



PROSNOW NEWS

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Edito

We stand now at the interesting moment of our project when we can start seeing the results of our efforts. Indeed, the 1st version of the demonstrator, developed within WP3, is now available. It materializes the concept of our service, providing high resolution, multiple scenarios and decision support tools.

We also stand at the other interesting moment of our project when we can start showcasing the results of our efforts! The second sessions of local working groups in our pilot ski resorts, worked well. The demonstrator was very well received, and the interactions helped improving the co-design process.

In terms of project management, it is time to report, in view of our review meeting in Brussels, in June, which will be an important milestone of the project.

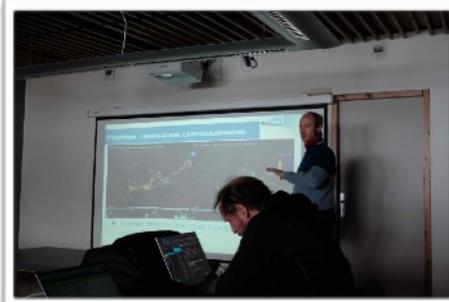
And finally, before thinking to exploit the added value of our service, perhaps in commercial term, it is also time to enjoy the last ski sessions of the spring !

The Project Office Team

Attended events

LWG meetings

Early February, PROSNOW members had their first 2019 ski resort meetings in France, La Plagne and Les Saisies. Meetings with the other resorts followed in March. People in ski-resorts were excited to play with the first version of the demonstrator and tons of feedback were received! The first demonstrator version of the future PROSNOW service is now available and tailored to partner ski resorts. Features include snow depth comparison between dates, climatology data and slope snowpack mapping.



Hugues François (IRSTEA) presenting the 1st version of the demonstrator

©S.Bruyère



Presentation and test of the demonstrator with LWG at Lenzerheide and Obergurgl.

Machine-made snow physical properties

Météo-France and TechnoAlpin have performed a series of tests in Val Thorens (French Alps), to measure the physical properties of freshly produced machine-made snow. Those measurements, along with the reconstruction of the 3D structure of several snow samples by micro-CT, will allow to

In the press

- PROSNOW is mentioned in DSF magazine N°50 (p34&47)
- Hugues François (IRSTEA) spoke about PROSNOW in « L'Essor 38 » journal.
- PROSNOW appears in the minutes of Rencontres Météo Montagne which took place in December 2018 where Carlo Carmagnola presented the first results of the project.
- PROSNOW will also make an appearance in the April issue of « Montagne Leaders »

Agenda

• **INTERALPIN and 2nd UAB meeting, 09/05/2019, Austria**

PROSNOW will be represented at the INTERALPIN 2019 in Innsbruck, the world's leading trade fair for all key players in the Alpine technologies industry. On Thursday, May 9th, 15.00-16.00, attendees of the INTERALPIN will have the opportunity to get to know the first version of the PROSNOW demonstrator and ask questions on the current developments and the future of the PROSNOW service. This PROSNOW session, open to all fair participants, will be followed by the 2nd User-Advisory-Board

better constrain the representation of snowmaking in the snowpack models.



Measures taken by M.Galvin (Technoalpin) and C.Carmagnola (Météo-France) ©C.Carmagnola

Special focus

Machine Learning and Copernicus data as support for Ski Resorts - By Valentina Premier, Carlo Marin & Claudia Notarnicola (EURAC)

How do the ski resorts look from space? **Remote sensing** is a valuable tool which can provide detailed and spatially distributed information about the snow cover extent. Recently, the European **Copernicus** program has thrown the doors to all remote sensing friends, providing free products. High resolution multispectral images acquired by **Sentinel-2** can be then easily exploited for evaluating the presence/absence of technical and/or natural snow simulated by the snow models especially at the beginning and at the end of the snow season, which are the most critical periods for the ski resort snow management. **Eurac Research**, partner of the PROSNOW team, is taking care of the process chain set up in the project framework. The researchers of the Institute for Earth Observation will provide remote sensed products useful for the validation of the snow models. The acronym EO4PROSNOW, namely Earth Observation for PROSNOW, does not need further explanation. The Copernicus Sentinel-2 mission consists of a constellation of two satellites, Sentinel-2A and Sentinel-2B, financed by the European Commission (EC) and operated by the European Space Agency (ESA). The first satellite, Sentinel-2 A, was launched in June 2015, and the latter, Sentinel-2 B, in March 2017. The constellation acquires optical images at a resolution up to 10 meters in the VNIR bands and with a revisit time of 6 days since the full constellation is operative.

