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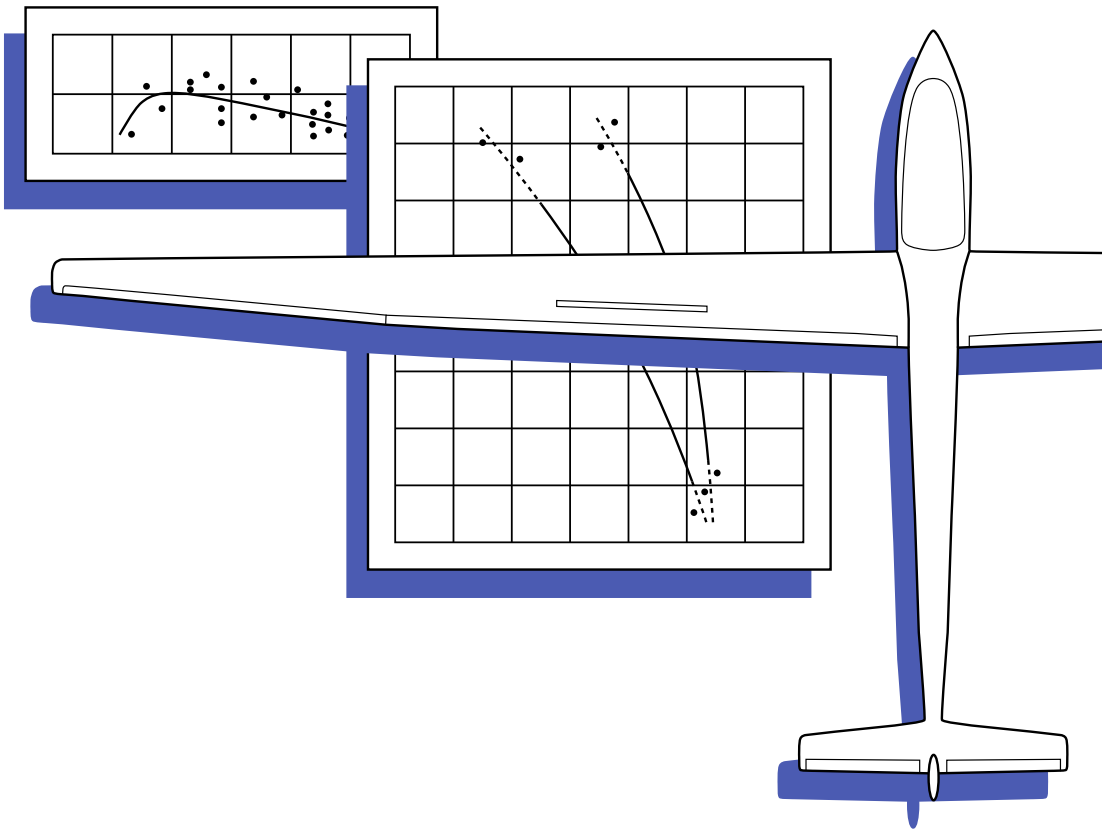

- **A paraglider flight over 8051 m Broad Peak**

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From the Editor

Publication Date

This issue is the second of Volume 45 of *TS*, corresponding to April – June 2021. For the record, the issue was published in December, 2021.

About this issue

The article in this issue of *TS* is dedicated to a paraglider flight in the Karakorum Himalaya in East Pakistan, carried out in 2016 by Antoine Girard. Edward Hindman, the author, describes this extraordinary record flight and in particular the meteorological conditions that allowed an ascend even above Broad Peak (8051m).

As a novelty for *TS*, a short video (as well as an igc file) of this flight is linked in the bibliography as "supporting data". We plan to keep this new feature of *TS* in the future. Enjoy reading and viewing !

Acknowledgements

We gratefully acknowledge Associate Editor Götz Bramesfeld, who oversaw the review of the Hindman paper in this issue.

