

# Climate Change Impacts on Benefits and Risks for Skiing in Finland

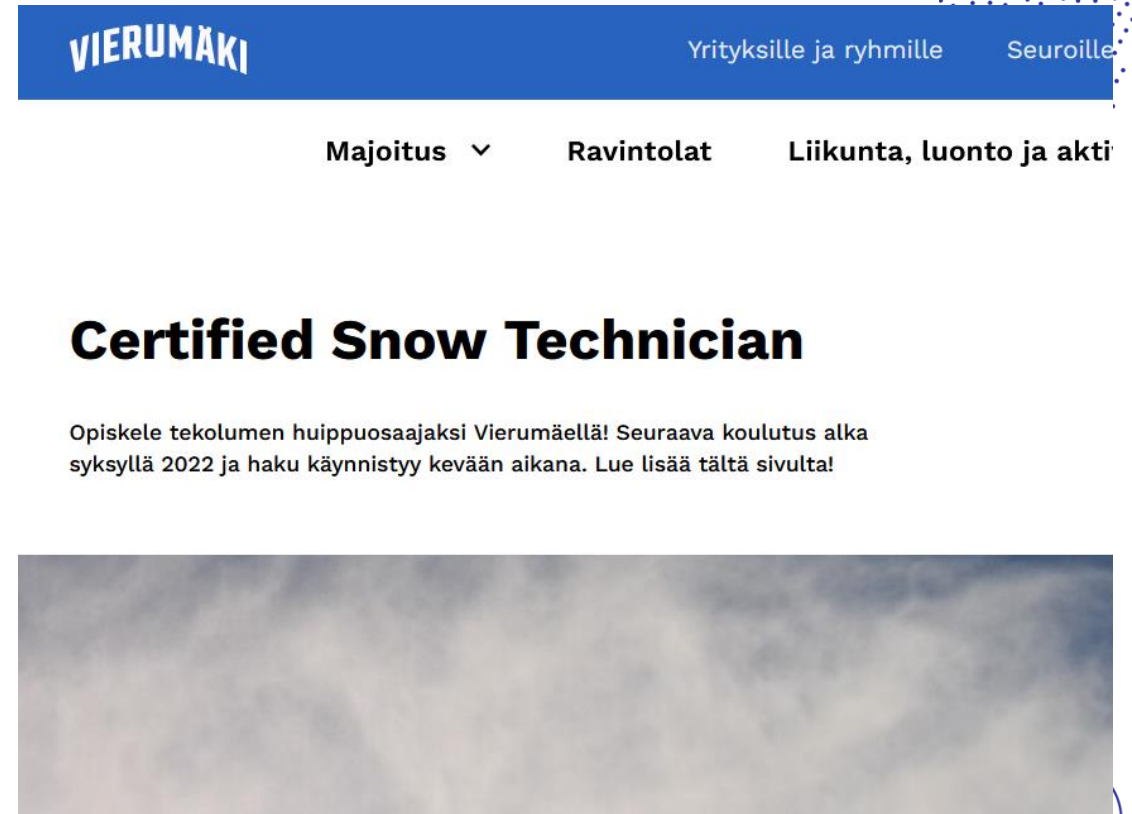
**Background:** Last Fall I was asked to help in preparing a lecture for **Vierumäki** to teach **snow technicians about the climate change risks and benefits for skiing in Finland**

- By iteration with FMI researchers and Vierumäki Director of the Sports Facility Maintenance Institute Manu Varho, a 2-hour lecture was made.
- Today I share my own experience and lessons I have learned since then.



**Hilppa Gregow**  
@HilppaGregow

**Prof., Head of Unit, Weather and  
Climate Change Impact Research  
2.2.22 Snow seminar**



The screenshot shows the Vierumäki website. The header is blue with the 'VIERUMÄKI' logo on the left and navigation links 'Yrityksille ja ryhmille' and 'Seuroille' on the right. Below the header, there are three main menu items: 'Majoitus' with a dropdown arrow, 'Ravintolat', and 'Liikunta, luonto ja akti'. The main content area features the title 'Certified Snow Technician' in bold. Below the title, a text block reads: 'Opiskele tekolumen huippuosajaksi Vierumäellä! Seuraava koulutus alka syksyllä 2022 ja haku käynnistyy kevään aikana. Lue lisää tältä sivulta!'. Below this text is a large, blurred image of a snowy landscape.

# **Snow research supports greatly our snow culture and snow lecture elements covered topics such as**

1. What are the trends in snow conditions in the past?
2. Why and how fast is climate changing ?
3. What about snow microphysics?
4. What about climate neutrality and how to optimize decisions?

**To be able to lecture about these and more – I needed info from snow, climate and forecast experts**

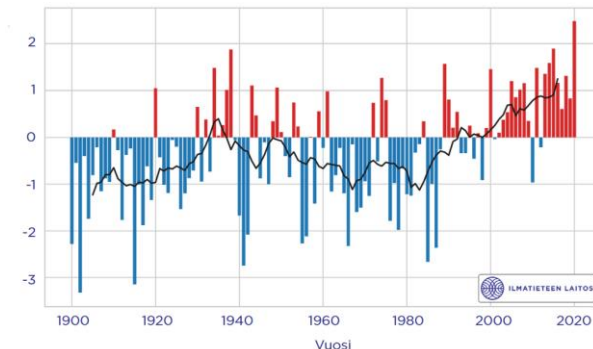
Anna Luomaranta,  
Natalia Korhonen,  
Anna Kontu,  
Leena Leppänen,

Andrea Vajda,  
Antti Mäkelä,  
Hilppa Gregow

For today's presentation  
I am also thanking  
Taru Olsson, Sara Filla  
and Otto Hyvärinen.

# Some of the concerns and facts: climate change impacts skiing culture and skiing skills

- Skiing is possible with natural snow and artificial snow – with freezing conditions – but it is increasingly warming.
- Ski tracks cost for us all – and many wait for them
- But in the future do people know how to ski anymore, if the timely window to ski shortens? Can people benefit of the shortlived possibilities created for them?



