you know if the cloud above you is a developing CB?

The answer unfortunately is neither simple nor unambiguous. There is no fool-proof way of judging the development above our heads.

The pilot can gather together the clues and come to a conclusion based on this, but without a weather radar, it isn't easy to recognise a cu-nim hidden behind a layer of stratus for example.
 Obviously, you need to be vigilant starting in the morning before flying, by looking at the weather forecast. It can clearly indicate a possibility of storms whether due to the arrival of a stormy front, or a high probability of isolated fair weather storms. An increase in humidity, a drop in pressure or the advection of cold air high up, are all factors that the weather forecasters can predict relatively well.

Observing from the ground is the next step. The formation of cumulus castellanus before midday, for example, can be a sign. Once you have taken off, it is difficult to judge the scale of the mass of clouds above your head.

Watching development on the horizon gives an idea of the instability of the air mass, but isn't a guarantee that there won't be a cu-nim or a very greedy congestus just above you.

WHY SHOULDN'T YOU FLY IN A NICE CLOUD?

Even if there is no risk of a storm, under 'normal' cumulus, it is best not to let yourself get sucked into the middle of the cloud. The reasons are obvious: Firstly it is forbidden because we aren't equipped for IFR. The risk of collision is real.

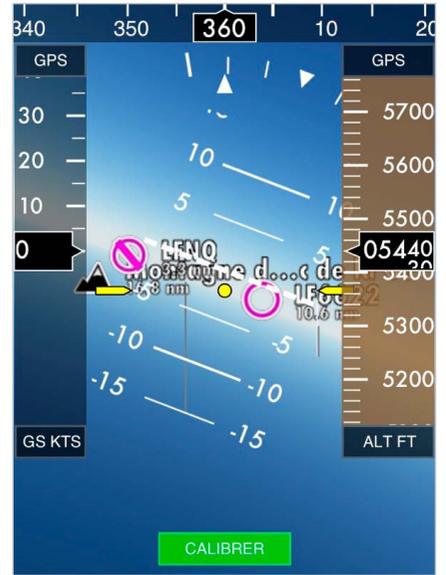
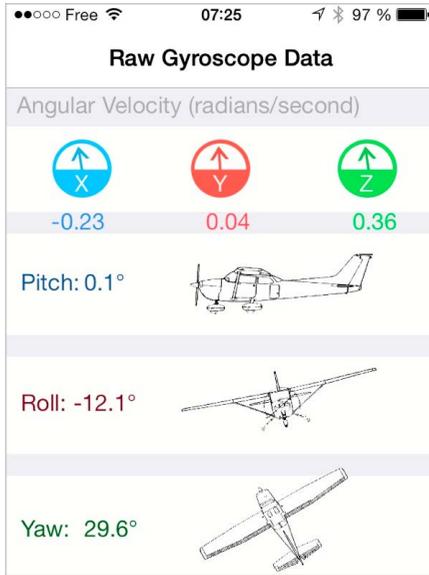
And then once inside, the rate of climb can increase even more: The heat released by the condensation increases the contrast in temperature, the rising air 'finds sustenance'.
 As a consequence, the turbulence can increase.



In a chaotic sky like this one, a cumulonimbus can hide itself behind an inoffensive looking layer.
 Photo: Daniel Tyrkas/SWING

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Even in a gentle cloud with moderate development, paraglider and paramotor pilots shouldn't be there. On the left, the tracklog of a pilot who went into a large but inoffensive cumulus at nearly 5000 metres, far from the terrain.

Despite using a compass, it was impossible for him to keep the easterly course that he had chosen from the first red arrow onwards.

He found himself banking heavily without really understanding why or how much.

Even on a paraglider or a paramotor, despite their enormous pendular stability, you need an artificial horizon to keep your direction after the loss of visual references.

It's true that, since the iPhone 4, the integrated gyroscope (middle diagram) can be used as a real artificial horizon if the algorithms of the application are reliable (right photo: App [Air Nav Pro](#)). This can help, but doesn't give the right to deliberately cross clouds in IFR.

