Preparation and maintenance of pistes

A review of state-of-the-art knowledge & methods

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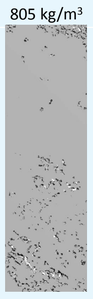
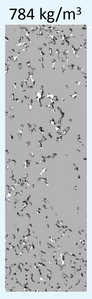
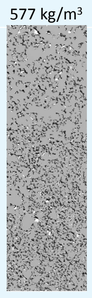
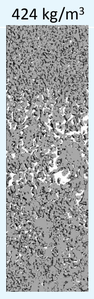
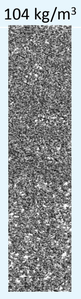
Introduction

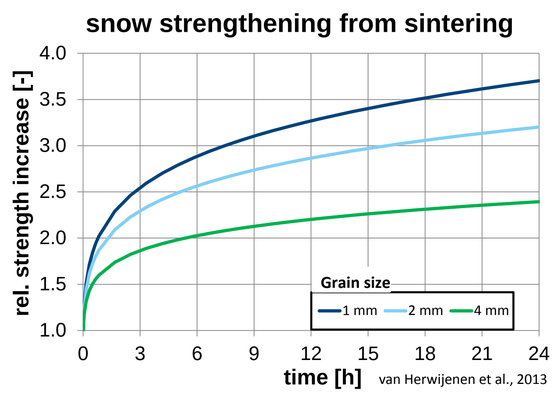
We present the new handbook of piste preparation, which is the only source of information that provides ski resort operators with methods and knowledge for quality assurance of the central product of a winter sports destination - the ski slopes, cross-country ski runs and snow parks. The new edition contains a completely new chapter, which also makes the layman understand the physical processes and the resulting properties of the snow. For the first time, current snow production technologies are compared. The completely revised book bridges the gap between research findings and day-to-day practical application on ski slopes. It provides important know-how to meet the increasing demands on snow sports offers, while the climatological conditions are becoming increasingly unfavorable.

Weitere Informationen zum neuen Handbuch Pistenpräparation und Pistenpflege

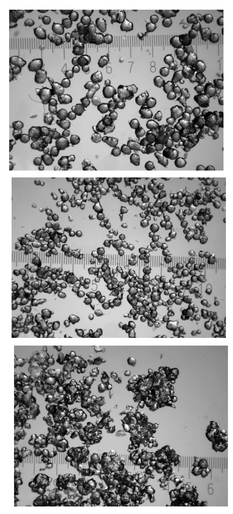
Science of Snow

- Basic structural properties
- Thermal properties
- Snow processes
- Mechanical properties
- Formation of natural snow
- Machine-made snow

Porous ice	Firn		Old snow	New snow
915–830 kg/m³	830–550 kg/m³		550–250 kg/m³	250–50 kg/m³
805 kg/m³	784 kg/m³	577 kg/m³	424 kg/m³	104 kg/m³
				
DH WC	DH WC	DH WC	DH WC	Natural snow
Lake Louise	Beaver Creek	Are, SWE	Lake Louise	Davos CH



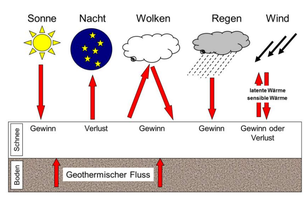
van Herwijenen et al., 2013

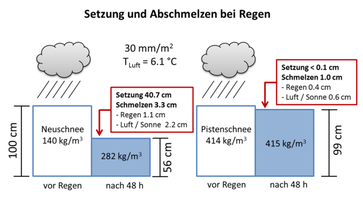


Microscopy and micro CT images of machine made snow of different grain size and wetness , SLF.

Meteorological factors affecting snow

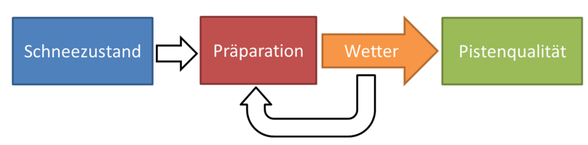
- Atmosphere
- Thermal balance on the snow surface

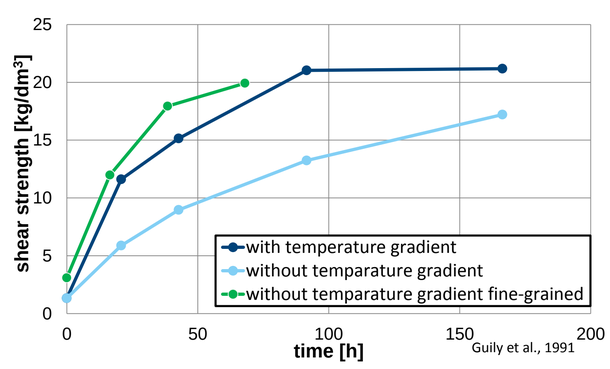




Preparing and maintaining ski pistes

- The optimal ski piste
- Principles of snow consolidation
- Snow preparation in accordance with snow and weather conditions
- Machines and their optimal use

