AN EXPEDITION OF SURPRISES

Jean-Marie Clement reports on an eventful Patagonia season

Electric activity and (main pic) the cloud during the eruption of the Chilean volcano Puyehue-Cordon del Caulle on 4 June, 2011

PATAGONIA 2011/12 was a season under the sign of adversity from both natural and meteorological phenomena, aggravated by the lack of collaboration by some air traffic controllers and the increasing appetite of the customs officers in the port of Buenos Aires.

The volcano Puyehue

The first natural, and certainly the most meaningful, phenomenon was the eruption of the Chilean volcano Puyehue-Cordon del Caulle, situated 100km NW of Bariloche, on 4 June, 2011. Photos 1 and 2, taken about 30km away from the crater, give an idea of the size of the cataclysm. The immediate consequence for Bariloche was a solid rain that covered the city and the lake with 12 inches of sand and pumice stone, because, unfortunately, that day the wind was blowing right on the axis of the volcano (310°).

After almost 4,000 people had been evacuated, normal life stopped completely for several weeks along hundreds of kilometres towards the east. The majority of wildlife died and thousands of bovines and sheep had to be euthanized because they were deprived of food and unable to eat the fodder that the farmers brought to them, because, never having seen it before, they did not know what it was!

Some days after the explosion, the volcano started spitting very fine, impalpable ash (as light as icing sugar) sowing this thick, deadly powder along its plume that turned according to the will of the wind and falling to earth along a cone of 90° angle having its bisector oriented precisely W-E and whose edges were,

unfortunately, the airports of Bariloche and San Martin de Los Andes. The consequence was the inactivity of one or the other, and the impossibility of flying below 3,000m along the 100km that separates these two airports.

The city of Bariloche remained paralyzed for more than a week: the time for the shovels to clean the streets (photo 3). The hangar stayed safe, on the one hand because of its shape and, on the other, thanks to the fast intervention of club members while taking big risks (photo 4). The runway remained unusable for four months: the time for rain and snow to make the dust penetrate the soil and for the wind to displace the rest eastward up to Buenos Aires (1,600km), where the airports had to close for several days, like those of South Africa, Australia and New Zealand. Bariloche's international airport remained closed from 4 June and only officially reopened on 20 December, while taking advantage of this forced stop to change the asphalt of the runway and add a water cleaning system in order to wash away the ash deposited on the asphalt.

In fact, commercial flights would only recommence at the end of January, and again with numerous interruptions each time the plume passed above the city. For the record, an airline jet remained trapped for several months on the tarmac. The pilot had received clearance to take off, but the controller did not realise that the cloud that was arriving over the city and the lake was, actually, a cloud of sand and ash, forcing the pilot to abort the take-off during the initial roll out. The controller had not been informed about the eruption of the volcano!

From the point of view of the ground handling around the parking and club runway, the situation was not brilliant as the whole area of the gliding club was completely protected from the wind, preventing it from blowing the five inches of ash away towards Buenos Aires! It was, therefore, necessary to live under these hard conditions, feet in the ash and, often, wearing a face mask; forced to go straight under the shower every day when back home (photo 5).

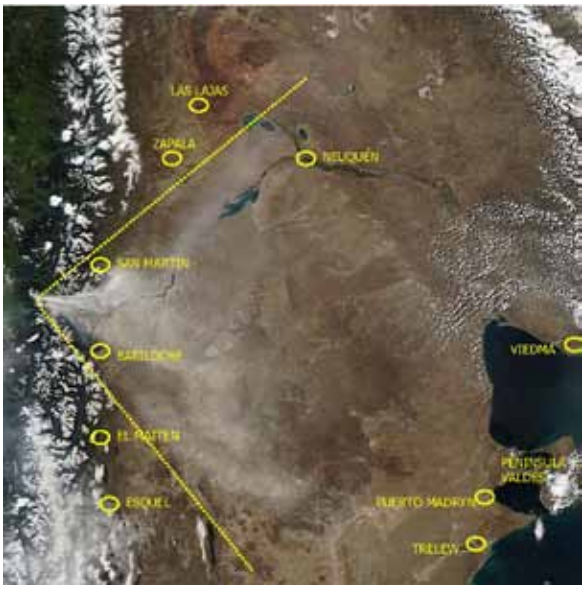
Of course, you will say: "But why the hell did you go there, knowing the situation?". After long reflection, and consultations with the German team, our decision to go was based on the facts that no eruption of the neighbouring volcanoes (Llaima and Chaiten in 2008) had lasted more than three months and that the area of influence of the plume had completely spared the neighbouring