**We need to understand the past  
– for mid term decisions**



ILMATIETEEN LAITOS  
METEOROLOGISKA INSTITUTET  
FINNISH METEOROLOGICAL INSTITUTE



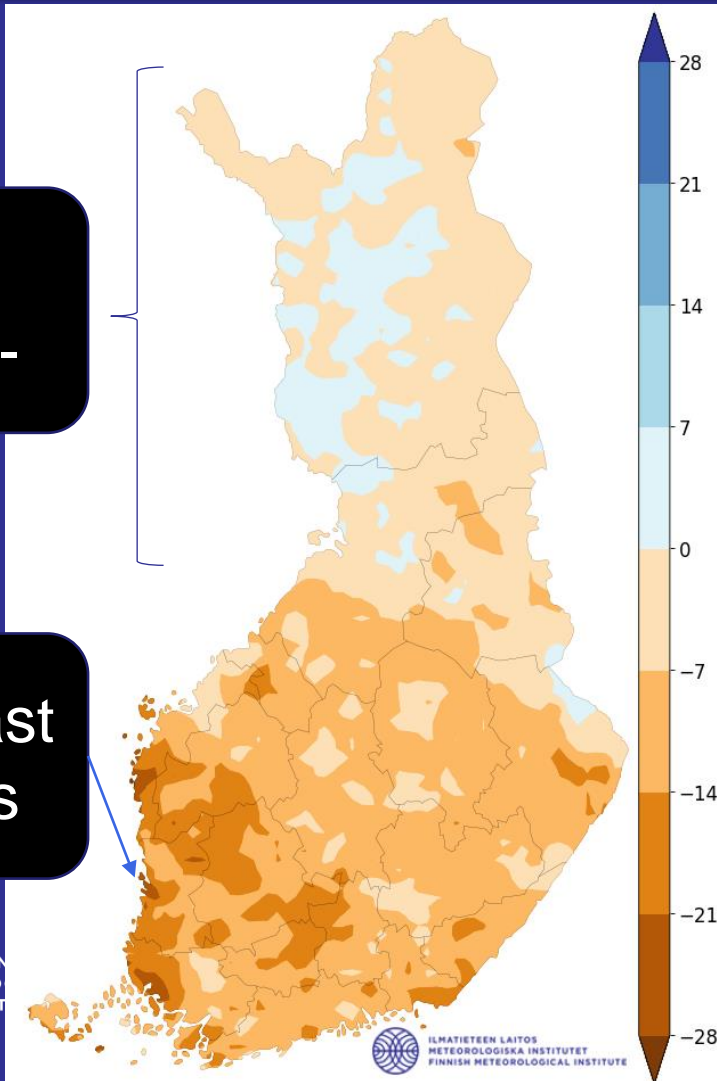
# Snowcover days and changes

## A comparison of 1991-2020 to past 30-year climates

### 1991-2020 and 1981-2010

North  
+ and -

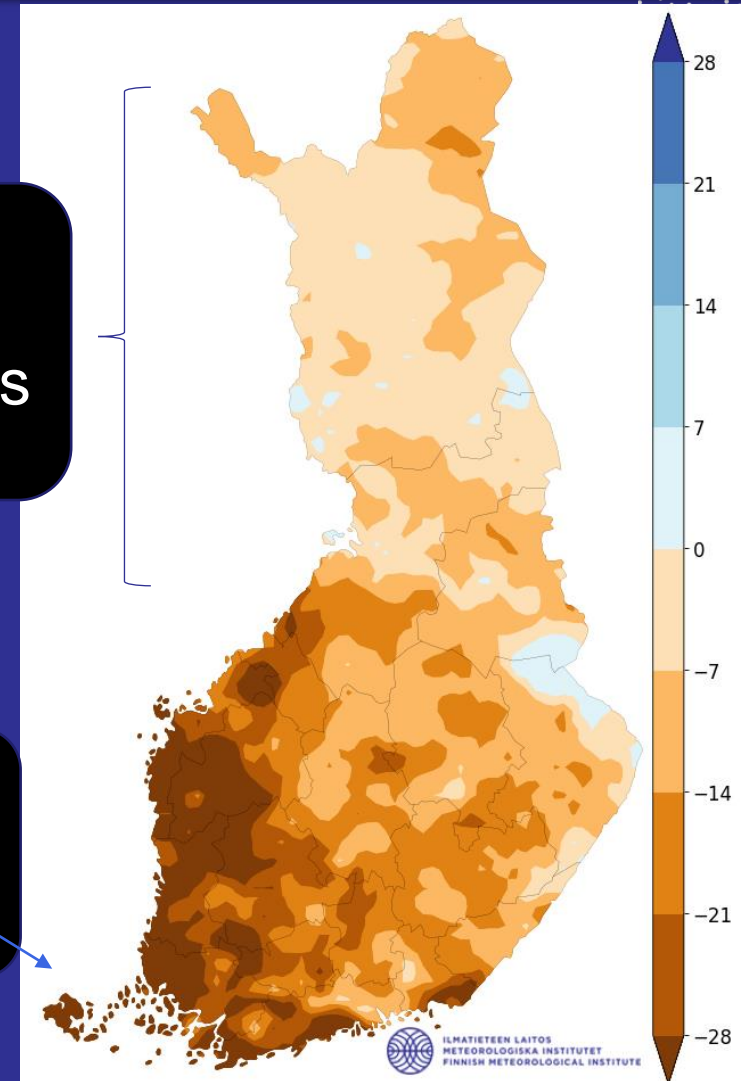
West coast  
-15 days



### 1991-2020 and 1961-1990

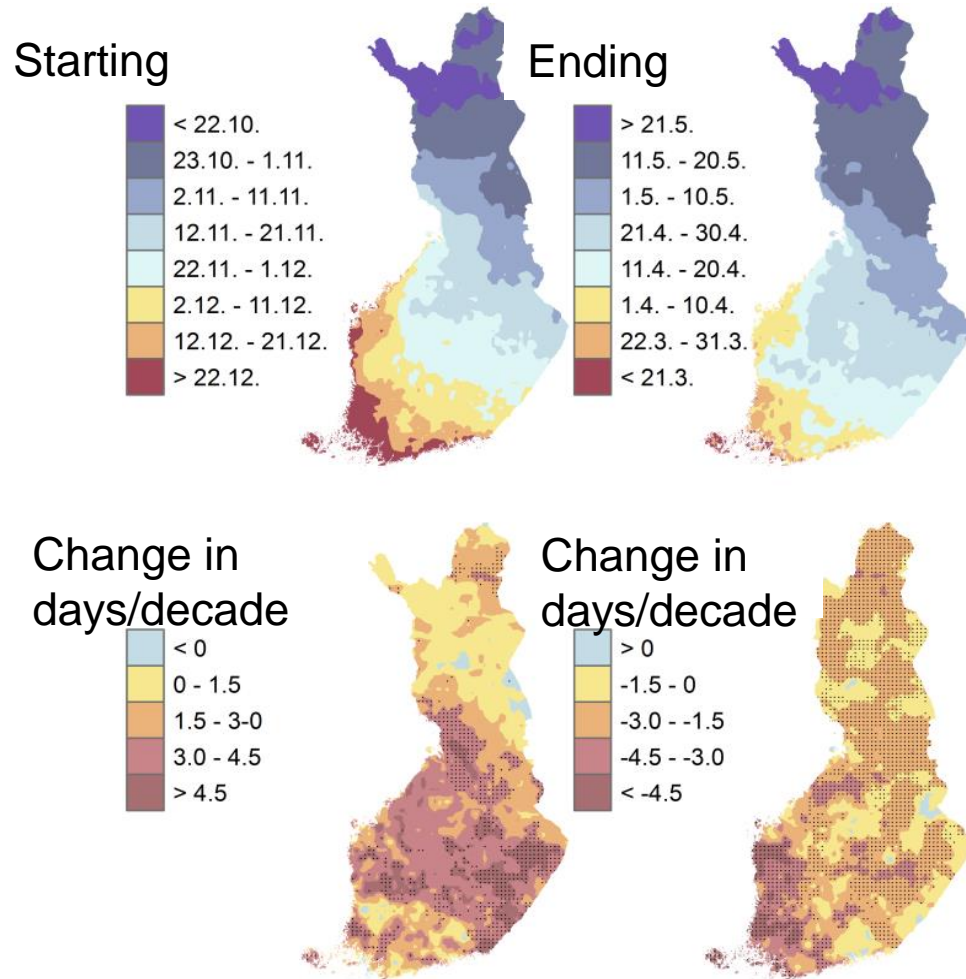
North  
-6..-9 days

Aland  
-51 days



ILMATIETEEN  
