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Deutsche Sporthochschule Köln  
German Sport University Cologne



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Joint Position Paper

# Expert Forum Climate.Snow.Sport

## D-A-CH | Prospects of snow sports in the face of global climate change

Climate mitigation and adaptation are among the major social, economic and technological challenges facing our society. Climate change is inextricably linked with changing conditions and uncertainties for winter sports in both its tourist and competitive forms. Despite advances in climate research, some questions remain unanswered, especially with regard to expected developments at the regional level.

The Foundation for Safety in Ski Sports (SIS), the Karlsruhe Institute of Technology (Institute of Meteorology and Climate Research) and the German Sports University (Institute of Outdoor Sports and Environmental Science) organised a transnational expert hearing entitled „Climate.Snow.Sport“, on the prospects of snow sports in the face of global climate change on October 1 /2, 2018 at the environmental research station Schneesfernerhaus/Zugspitze, and in Ruhpolding on January 15/16, 2019.

Discussions included the following key questions:

- | How strong is wintertime climate warming in the Central European mountain regions compared to the global trend?
- | How reliable are climate projections for the winter climate in Central Europe for the near (until 2050) and distant future (until 2100)?

- | How does the expected change in snow cover duration and snow cover depth spatially differ in the Central Upland ranges of Germany (Mittelgebirge) and the Alpine region?
- | What influence does the variability of atmospheric circulation have on the winter climate?
- | What impacts must be expected for technical snowmaking?
- | What strategies and measures for adaptation and climate mitigation can be recommended?

A total of more than 20 authors from 14 scientific institutions have contributed to the presentation of the current state of research in the form of a position paper and a series of scientific articles in the journal FdSnow, issue 53, in an overview that is the first of its kind and well worth reading. Our thanks go to all our colleagues for their willingness to engage in constructive, open discussion and to formulate joint positions and strategies for action.

**Prof. Dr. Ralf Roth**  
**Prof. Dr. Hans-Peter Schmid**  
**Dr. Karl-Friedrich Ziegahn**

## Joint position paper

# Expert Forum Climate.Snow.Sport

In this position paper, the participating experts and research institutions found consensus to confirm the following core statements for the Alpine region and the German Central Upland ranges (Mittelgebirge). They also point to knowledge deficits and possible strategies for action.

## Core statements

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- | Scientists and research institutions agree that an increase of the average annual temperature in the Alpine region and the Central Upland ranges of at least another 2°C by the end of the century must be expected. The increase in temperature affects all seasons. Only by implementing far-reaching measures to reduce emissions, as stipulated in the Paris Climate Agreement of 2015, could this value be undercut.
  - | As a result, the natural snow cover suitable for snow sports will continue to decline in the long term up to mid-elevations in both the Alpine and the Central Upland ranges. The duration of snow cover will be reduced by some weeks in late winter, and to a lesser extent in early winter.
  - | In this context, the general climatological conditions for technical snowmaking are also changing.
- The number and duration of potential snowmaking opportunities will decrease.
- | Statements about the near future (up to 2050) are more difficult to make, as the often high natural climate variability is superimposed on the long-term trend. Such strong fluctuations can significantly mask the gradual rise in mean temperature until 2050.
  - | However, the combination of variability and continuous warming means that there will be recurring new temperature maxima. In the case of precipitation, the variability is particularly high and it is therefore difficult to identify clear trends at present.



## Knowledge deficits and research relevance

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The scientists identify knowledge deficits and relevant research potential in the following subject areas:

- | **Persistence of weather conditions:** There are indications that weather conditions generally tend to last longer, due to the effects of climate change on atmospheric circulation (increased persistence), and can, for example, characterise an entire winter season.
- | **Extreme events:** There is increasing evidence that extreme events are both increasing and intensifying. Detailed research is needed to better understand the causes and dynamics of such extreme events and their statistical properties.
- | **Data uncertainties:** Statements on the mean temperature development are relatively reliable. Statements on precipitation development, on the other hand, are subject to considerable uncertainties. There is an urgent need to further improve the data situation by integrating new observation methods.
- | **Precipitation development:** In order to be able to estimate developments in precipitation more reliably, further knowledge about precipitation formation processes is necessary, especially pertaining to mountain regions.
- | **Climate predictions:** Significant improvements in seasonal and decadal weather and climate prediction, e.g., by refining the spatial and temporal resolution of models, are a prerequisite for assessments of short and medium-term snow cover variability.

These core statements provide lift operators, the recreation industry, and winter sports associations and destinations with opportunities to actively participate in addressing the societal grand-challenge of „climate change“ with appropriate measures to adapt to the consequences, and to reduce greenhouse gas emissions.

To capitalize on these opportunities, objective risk assessments and adequate handling of uncertainties are essential in the winter sports regions in question. Due to specific regional and microclimatic characteristics, as well as different starting situations, formulation of site-specific statements is complex and difficult. Therefore, it is essential to involve qualified experts from the fields of climatology and meteorology, who are familiar with existing data in the respective region and who can provide science-based advice.



## Strategic approaches for action

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From the perspective of the experts, the following strategic approaches should be pursued:

- | Adapted technological and organisational **innovation, and diversification** of activities on offer to secure and further develop winter sports into the future
- | Increased use of **renewable energy sources** and increased energy and resource efficiency in all sectors of winter sports.
- | Intensification of winter sports-related **climate- and adaptation research**.
- | Establishment of **interdisciplinary partnerships, networks and systems** for the exchange of information at all levels, for the sustainable development of the sector.
- | Implementation of site-specific **vulnerability analyses** to document and assess climatologically relevant parameters (exposure), sensitivity and adaptation capacity of winter sports regions.
- | Establishment of **resilience strategies** to improve resistance and adaptability and to strengthen the innovative capacity of winter sports.

To ensure future development of winter sports, additional measures beyond these strategies for action are necessary:

Consistent knowledge transfer between science and applications facilitates communication, optimizes mutual benefit, and accelerates the search for solutions. In addition, to keep public discussion on a rational level is an important objective for all involved parties



## Participating experts and institutions

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## Organisation and professional support

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