FLYING IN A STRAIGHT LINE: MISSION IMPOSSIBLE?

But there are other reasons which should persuade a pilot to avoid flying in clouds: It is really impossible to fly in a straight line without visual landmarks.

You would think that, as a paramotor or paraglider pilot suspended with our centre of gravity seven metres below the wing, the pendular stability would prevent a loss of control, but that is only half true.

Certainly, unlike us, a plane or a sail plane without an artificial horizon can find themselves 'flying on their roof' without realising it, because the centrifugal forces can seem like gravity, which makes the pilot feel as if he is still flying with his feet below him.

On a paraglider that can't happen in the same way, but all those who have intentionally or unintentionally flown in clouds confirm that the wing really can be in a gentle spiral even though the pilot thinks he is flying in a straight line.

Even keeping your eye constantly on the compass (an essential piece of equipment in a cloud, whether based on a GPS or the Earth's magnetic field), it is surprisingly difficult to keep your chosen course.

Apart from losing visual references, another reason for this difficulty was suggested by Burkhard Martens, author of several works about flying distance on a paraglider and who quoted a pilot who wished to remain anonymous:



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“Numerous thermals and, even more so, the clouds capping them rotate. If you want to keep a straight line trajectory compared to the ground, you therefore need to constantly turn into this mass of rotating air. In cloud, I have already had the experience of following my compass and GPS, and keeping flying in a straight line compared to the ground by pulling on enormous amounts of brake on one side. In other words, I flew in a straight line on the map, whilst spiralling in the air mass...”

Once inside, it can be difficult to find the way out, and to escape in the direction planned. If the cloud is far from the terrain the risk of collision is limited to other aircraft. Moreover, don't count on the sun

to keep your bearing: Once in cloud, in the diffused light, there are no bright patches to show the direction of the sun contrary to what you may have hoped.

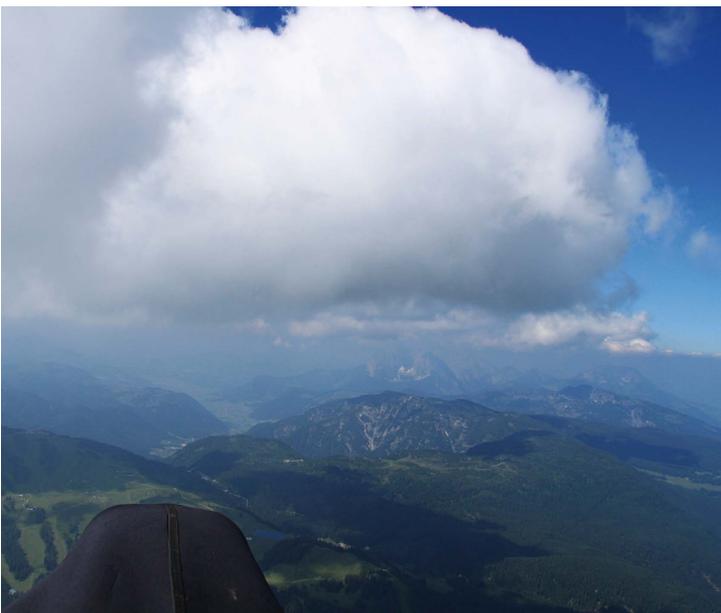
THE 45° RULE

Therefore we should avoid going into a cloud, even a modest one. To reduce the risk of this happening, lots of pilots flying in thermals use the '45° rule'.

It says that, if the pilot can still see blue sky at 45° above and in front of him, he could in theory always escape because, if the cloud starts to really pull, the pilot can still get to the edge of the cloud quite simply because the normal maximum climb rate is usually about 10 m/s, and a paraglider goes forward at about 10 m/s.

