

CLIMATE CHANGE & SKI TOURING

Awareness of climate change and its impacts has been growing for some years; last year's Extinction Rebellion protests signalled a greater consciousness of the need for behaviour change, even if many people remain in denial or feel that other people and countries should be the ones changing their behaviour.

Most Eagles probably support the principle at least, and can see the changes that have already taken place during their lifetimes; but this feature challenges whether we are doing enough to change our own behaviour. It starts with a review of the impact that climate change has already had on ski touring in the Alps over the last fifty years, and the likely progression for the rest of this century. If this seems unpalatable, the next article gives an example of a resort that was forced to take action, and then Steve Wright and Dave Vincent, from the Climate Care subcommittee, describe some of the ways in which the Club and its members can respond.

EFFECTS OF CLIMATE CHANGE ON SKI TOURING IN THE ALPS

Jacques Mourey

The 21st century has seen a big increase in ski touring activity in the Alps, along with

strong growth in the number of participants. One result of this is a reduction in the level of commitment of these participants, as well as their average skill level; so today we see ski resorts offering marked itineraries for touring while, in the mountains, refuges open ever earlier in the season to benefit from the growth in custom.

However, just like Alpine skiing, this activity also has to face up to climate change, which offers a gloomier perspective for the future. The one essential condition for ski touring is the presence of snow; but climate change, which has been clearly accelerating since the 1990s, has made this an ever less abundant commodity. In this article we will first present some key numbers on the reduction in snow cover over time, then we will try to assess some of the implications for ski touring.

Since 1970 the average duration of snow cover in the Alps has reduced by 38 days

In the Alps, and more generally across all mountain regions in the world, we have seen a rise of 2°C in annual mean temperatures since the end of the 19th century - twice as rapid as the increase in the global mean. If we look specifically at winter temperatures, the increase is

even greater: a rise of 2.8°C as against 1.5°C for average summer temperatures. This results in a change in the pattern of precipitation, leading to a reduction in both the duration of snow cover and the quantity of snow. Between altitudes of 2000 and 2700m, the number of days with snowfall as a proportion of all days with precipitation has dropped significantly, and periods of complete melting are more frequent

and more severe. As a result, the duration of snow cover between 1150 and 2540m reduced by 8.9 days per decade between 1970 and 2015; on average this period started 12 days later and finished 26 days earlier in 2015 compared with 1970. So the duration of snow cover has decreased by 38 days over the last 45 years.

