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Press release

Eidgenössische Forschungsanstalt für Wald, Schnee und Landschaft W
Jochen Bettzieche

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Photovoltaic energy: optimising yield in winter

SLF researcher Anja Mödl is investigating how snow-covered terrain reflects sunlight. Her findings should help to optimise the electricity generation of PV systems.

- Snow boosts solar power: Reflected light from mountain slopes makes PV systems more efficient.
- High mountain measurements: The SLF researcher analyses the reflected light spectrum using sensors.
- Only in perfect conditions: Measurements are taken in the middle of the day, on days when there is no cloud cover.

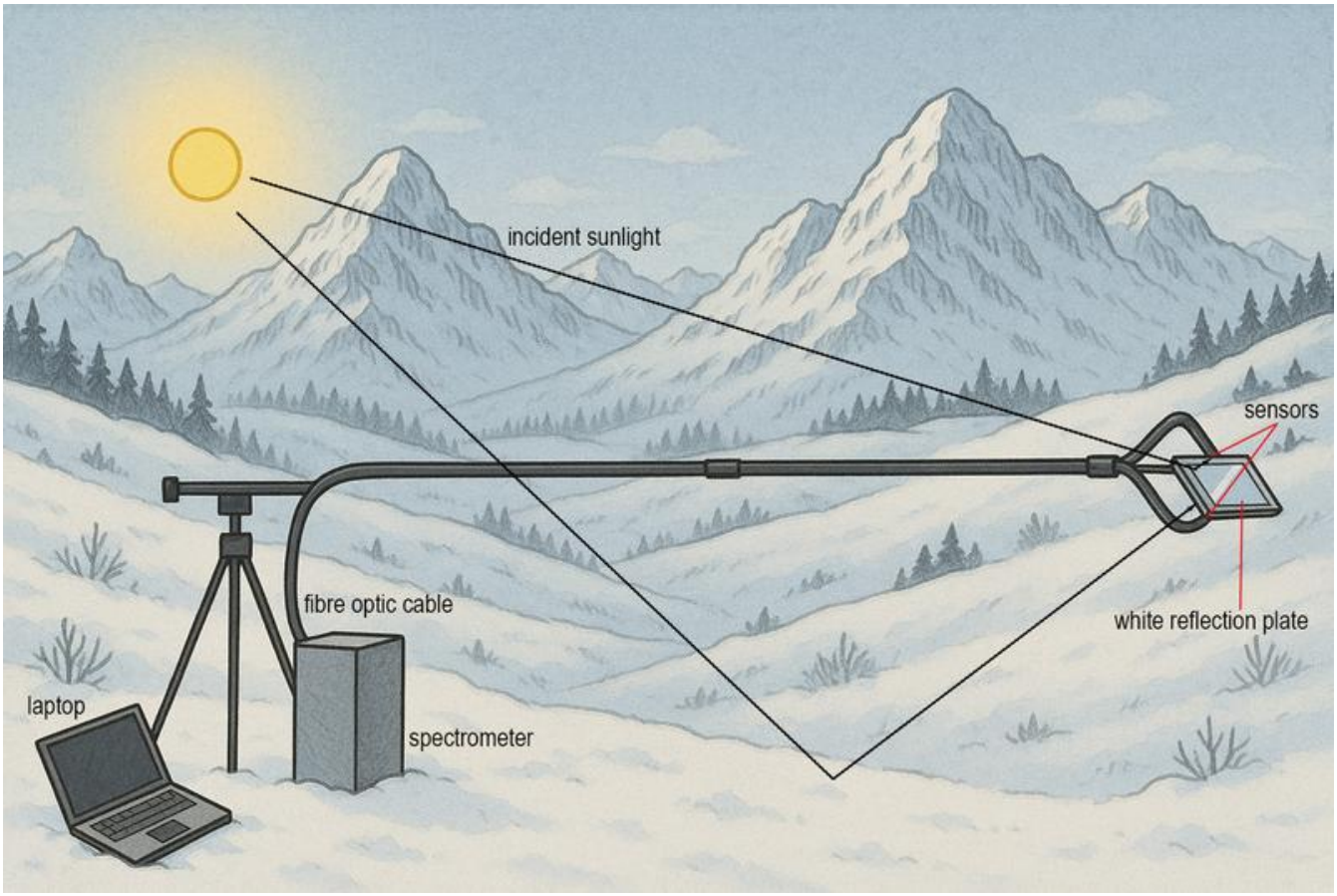
"Not a cloud in the sky, that's perfect." Anja Mödl is pleased. The PhD student at the WSL Institute for Snow and Avalanche Research (SLF) is standing in the Meierhoftälli near Davos, at an altitude of around 2,400 metres. She places her spectrometer in the snow next to a test area that she has marked out previously, and around which she has placed red and white barrier tape to keep skiers and snowboarders away.
Mödl uses sensors to measure both the incident (i.e. incoming) sunlight and the sunlight reflected by the snowpack. Her aim is to determine where and how energy suppliers can best position solar modules in mountain regions in order to generate as much electricity as possible in winter. Because not all light is the same. The snow reflects the sunlight predominantly forwards in the direction of incidence. In the mountains, this means that most of it is projected onto the slopes, which in turn reflect it again. "It can travel back and forth between slopes several times," explains Mödl.
The key point here is that the snow surface reflects different wavelengths to differing extents. As a result, the light spectrum changes with every reflection. This means that the intensity of certain wavelengths becomes stronger over time than in the incident light. "I want to find out how the spectra differ in different locations such as south-facing slopes, north-facing slopes and those in between," says Mödl. Her measurements should help to optimise PV systems so that they also make use of light reflected from neighbouring slopes. Ideally located and correctly aligned, they will generate electricity even more effectively in the winter months than is currently the case.
Concentrating hard, Mödl screws together the boom to which her sensors are attached and aligns them so that she can record wavelengths of between 340 and 2,500 nanometres. This extends far beyond the visible spectrum, ranging from ultraviolet to well into infrared. Photovoltaic applications actually only require the range from 500 to 1,100 nanometres, i.e. from green to near-infrared. "With the broader spectrum we find out a lot more, for example about the warming of rocks and snowmelt," explains the researcher.
She has to hurry as time is short. "I can only measure between 11 a.m. and 1 p.m., otherwise the angle of incidence of the sunlight changes too much." In that case the results would not be comparable. This means that she has to climb up to her measuring sites again and again during the winter season, setting everything up and then dismantling it each time.
Mödl will analyse the data over the summer. "I also plan to compare the data with model calculations," she explains. As well as providing initial insights into the effect, this will clarify whether and how she should refine her method. She is already clear about one thing: "To reach sound conclusions, I have to record data under a range of conditions." This includes fresh snow and old snow, but also different levels of snow cover, i.e. how many rocks are snow-covered and how many are snow-free. So she and her equipment will be taking to the mountains again next winter – several times a week depending on the snow conditions and weather.

contact for scientific information:

Anja Mödl
Schnee und Atmosphäre
Schneeprozesse
anja.moedl(at)slf.ch
SLF Davos

URL for press release: https://www.slf.ch/de/news/photovoltaik-ertrag-im-winter-optimieren/ More images for download on the SLF website

SLF researcher Anja Mödl aligns her sensors. (Photo: Jochen Bettzieche/SLF)
Jochen Bettzieche
Jochen Bettzieche/SLF



Schematic representation of the experimental setup. (Graphic with support from AI: Anja Mödl / Jochen Bettzieche / SLF)
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