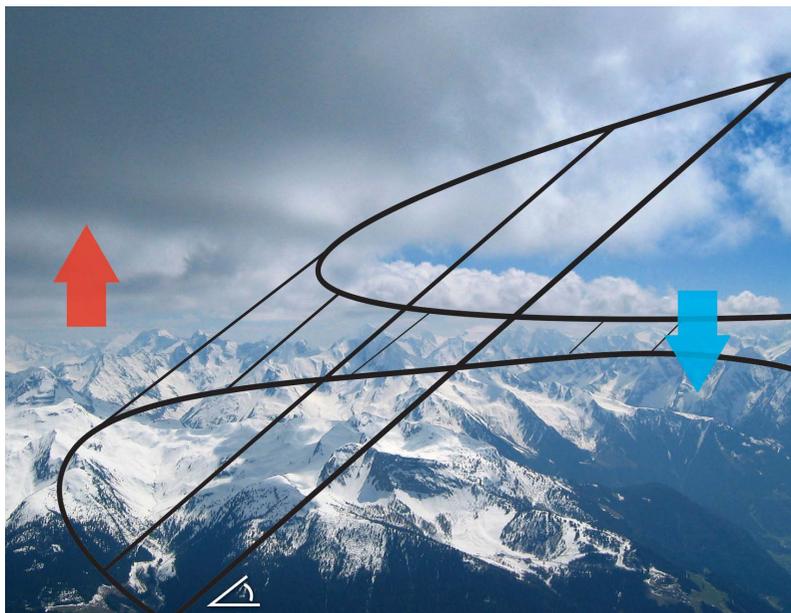
Strong lift in sight: The base of this cloud bulges upwards. This is the point where the lift will be the strongest.

Photo: Burkhard Martens, from his book: **Cross Country Flying**
www.thermikwolke.de



The well known 45° rule is a good way to keep sufficient margin to reduce the risk of getting swallowed up by a cloud, whether under a big isolated cumulus or a cloud street like here.

While the pilot can see the blue sky at 45° in front of him, there is a high probability of reaching the edge of the cloud, even if it starts to draw air in at 10 m/s...





Inoffensive, as long as the visibility downward is guaranteed. Stunning towers during a morning flight on the island of Tenerife. Photo: Sascha Burkhardt

Therefore, at worst, the trajectory is 45° upwards, where the pilot can still see blue.

BASE IN A DOME

This rule obviously also works in cases where the base of the cloud forms a dome. This happens on days where there are strong thermals.

The edge of the cloud is lower than the middle, the pilot who lets himself go right up to the base is therefore flying inside the dome.

To get back to the edge of the cloud, the pilot needs to descend lower than if the base of the cumulus was flat.

If the pilot climbing under the centre of the cloud respects the 45° rule, he will keep a good margin and stop climbing earlier, even though the base of the cloud is still far above him.



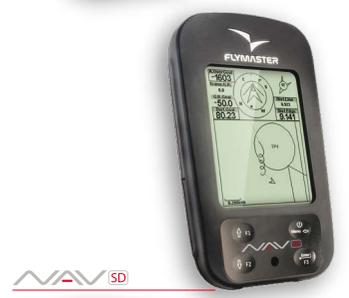
A very stable day, where the mist stays at ground level. The only thermals capable of piercing the layer come from the chimneys of an industrial complex...
Photo: Paul Haxby



Flying in the wispiess. Visibility disappears very quickly if the pilot isn't vigilant.
Photo: Sascha Burkhardt.



NEW SD series



About 8h30 on a beautiful September morning. The privilege of a paramotor is exploring this ephemeral countryside near Chambéry... Photo: Franck Simonnet

PLAYING WITH THE CLOUDS

There really are times when pilots can play with the clouds. Near the relief, the rules only require us to stay just out of the clouds. It is exhilarating to fly around these immense balls of cotton wool...

Very often there is the opportunity during a ploop in the mountains. Taking off above an intermediate layer of clouds, the pilot can go down through it if there are big enough holes.