(Above) Bariloche main street (Mitre) and (right) cleaning the hangar
(Below) Under the ashes, waiting for better times

(Above) The plume with clear sky, January 2012 (left); primary ashes embedded in the cloud layer, November 2011
(Below) In flight at 14.500ft above the erupting crater (left); Rio Caleufu covered with ashes

INTERNET LINKS:

- Special site prepared by a club pilot, containing all the useful links: *www.inglaner.com/volcan_puyehue.htm*
- Animation covering 12 days of the eruption from 4-16 June 2011: *http://upload.wikimedia.org/wikipedia/commons/d/d3/Two_Week_Movie_of_Chilean_Volcanic_Eruption_xo.ogv*
- Animation of the eruption from 13 June 2011: *http://www.youtube.com/watch?v=1620KyV2jsg*
- Animation of the eruption from 6 January, 2012 (HD): *http://vimeo.com/36261528*
- More photos: *www.topfly.aero*



Plume and affected area on 29 January, 2012

airports of (B) El Maiten (100km south), (C) Esquel (200km south), (D) Zapala (250km north), so we could have moved the camp there if necessary. Actually, none of the plans B, C or D could be applied. For (B), the runway of El Maiten was too soft to allow the Nimbus to take off with two pilots, which forced me to abandon my passenger on the ground to return by bus, in his flight suit designed for -30°C but with +25° on the ground and not a single penny in his pocket!

For (C), Esquel turned out to be practically QGO because the local ATC suddenly passed from one airplane a week to four a day (partially replacing Bariloche). So big panic, to the point that the Swiss, Jean-Marc Perrin (DG -800) and the US Perlan Project team (DG-1000) had to abandon this solution after a few days, because they had to take off before the airport opened and land after it closed, while prohibited from flying in half of the TMA – the good one, where the wave stays.

The plan (D), moving to Zapala, could never be applied because of the abnormally south position of the Pacific anticyclone, so that the meteorological conditions were never favourable for more than one day at this latitude, thus eliminating any interest for a move that would mean losing two days and a lot of money. On the contrary, it would have been wiser to move the camp at least 300km south, which proved impossible because of the absence of infrastructures and logistics compatible with the transportation of one container and the operating contingencies of the Nimbus 4DM, unable to taxi with its sole engine. Jean-Marc Perrin, coming from Switzerland with his own car, trailer and the DG-800 in 15m, could therefore take advantage of these precarious runways and thus log flights between1,500 and 2,000km, allowing him to win the OLC 2011.

Gliding and volcanic ash

To all things misfortune is good, it is said. If ash is actually a poison for the engines and prevents all take-offs, the situation changes when the motor is put back.

Once in flight, we discovered two types of volcanic ash. Primary ash is the fresh ash leaving the crater and materialised in the plume, isolated and easily visible in a clear sky (photos 6 of January 2012), but hard to identify when absorbed into a cloud layer (photos 7 and 8 of end 2011). Its extent perpendicular to the axis of the plume is quite limited – about 10km at a distance of 100km away from the volcano – but its density and toxicity are very high. Better to stay home, wearing the mask if required to go out.

The photo on the left shows the position of the plume of primary ash on 29 January, 2012. When the wind turns quickly, the ash front penetrates into the air mass like a cold front, see photo 10. Luckily, we have never been forced to fly under these conditions where the visibility is only a few tens of meters.

The secondary ash is the consequence of wind erosion and lifting of the primary ash deposited on to the ground by the plume, carried away towards the east, day after day. The photo on the left shows the extent of the damaged zone, a triangle whose leg is more than 600km long. Photo 9 shows the total

desertification of the territory (we are flying abeam Caleufu, the wing pointing east, the territory visible on the photo is about 80 x 80km), and also the intensification of the density of ash in suspension while going eastward.

