technology
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April 7th, 2011

- **Spring Meeting: Start of National Austrian KLI.EN SNOW Project and**
- **Panel Discussion on Interaction “Snow Quality and Sustainable Snow Production”**

Part 1: Outreach activities and partnerships of the “SNOW” project

Meinhard Breiling

Coordinator TTL

An intermediate state of the development of the Dendrite Generator DG

Dendritic snow produced by a DG prototype

Project SNOW

- Builds on a series of previous projects
  - Projects related to the quality of snow and snow physiscs
    - PRIZE09 „Dendritic Snow Production“ Feb. 2010 to Jan. 2011
      - Funded by the Uni:INVENT program of Austria
    - EU INTAS Project 03-51-5296 „Influence on snow vertical structure on hydrothermal regime and snow related economical aspects in Northern Eurasia” May 2004 to April 2007
      - Funded by European Union
    - UNESCO Snow Classification System of 2009

Devoted Developers of the DG

Project SNOW

– Projects related to availability of snow for winter tourism
  - Climate sensitivity of Salzburg districts, Dec. 2006 to August 2008
  - Climate change and winter tourism in Japan, Ph.D. work Univ. of Tokyo, K.I.Hatanaka, April 2000 to May 2004
  - Climate sensitivity of Austrian districts, Dec. 1995 to August 1997

The tourism industry depends on snow

Project SNOW

- Major events contributing to international networks in snow sciences and know how gatherings
  - TTL Snow Conference, Nov. 2004
    - http://ttl.tuwien.ac.at/content/conference_vienna2004.php
  - TTL Polar Tourism Conference, Oct. 2008
  - EGU conferences (S. Sokratov)
  - International Glaciological Society Conferences
  - University exchange programs (ERASMUS)
  - Individual contacts of SNOW researchers

Polar Tourism Conference 2008

Some science partners: TU Luleå

Some science partners: Moscow State University

Some science partners: Russian HydroMet Institute

Some science partners: Slovak Academy of Sciences: Liptovsky Mikulas

Some science partners: WSL Davos

Some science partners: Ovidius University Constanta

Some science partners: Uzbek Academy of Sciences

Some science partners: Byrd Research Laboratory – Ohio State University

Some science partners: Kyoto University

Part 2: **Panel Discussion on Interaction “Snow Quality and Sustainable Snow Production”**

Sustainable snow production is associated with:

- Find means to prolong the touristic season for snow based activities at no additional resource cost
- Essential for the economic survival of touristic regions
- Distinction between sustainability of snow use, snow production and snow conservation is possible