Without wind at all levels, going from one layer of cloud to another should, in theory, be very calm.

It's a good opportunity to get near to the clouds, but obviously the pilot must keep an eye on the cloudy air mass and check that the holes don't fill in.

The clouds can increase their volume both vertically as well as horizontally. A sea of clouds in the bottom of the valleys can quickly build and cover the anticipated landing field. It is best, therefore, to constantly have a plan B to land higher up if necessary.

If the layer of cloud marks a limit between two air masses of different wind speeds, the crossing might be a bit turbulent. In winter, if the clouds float above a lake of cold air, it happens that the air above, coming from the south, will be warmer and susceptible to Föhn type turbulence.

Above the clouds, the pilot is shaken







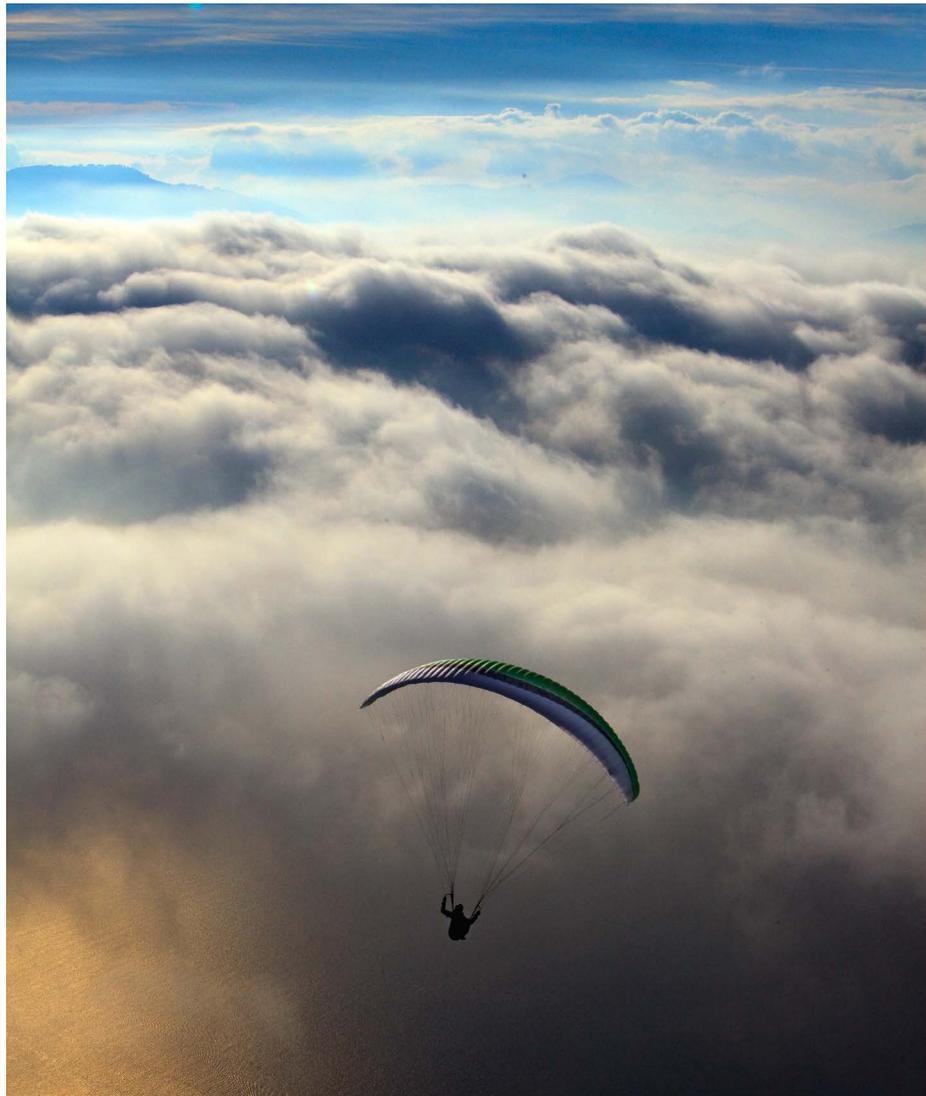
Photo: Karen Skinner / Niviuk

When there is wind as is the case here, the 'cloud falls' and the eddies (on the right) show the areas to keep away from.

about but then descending, through the layer, the pilot dives into a sea of oil, calm but cold...

