

SMALL MID-MOUNTAIN SKI RESORTS FACING CLIMATE CHANGE: THE TESTIMONY OF SAINT-HILAIRE-DU-TOUVET, CHARTREUSE, FRANCE.

Guillaume Broust ¹, Sandra Buisson ¹, Marion Couble ¹, Elodie Eymard ¹, Jocelyne Grosso ¹, Fabrice Konarski ¹, Pascal Lacroix ¹, Isabelle Lecomte ¹, Olivier Prache ¹, Pierre Roigt ¹, Loïc Vicier ¹, Joe Vicier ¹ and Anne Dufour ^{1, 2*}

¹ AG'HIL association (AGir pour la station de ski de Saint'HIL), Plateau-des-Petites-Roches, France

² CEN, Météo-France, CNRS, Grenoble, France

ABSTRACT: Saint-Hilaire-du-Touvét is known worldwide by paragliders thanks to its breathtaking panorama embracing, among others the Mont-Blanc. It has been in the spotlight of the Coupe Icare for more than 50 years. Less known, a small mid-mountain ski resort benefits from the same exceptional site. It is currently under threat. Indeed, the ski resort had to close following a natural disaster in December 2021. Its economic model was called into question: it was based on the coupling between the loss-making winter operation of the resort and the surplus summer operation of a funicular between the village and the valley. This funicular was also closed following a debris flow during the same event.

A collective of residents of the Plateau-des-Petites-Roches (sentimentally attached to the village ski resort) has therefore decided to take matters in hand and to operate the resort from winter 2023/2024, based on an associative, agile and inexpensive structure. The idea, already at work in about 5 small resorts in the French Pre-Alps, is to bring together a collective of volunteers to carry out a few fairly simple functions (like drag lift keeper or cashier), to train volunteers for the most technical parts (ski groomer operators, mechanics, etc.) and ultimately to employ certain key positions (ski patrollers, operations manager).

The 2023/2024 season is over and we would like to highlight for this first season :

- a great intergenerational human experiment full of collective energy,
- the intact desire to make all the children of the village ski on their territory,
- a torch-lit ski descent to celebrate the technical approval in January 2024,
- the 25°C of the seasonal dismantling day (6 April 2024) after only thirty minutes of possible opening due to lack of sufficient snow during this winter.

This is intended to be a testimony to the impact of climate change in mid-mountains on a small structure and to the question that this same climate change raises about the "Ski pour tous" moto ("skiing for all") that is partly in the hands of such small resort.

KEYWORDS: Small ski resort, climate change, ski for all, adaptation, agility

1. INTRODUCTION

Saint-Hilaire-du-Touvét, a hamlet in the Plateau-des-Petites-Roches commune, lies at an altitude of 1,000 metres in the Chartreuse mountain range. Set on a plateau between the Dent de Crolles summit and overlooking the Gresivaudan valley, Saint-Hilaire is like a balcony benefiting from an outstanding panorama. 25 km from two major Alpine conurbations, Grenoble and Chambéry, it is a major tourist attraction in the region.

It is even known worldwide for free flight activities particularly for the Coupe Icare, the world's largest free-flight and ultra-light air sports event organized since 1974 (Lange, 2019). Less known, a small family ski resort is nestled in the heart of the village, with slopes carved out of the heart of the forest and sheltered by the imposing limestone cliffs of the Chartreuse.

This paper details the history of the ski-resort of Saint-Hilaire-du-Touvét and how climate, both climatic event and climate change, impacts its trajectory. Its associative status in 2024 will be presented, along with all the questions and issues raised during the process.

* Corresponding author address:

Anne Dufour, AG'HIL association , 38660 Plateau-des-Petites-Roches, France ;
tel: ++33 476637925
email: anne.dufour@meteo.fr

2. HISTORY

The history of the ski resort is inextricably linked to that of the funicular railway. For a long time, they were operated by the municipality and based on the combination of the resort's loss-making winter activities and the surplus summer activities of a funicular between the village and the valley (see Figure 1). The combination of these two tools has been a successful example of 4-season tourism, providing 10 full-time equivalents jobs (including 3 all-year permanent jobs supplemented by seasonal workers during hearts of summer and winter).



Figure 1 : Logo of the municipal agency that operated both the funicular and the ski resort until 2021, highlighting the coupling of those two tourist attractions in the municipality.