Alpine-wide PROSNOW survey

Besides the intensive and fruitful co-design work in the local working groups of the pilot ski resorts, we also want to open and broaden our view to the large variety of alpine ski resorts and learn more about their snow management practices and opinions on tools and services like PROSNOW. Therefore, we kindly invite representatives of ski areas to participate in our anonymous PROSNOW online survey and take the chance in co-shaping a forecasting service tailored to the specific needs of snow management in ski areas. The survey will be open to ski areas until May 6th. Please, feel free to share the survey links with as many ski areas as possible:

-English version: <https://sondage.irstea.fr/index.php/274949?lang=en>

-German version: <https://sondage.irstea.fr/index.php/274949?lang=de>

-French version: <https://sondage.irstea.fr/index.php/274949?lang=fr>

-Italian version: <https://sondage.irstea.fr/index.php/274949?lang=it>

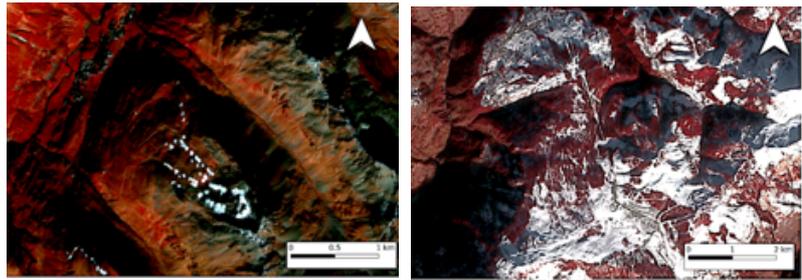
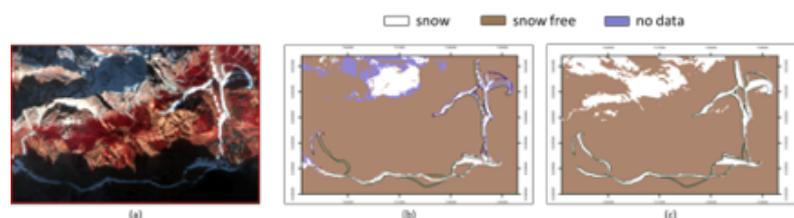


Fig1. Examples of Sentinel-2 false color composition R:NIR-G:RED-B:GREEN acquired over Obergurgl ski resort, Austria, on 26th October 2018 (on the left) and over Les Saisies ski resort, France, on 31st December 2018 (on the right).

Two examples of what we can easily observed from space are shown in Figure 1. The spectral information can be intuitively interpreted by this representation as false color composition, where the ski slopes are easily detectable. On the left, the Austrian ski resort Obergurgl is represented at the beginning of the season, where technical snow produced by the snow guns is clearly visible. On the right, the French ski resort Les Saisies presents a mixture of technical and natural snow at the end of December. But for the classification task, i.e. the conversion of the reflectance measured by the satellite sensor in a specific semantic class, one more ingredient has to come up. The EO data are classified by using **machine learning** techniques, in details an algorithm based on Support Vector Machine. The algorithm is trained by feeding it with the most certain data, the so-called training samples. The obtained classified image provides the user with the information about the presence or absence of snow. The classification is performed for the scenes with low cloud coverage. The algorithm makes use of all available spectral information resampled to 10 meters and trained separately for each PROSNOW ski-resort and seasonal period. The obtained 10 meters resolution maps allow the proper detection of the snow management activities on the ski slopes (see Figure 2). The areas covered by a mixture of snow and non-snow, clouds or in bad illumination conditions are classified as no-data and only the most certain classified snow or snow-free pixels are considered in the validation framework. This is how EO4PROSNOW will help the snow modelers to evaluate their hindcast simulations over the different ski areas involved in PROSNOW. Considering several snow seasons, EO4PROSNOW allows the generation of a significant amount of reference pixels to spatially assess the accuracy of the snow simulations.