Kitzbühel Hahnenkamm

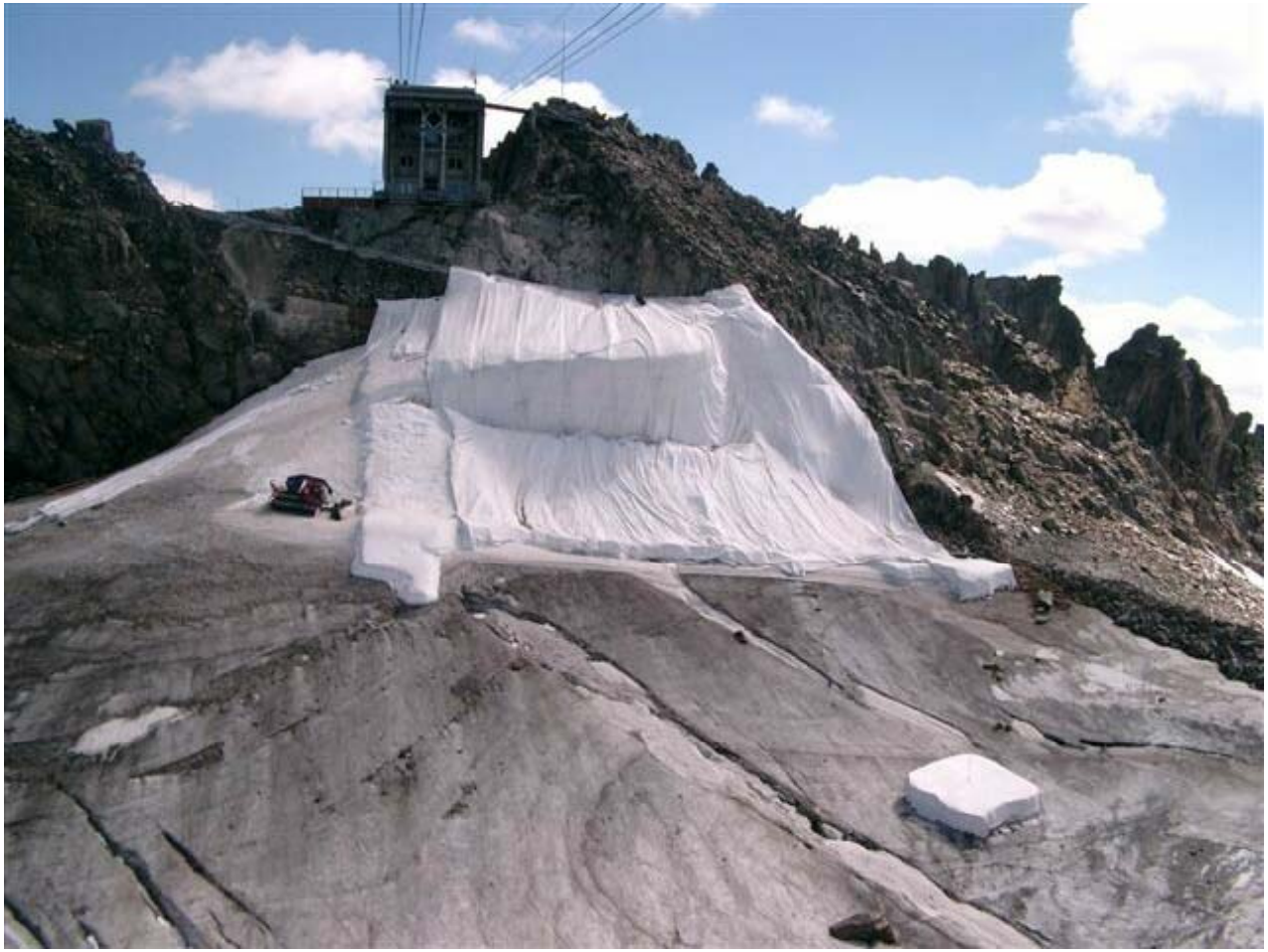
Alpincenter Kaprun

Iglo Dorf Kaprun

Sustainable snow production and snow conservation

- Sustainable snow production is not defined yet
  - Danger of misinterpretations
  - In general: produce the same amount of snow with less resources
- Various methods seem feasible
  - Conventional snow making based on snow making devices
  - Cooling the ground (TU Luleå) gives up to 20 days longer season e.g. in Jukkasjärvi Icehotel
  - Conserving the snow of last season (snow farming), e.g. Davos
- Various methods not feasible (at least in EU)
  - Cloud seeding (Russian partners)
  - Micro-organism induced increase of dew point

Snowfarming



Source: M.Phillips, WSL Davos, 2006

Cloudseeding

Quelle: A. Sinkevich, Voichev Laboratory

Dendritic snow production has a quality advantage

- Snow can be produced between 100kg to 300kg per m^3
- Artificial snow conditions become more sophisticated
- More snow applications become possible
  - Not fully explored potential

Qualtity check of snow production

Hypothesis by SNOW Project Team

- A better snow quality is connected with a more sustainble production/use of snow
- We have some points as input to the discussion

Is a better snow quality production also more sustainable? Example DG

- Dendrite Generator saves resources :
  - Less energy to pump water through the system, engines need not to be so strong
  - Higher potential to combine snow making with renewable energy production.
  - Water is used to almost 100% as compared to < 90% in case of technologies depending on wet pulb temperatures

Is a better snow quality production also more sustainable? Example DG

- Dendrite Generator has potential to save costs:
  - Less resource use means less costs
  - A less demanding water supply systems make the given infrastructure more valueable
    - The existing pumping infrastructure is often at the limit, in case of highest demand only a portion of conventional snow makers can be supplied

Is a better snow quality production also more sustainable? Example DG

- Dendrite Generator tempers some known conflicts:
  - It produces snow without noise, people can sleep at night
  - It softens the icy underground of skipists, the risk of severe accidents is reduced

Discussion

- Several hundred people were invited to contribute via e-mail. The EGU conference in Vienna helped to get international attendance.
- Written comments of people that could not attend were sent to the organizers that were used as an input to the discussion
- Many people invited work in the one or other way with the development of innovative methods of snow production/conservation/use
- 15 persons attended the discussion representing
  - Austria
  - Germany
  - France
  - Russia
  - Switzerland
  - United Kingdom

Discussion 1

- Shall we use the term „sustainable“?
  - Pros
    - Sustainable is a wider term than „green“ or „ecological more benign“ term
    - Sustainability indicates social, economic and ecological concerns
  - Cons
    - Sustainable should not be used in the narrow sense of snow making
    - Sustainability for snow making refers entirely to an engineering concept and not to a regional development approach

Discussion 2

- Shall we put the [sustainable] use of snow in focus ?
  - Pros
    - Sustainability use of snow is more comprehensive than snow production and snow conservation and better suited to compare different approaches.
    - Sustainable use concepts can do important improvements. They focus on management and not necessarily on new technologies
  - Cons
    - The snow topic is too narrow for a separate „sustainability“ and only part of a more holistic sustainability concept

Discussion 3

- Shall we put the [sustainable] production of snow in focus ?
  - Pros
    - In case of an engineering approach „sustainable snow production“ can be used
  - Cons
    - „Sustainable snow production“ is too narrow
    - Better terms
      - Innovative snow production
      - Resource efficient snow production
      - Efficient snow production

Discussion 4

- Shall we put the [sustainable] conservation of snow in focus ?
  - Pros
    - To get more attention for a topic not yet sufficiently considered
  - Cons
    - Sustainable refers here only to resource savings
    - Sustainability is primarily used to support the local communities and for many communities snow production/ snow conservation is yet too expensive

Conclusions of discussion

- „Sustainable“ and „sustainability“ will be avoided in future declarations/discussions
- Instead „Ressource efficient and innovative snow production/ snow conservation/ snow use will be targeted by future declarations
- Comparing available methods, both in price and resource performance will be a coming issue of the interested scientists represented today

THANK YOU FOR YOUR ATTENTION!