Photo 11, taken 50km north of Bariloche at 6,700m and looking south towards the lake and the city, shows the position of the wind erosion ash front; the mountains located to the west appearing clean whereas everything that is downwind of the front is totally unflyable, at least with an engine. We had twice been forced to fly down home while crossing the secondary ash cloud. The top of this cloud doesn't exceed 3,000m and the visibility is around a few hundred meters, in all directions. Considering the absence of icing risk, the presence of three redundant GPS navigation systems and of two gyroscopes supplied by three independent electric circuits, the IMC descent didn't pose any problem, except that the time it took to come down from 3,000m in this mash seemed to me an eternity that will not quickly fade from my memory.

But not everything has to be thrown away: the ash lifted by the wind are so light that they gorgeously materialised the hydraulic jumps and the classic rebounds. Very useful at the start, allowing us to easily identify the heart of the lift! Photo 12, taken at 3,000m and 10km north of the airfield looking north, shows the perfect materialisation of a small hydraulic jump, with the presence of Kelvin Helmholtz rolls, while the particles of air and ash were falling at a super critical speed. This results in a speed higher than the average speed of the surrounding air mass, consisting of a practically vertical rise of the particles from the ground until the altitude at which the speed becomes, once again, equal to that of the surrounding air mass – in this case, around 3,500m.

One can observe that, about 50km north, this system gives way to a classic, sinusoidal, rebound wave system without Kelvin Helmholtz rolls. Photo 13, looking eastward, shows the materialisation of the lifted ash trapped in a magnificent hydraulic jump located downwind, right in the middle of the Pampa about 50km away from the mountains. This photo shows three important features of the hydraulic jump: the presence of rolls aligned with the axis of the wind ending precisely at the front; a unique, practically vertical front, in which the particles of air and ash rise to the altitude of the laminar layer; and a high altitude cloud having a leading edge located into wind with respect to the ground line of the front (the shadow can be seen). In this case, it can also be observed that the ash does not pass into the laminar layer and remains caught between the ground and about 3,000m. A disaster for power planes, light or commercial aviation.

Photo 14, taken at 5,000m and 50km north of the airfield, looking north-east, shows the total absence of exchange between the two air masses and also the vertical amplitude of the sinusoidal displacement of an elementary particle, which is in the order of only 200 to 300m. This characteristic represents the fundamental difference between thermal and wave lift. In the first case, each elementary particle travels the whole distance from the ground to the cloud, while, in the

Above left to right: Front ash arriving from NW; wind ash in movement; hydraulic jump materialised by the ash; hydraulic jump materialised on the pampa

Below: Materialisation of the rebounds by the ash

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FLYING DEEP INSIDE THE ANDES OFFERS AN UNFORGETTABLE SPECTACLE THAT REPLACES WITH GREAT PLEASURE ANY SPEED OR DISTANCE RECORDS

second case, it travels vertically only a few hundred metres and the movement is transmitted from one particle to another, similar to the game of colliding pendula. It is therefore necessary to forget the classic diagram that can be found in the best books, in which one sees a sinusoidal movement of the fluid lines having an amplitude of the same order of magnitude as that of the mountain, whereas, the actual slant of the ascending and downward fluid lines is only a few degrees, hardly visible on a drawing at scale 1/1.

In conclusion, whatever the wave mode, no air particle is transferred from the turbulent layer to the laminar layer, which was always completely devoid of dust.

A capricious meteo

We therefore made "bad luck, good heart" (the best of a bad job); the ash was not the main thing that spoiled the season, the weather conditions did. Indeed, the direction of the "bad" wind, the one that made the plume pass above our heads, was about 310° orientation too far north to give good waves, because the subtropical air masses are too warm and humid and, in general, anticyclonic.

It is well known that it is not so much the speed of the wind that defines the intensity of a wave system, but more its temperature, temperature gradient and density (so, the colder, more stable and drier, the more powerful the wave).