Fig2. Example of assessment of snow cover in the ski resort located in Colfosco (Italy), 11th December 2015. (a) Sentinel-2 false color composition R:NIR-G:RED-B:GREEN. (b) Sentinel-2 snow cover map. (c) AMUNDSSEN snow cover map.



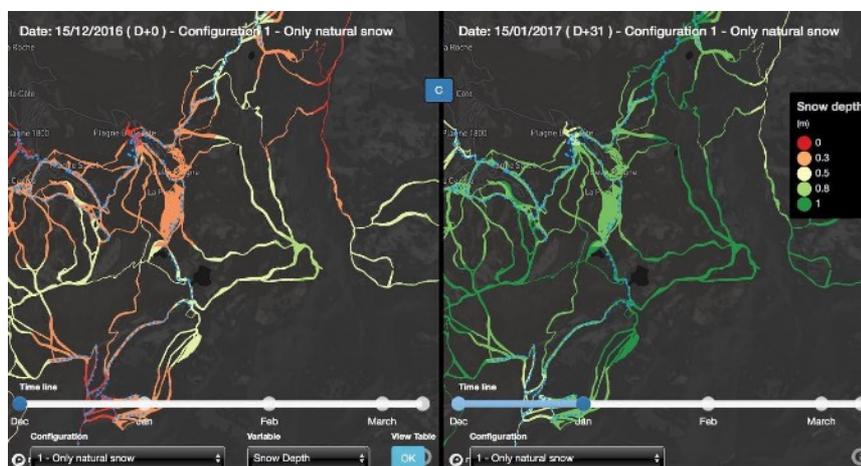


The release of PROSNOW demonstrator

Here it is... the first version of the PROSNOW demonstrator!

What a pleasure to see ideas materialise! After numerous interactions between project members, pilot ski resorts and external partners, and a very active development phase by IRSTEA, the first version of the PROSNOW interface has been released. Presented and discussed interactively with pilot ski resorts (demonstration based on their data), the tool is already active and introduces the main features expected from the project. It weaves together snowpack models, weather predictions and locally acquired data to provide local snowpack simulations for different machine-made snow production configurations and timelines. The ski-resort domain is displayed as an interactive map, divided into sub-sectors with related snow and weather variables and slope opening risk indicators.

Find out more in the [introduction video](#) (available in 4 languages) or ask us directly for a commented walkthrough!



Portraits of PROSNOW members

Sébastien Bruyère, Engineer at TEC

1. Hello Sébastien, can you tell more about yourself?

I am an engineer working at TEC, a hybrid company linking research and consultancy for the climate change topics of mitigation and adaptation. I have some experience in and passion about energy efficiency, especially when it's related to lifestyles. I studied originally in Grenoble, so I have a small part of mountain in my heart, although I spend most of my time in the streets of Marseille, which is a bit hilly but definitely lacks snow.





2. What is your role in PROSNOW?

Being part of TEC, we co-coordinate the project with Meteo France. It means that we have to make sure that the project will complete its objective and understand each partner's role so that we know who is the best partner to request for each task. Therefore we have a role in different work packages, but to say it quickly, we report, we communicate, we provide a work environment, and we summarize. I'm also in charge of the demonstrator development, the service interface you will be able to use at the end of the project. I'm not a snow expert like most of my project fellows but I tend to understand it more and more, which helps me to structure the resulting information of the PROSNOW service the best way. Sometimes I even start to talk about snow water equivalent or TF-10 guns during evening dinners.