On a paramotor it is very easy to 'visit' the countryside formed by clouds. In every season, but especially in autumn and winter, there are opportunities to take off in calm air and head for cumulus clouds or indeed altocumulus, turning around them or playing leapfrog from one cloud to another.

There too, you need to just keep a close eye on development. Is there a risk of the clouds joining up to form a single closed layer?



Another windy day: The clouds are brushed in one direction; on the surface of the water another wind seems to be blowing. When crossing between the two layers, the pilot anticipates light turbulence.

Photo: Gudrun Öchsl,
<http://www.profly.org/english/index.htm>

DUNE CUMULUS

In rare cases, paraglider or paramotor pilots are lucky enough to be able to soar in front of a cloud. Thermals and clouds don't necessarily move 100% with the wind. They can also create relief which the meteo wind blows around. In this case, in the lee of the cloud, the pilot can encounter turbulence, but in the wind on the front of the cloud, he can take advantage of dynamic rising air. Without a motor, the main problem is getting there, which makes this situation so rare. With a paramotor it is easier, but as this type of situation only happens when there are thermals and wind, the opportunity isn't necessarily compatible with paramotoring.



This one is clearly developing, best to stay away.
Photo: Christophe Champetier



An unusual view down onto cumulus above the Pyrenees: Karen Skinner during her record in October 2013, when she got to 6360 metres.
<https://vimeo.com/79760168>
Screenshot: Karen Skinner / Niviuk

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It is the same with phenomena like the Morning Glory in Australia. It's a rare phenomenon, a cloud in the shape of a roller which measures up to 1000 kilometres long, with a height of 1000 to 2000 metres.
http://en.wikipedia.org/wiki/Morning_glory_cloud

To get above these giant rollers you need a motor, and then the pilot might be able to use the dynamic rising air. Three paramotor pilots including the late Chris Atkinson, got near the Morning Glory and made a film which, as you can see from the trailer, has some impressive sequences. (Photo on the right).
<https://www.youtube.com/watch?v=o9MsWeuDauU>

On a hang glider it is a bit easier to approach this cloud to use the dynamic lift after a tow launch. Jonny Durand did it and documented his flight in this film. (Photo right):
<https://www.youtube.com/watch?v=RzurOLMD1BM>