METEOROLO  
FINNISH MET

# Mid term decisions: we need to know the trends in changes and assess the coming decades with scenarios



- Permanent snow season starts later in the eastern and southeastern part of Finland
- Earliest offset of snowcover is nowadays in Western Finland
- The duration of snowcover conditions has shortened in the whole country

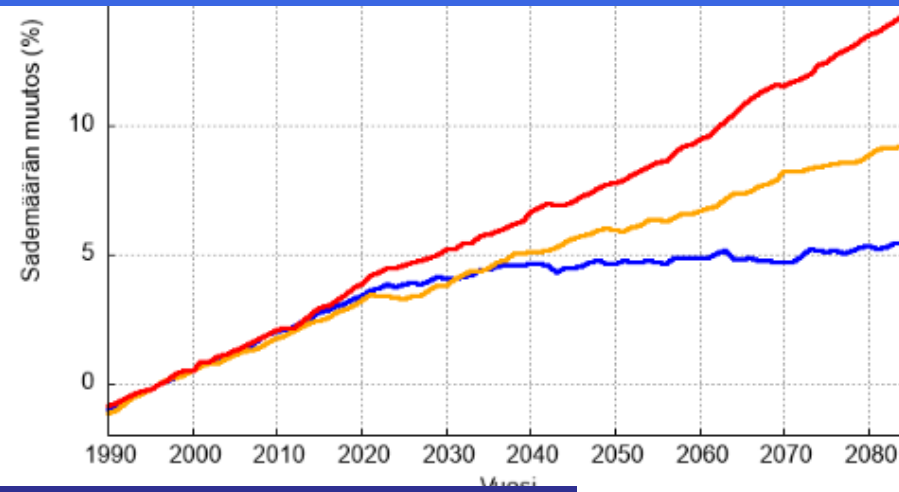
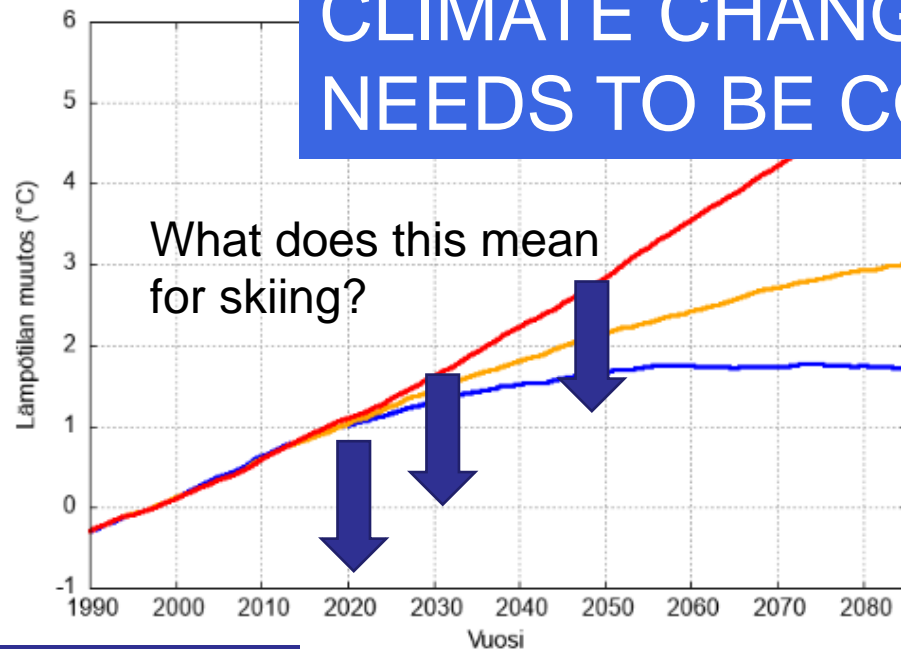
# **We need to understand the future – for long term decisions**