Very Respectfully,

Arne Seitz
Editor-in-Chief, *Technical Soaring*
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A paraglider flight over 8051 m Broad Peak

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Abstract

The 23 July 2016 paraglider ascent of Broad Peak in the Karakorum Himalaya of eastern Pakistan is described and the enabling meteorological conditions are presented. The pilot, Antoine Girard, climbed the final meters to top the summit using lift not previously used by soaring pilots at these altitudes.

Introduction

My fascination with Mt. Everest began in 1963 after the Americans first climbed the peak [1]. I was not the only one drawn to the mountain. Over the years, the mountain had become the world's highest junk yard, littered with climbers' used oxygen bottles and other debris. Could there be another, cleaner way to ascend? In the early 1980's I began climbing mountains in my glider using the rising air produced by the mountains themselves [2]. In 1985 I proposed an ascent of Everest in a glider, without even touching the mountain [3]. To investigate such an ascent I needed to locate the rising air produced by the mountain.

My trek to Everest's south-side in 1992 demonstrated that thermals exist above Namche Bazar which are expected to support sailplane flights [4]. On a 1995-1996 trans-Himalayan meteorological expedition conducted by The City College of New York and Tribhuvan University located in Kathmandu NEPAL [5] my colleagues and I studied air motion and air pollution transport from the foothills to the high-Himalaya and into Tibet. We discovered that afternoon convection reduced pollution in the foothill valleys of Nepal and in Tibet.

We calculated that the convection in Tibet could enable a soaring ascent of Everest [6] with a glider. To my knowledge, no such ascent has been attempted from either Nepal or Tibet (my complete Everest studies are at `ehindman.ccny.cuny.edu`).

In July of 2019, the *NewYorkTimes* reported that 150 paragliders landed on the 4808 m summit of Mont Blanc in the Alps of western Europe (Fig. 1) - a paraglider is a high-performance parachute. A glider has never soared Everest but could a paraglider?

I discovered that in 2016 a paraglider ascended from near the base to above the 8051 m summit of Broad Peak in the Karakorum Range of northeastern Pakistan [7]. Here I describe this

Fig. 1: '...after a hot day in June 2019, when about 150 paraglider pilots rode powerful thermal winds to the top of Mont Blanc....' From the *New York Times*, 26 July 2019, photo credit: Casu Igor.

This article was peer reviewed by two independent, anonymous reviewers.
Presented at the OSTIV Meteorological Panel, Istanbul Aydın University, Turkey, 17 February, 2021

(a) 1400 Local time (LT)

(b) 1520 LT

(c) 1550 LT

Fig. 2: Paraglider pilot Antoine Girard ascends 8051 m Broad Peak, 23 July 2016, photo courtesy of Antoine.

remarkable flight and, from my experience, the extraordinary meteorological conditions enabling the flight. The flight was the first voluntary paraglider ascent above 8000 m and, as of this writing, a world record for absolute altitude achieved.