2.1 Funicular

It was built in 1924 to transport the materials needed to build sanatoriums in the upper part of the village. It links the Gresivaudan Valley (260 m asl) and the plateau (950 m asl) within 20 minutes for 1 480 m rail long. It is owned by the municipality since the mid-70s.

It is nowadays used as a tourist attraction (50,000 visitors/year) and is widely used by paragliders to reach take-off areas. It is one of the oldest tourist railways in the French Alps, and celebrated its 100th anniversary in July 2024 (see Figure 2).



Figure 2 : Top : inauguration day in July 1924; bottom : flyer for the 100th anniversary in July 2024. © Ed. Lab.

2.2 Family ski resort

It was created in 1968.

Saint Hilaire is a human-scale family resort *par excellence* : the ideal place to discover and learn to ski, in a privileged setting beneath the imposing limestone cliffs of the Rocher du midi and facing the Belledonne, Vercors and Mont Blanc ranges (see Figure 3). The altitude of the resort varies from 975 m asl to 1,320 m asl.

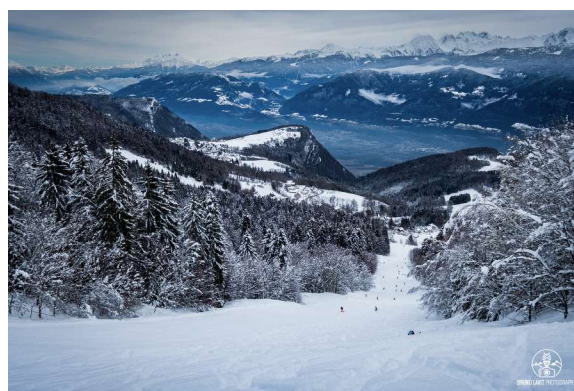


Figure 3 : From the top of the resort, facing Mont-Blanc and Belledonne ranges. © Bruno Lavit.

The resort lies in the forest. It has 5 ski lifts serving 10 downhill ski runs for 10 km (2 green, 3 blue and 5 red); a playground area for beginners is also located on the slopes (see Figure 4) along with some facilities : 1 heated picnic room and 1 restaurant at the foot of the slopes. Besides downhill skiing, there are also cross-country skiing, snowshoeing and sometimes speed riding.



Figure 4 : Ski map of Saint-Hilaire ski resort.

3. CLIMATE CHANGE AND CLIMATIC EVENTS

The ski resort's mid-mountain location is a risk factor in terms of snow cover in a context of global warming which jeopardises its viability (cf §3.1).

In addition, a debris flow in December 2021 (cf §3.2) had an impact on the resort, but above all caused lasting damage to the funicular, putting an end to the bimodal operating mode that had prevailed since the 1970s (cf §3.3).

3.1 *Climate change in Chartreuse*

Climate change in Chartreuse and its impact on snow cover is assessed at the Col de Porte site, located at an altitude of 1,325 m asl (see Lejeune et al, 2019), 9 km away as the crow flies from the ski resort. Considering the winter period from the 1st of December to the 30th of April, the daily dataset exhibits changes in 30 years between the 1960–1990 period to the 1990–2020 period (see Figure 5) :

- no significant change in precipitations;
- an unambiguous decrease of the mean snow depth of 38 cm (40 % of the mean snow depth for 1960–1990);

- an increase in temperature of +1.00 C.

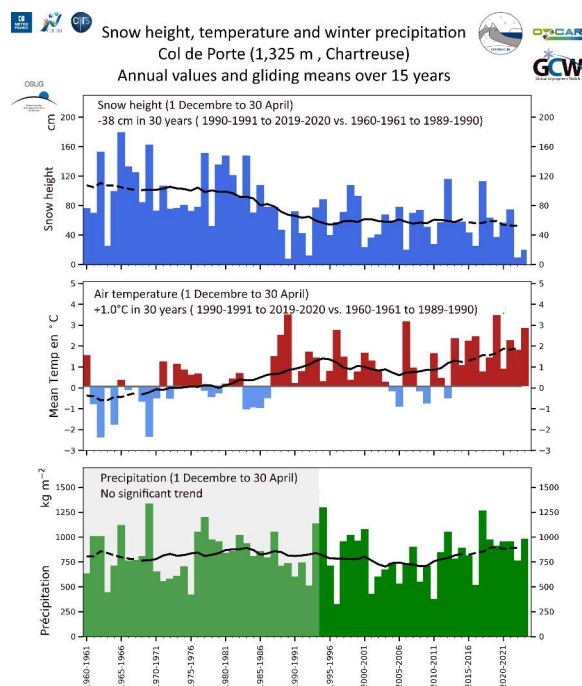


Figure 5 : Changes in snow cover, air temperature and precipitation at the Col de Porte site, in the Chartreuse massif at 1325 m asl, over the period 1960/1961 to 2023/2024. Courtesy of Météo-France.