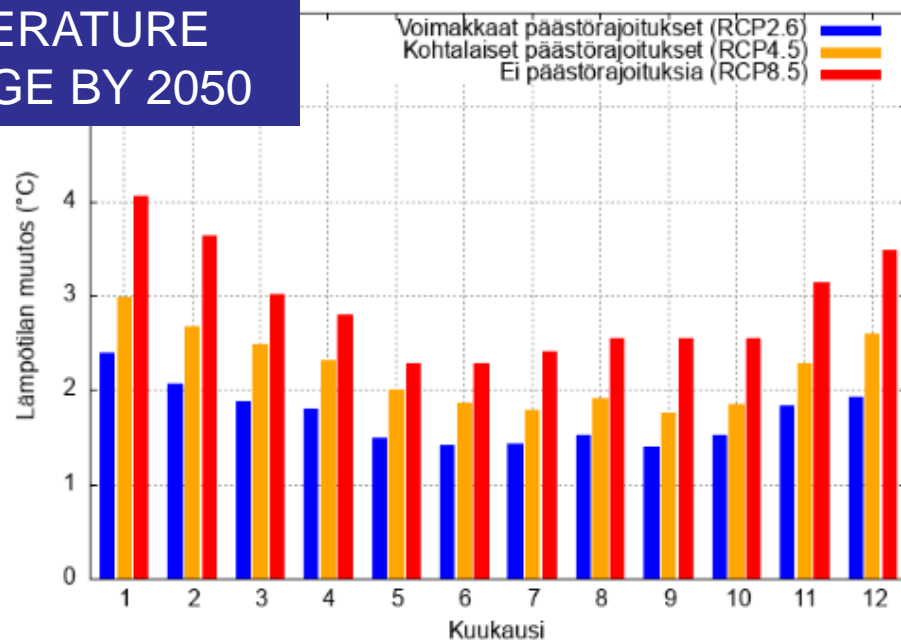
ILMATIETEEN LAITOS  
METEOROLOGISKA INSTITUTET  
FINNISH METEOROLOGICAL INSTITUTE

# CLIMATE CHANGE IMPACT PROPAGATION NEEDS TO BE COMMUNICATED BETTER

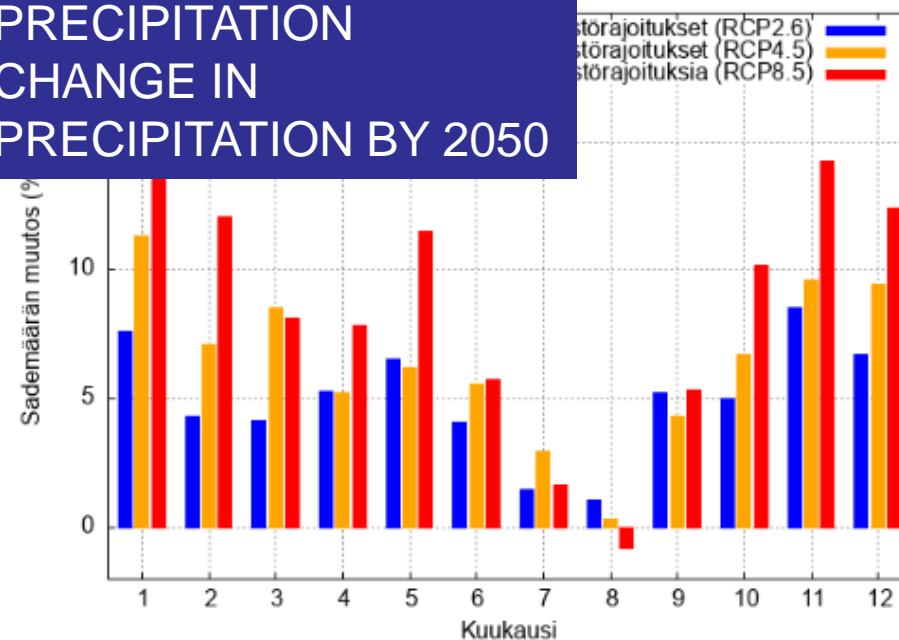
Example  
Päijät-Häme  
timeseries of  
change



## MONTHLY TEMPERATURE CHANGE BY 2050



## MONTHLY PRECIPITATION CHANGE IN PRECIPITATION BY 2050



Example of  
where we are  
in 2050 in  
Päijät-Häme





# SUOMI-project results: coming up soon

- Implementing the results of Gregow et al., 2021<sup>1</sup> as an interactive user experience
  - Supports especially the regional adaptation planning
- Will be part of the ClimateGuide.fi-portal, which is under renewal
  - Present climate and observed changes
  - Future
    - 2030, 2050, 2080
  - Descriptions of the phenomena
  - **Changes in the extremes**
  - Flood risks
  - **Snow**
  - **Seasonal changes**
  - Changes in the sea areas
    - Sea level height, temperature, nutritions, salinity
  - Besides numerical values, also easy-to-read short articles
- Information to all of Finland in the same way

Temperature

- Annual
- Monthly

Max. & min. temperature

- Annual
- Monthly

Precipitation

- Annual
- Monthly

Extreme temperature days

- > 25°C
- > 30°C
- < 0°C
- < -10°C
- < -20°C
- < -30°C

Season lengths

Snow depth

Heavy rainfall days (>20 mm/vrk)