3. What are your expectations regarding PROSNOW?

Being not initially from the snow world, I consider PROSNOW outputs in comparison to other topics I'm aware of. I attended to some snow stakeholders meetings and I saw how tricky and conflictual the management of water and energy can be for the ski resorts and their ecosystem. They need to obtain higher and higher quality of information in order to manage their snow. PROSNOW won't provide brand new information but it will structure the existing one in a more optimized way. This way, ski resort managers can rely on this information more efficiently for an activity which requires quick decision making processes. My expectation is that it is active at the end of the project, pleases users and contributes to the ski resort activity evolution.



TEC was acquired by Ramboll France SAS on February 28th, 2019. Ramboll Group is a leading engineering, design and management consultancy which provides advice on environmental issues. PROSNOW colleagues will now have their office in Aix-en-Provence.

Judith Köberl, Scientist at Joanneum Research



1. Hello Judith, can you tell more about yourself?

I am a scientist working at the research company JOANNEUM RESEARCH in Graz. Having an economic background and a special interest in weather and climate, my working and research focus is on the economics of weather and climate risks. In my free time, I enjoy exploring the hills of Graz in my running shoes (in all weathers) or heading west to the more mountainous parts of Austria for hiking, skiing and ski-touring.



2. What is your role in PROSNOW?

I am involved in analysing the market needs for climate services in the field of ski tourism and in quantifying the economic benefits of using PROSNOW as a decision support system in snow management. Together with my colleagues at JOANNEUM, I am also in charge of coordinating both, the spreading of project results among ski industry professionals and the preparatory works for making PROSNOW a viable service beyond the end of the project. Hence, for me, the upcoming start of the second half of the project means entering the most exciting project phase.

3. What are your expectations regarding PROSNOW?

I think one of the great assets of the PROSNOW project is the direct involvement of leading companies in snow management facilities and software and the planned integration of PROSNOW predicted information into these existing snow management systems. This will allow ski areas to just keep on using tools they are already familiar with while still benefiting from the information provided by PROSNOW. I expect this integration strategy to form the optimal basis for a widespread distribution and usage of PROSNOW information, which I believe will improve snow managers' anticipation capabilities and support resource efficient snow management.

Hugues François, Scientist at IRSTEA

1. Could you tell us more about yourself?

My first works that focused on mountainous areas did not address resorts' issues specifically, but were more focused on questions about the development of remote areas. When the time came for me to complete a PhD thesis, I was funded to study mid-mountain resorts' adaptation by the diversification of tourism products and services. After this first work, I designed the French BD Stations (station stands for resort in French); a database about ski resorts which was the first step for initiating the collaborative research with the Snow Research Center (CEN), which has allowed us to cross our knowledge of ski resorts on the one hand and snow physics on the other.



2. What is your role in PROSNOW?

My original scientific background mainly relies on social science and ski resort governance and management from a land planning point of view. The birth of the Stations database pushed me to discover the (wonderful) world of SQL and its limits led me to explore other languages to fulfill my aspirations. At the same time, I enlarged my scientific field of activity and began my first investigations around modeling snow reliability in ski areas. Now, with PROSNOW, I have tried to create a link between these different approaches. As the WP2 leader I'm responsible for the social science side of the project. At the same time I still work in WP1 in collaboration with the CEN for the spatial interpolation of weather and snow modeling output and, finally, in WP3 I directly contribute to the central data server design.

3. What are your expectations regarding PROSNOW?

PROSNOW is a way to pass on our research from our office to the people in charge of the resorts. Occasionally we spend some time communicating with other scientists or contributing to public debate, but PROSNOW goes further. The best way to deliver messages from science is maybe when the people involved can concretely use it in their daily tasks. It is the first step to passing on other ideas, to showing them different ways of depicting reality and thus sensitize the users to other issues: today we aim to extend forecasts to a seasonal scale. I hope this lead us, bit by bit, to be able to discuss the end of the century!