These changes are all the more noticeable for the lower part of the resort as it is located at a slightly lower altitude than the Col de Porte site. Thus the increase in temperature has an even greater effect on the change in the phase of precipitation towards more rain and less snow. It makes it more difficult to operate the ski resort.

The Isère département conducted a study on the viability of its ski resorts in 2019 (Gerbaux, 2020) based on the methodology of Spandre (2016). According to this study and given the presence of 24 snow cannons, snowpack forecasts for 2050 show that the upper two-thirds of the ski area will only be able to count on 31 to 60 days of snow reliability per year, while it will be reduced to a maximum of 30 days per year in the lower third (excluding the pistes with snow cannons, see Figure 4).

3.2 *December 2021 natural disaster*

A rare and unfortunate combination of natural phenomena led to impressive debris flows on 29 December 2021 : a rockfall in April 2021 (providing part of the debris of the December flood), the rapid melting of a large snowpack during a major rain-on-snow event associated to heavy rainfalls. These debris flows had a dramatic impact on the

2 city's historic tourist attractions, the funicular and the ski resort.

The Montfort torrent flooded the just renovated lower station of the funicular, burying the tracks and one of the cabins under metres of debris and detaching the lower part of the railways (see Figure 6). The studies and work required to bring it back into service are colossal, and it is unlikely to reopen before 2027.



Figure 6 : Impacts of the 29 December 2021 natural disaster (debris flow) around the lower station of the funicular. Right : detached railway. Left : One of the cabin buried under metres of debris. © Radio France - Dominique Clouzeau.

The impacts on the ski resort were less severe : some ski runs and the water dam for snow making were rocked and the water supply to some snow cannons was damaged (see Figure 7).



Figure 7 : Impacts of the 29 December 2021 debris flow on the ski resort infrastructures. Top : ski run rocked. Bottom : water dam for snow making rocked. © Radio France - Dominique Clouzeau.

3.3 *Implication for the ski resort*

For many years, the company operated by the municipality has managed to find a balance thanks to the complementary of the ski resort and the funicular. The average annual turnover was around €600,000. The funicular represented 80% of the turnover and the profit generated by the funicular helped to balance the accounts (the average loss of the ski resort is around €100,000 per winter). With the closure of funicular until at least 2027, the municipality did not have the financial capacity to manage the loss-making ski resort on its own, so it was necessary to consider other ways of managing the resort¹.

After a participatory process involving residents and local socio-economic stakeholders and after the refusal of the Gresivaudan community of municipalities to take over the resort, an association took up the challenge by responding to the 2023 municipality's call for projects. This association, AG'HIL (AGir pour la station de Saint'HILaire – Act for Saint-HILaire ski resort), has proposed to operate the ski resort on a voluntary basis in a friendly and inter-age spirit to promote the dynamism of the village, as a temporary and short-term solution while waiting for the funicular to reopen.

4. AG'HIL : ASSOCIATIVE SKI RESORT

A collective of residents of the Plateau-des-Petites-Roches has therefore decided to take matters in hand and to operate the resort from winter 2023/2024, based on an associative, agile and inexpensive structure. The idea, already at work in around five small resorts in the northern French Pre-Alps, is to bring together a collective of volunteers to carry out a few fairly simple functions (like drag lift keeper or cashier), to train volunteers for the most technical parts (ski groomer operators, mechanics, etc.) and ultimately to employ certain key positions (ski patrollers, operations manager).

The challenge was met in a relatively short period of time thanks to a strong mobilization of volunteers (240 members in 2023, ~10% of the total population of the village) and the valuable help of former professionals of the resort as well as the support of the municipality and other volunteers ski resorts that kindly shared their experience.

