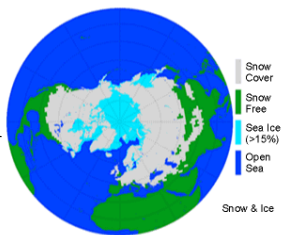


Snow in science only related to „Natural Processes“ of Landscape

- In approximately half of the globes areas
 - 75 million km²
- Permanent snow and ice
 - Polar regions
 - Glaciers
- Temporal snow cover
 - Snow is coming and returning on an annual base
 - Most habitated areas experience temporal snow
 - In Japan and Austria several weeks or month
- Snowfall events
 - Induce change in effected landscape
 - Is counterpart to vegetation period
 - If snow is away life is starting again



http://nsidc.org/foot/snow_extent.html

Humans adapted to their specific snow conditions

- Availability of water for agriculture
- The intensity of run off in rivers
- The safety of population with regards to risks
 - Mountains and snowy regions were often considered as „tabu“ and places related to „death“
- In Japan there is indogenous wisdom based on yukigata
 - Traditional signs in landscape
 - Indicate the time to start planting rice
 - To start travelling

Yukigata: Signal based on snow pattern



Yukigata "Swan"

Applications:

- Regional Flooding Potential: Average and maximum snow depth over observation period
- Economic Importance



Applications:

- Risk and Safety Issues in Snowy Regions
- Economic importance



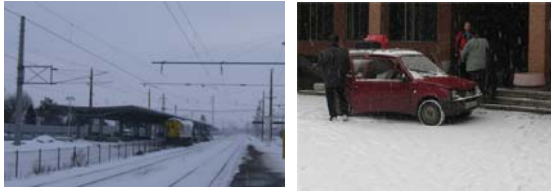
Applications:

- Agriculture: Snow melt and irrigation water
- Economic importance



Applications:

- Transportation during Snow Season
- Economic Importance



Applications:

- Urban Issues: Extreme snow depth, roof stability & roof avalanches
- Economic Importance



Applications:

- Energy Supply: Pipelines, snow and permafrost
- Economic Importance



Applications:

- Snow Removal: Russian case study
- Economic Importance



Applications:

- Revenues for Winter Tourism
- Economic Importance



Part 2: Snow and Winter Tourism in Austria and Japan



Snow and Winter Tourism in Austria

- Is the single most important economy in rural Austria
- About 4% of Austrian GNP
 - In certain provinces like Tyrol and Salzburg much higher
 - Half of rural income during winter



Development of Winter Tourism

- Requires rich societies
- Enough income from tourists
- Austrian rural areas serve also countries like Germany or Netherlands for tourism
 - About 35% domestic tourists
 - About 65% international tourists
 - “Rural” and “mountains” is also an export product in Austria



Zell am See



Winterlandscape

- Winter and snow are important factors of selling rural landscapes
- Higher value with appropriate activities



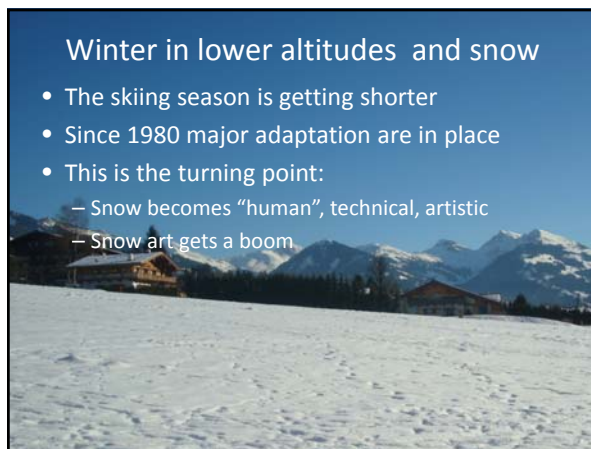
Natural Hazards

- Snow can be very dangerous
 - Avalanches increased with intensity of use
 - Even historically “tabu” areas become frequented