The flight

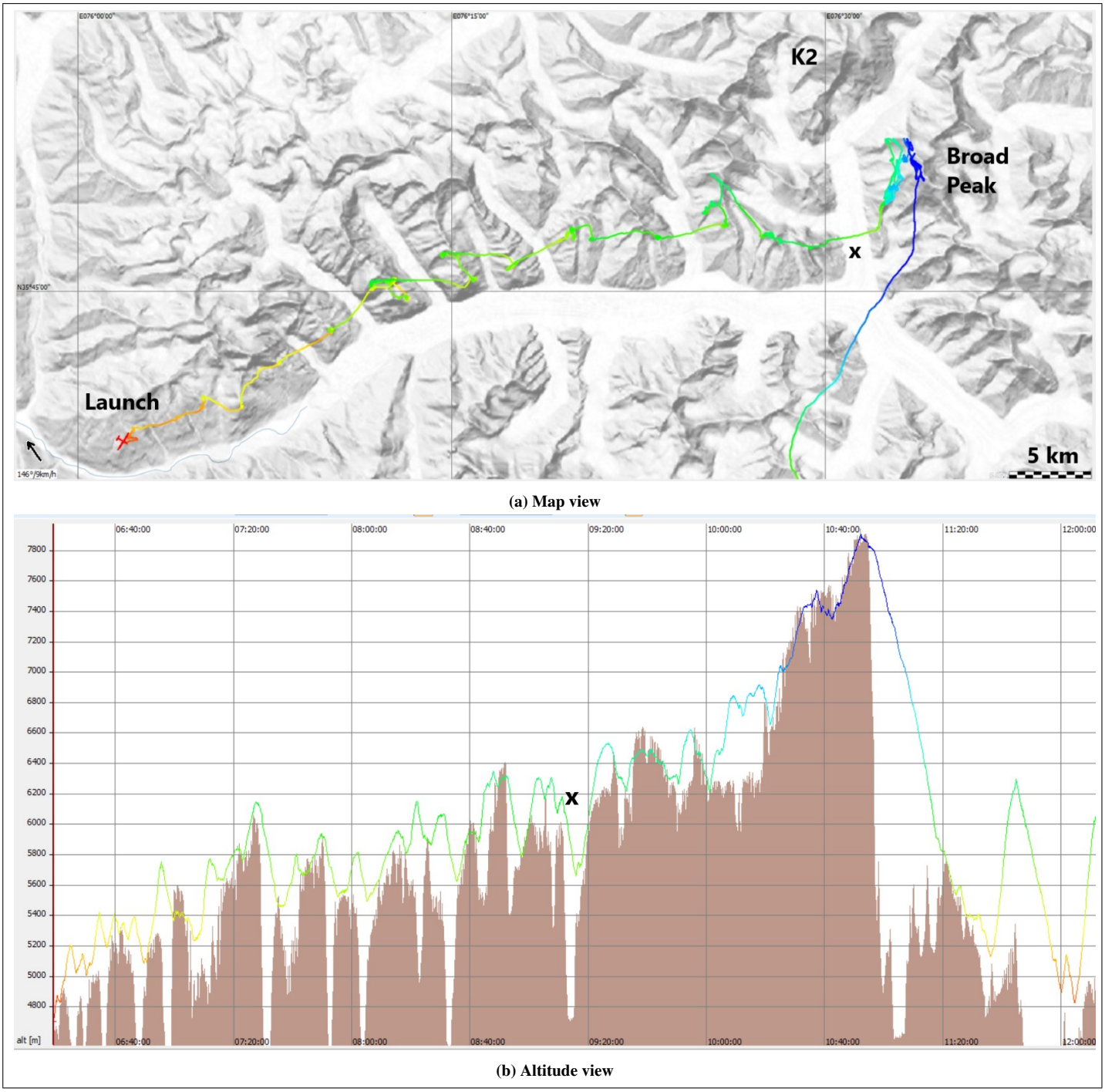
The images in Fig. 2 show Antoine Girard flying on 23 July 2016 an Adidas CIN-GTO2 paraglider. He launched at 1120 Local Time (LT) (0620Z) from a south-facing slope to the west of the peak. The top image, taken at about 1400 LT, illustrates the approach to Broad Peak. K2, on the left of the image, is the second highest peak in the world (237 m lower than Everest). The center image shows Antoine above the summit ridge and the bottom image, taken over the peak, indicates the 8157 m altitude reached.

Notice the image containing K2 shows the peak is producing a banner cloud whose base is at about 7000 m. Similarly, in the right-hand corner of the center image, a banner cloud is seen forming downwind of the Broad Peak summit ridge. These clouds often form in the wake of tall, isolated peaks like Everest [8]. Probably the most famous forms downwind of the Matterhorn in the Alps.