The association was created on 29 April 2023, the legal authorization to open the resort was obtained 8 January 2024, allowing a torchlight

¹ <https://www.petites-roches.org/msp/newsletters-archives/>, newsletter 12, 14, 15, 16, 18, 20, last access 23 August 2024.

descent on a thin natural snowpack the 13 January 2024 (see Figure 8).

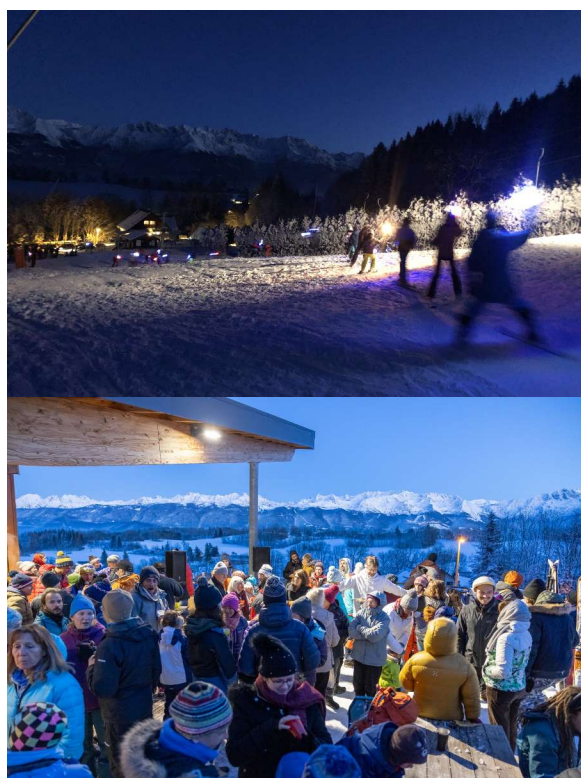


Figure 8 : First and only day of opening for the 2023-2024 winter season on 13 January 2024 : torchlight descent (© Guillaume Broust) and mulled wine to celebrate (© La Fouche).

Unfortunately, the 2023/2024 winter experienced a severe lack of snow at mid-range altitude, one of the 5 worst seasons of the 63 years of records at the Col de Porte site located 9 km far from St Hilaire (see Figure 5). Moreover, no major snow-fall happened once the legal authorization to open the resort has been approved by the prefecture as shown in Figure 9.

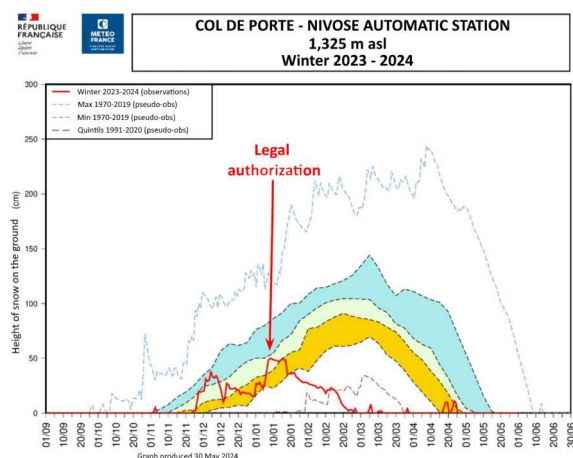


Figure 9 : Snow coverage at the Col de Porte site compared to climatology. The obtention of

the legal authorization is represented by the red arrow. Courtesy of Météo-France.

If the opening night mid-January was a success, the fact that it was the only opening slot left a bitter taste. However, this is compensated by a huge investment on the part of many people, a friendly and festive atmosphere and the re-appropriation of know-how through training and the pooling of everyone's skills :

- Training of ski-lift operators ;
- Training of mecanicians ;
- Training of operation managers and the association's managers ;
- Maintenance of ski-lift ;
- Repair of snow groomers ;
- Maintenance of the slopes ;
- Finding volunteers ski patrollers- and recycling of some of them ;
- Training of cash registers ;
- Maintenance of snow cannons and water dam associated ;
- Training of snowfarmers ;
- Setting up communication ;
- Search for subsidies ;
- Setting up all the regulatory aspects ;
- Agreement with the municipality ;
- Networking with small resorts around, mainly in Isère.

The General Assembly of 3 June 2024 voted to renew the experiment for next winter 2024/2025... hoping that snow conditions will be there!