Between now and 2100, as climate change

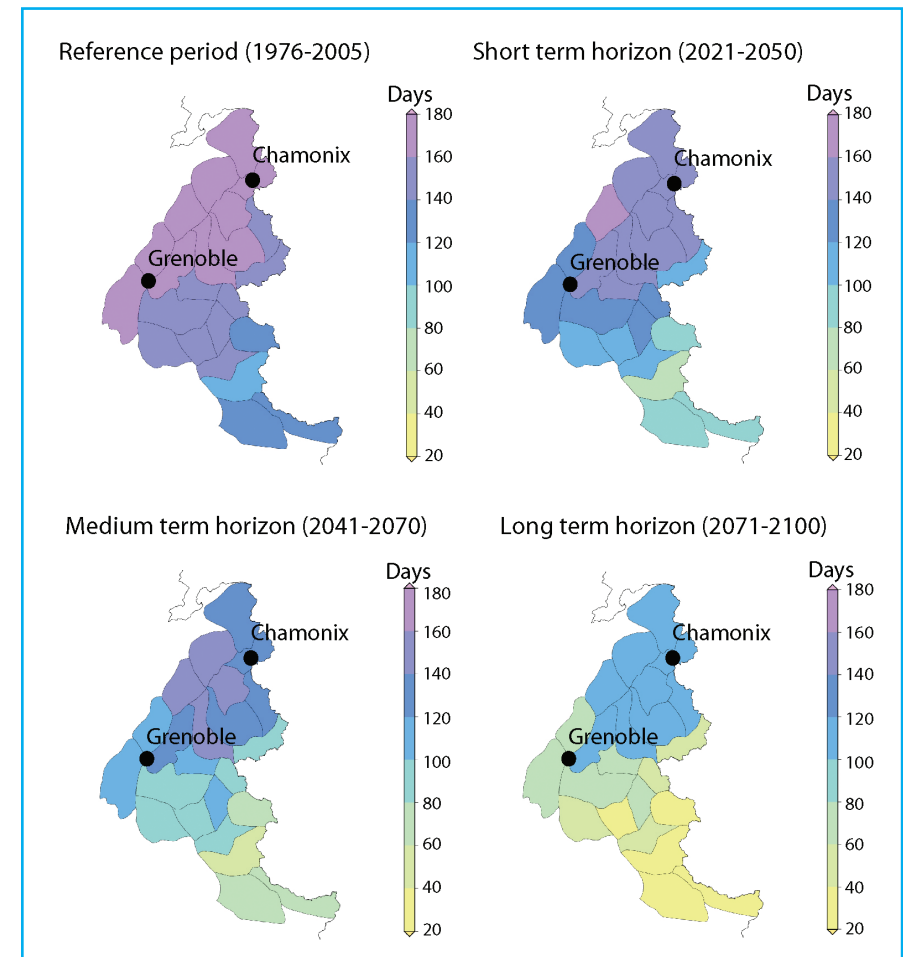


Figure 1: Snow cover projections for the French Alps 1976 – 2100. Source: Météo France

continues and accelerates, the number of days with at least 5cm of snow on the ground will continue to reduce very significantly. For example, in the Mont Blanc massif, the number of days with snow on the ground at an altitude of 1800m is likely to drop from 170 to 102 days. Figure 1 shows the expected evolution of the number of days with at least 5cm of snow on the ground in the French Alps between the reference period (1976-2005) and the periods 2021-2050, 2041-2070 and 2071-2100 (data from Météo France).

The same Figure shows an even more alarming prospect for the Southern Alps: in the Mercantour massif, the number of days with snow on the ground at 1800m will fall from 122 to 24 days. The ski touring season in these areas will be short or non-existent.

This reduction in snow cover in the Alps will also manifest itself as a progressive rise in the snow-line and changes in snow characteristics. As a consequence:

There will be a reduction in the number of areas and periods suitable for ski touring

One of the main impacts of climate change on ski touring will be a decrease in the length of the season, and the areas and sectors which are suitable. As one of the effects of reduced snow cover is a rise in the altitude of the snow-line, it will be increasingly common to have to carry skis to the starting-point of the tour, where skins

can be used. Some skiers now prefer to find starting-points high on the mountain – which are often already over-used – to avoid long walks in carrying skis. Now that we see waymarked ski-touring routes within ski resorts, may we also soon see snow-cannons along these routes?

The reduction in snow cover also makes some routes, notably couloirs and steep faces, infeasible as they need large quantities of snow to cover rocky outcrops or to make the line wide enough to be skiable.

The second consequence of climate change is that **snow conditions will vary more rapidly and powder snow will be ever less frequent**. Tourers will have to become used to skiing on spring snow more often, even in the middle of the season. This observation stems from the rise in winter temperatures, which leads to longer and more intense periods of snow-melt during the winter, while solid precipitation (snow, hail etc) will only occur at higher and higher altitudes.

We can give as an example this last winter (2020), when in the Northern Alps the rain-snow boundary several times reached altitudes between 2300 and 2500m. This entailed serious, sometimes complete, melting of the snowpack at lower altitudes and, when combined with strong winds, the formation of a layer of ice several centimetres thick on top of the snowpack (*neige vitrée* / glazed snow). That resulted in a general lack of snow cover below 1700m, while certain pitches, particularly the approaches

to cols and ridges, were very difficult to ski. For example, there were warnings against skiing the Vallée Blanche on Mont Blanc because the glazed snow made it particularly difficult and dangerous for skiers. As the climate grows progressively warmer, this kind of event will become more frequent in the years to come. Ski tourers will have to pay more and more attention to snow and weather conditions, and will more often have to move to a different area in order to find good-quality snow.

But it is important to acknowledge that ski tourers will see some benefits from the reduced snow cover. As the quantity of snow is reduced, so also there is a reduction in the number and size of avalanches below 2000m. On the other hand, there is an

increase above this level. The number of powder-snow avalanches has fallen but this is offset by an increase in wet-snow avalanches. Nevertheless, it is estimated that the number of natural avalanches across all altitude bands will have decreased by 20-30% by the end of the century.