Lightning & thunderstorms

Floods

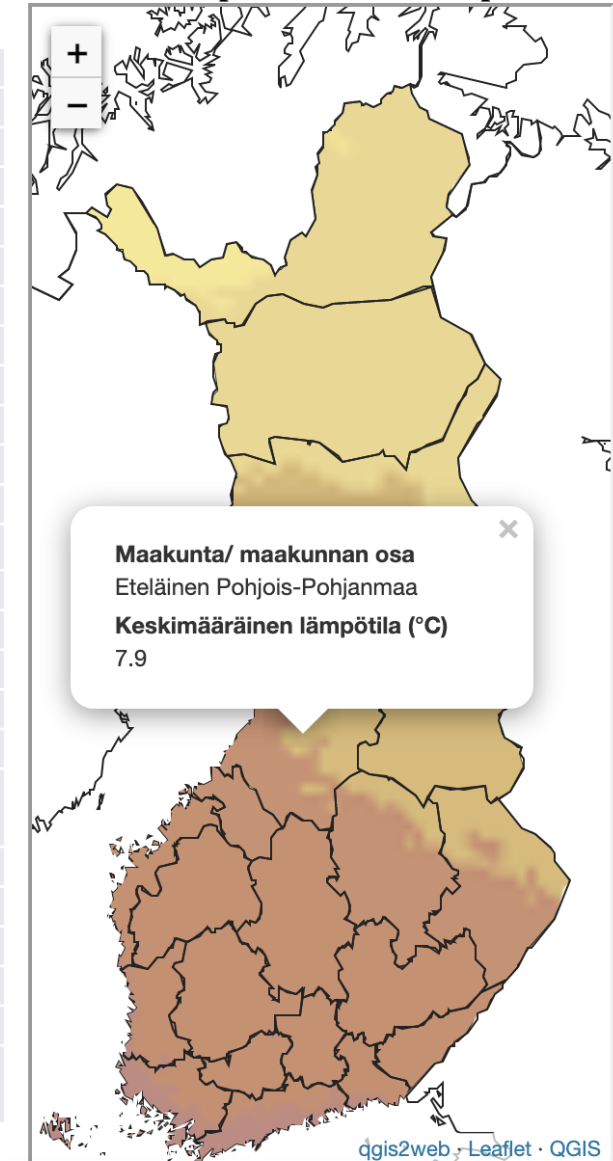
Sea level

Sea surface temperature

Sea salinity

Sea phosphorus and nitrogen

Vuosikeskilämpötila 2085 - suuret päästöt



**We need to be prepared for  
seasonal conditions as well**

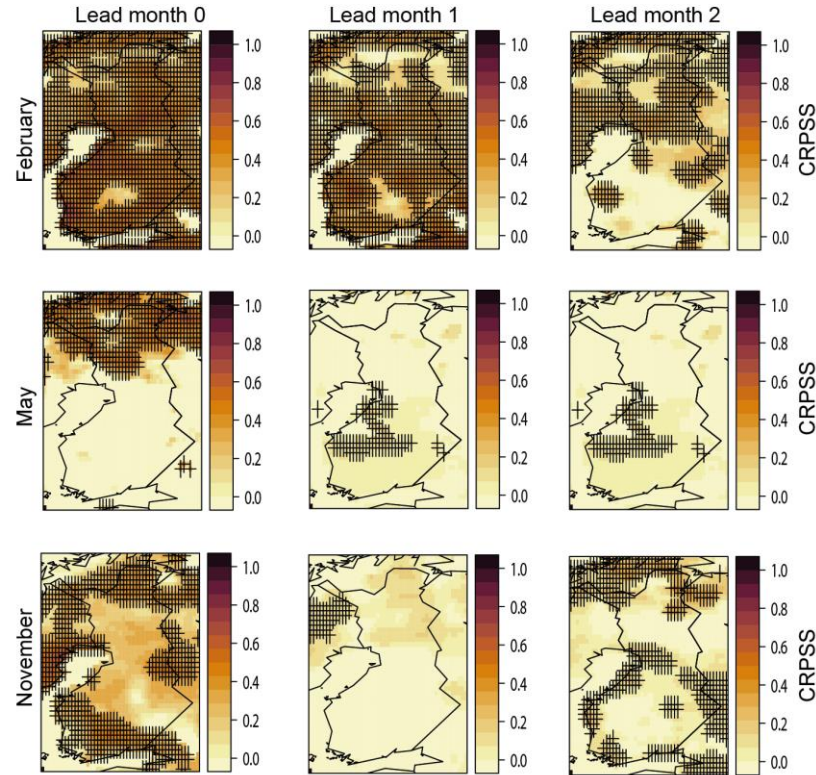


ILMATIETEEN LAITOS  
METEOROLOGISKA INSTITUTET  
FINNISH METEOROLOGICAL INSTITUTE

# Seasonal snow forecast products for Finland

→ Developed for and tested with 7 ski centres during winter 2019-2020