Then, when the wind direction turned below 280°, we were delighted to regain the legendary purity of the Patagonian air and its fabulous waves, to a degree where, taken by the rage to fly at any cost and considering the particular conditions we were facing, we learned to fly with south wind, therefore parallel to the main line of the Andes. This technique is the same as we apply in the Alps, flying up and down from rebound to rebound, from peak to peak (positive wave), from lake to lake (negative wave). The only difference was that we had no landable field within a radius of 100km, so "goodbye high speeds"!

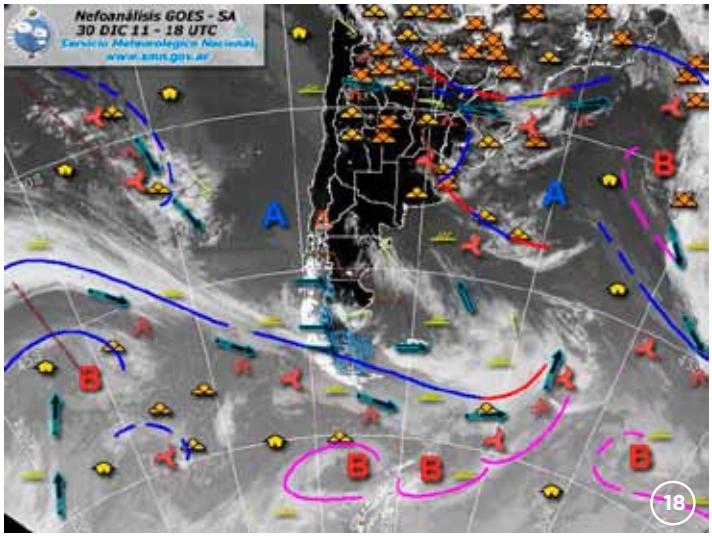
However, flying deep inside the Andes offers an unforgettable spectacle that replaces with great pleasure any speed or distance records. Figure 19 shows the situation on 11 January, where the wind at altitude blew 30 to 40kt full south, while it was, as usual, 20kt/300° on the ground. A rare situation but no less interesting.

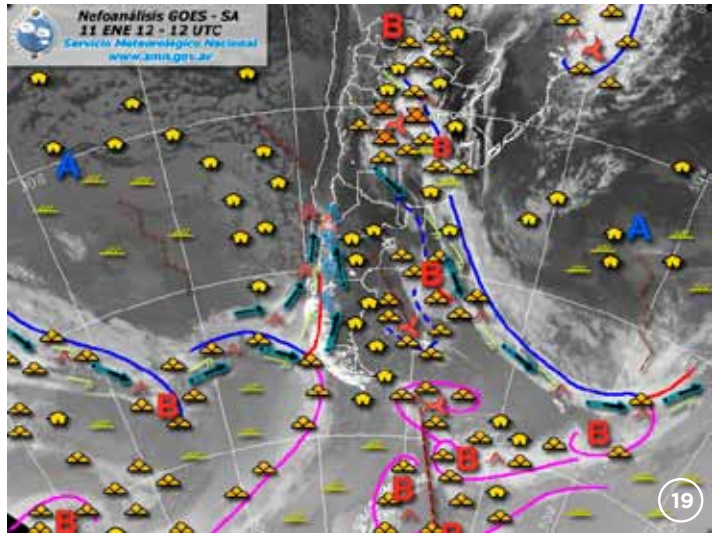
These anomalies of pressure and temperature have been reported in figure 20, where we see the temperature at 6,000m parallel with the QNH at the take-off time. The first observation is that the temperature has always been above the standard (-24°C). The average is even 10°C above the standard and it is my opinion that this is the most meaningful phenomenon, since, 10 years ago, it was around the standard. A warm-up of 10°C in altitude is a real atmospheric cataclysm, whose consequences are completely unknown and unpredictable, this phenomenon being apparently ignored by the meteorologists and climatologists who keep their eyes on their thermometers on the ground or on the remaining polar ice! One more reason, in my humble opinion, for reducing the impact of human activities on global warming and an interesting subject for a debate about "environmentalism" and anthropo-centrism!"