Melting glaciers render some routes impracticable

In the high mountains, ski-touring routes are often modified as a result of summer glacier-melt. The main long-term difficulty is linked to the loss of thickness of the glaciers, which is in some cases very substantial. In the Mont Blanc massif, the Mer de Glace at 1900m altitude lost 166m of depth between 1890 and 2014, and the Argentière

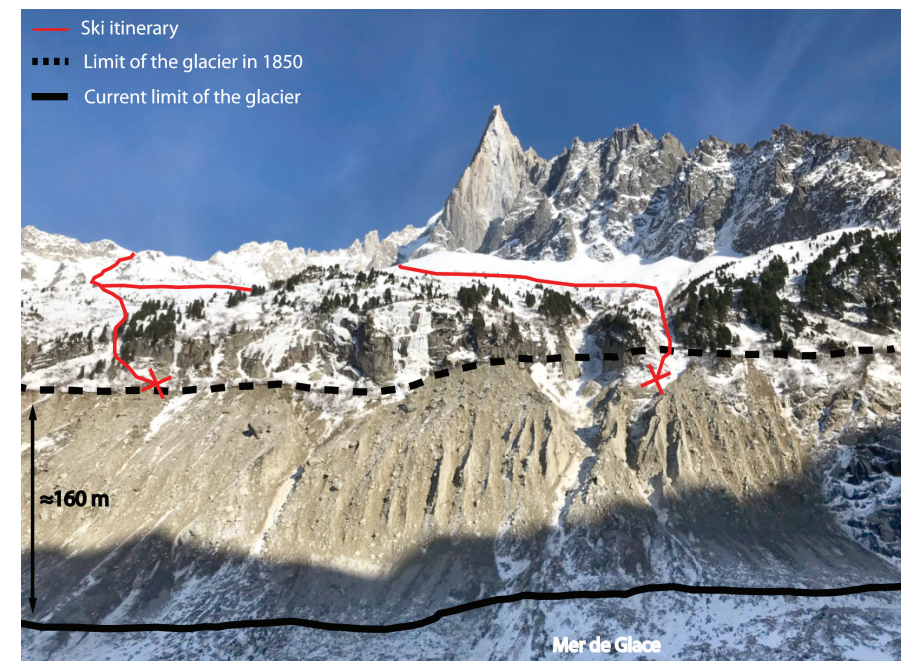


Figure 2: Pas de Chèvre itinerary, 25 February 2020. Photo: L. Moreau

Glacier lost 80m between 1994 and 2013. As a result, the slopes to the sides of the glaciers are higher, steeper and subject to frequent rockfall and landslips from lateral moraines that have only recently become free of ice.

Some routes have become more difficult and more dangerous, sometimes even impossible. One example is the Pas de Chèvre ski itinerary from the top of the Grands Montets, which is infeasible earlier and earlier in the winter season, as the right-hand lateral moraine of the Mer de Glace is steeper, subject to rockfall and short of snow ever sooner each year. There have been several accidents on this route in recent years. Figure 2 shows this section of the Pas de Chèvre itinerary on 25 February 2020; the glacier has lost 160m of thickness at this point, making the descent of the moraine only feasible when there is excellent snow cover.

Of course, this problem is not unique to the Mer de Glace; there are other examples on most glacier itineraries in the Alps. The emblematic Haute Route, linking Chamonix to Zermatt, crosses numerous glacial basins where you will find this kind of problem. On top of this, glacier melt combined with reduced snowfall leads to less well-formed snow-bridges, which become more fragile and less durable at the end of the season.

Conclusion

Several recent studies have found that the majority of ski tourers are not prepared to

limit their activity in line with changes in the extent of snow cover. Instead we must expect that participants will progressively focus their activity on the same areas, where the best conditions are to be found. Other socio-economic and cultural factors are also driving a trend towards more and more geographical concentration: people are more risk-conscious and want to minimise the risk in their sport, but at the same time they want to cram more activity into a limited time, so prefer locations that are easily and quickly accessed, with a minimum of logistics.

Unfortunately, it is likely that these effects on ski-touring conditions will not only continue, but will be amplified and will impinge upon even the highest altitudes within our massifs over the coming decades, as climate change accelerates and its impacts grow. It is estimated that the majority of ski resorts in the Alps will no longer be operational by 2100. The outlook for ski tourers is somewhat less traumatic than for downhill skiers: even though the snow will be less widespread, they will be able to move around and adapt the times and locations of their trips to benefit from the locations and periods when there is snow. The reverse of this coin will be a growing concentration of participants in the same locations and on the same routes – a problem already common in summer mountaineering – while of course there will be many fewer great powder days.

The outlook described in this article is



Mer de Glace from la Flégère, 6 February 2020. Photo: Bill Stephens. Compare this with the watercolour reproduced in Bill's article in YB2015.

based on data for the Alps. However, it seems likely that it will be similar for the majority of mountain ranges in the world, where the mean annual temperature rise is twice that for the world as a whole.

Finally, and to finish in a more optimistic key, it is important to note that climate change also offers new opportunities and will allow the development of new sports, while what we now think of as summer activities will be possible for longer periods, in some years right through the winter. Climate change does not signal a reduction in opportunities for outdoor sports in the mountains, in fact the opposite!

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Translation by Mike Hendry.