Winter in lower altitudes and snow

- The skiing season is getting shorter
- Since 1980 major adaptation are in place
- This is the turning point:
 - Snow becomes “human”, technical, artistic
 - Snow art gets a boom





Kitzbühel

- Is one of the oldest and most famous resorts in Austria
- Is situated in comparatively low altitude



Apres-ski

- Places like Kitzbuehel offer cozy atmosphere after skiing
 - Coffeehouses
 - Drinking and dining
 - Amusement and nightlife
 - Shopping
 - Snow is often missing in winter



.....and a little bit of culture



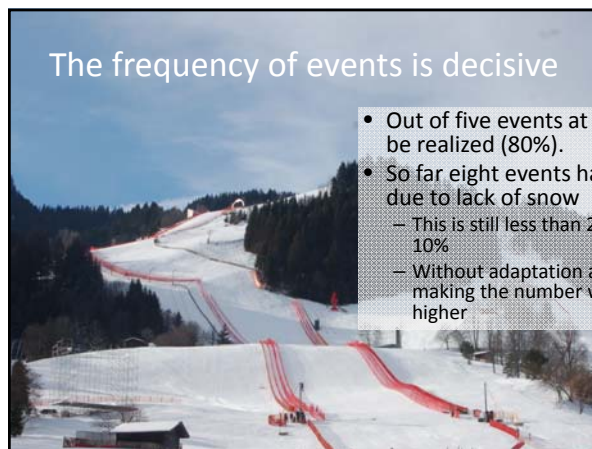
Old churches and historic buildings

Give the place a flair
A feeling of good old world and values



The Ski World Cup

- Is in principle planned every year at the end of January, if it is not too warm
- This happened last time in 2007 due to lack of snow

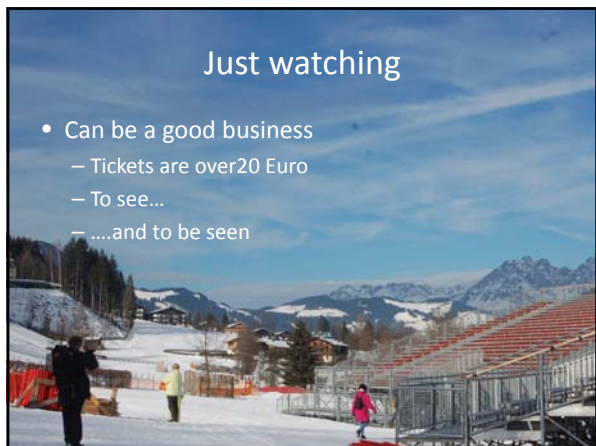


The frequency of events is decisive

- Out of five events at least four should be realized (80%).
- So far eight events have been realized due to lack of snow
 - This is still less than 20%
 - Without adaptation a higher number is needed

Just watching

- Can be a good business
 - Tickets are over 20 Euro
 - To see...
 -and to be seen



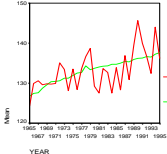

Japanese Winter Tourism

- In many rural areas winter tourism developed to profitable income
- Because of winter tourism, more people can stay in rural areas
- Winter tourism development is in stagnation in Japan
- Regions in Japan can experience very different situation
- I will refer to situation in Shiga ken



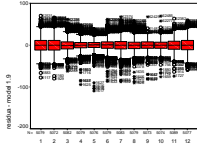

The Climate Problem

- During the last 60 years we observed a statistical warming of 1°C during winter period
- This changed the situation of Japanese winter tourism resorts: less snow

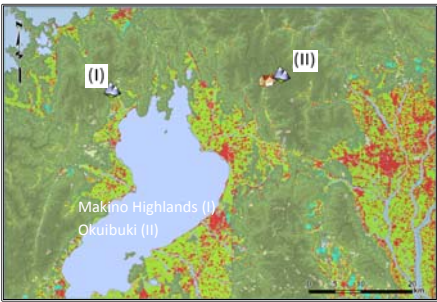


Annual mean temperature left vs. Fluctuations of monthly mean temperature, right.