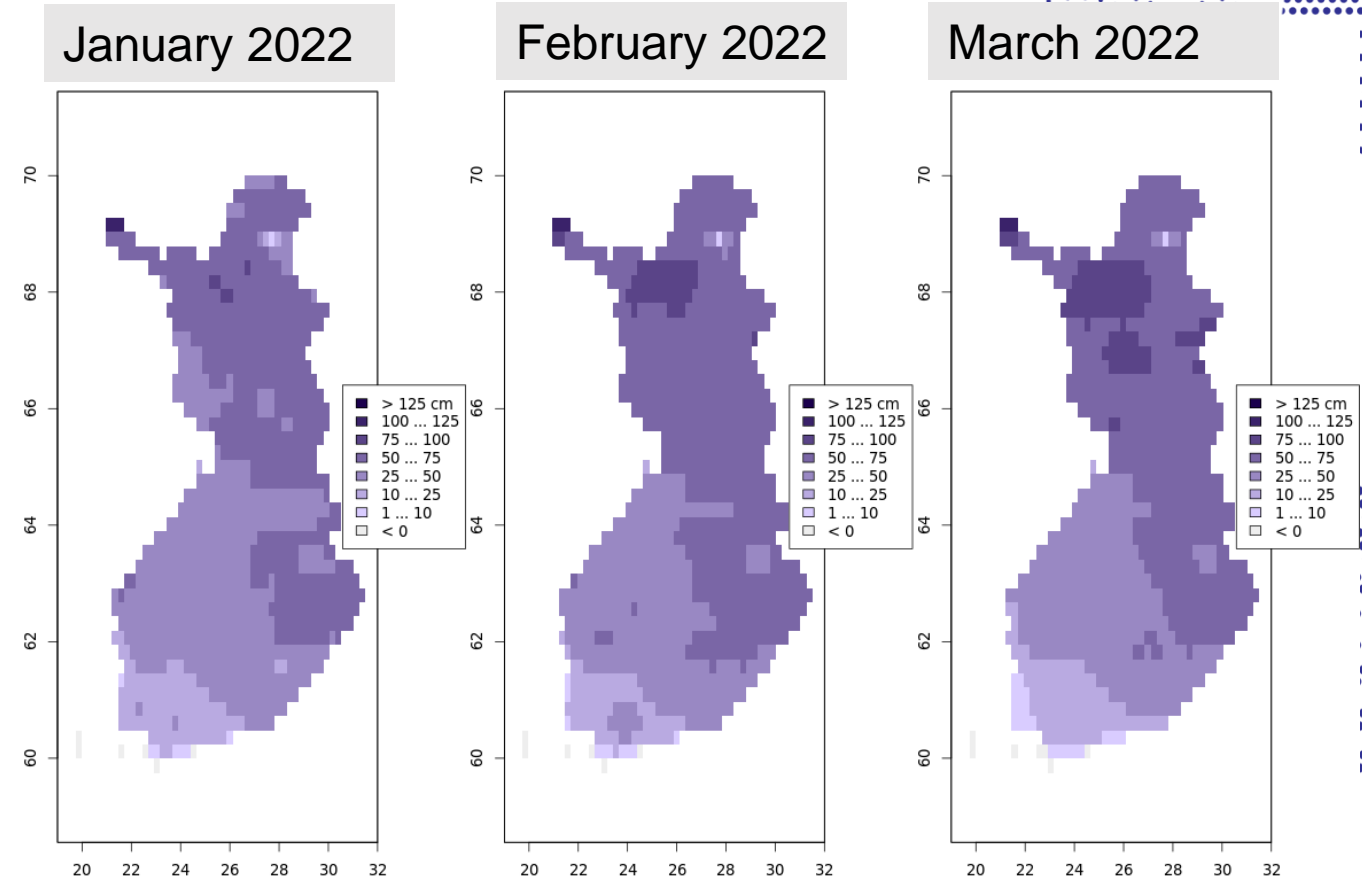
## Skill of bias corrected snow depth forecasts



Input data: bias adjusted ECMWF SEAS5 data

The forecast skill depends on the season. **The best skill is in the first two months, but some skill still present in third month.**

## Monthly snow depth for Finland, issued on 5<sup>th</sup> Jan 2022



Source: Vajda et al.

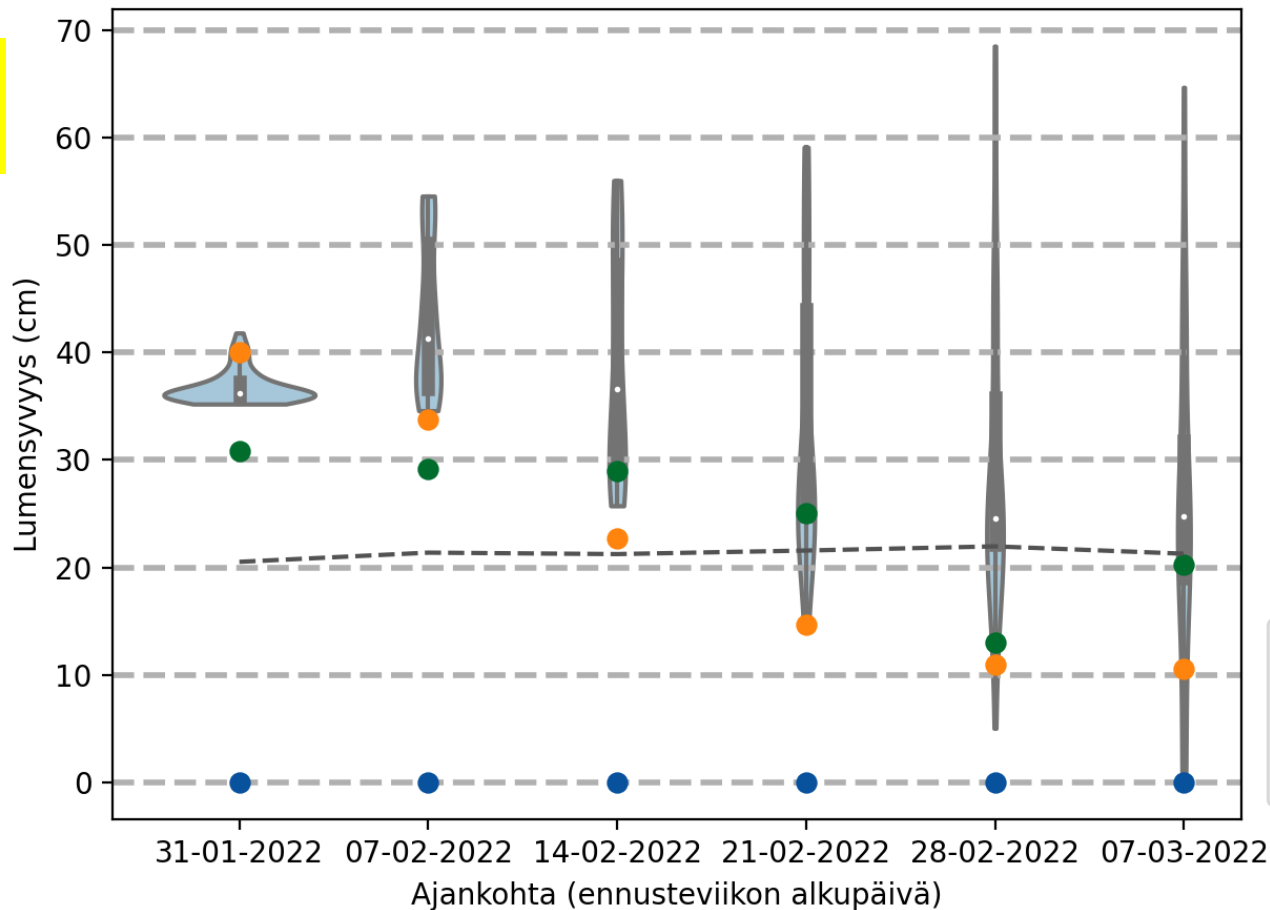
[http://www.indecis.eu/docs/Deliverables/D6.3\\_AnnexC.pdf](http://www.indecis.eu/docs/Deliverables/D6.3_AnnexC.pdf)

