

THE QUEEN OF THE COMECHINGONES

South America's most beautiful cloud

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It is that glider pilots rather than meteorologists know the most beautiful clouds. The famous Moazagotl cloud, for instance, which forms on the leeward side of the Giant Mountains in Germany when the föhn blows from the south, has become reknowned in the gliding world, thanks to those pilots who first discovered and exploited the orographic wave movements associated with this handsome cloud.

All these characteristic cloud formations have evocative names. In Italy, the lovely wave cloud that forms in the Bove Valley in Sicily, to the lee of Mount Etna, has earned the appellation "The Countess of the Wind".

Argentina, too, has its beautiful wave cloud which forms during the cold season downwind of the Sierra de Comechingones, in the Calamuchita and La Cruz valleys in Cordoba Province. Because of its rare beauty and its enormous size, this cloud was baptized "The Queen of the Comechingones" (La Reina de los Comechingones) by the pilots of the now defunct Argentine Gliding Institute (INAV) which was located in La Cruz Valley. It is interesting to note, by the way, that the cloud takes its name from the Comechingones Range, The Comechingones being the Indians, who once lived in the Calamuchita and La Cruz valleys.

In the early fifties, the author had the good fortune to work for four years in La Cruz Valley as head of INAV's Meteorological and Aerophysics Division, and so was able to study the phenomenon at first hand.

The most effective orographic waves occur in these valleys with southwesterly winds which are extremely uniform in direction and become gradually stronger with height, increasing from around 15-20 km/h at the surface to as much as 90-100 km/h at 6000 m. At all levels the wind blows from the third quarter, there being little tendency to back or veer aloft. Regarding air temperatures during development of the situation, soundings made between 1951 and 1955 indicate that these virtually follow the adiabatic lapse rate from the surface to 3000 m. At this level, since the wave movement is already fairly effective, the temperature-height curve in La Cruz Valley is decidedly influenced by atmospheric oscillations. On the upwind side of the Sierra de Comechingones, instead, the lapse rate between 3000 and 4000 m is markedly less than 1°C/100 m, varying between 0.5 and 0.6°C. During the four years the author was at La Cruz, because of turbulence

and the strong SW wind, it was possible to take soundings in the mountain slope regions only twice. On these occasions long banks of strato-cumulus were found on the upwind side, with the condensation level at about 1700 m.

The wavelength varies with wind speed. At around 50 km/h the wavelength is about 12 km, while with upper wind speeds of 90 to 100 km/h, it increases to between 20 and 25 km.

In the Calamuchita Valley the first wave is marked by the formation of a band of lenticular altocumulus stretching parallel to the Sierra de Comechingones (Fig. 1). When there is sufficient moisture in the surface layers, very turbulent-looking fracto-cumulus may occur in rows parallel to and beneath the upper wave cloud. These clouds form on elongated rotor with a horizontal axis, the structure and dynamics of which are identical with those usually encountered in wave situations. Most times, however, owing to the lack of moisture in the lower layers, the presence of the rotors is not marked by any cloud formation.

Small lenticular clouds, associated with secondary wave movements generated by the weaker winds blowing in the free atmosphere at the same height as the mountain peaks, often appear beneath the wave cloud that forms in the upper layers (Fig. 2).

As regards the synoptic situation during the development of these efficient southwesterly wave movements in the Calamuchita and La Cruz valleys, it has been observed that the best conditions are created by an occluding dynamic low, fringing the Province of Buenos Aires or the coast. This low pressure zone exerts an easterly pull on the air mass over the central plain. This causes a strong airflow from the southwest that strikes the mountain range in Cordoba Province and produces effective lee wave movements.

The maximum heights attained by INAV gliders in such situations are around 6500 m, the most interesting flights being those by Scheidhauer, Dori, Picchio and Sanchez.

The most fascinating situation observed by the author occurred in the Calamuchita and La Cruz valleys on 27 April 1954, when there was a really magnificent Queen of the Comechingones. On that occasion it was possible to follow the development of the wave situation minute by minute and to acquire detailed photographic documentation of the whole event from beginning to end.

The map of surface weather on 27 April 1954 at 09.00 hours revealed a strong

dynamic low centred off the Atlantic coast of Buenos Aires Province and moving southeastwards. The cyclonic circulation of the winds, continuously increasing as the low gradually deepened, drew the air mass of the Buenos Aires and Cordoba regions eastwards, thus creating uniform flow from the third quarter (Fig. 3). Right from 09.00 hours, this air flow prevailed at all altitudes, speed increasing with height, exceeding 100 km/h at 6000 m.