Source: P. Charmanop 2008, internal work document, U-Tokyo



Selected resorts in Shiga prefecture



Makiho Highlands (I)
Okuibuki (II)

Source: I. Hoshizaki 2009

Makino highlands



Source: M. Drieling, Nov. 4th, 2009

Makino Highlands

- Was established in the 1920s
 - Situated in 100m to 500m altitude
 - As one of the three main resorts in Kansai area
 - Some 300,000 visitors in winter, now 30,000



Source: M. Drieling, 2009

Major changes in Makino highlands

- Season from 100 days to January
- Snowcover of regularly more than 100cm does only reach occasionally 50cm
- Built out of Makino highlands in early 1990s was not realized
 - Due to a change of economic situation and not due to expected climate change



Okuibuki Skilift



Source: M. Drieling, 2009

Okuibuki resort

- Established in 1970s as business of one family
 - Beside 9 skilifts one Minshuku hotel
 - Most tourists of 100,000 tourist are day tourists
- Situated in 700m to 1200m altitude
 - 100 days skiing season
 - 22 ha skiing areas on 11 ski pists



Major changes in Okuibuki resort

- Limited tradition as ski resort
 - There was no access before 1970s
 - Development of rural areas made the use as skiing area possible



Source: Okuibuki Ski resort, 2009

Part 3: Snow and Art

- Each snowcrystal is an artwork
 - Every snowcover is unique

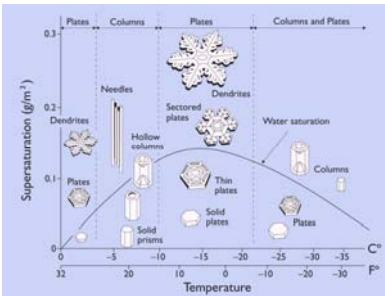


<http://www.itc.caltech.edu/~atmos/snowcrystal/>

Snow and Ice as Building and Art Material

- There are many kinds of snow
- Inuit languages have 100 names for different varieties of snow
- Unique is that snow consists of air and water
- Negative temperature required
 - Continuation of cold temperature needed
 - Otherwise melting and disappearance of snow

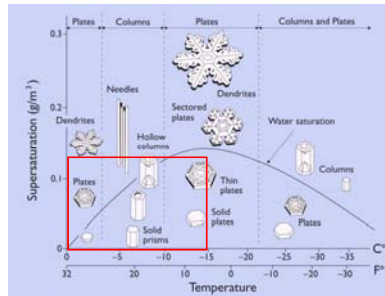
Conditions define snow habitus



- Nuclei for condensation
 - Temperature
 - Supersaturation
- Snow crystals
 - Many different and unique forms of snow crystals
 - But not two of them that are identical
- Snow flakes
 - Agglomeration of crystals
- Snow cover layers
 - Snow flakes of same snow event
- Snow cover
 - All snow layers

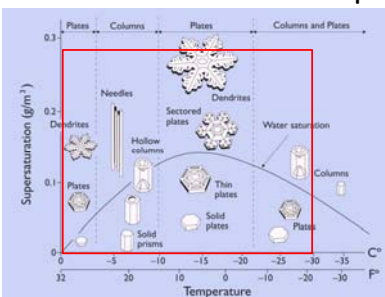
Quelle: NSIDC Colorado after Nakano

Man made artificial snow



- Current artificial- or technical – snow has a limited red frame
- Artificial snow is expensive
- Artificial snow is heavy
- Resource use in particular water and energy are considered as too high
- Better methods to produce artificial snow are required

Artificial snow expended



- Artificial snow comes closer to natural snow
- New procedures to produce artificial snow are developed
- Resource demand will be reduced
- Artificial snow will become cheaper
- New uses for snow as material are conceivable



Austrian Japan Efforts for Better Snow

- New concepts of artificial snow
- Artificial cloud concept

Landscape architect students in snow

- Snow used to sculpture and experiment
- In this case wet snow
 - Due to plus degrees
 - Non sustainable art work

