# Integrating the ATES into the avalanche information in Aran Valley (Central Pyrenees)

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ABSTRACT: During the 2011-12 winter season, the Aran Avalanche Center established an Avalanche Terrain Exposure Scale (ATES) pilot area in Aran Valley. The ATES was developed by Parks Canada and the Canadian Avalanche Center in order to provide users with information on the terrain. Having tested the method and its acceptance by potential users, last season 33.000 ha were mapped, corresponding to the areas more heavily used in winter. The maps were made available to the users via web (www.lauegi.conselharan.org, kmz format) and by means of panels in the main trail heads.

In addition, an analysis of the accidents occurred in Aran Valley and in the Aigüestortes National Park (southern side of the range) during the last 25 years was performed. It was found that the majority of the accidents occur in Complex (55%) or Challenging (26%) terrain when the danger is Considerable (3).

During the 2012-13 season, the ATES was included in the daily Avalanche Report through Avaluator™. The implementation of the ATES and the use of Avaluator™ in the Avalanche Reports have resulted in a better information about terrain, a better integration of terrain in decision making and, moreover, in a better danger rating. The good results obtained will encourage the spreading of the method to other areas of the Pyrenees

KEYWORDS: ATES, avalanche terrain, trip planner, Aran Valley, Pyrenees

## 1 INTRODUCTION

Since the establishment in 2004 of the ATES developed by Parks Canada (Statham et al, 2006), numerous applications have been made in various parts of the world, USA, New Zealand and Europe (Catalonia and Norway).

This tool is essential for backcountry practitioners and its advantages are well proven.

The Aran Avalanche Center went into the trouble of integrating the ATES into the decision making process, by providing this tool to the user and bringing together the information on the field and the avalanche danger in the same web site.

### 1.1 The Aran Valley

The Aran Valley is a 600 km$^2$ territory presently under the administration of Catalonia (Spain). Located at the central part of the Pyrenean range, it stands halfway between the Spanish and the French states (Figure 1).

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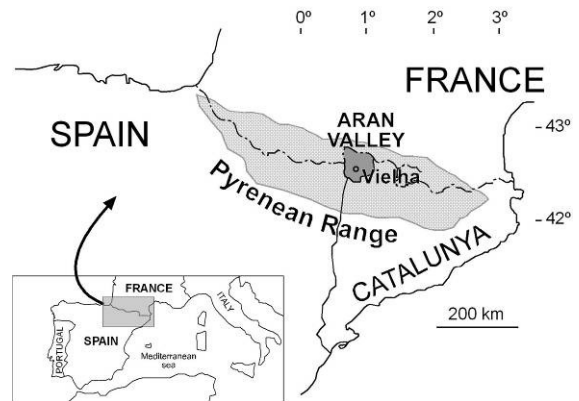Email: j.gavalda @aran.org

Figure 1: Location of the Aran Valley.

The area presents an oceanic climate and is strongly influenced by the wet fluxes coming from the Atlantic Ocean. This constitutes the main differential feature in comparison to the rest of the Spanish Pyrenees. Precipitation is abundant, over 1000 mm per year and even reaching 2000 mm. The total amount of fresh snow at 2200 m asl is about 500-600 cm per year and the distribution of precipitation is quite homogeneous throughout the year (Oller et al. 2006).

## 2 BACKGROUND

In 2003-04, the current Aran Avalanche Center (Centre de Lauegi) was created with the purpose of carrying out the local forecasting for

the Bonaigua pass and the road to Beret. During the 2005-2006 winter season, a local forecasting for mountain itineraries was set up in the Aran Valley, providing specific (local) information on avalanche danger for the most visited areas (Gavaldà and Moner, 2006, 2008).

During the winter of 2010-11, a pilot project in a small area of Aran Valley was launched (Bacardit et al. 2011). The results were very satisfactory and we then continued to map other highly frequented areas.

## 3 METHODS

### 3.1 ATES maps

The methodology described by Parks Canada in their Technical Model (v 1/04) was strictly followed in the development of the ATES. By using the same parameters and symbols, the result is a scale which is easy to understand for all users regardless of their origin.