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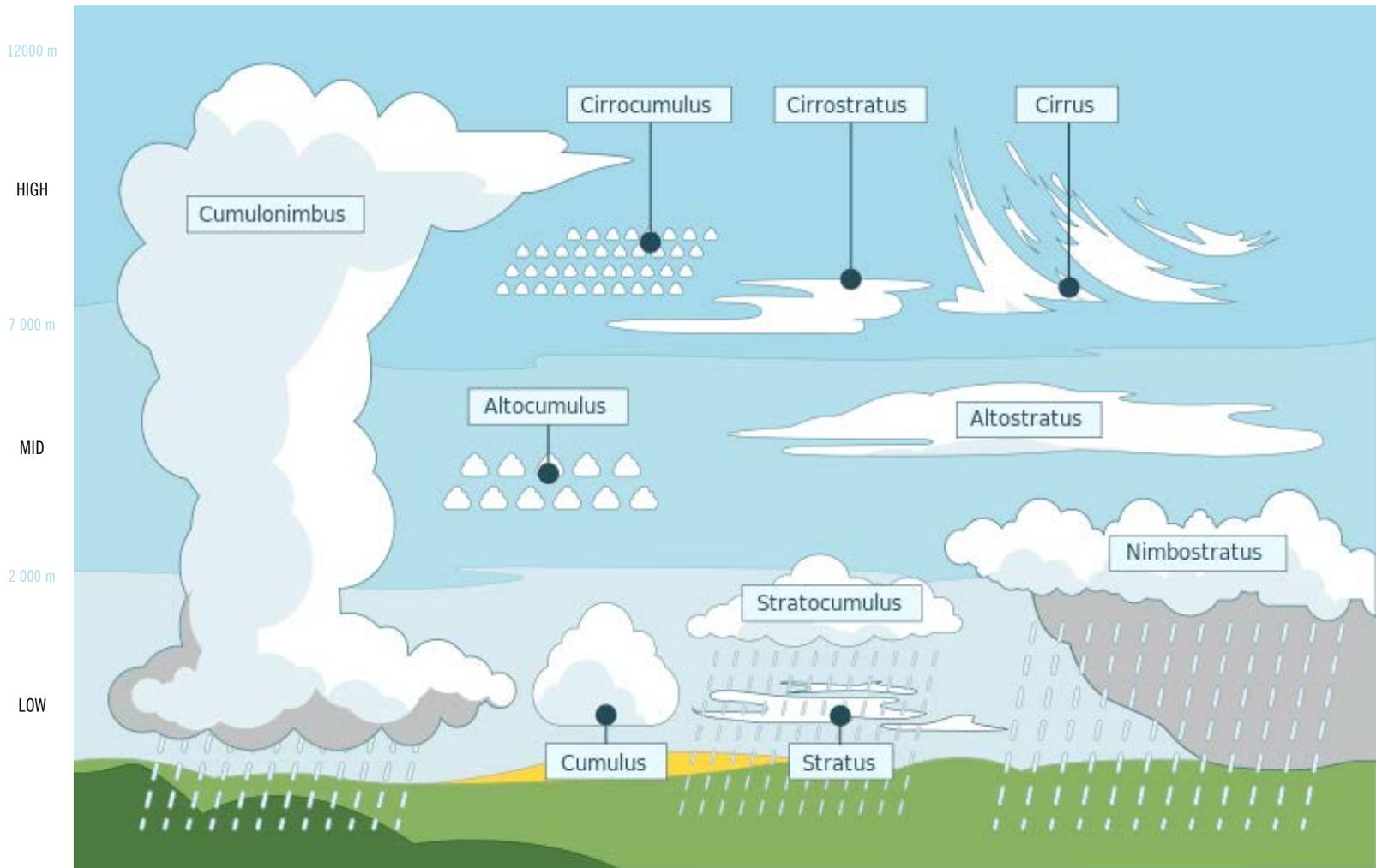
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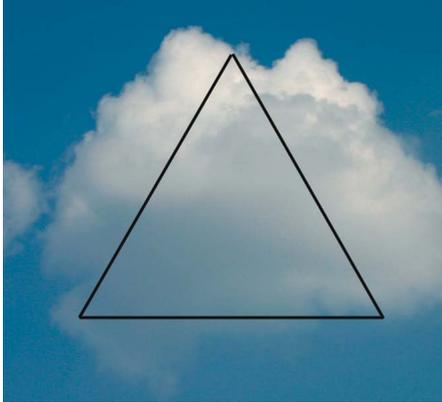
We (almost) learnt it all when we were training, but now is a good time to revise the exact names of the different types of clouds.
Diagram: Valentin de Bruyn <http://etaminstudio.com/en>



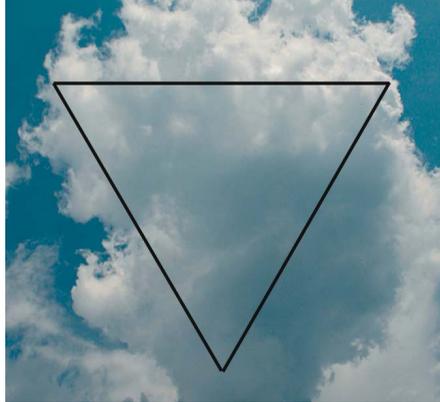
The birth of a cumulus from a few wisps. It's worth noting that in the first boxes in the second row, cumulus in nice weather can very closely resemble a rotor cumulus which indicates strong wind and turbulence. In this case, to determine the difference, you need to analyse the aerological context.