# Point-wise forecasts are also piloted

## Sub-seasonal snow forecast products for a city

Weekly snow accumulation for Helsinki, issued on 1<sup>st</sup> Feb 2022

Look: uncertainties  
are given as well.

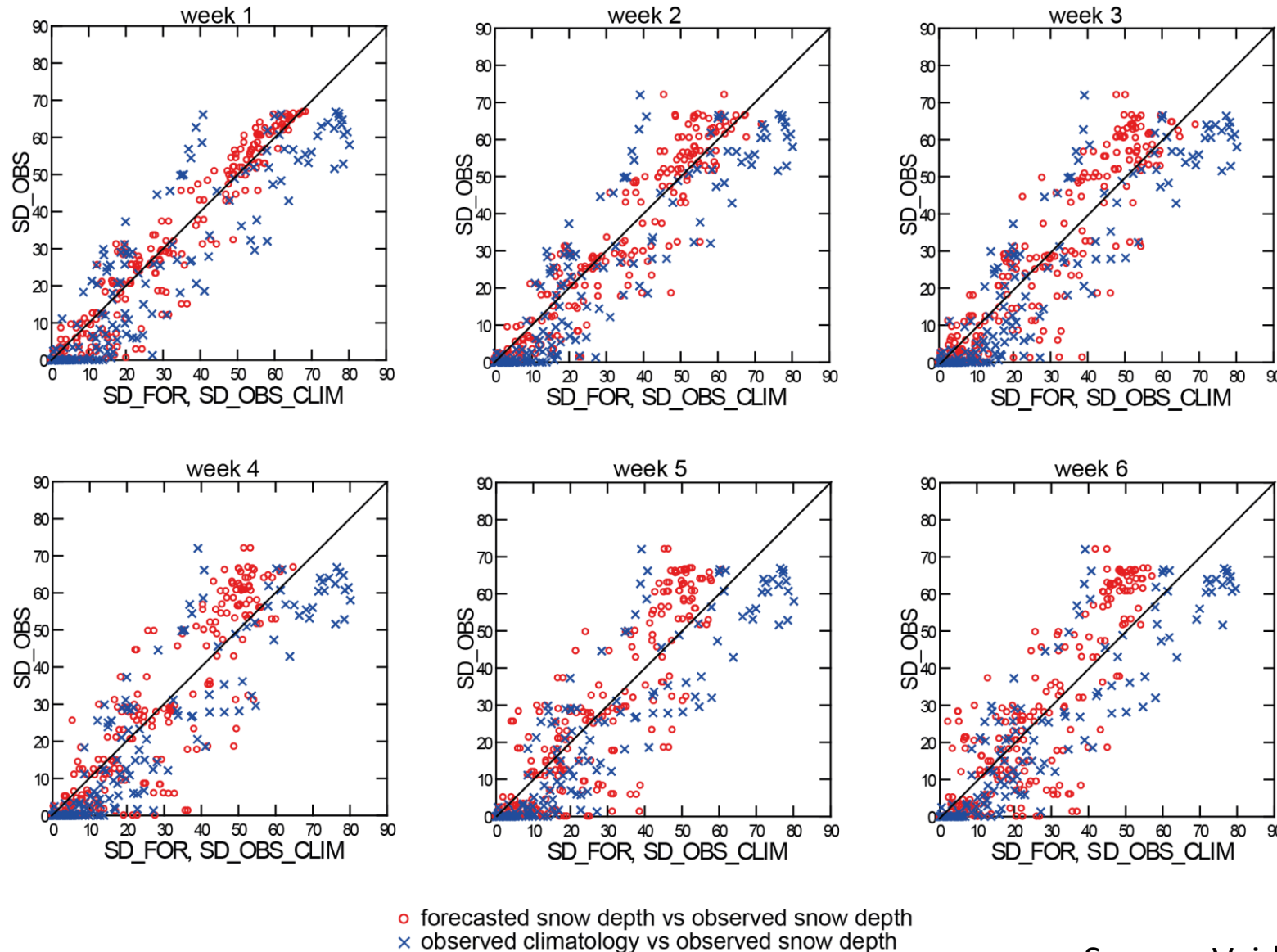


Look: also the  
climate and  
past three year  
winter conditions  
are plotted to help  
information users  
to understand the  
forecast better.

- 2000-2019 talviilmasto
- 2018/2019 talvihavainto
- 2019/2020 talvihavainto
- 2020/2021 talvihavainto



# Preliminary evaluation of snow depth forecasts for winter 2020-2021



- Snow observations for winter 2020-2021 evaluated against forecasts and observed climatology from 7 locations
- Raw data used in the forecasts during the pilot 2020-2021
- Forecasts performed better than climatology
- Larger amounts of snow accumulations are underestimated
- Bias correction improves the forecasts quality at longer lead times