5. DISCUSSIONS

The adventure of taking over the ski resort as an association was made possible by pooling a wide range of skills and training. The agility of this structure makes it easier to manage the ups and downs of snow conditions linked to climate change. The benefits of this new project are numerous :

- creating links within the village ;
- re-appropriation of a local tool and know-how ;
- widespread acceptance and awareness of climate change amongst inhabitants.

On this last point, it's interesting to note that while humans adapt fairly easily to the low-frequency consequences of long-term climate changes (in this case, a gradual reduction in snow cover), it's often when sudden events occur (in this case, debris flows of 2021) that awareness is raised, leading to more radical changes in the way we operate and adapt as described in Schneiderbauer (2021). The rebirth of the ski resort through an association is akin to a collective mourning process for the village.

The operation of ski resorts by volunteers seems to be one of the ways to maintain an alpine skiing in mid-range mountain areas under the pressure of climate change and even climate disruption. In France in 2024, there are already less than 10 resorts operated by volunteers, and their number has increased in recent years, even if some of them decided to go in that direction a long time ago (like the oldest, since 1974, in Belledonne range, the Col du Barrioz resort).

The corollary is that the French motto "Ski pour tous" (skiing for all) is being called into question. In fact, small mid-range resorts offer a number of advantages for attracting young people in particular to skiing: they are often easier to get to than the big, high-category resorts ; their ski passes are cheaper and accessible to as many people as possible, including families, the latter being also favoured by the conviviality of small ski resorts.

The skiers trained today in small resorts will be tomorrow's customers of the big resorts, but they will also be the workforce of tomorrow's resorts. Otherwise, the decline in the number of skiers, and especially local skiers, will reduce the pool of future professionals in the sector. By the way, a working group on small and medium-sized resorts, led by DSF, the French chamber of ski area operators, was set up this year.

6. CONCLUSIONS

In the village Plateau-des-Petites-Roches/ Saint-Hilaire (French Alps), both climate change and an isolated natural disaster have led to the closure of the small ski resort in 2021.

A collective of residents of the village have decided to run the resort on a voluntary basis from winter 2023/2024, using an associative, agile and inexpensive structure : an association called AG'HIL to cope with the increasing variability of snow conditions. The idea is to promote the village's dynamism, in a spirit of conviviality and inter-age, assuming the temporary nature of the proposed solution.

The main aims of this initiative are to give children in this mid-mountain area the opportunity to learn to ski together regardless of their parents' income (Figure 10), and the empowerment of citizen to maintain the vitality of their territory while having the time to assimilate and accept the consequences of climate change by taking action.

The first year of activity, with only a few hours of operation due to a lack of snow, is a true symbol of the climate change underway in these fantastic and fragile territories and will require inventiveness and ingenuity in the future.



Figure 10: Joy of a 9-year-old boy of the village © La Fouche.

REFERENCES

- Gerbaux, M., P. Spandre, H. François, E. George-Marcelpoil and S. Morin. Snow Reliability and Water Availability for Snowmaking in the Ski resorts of the Isère Département (French Alps), Under Current and Future Climate Conditions, *Journal of Alpine Research | Revue de géographie alpine*, 108-1 | 2020, last edited on 20 August 2024, URL : <http://journals.openedition.org/rga/6742> ; DOI : <https://doi.org/10.4000/rga.6742>, 2020.
- Lange, M., D. Raibon-Pernoud and B. Méténier. La fabuleuse histoire de la Coupe Icare, Editions Coupe Icare, pp192, 2019.
- Lejeune, Y., M. Dumont, J.-M. Panel, M. Lafaysse, P. Lapalus, E. Le Gac, B. Lesaffre and S. Morin. 57 years (1960–2017) of snow and meteorological observations from a mid-altitude mountain site (Col de Porte, France, 1325 m of altitude), *Earth Syst. Sci. Data*, 11, 71–88, <https://doi.org/10.5194/essd-11-71-2019>, 2019.
- Schneiderbauer, S., P. Fontanella Pisa, J. L. Delves, L. Pe-doth, S. Rufat, M. Erschbamer, T. Thaler, F. Carnelli and S. Granados-Chahin, Risk perception of climate change and natural hazards in global mountain regions: A critical review". In: *Science of the total environment* vol 784, p. 146957, 2021.
- Spandre, P., S. Morin, M. Lafaysse, E. George-Marcelpoil, H. François, Y. Lejeune. Integration of snow management in a detailed snowpack model, *Cold Reg. Sci. Technol.*, 125, 48–64, 2016.