In the regions on the leeward side of the Sierra de Comechingones, the layers higher than 3000 m were sufficiently moist to permit the formation of medium-high stratified banks of cloud (Fig. 4). The surface wind was blowing from the south at 6 km/h.

As time went by, the sky gradually cleared and the strength of the wind increased. At 11.45 in the Calamuchita Valley a number of lenticular altocumulus formed at about 4000 m. However, these were simple cigar-shaped lenticular formations, evidently associated with local undulatory pulses and they dissolved a few minutes after being formed. Rows of strato cumulus then started to appear over the top of the Sierra de Comechingones (Fig. 5).

At 12.30 the surface wind was still blowing from the south and was getting stronger, its speed having risen to 22 km/h. The barometer showed a tendency to fall more rapidly than usual.

By 14.30 the surface wind had decreased slightly and had also veered to the west. This was just what was needed. In fact, to the lee of the Sierra de Comechingones a band of lenticular cloud started to form at around 6000 m, as photographed by the author at 14.35 hours (Fig. 6).

The cloud, pulsing continuously, gradually stretched towards the Sierra Grande (Cordoba) parallel to the mountain range. At 15.00 hours the formation had the appearance of a large, compact, shining elongated bank (Fig. 7), while by 15.25 it was as illustrated in Fig. 8. The formation was at its largest at 16.10, when it was very dense in the centre and almost transparent on its southern edge (Rio Cuarto). The huge cloud by then resembled the beautiful white wing of an enormous dove. It was over 100 km long and was broadest at its northern end (Cordoba) (Fig. 9).

This lovely cloud reigned supreme in the sky for over two hours.

The wind stopped blowing at 18.00 hours and the white dove's wing started fraying at the edges and then gradually dissolved. Half an hour later all that remained in the sky of the Comechingones were the last

few traces of what had been Her Majesty the Cloud (Fig. 10).

After having watched that magnificent cloud for a whole afternoon I felt sick at heart to see it vanish inexorably into the blue sky. Would I ever see it again, I asked myself. I did, but never was the Queen as elegant and beautiful as on that April day in 1954.

Fig. 1. Characteristic wave formation of "altocumulus lenticularis" over the Calamuchita Valley stretching parallel to the Sierra de Comechingones, Argentina.



Fig. 2. Upper wave cloud and small lenticular clouds below, associated with secondary wave movements in the lower layers.



Fig. 4. Formation of medium-high stratified banks of clouds at the leeward side of the Sierra de Comechingones on 27 April 1954.

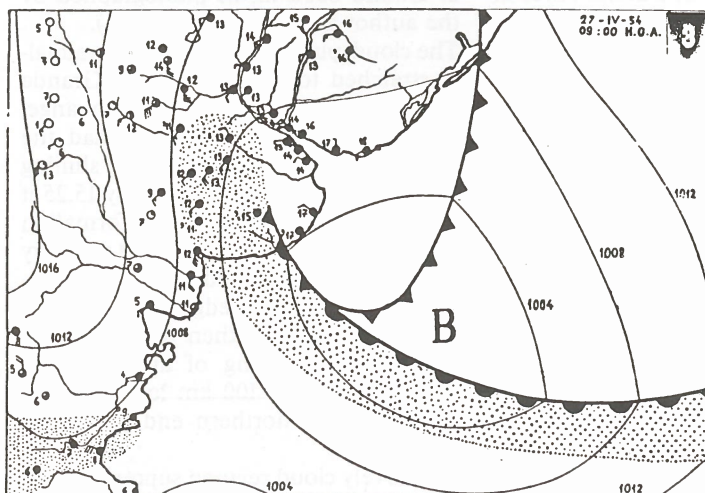


Fig. 3. Synoptic surface weather chart of 27 April 1954, 9.00 hours, the specific case of forming the beautiful cloud formation described here.



Fig. 5. Rows of stratocumulus and a number of altocumulus lenticularis at about 4000 m MSL forming over the tops of the Sierra de Comechingones at 11.45 hours on 27 April 1954.



Fig. 6. At 14.35 hours on 27 April 1954 a band of lenticular cloud started to form at around 6000 m MSL over the Sierra de Comechingones.



Fig. 7. At 15.00 hours on 27 April 1954 the cloud gradually stretched towards the Sierra Grande (Cordoba) parallel to the mountain range.



Fig. 8. The cloud configuration 25 min later as in Fig. 7.



Fig. 9. The cloud formation in its largest extension at 16.10 hours. This lovely cloud reigned supreme in the sky for two hours.



Fig. 10. At 18.00 hours on 27 April 1954 the cloud gradually dissolved and only half an hour later these last few traces remained in the sky of the Comechingones.