Figure 3 presents the recorded traces of the flight [9]: the top image is the map-view and the bottom image is the altitude-view. The traces show Antoine launched at 1120 LT from an elevation of 4600 m and 48 km south-southwest of Broad Peak. He launched from the southfacing slopes of the long west-east Baltoro Glacier. He then 'hop scotched' along the southern slopes of the glacial valley to reach the west-facing slopes of the peak, strategy similar to the 'roller-coaster' flight of the migrating geese in the Himalayas [10]. The **X** in the traces shows Antoine's location at about 1400 LT approaching the western slopes.

Figure 4 is a blowup of the portion of Fig. 3 that shows Antoine's flight track above the western slopes of Broad Peak. To ensure this portion of the flight is correctly reported, I obtained Antoine's comments: *"The thermal was present up to the top of Broad Peak. I had to stop doing circles because I was stuck between the cliffs and the clouds! I had to keep the cliffs in sight all the time which forced me to do figure-eights and not circles. I left the thermal just above the summit because I was too cold. Indeed, I was able to do some soaring on the summit ridge. Below 8050m there was not enough wind for ridge soaring, only thermal flight was possible. Above 8050m the wind was strong and allowed dynamic flight.*
The wind at 7800m must have been 15 to 20km/h. At the top there was between 35 to 50km/h gusts. I did a speed flight at almost 100km/h when I am supposed to fly at 54km/h with no wind (54km/h at 8000m according to the air density and the calculation formulas with my wing, 39km/h at 2000m with a sink rate of 1m/s).
For the final ascent there were only thermal bubbles which changed places regularly. Then a stronger cycle took me over the top in one go. The clouds disappeared at the same time on the west face of the Broad Peak." I think the short-lived 'thermal bubbles' were caused by a shallow convective layer attached to the snow-free rocks of the summit ridge.

I asked if a glider could have ascended the west face with him? My glider has a 17.5m wing span with a thermalling speed of 65 km/h and sinking speed of 0.5 m/s at sea level. I climb in thermals with paragliders and can keep up with them, but I cannot turn as tightly as they can. He replied: *"I don't think that on this day it was possible with a glider like yours, the thermals*



(a) Map view

(b) Altitude view

Fig. 3: The recorded traces of the flight. The color of the traces changes as the altitude of the paraglider changes: warmer colors - lower altitudes, colder colors - higher altitudes.

were too small... On the other hand, it was possible to do soaring with your glider from 8000m. The 6000m to 6800m zone was possible with your glider because the thermals were wide but not between 6800m and 8000m! I think you need more wind!"
A video [11] dramatically illustrates the ascent in the thermal bubbles marked by the associated cloud fragments. Careful study of the trace reveals his turns in the dynamic ridge lift were less than 100 m in diameter. This tactic enabled him to ascend in the embedded puffs. The puffs were likely generated by the snow-free rocks of the summit ridge plus the forming cloud frag-

ments. This lift – at this altitude, at this location – has never been experienced before by humans.

Prior to his paraglider ascent, Antoine climbed twice by foot on the west face of Broad Peak. Thus, I think he had intimate knowledge of the winds that may have helped the successful paraglider ascent. Antoine learned to paraglide in 2007 to climb the peak and fly from its 8051 m summit. In 2008 while climbing the west face, he was stricken by appendicitis and was forced down. After recovery, he summitted but did not attempt a paraglider descent. In 2009 he climbed to 7200 m where he was stopped by weather. Nevertheless, he descended successfully via paraglider.

The 2016 paraglider ascent of Broad Peak was one segment of a 1200 km circuit around northeastern Pakistan. He was bivouac-cross-country flying; carrying all his camping supplies underneath his seat. He launched from mountain slopes in the morning thermals and rode them all day (assuming the weather cooperated) until he landed on slopes in order to enable the next morning's launch. He flew the circuit supported by provisions obtained in the valleys below. To obtain provisions, he would land in a valley and, after reprovisioning, climb on foot a nearby slope for the next morning's launch. The circuit was flown solo, without a teammate in a second paraglider. His progress was followed remotely through his SPOT feed.