In order to develop the ATES Technical Model, we used topographic and ortophotomaps at 1:25.000 and 1:5.000 scales; a slope map produced by the Terrain Digital Model (30 m resolution); the Catalan Avalanche Data Base (www.icc.cat/msbdac) and photos from the area. Furthermore, a very good knowledge of the terrain in winter conditions was essential. To rate the descriptor "Avalanche frequency" we used the new avalanche size scale in consensus with the European Avalanche Warning Services (www.avalanches.org).

GIS tools like ArcMap 10.1 were used to create the maps and subsequent exports have been made to Google Maps and Google Earth.

Out of the 11 variables considered in the Technical Model, "Glaciation" has not been rated because in the Aran Valley there is no glacial terrain. With regards to the other variables, "Slope angle", "Route options", and "Exposure Time" were the most determining factors to finally assign a terrain class, Simple, Challenging and Complex. For the time being, we haven't used the Class 0 "Non Avalanche Terrain" proposed by Campbell et al, 2012.

Both trip and zones have been mapped. A total of 33,000 has are currently mapped, corresponding to the most frequented areas of the Aran Valley and those where the largest part of activities, both backcountry and out-of-bounds, take place. 23% of the mapped zones were in Simple terrain, 33% were in Challenging terrain and 25% in Complex terrain.

Regarding the trips, we mapped a total of 71 routes, 13 of which correspond to Simple terrain, 33 to Challenging terrain and 25 to Complex terrain.

### 3.2 ATES and avalanche accidents

In order to verify the correspondence of avalanche accidents and the Terrain Class, the data of the accidents recorded during the last 25 years in the Aran Valley and in the Aigüestortes National Park (southern side of the range) were crossed (figure 2). The data used were provided by the Catalonian Geological Institute (www.igc.cat) and our own sources. For accidents that lie outside the boundaries mapped, a specific classification was made following the same methodology.
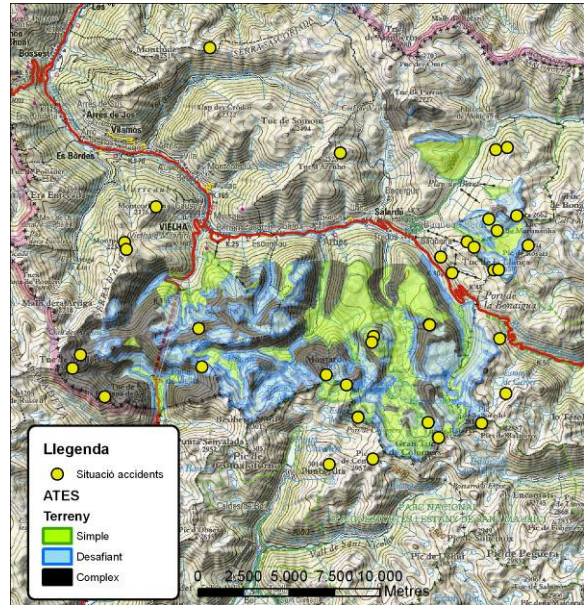


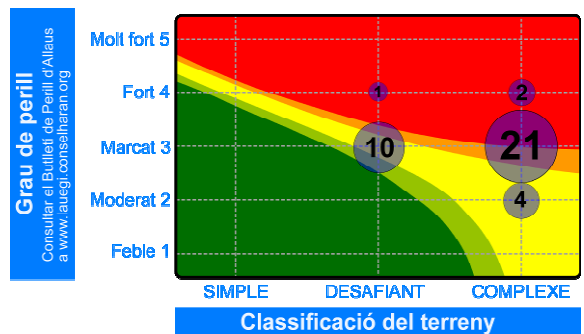Figure 2. Distribution of avalanche accidents and ATES mapping.



Figure 3. Distribution of accidents according to the degree of danger and the ATES classification using the Avaluator™ trip planner tool. Circles indicates the number of accidents.