Picture from Anton Mitterle, TU Wien

Installations in Snow

Jukkasjaervi Icehotel, Sweden

- Challenge for 30 artists (sculptors)

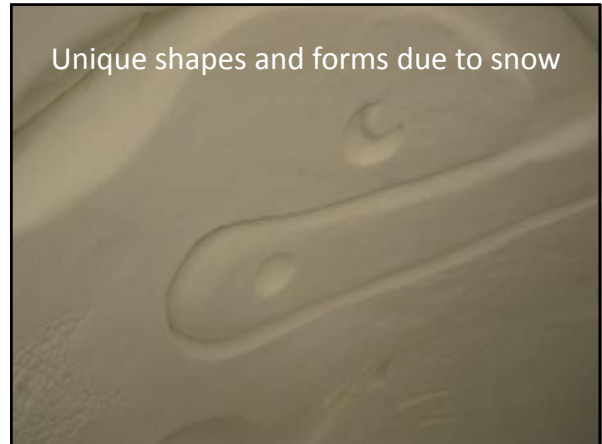
Buildings out of Snow and Ice

Cool life styles in art rooms

- Each room designed by an artist
- Long waiting list
- Artists do not earn

Individual rooms lasting for 111 nights

- Idea to prolong season
- Could sell three times more
- Prizes are 300 Euro per night and room

Outside Construction

- Is patented
- Is technically advanced and fast
- Volumes with 6000m2 inside space constructed in 20 days
- Artificial snow is used to construct the walls
- Stored ice from last year is used to enable an early start
- Criterion is to have a very long season



Piteå Ice Music Hall

- Baic construction with help of balloons
- Combined with artificial snow making



Ice Music

- All music instruments were constructed from snow and water and worked only under 0 degrees

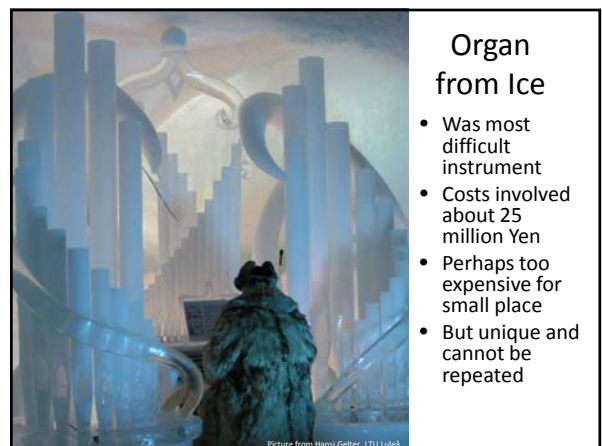
Picture from Hansi Geller, LTU Luleå

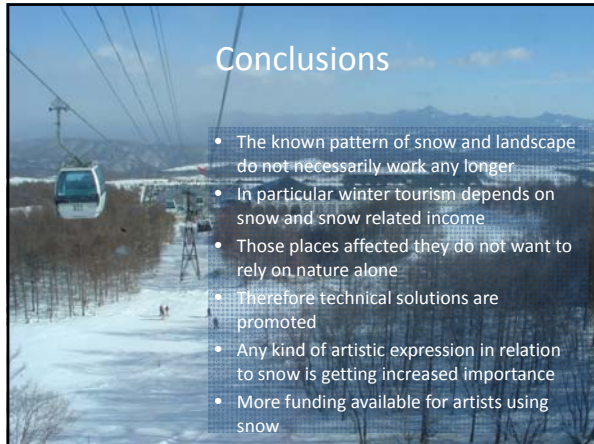


Organ from Ice

- Was most difficult instrument
- Costs involved about 25 million Yen
- Perhaps too expensive for small place
- But unique and cannot be repeated

Picture from Hansi Geller, LTU Luleå





Conclusions

- The known pattern of snow and landscape do not necessarily work any longer
- In particular winter tourism depends on snow and snow related income
- Those places affected they do not want to rely on nature alone
- Therefore technical solutions are promoted
- Any kind of artistic expression in relation to snow is getting increased importance
- More funding available for artists using snow

Domo arrigato