A glance on the curve of the QNH corroborates the moving down of the

(Above) Looking for somewhere to put the wings down.

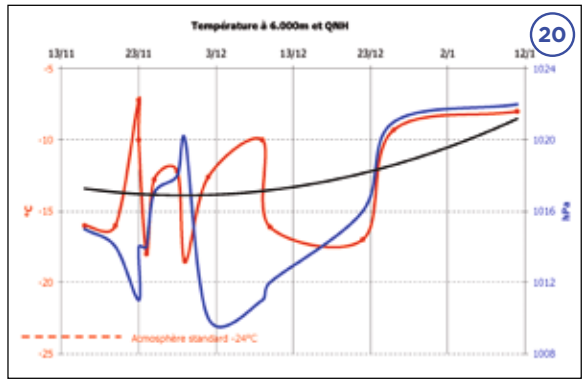
(Below) Storage of the wings under the flying containers (left); the dog will sniff them all





(Above) Nefo of 30 December, 2011 (left) and of 11 January, 2012

(Below) Evolution of the temperature at 20,000ft and the QNH at take-off



anticyclone 1,000km southbound, or isn't it rather the opposite? One could also say that the temperature increase might only be the consequence of the pressure centres shifting. Messrs meteorologists, you have the chair, I remain at your disposal to start the debate.

Consequently, the gliding activity has been the lowest of these past 10 years, with only 160 hours and 30 flying days out of 65 available days. The situation deteriorated continuously from mid-November, with periods of up to nine consecutive non-flyable days in December, essentially for lack of wind due to the positions and the strength of the anticyclones. The few thermal days were hard to fly because of the ash, which was put back in circulation by the convection. And since the two nearest emergency strips to the north and south (respectively 80km and 100km) were unusable for take-off, no one wanted to take the risk of derigging the Nimbus in the ash!

Figure 18 shows the situation on 30 December after seven days without a breath of wind – very nice for swimming in a mirror lake! The Pacific high pressure centre is simply 1,000km too south and the one on the Atlantic took the place of the usual low-pressure centre that is the engine of the system – the one that "pulls" the flow and keeps the jet-streams blowing. The situation in southern Patagonia was locally very good between 500km and 1,000km south from Bariloche; hopeless for us, but so good for Jean-Marc.

The via crucis of the customs

Considering the very low number of European gliders (only four), we agreed to send only one container, using that of the Germans, whose coordinator was Diether Memmert. At the beginning, I underestimated the cost of two out and return trips from southern Europe to Osnabrück (near Hamburg) with trailer, ie 5,000km and eight travelling days. It was necessary to dispense 3,000 euros in tips at all levels of the bureaucracy just to be able to leave the port within a reasonable time; days rather than weeks!

The return was no less delirious: at the end of two weeks of endless discussions between our agent and the customs – while Diether had already returned to Germany – the "narcos" required us, without any possibility of negotiation, to fully empty the container, setting all pieces on the ground in the port. A total catastrophe. Diether and I had to return to Buenos Aires, hire some dockers and organise the removal of four fuselages, 14 wings and about 50 bags and cases. These were laid on melting asphalt under the sun of a torrid summer, slaloming with our wings between mad trucks as we did our best to urgently leave this hell (photo 15), and praying to God that the containers that passed continuously over our heads remained firmly hung (photo 16). A Kafkaesque delirium that cost us more than another 4,000 euros, just for allowing an unhappy dog to put her nose on absolutely all the pieces (photo 17).

And to reach the peak of absurdity, they required us to check the container through the scanner after the control by the dogs. The decision is taken: never again! We are therefore working in search of alternative solutions, while hoping that the World Gliding Championship in Argentina next January can bring some improvement to the customs situation.

Jean-Marie Clement's first flight was at 14 in 1959. A national team member in 1963, he was CFI in 1964, before a professional pause working in Turin. After a first 1,000km in wave in 1982, he's applied an engineering mind to create and divulge an almost unique understanding of wave and dynamic flight. Jean-Marie was European champion in 1989, has 26 national and six world records, and 6,000+ hours