A quick analysis of the data can be carried out, taking into account the limitations caused by the small number of accidents considered.
This analysis of data shows that the majority of the accidents occur in Complex (71%) or chal-

lenging (29%) terrain. No accidents are reported in Simple terrain (figure 3).

Main accidents occur in danger 3 (Considerable) both Complex (55%) and Challenging (26%) terrain.

It is noteworthy that no accidents are reported in Normal Caution zone (green area).

## 3.4 EXPERIENCE

After a first experience using the ATES in the Pontet area, we began to apply the ATES in the whole Aran Valley, in those areas where winter backcountry activities are frequent.

This implementation was based on the following strategies:

- The inclusion of ATES ratings for the Aran Valley in the website of the Avalanche Forecasting Center (www.lauegi.conselharan.org) and the display showoff the terrain classification in a 3D Google Earth Map, by downloading the KMZ file (figure 4).

- The release of a brochure map of the Aran Valley including ATES Public Communication Model and trip classification with a wide distribution for both backcountry and out of bounds users.

- Currently, 5 information panels have been placed at the main gateways with the ortophotomap, and the terrain classification (both trips and zones). The panels include instructions explaining how to use the information provided. We have also included a QR code for easy access to current conditions.
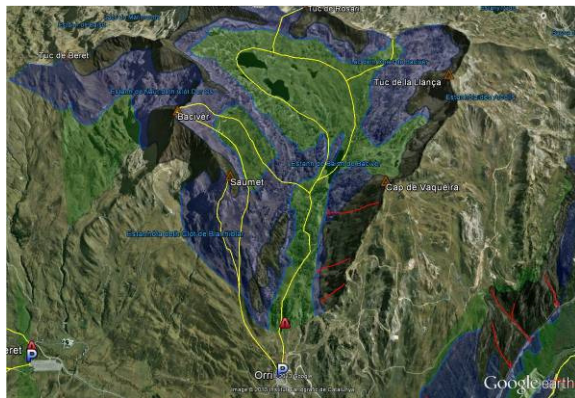


Figure 4. ATES of the Baciver area view with Google Earth. Simple terrain in green, Challenging terrain in blue and Complex terrain in dark grey. Backcountry trips are plotted in yellow in this version.

We have incorporated the Avaluator™ v.2.0 developed by the Canadian Avalanche Center (Haegeli, P., 2010). The Avaluator™ is a simple trip planning tool developed by the Canadian Avalanche Association. It combines the three sides of the avalanche danger triangle in one single chart: Terrain (by mean of ATES); avalanche danger (by means of the danger rating of the day); and group (by means of the avalanche training level recommended for the particular situation). That results in a simple and clear tool for the users of the avalanche information and, as well, in a more user-focused view for the forecaster in charge of the advisory. When the danger is rated the question "what level of training is needed for every type of terrain in the present situation?" arises and sets the focus of the analysis.

The aim of this tool is to guide the user through an objective and systematic choice of the trip which is most suitable to the terrain (ATES) and the snow conditions and avalanche danger at the time (Avalanche Danger Bulletin).

The Avaluator™ has been incorporated into the head of the avalanche bulletin highlighting the situation at the time (figure 5). By using this tool, the user combines both pieces of information and gets as a result a set of recommendations appropriate to his training and experience in avalanche terrain in order to successfully manage the avalanche danger.



Figure 5. Header of Avalanche Bulletin posted by the Aran Avalanche Center during 2012-2013 season.

## 6   CONCLUSIONS

Undoubtedly the ATES is an excellent tool for decision making both before and during the trip.

The use of the Avaluator™ in Avalanche advisories invites users to continually keep in mind the type of terrain along which they are moving and to improve their preparation.

Finally, it should be highlighted that ATES is a very innovative tool in European mountains and it is ready to be exported to other Pyrenean and Alpine areas. For instant implementing the ATES in National and Natural Parks in the Pyrenees could respond to the current need to manage the winter activities of an increasing number of visitors more securely and objectively. In conclusion, the implementation of the ATESin the Pyrenean range is an undoubtedly promising project that deserves consideration.

## 9   ACKNOWLEDGEMENTS

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