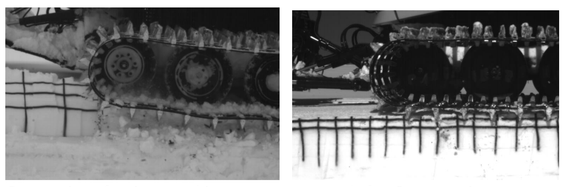




Guily et al., 1991

Preparing and maintaining a ski racing track

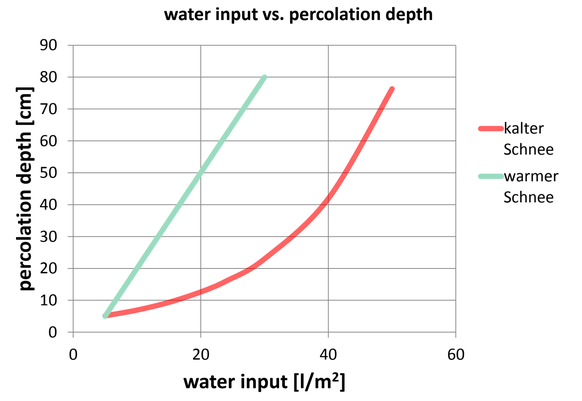
- Goals of racing track preparations
- Preparatory work
- Watering a ski racing track
- Chemical snow hardening
- Snow clearing



Penetration of a piste machine on new snow and after 3 preparation runs

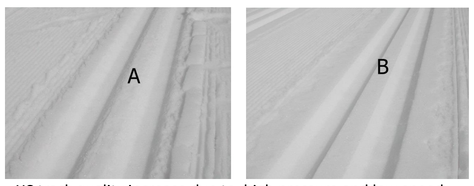
Race piste watering using an on-board water injection system

Watering experiments on snow of different grain sizes and densities



Preparing and maintaining cross country ski tracks

- Goals of racing track preparations
- Preparatory work
- Watering a ski racing track
- Chemical snow hardening
- Snow clearing



XC track quality increase due to high pressure and low speed preparation

Fleece cover on a XC WC track (Korea) to prevent melting and softening

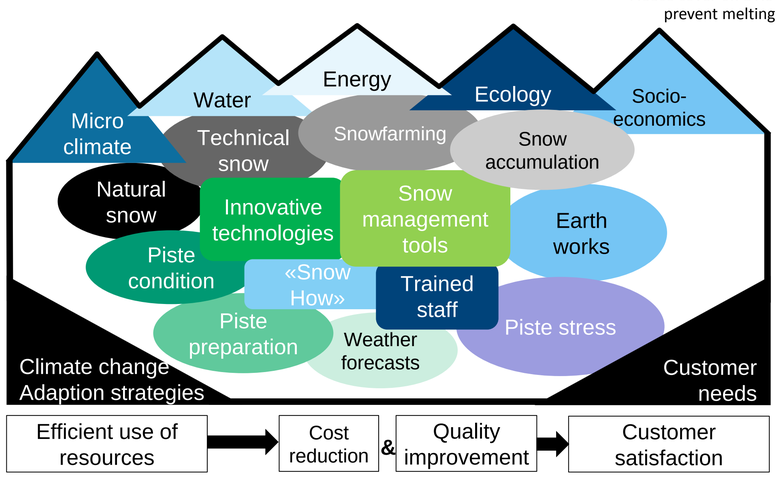
Constructing and maintaining a snow park

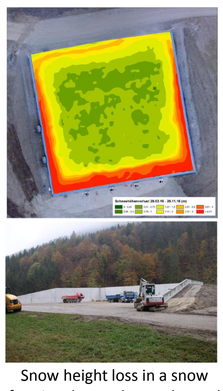
- Freestyle Parks
- Cross tracks
- Halfpipes

Attractions parks	Cross tracks	Freestyle parks	Halfpipes
• Airbag Jump • Photo Jump • Speed Track • Toboggan/-Tube Track • Snow Playground ...	Ski-/Bordercross (professional)	Slopestyle (professional)	Superpipe (professional)
	Freeridecross	Freestyle Park • Large • Medium • Small	Medium Pipe • Wall < 4 m
	Funline	Kids Park	Small Pipe • Wall < 1.5 m

Snow management

- Standardized workflows and management system
- Technical snow and micro climate
- Piste preparation
- Snowfarming
- Further measures
- Climate change and snow guarantee





Snow height loss in a snow farming depot due to thermal radiation of concrete walls (Krämer et al. 2017)

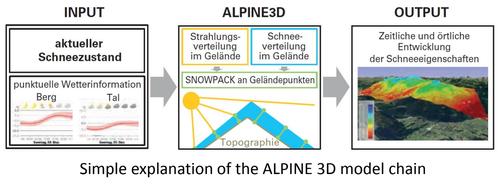
Construction, maintainance and terrain adaptions for a halfpipe

Measuring methods and equipment

- Snow measurements
- Meteorological parameters
- Snow cover models
- Snowmaking app
- Tools for snow park constructions

SLF snow meter to quantify snow density and wetness

ICE CUBE device to quantify the microstructure of snow (SSA)



Simple explanation of the ALPINE 3D model chain

Terrain adaptions for ski pistes followed by successful re-vegetation (Bernhard Krautzer)

BFW Bundesforschungszentrum für Wald
tirol Unser Land
BUNDESMINISTERIUM FÜR NACHHALTIGKEIT UND TOURISMUS
WILDBACH- UND LAWINENVERBAUUNG
WSL
SLF