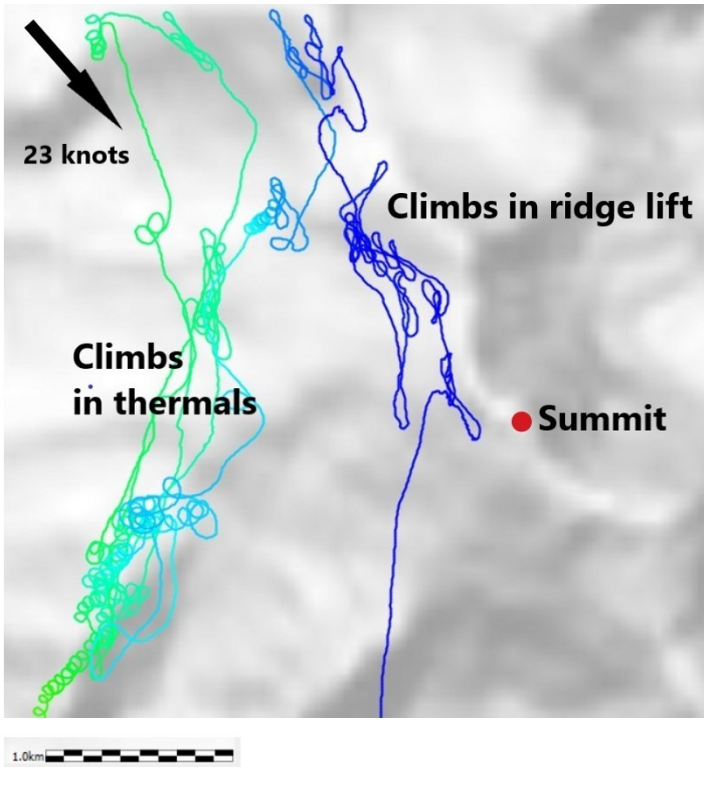


Fig. 4: Antoine's flight track over the western slopes of Broad Peak. The summit winds are indicated.

The meteorology

The winds Antoine used to ascend Broad Peak are illustrated in the sequence of atmospheric profiles for the west base of the peak, Fig. 5. The profiles span the duration of the flight. It can be