Beautiful ambience during a calm flight above an inoffensive layer...
Photo: Thomas Ulrich/Advance





A little reminder: The cloud is useful as long as its base is wider than the top, there is the possibility that it is still going up from below. But it isn't a certainty. The life span of lift under a cumulus is often shorter than you would think.



If the cloud forms a triangle which points down, it is generally a bad sign, the thermals have no doubt stopped feeding it. It's even more the case here, as the edges of this cumulus are fragmented.



Coming from far away to use a thermal marked by a cumulus, aim for the darkest, thickest point. Photos: Burkhard Martens, from his book: **Cross Country Flying**, www.thermikwolke.de

A great game: soaring between real relief and cloud relief. You just need to keep a watchful eye out for an escape route. Photo: Niviuk



TECHNIK CLOUDS

Another clue as to the strength of a thermal cloud is given by its shadow on the ground: If it is very compact with clear edges, it's a good sign. If the shadow starts to have holes in it, the cloud is no doubt breaking up.
Photo: Air Design

The base of the cloud forms a vault above the pilot, lower at the edges than in the centre. This effect can be seen under very strong clouds, here at more than 4500 metres. Photo: THERMIK editor



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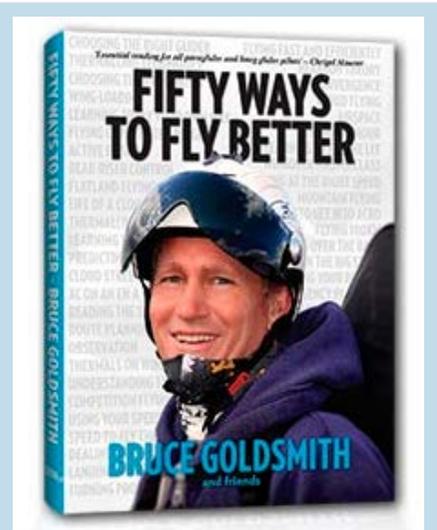
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 <p>Cross-Country Flying</p> <p>neu-neu-neu-neu-neu-neu-neu-neu English version second edition!!! now available. Info: Klick picture.</p>	 <p>Der Streckenflug Film</p> <p>neu-neu-neu-neu-neu-neu-neu-neu now available Info: Klick picture.</p>	 <p>Der Streckenflugfilm</p> <p>4,5 Stunden Spielfilme Info: Klick Bild</p>

Some of the photos in this article came from the author Burkhard Martens who is a specialist in distance flying and a recognized author. A new edition of his book, Cross Country Flying, will be out soon.
www.thermikwolke.de



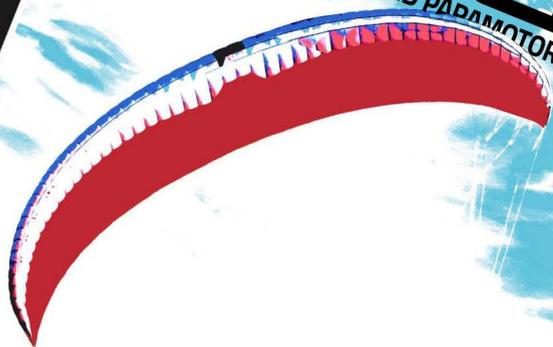
Bruce Goldsmith's book, *50 Ways To Fly Better*, also has some good advice for flying near and under clouds.

Often clouds form in streets or hexagons. In a future edition we will explain why, when and how the pilot can make the most of them...
Photo: Francis Cormon



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