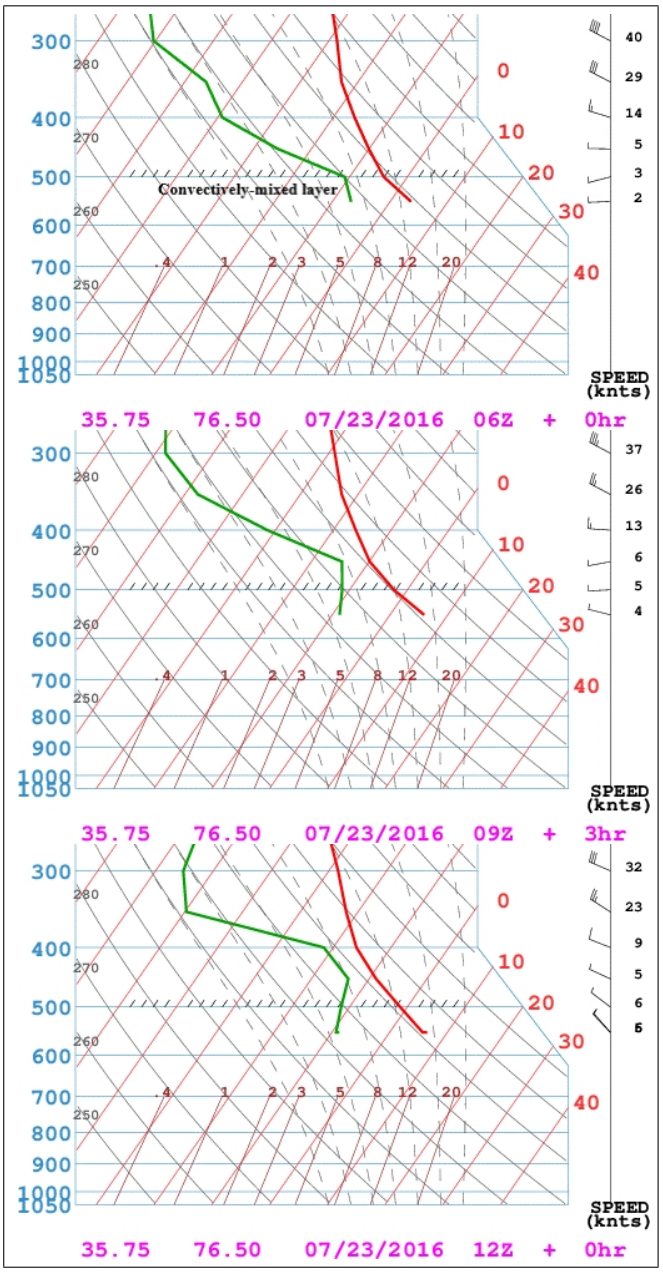


Fig. 5: Atmospheric profiles for the west-base of Broad Peak from the `READY.ARL.NOAA.gov` archives. The profiles are displayed on the American Skew-T-log P adiabatic diagram: the green line is the dew-point temperature, the red line is the air temperature, the pressure levels (mb) are the horizontal blue lines and the right leaning red lines are the isotherms (°C). The speed and direction of the horizontal winds are displayed on the scale to the right.

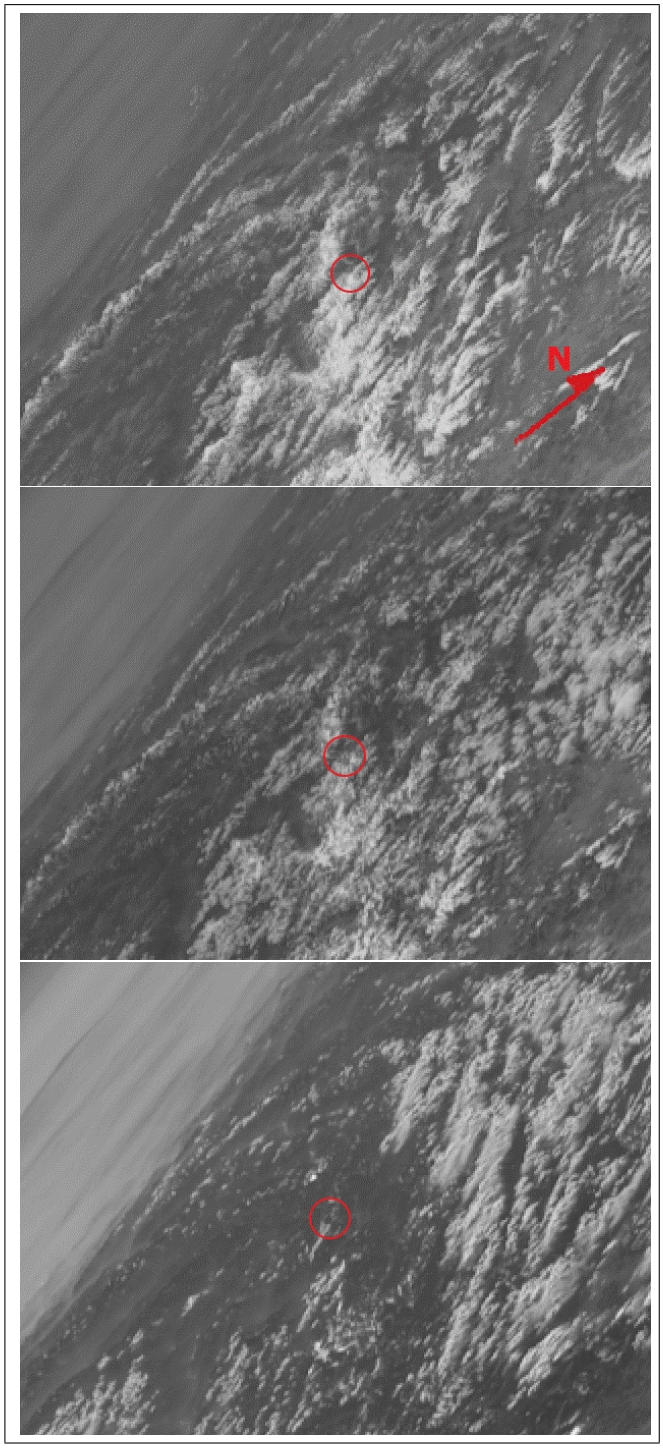


Fig. 6: The Japanese HIMAWARI-8 geosynchronous meteorological satellite imaged the region of the flight. The red O in an image marks the location of Broad Peak.

Fig. 7: Locations of Broad Peak and Mount Everest in Middle-Asia.

seen from the figure, the horizontal wind speeds *decreased* during the flight. The decrease supports his statement *"The thermal was present up to the top of Broad Peak"*. Thus, the low-speed winds were enough to support a paraglider ascent but probably not a full-size glider ascent. Further, high-speed winds and the associated shear tend to weaken the thermals.

The thermals are inferred from Fig. 5 by the depth of the convectively-mixed layer; the deeper the layer the stronger the thermals and vice versa. That layer *deepened* and *dried* during the flight: At 06Z, the top of the layer was at the 500 mb level and rose to the 400 mb level by the end of the flight. At 06Z, the dewpoint was -7 °C at the surface (~ 540 mb level) and reduced to -10 °C by the end of the flight.

The temperature at the summit was -22 °C but Antoine reported reading -9 °C on his thermometer. He explained part of the difference: *"For the temperature, the probe indicated -9 °C but from experience it is 4 °C or 5 °C hotter than reality, I think it is the battery which heats up or another parameter. (la sonde est dans le variométre)."*

A Japanese geosynchronous meteorological satellite imaged the region of the flight. A sequence of visible images from the satellite is shown in Fig. 6. The sequence illustrates the behavior of the mountain-induced convective clouds. The sequence corresponds to the times of the atmospheric profiles. It can be seen as the day progressed the peak became less cloud covered. This behavior is consistent with the atmospheric profiles that showed the day-time drying.

Summarizing the meteorology, the atmospheric profiles and visible images show Antoine flew in unusually favorable conditions for a paraglider.

Do the 'Broad Peak' meteorological conditions exist in the Mount Everest region of the Himalayas? As can be seen in Fig. 7, Broad Peak is land-locked while the south-side of Everest is open to the Bay-of-Bengal. The north-side rises from the 5000 m Tibetan plateau. This location causes lower convective cloud bases on the Nepal-side than on the Tibet-side. Nevertheless, I am searching for conditions similar to those during the successful Broad Peak ascend in the Everest region [12]. I am

using the meteorological systems reported here as well as results from recent field studies reported in the literature.

Conclusions

The 2016 paraglider ascent of Broad Peak was one segment of a 1200 km bivouac-crosscountry circuit around northeastern Pakistan. The pilot, Antoine Girard, ascended 8051 m Broad Peak using thermals until just below the summit. There he flew in dynamic ridge lift that contained thermal bubbles caused by the snow-free rocks of the summit ridge. The meteorological analyses show Antoine flew in unusually favorable conditions for a paraglider. This lift at this altitude at this location has never been experienced before, probably not even by soaring birds.

Acknowledgements

This study has been read and approved by Antoine Girard. The video segment [11] was from the video he produced about his 1200 km circuit around northeastern Pakistan. The satellite images were retrieved by Scott Lindstrom at the Space Sciences and Engineering Center, University of Wisconsin, Madison.

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