# I was giving the lecture 15.12.21 Then in the southern part there was hardly any snow

#Valtteri 2022  
Helsinki  
snow depth  
25 cm

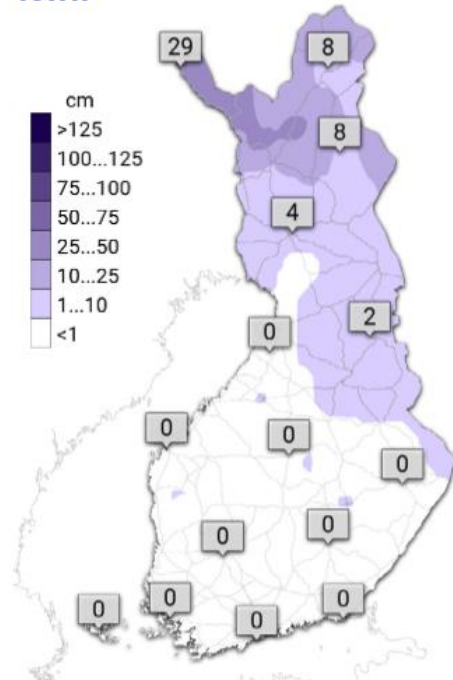
## AURINGONPAISTETUNNIT

### KUUKAUSISUMMA

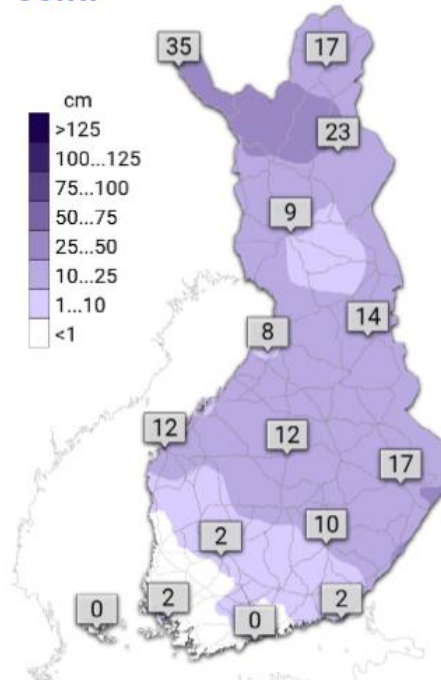
PAIKKAKUNTA	2021	1991-2020
UTÖ	51,2	34
MAARIHAMINA	43,9	
TURKU	36,1	34
HELSINKI	49,4	34
JOKIOINEN	25,2	28
KOUVOLA	16,8	23
JYVÄSKYLÄ	21,3	20
SEINÄJOKI	45,4	31
KUOPIO	17,0	
OULU	26,4	
ROVANIEMI	15,4	
SODANKYLÄ	29,8	18
UTSJOKI	2,4	9

## LUMENSYVYYS

15.11.



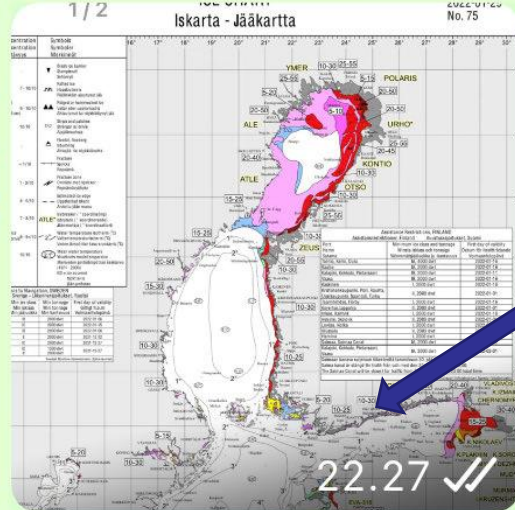
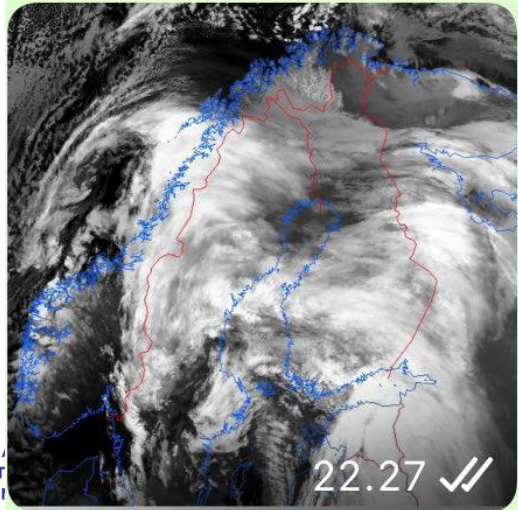
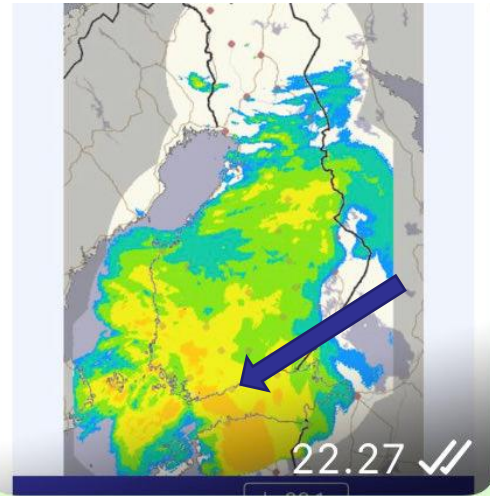
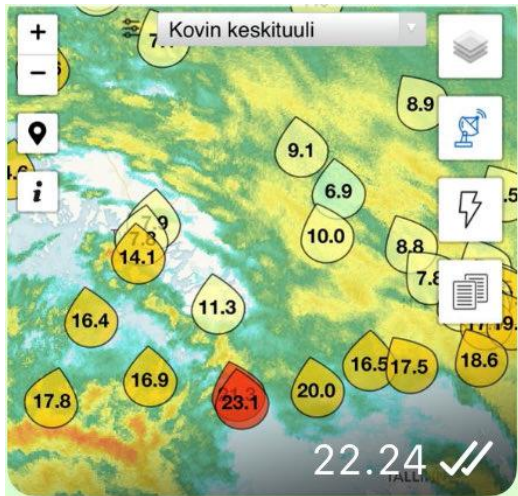
30.11.





# January 2022

## Weather perspective and #Valtteri



**Higher resolution is needed for the cities. We need Microscale weather and climatic impact forecasts!**

Thanks Taru Olsson for the snow graphs



ILMA-  
MET-  
FINI

# January 2022 City perspective and #Valtteri

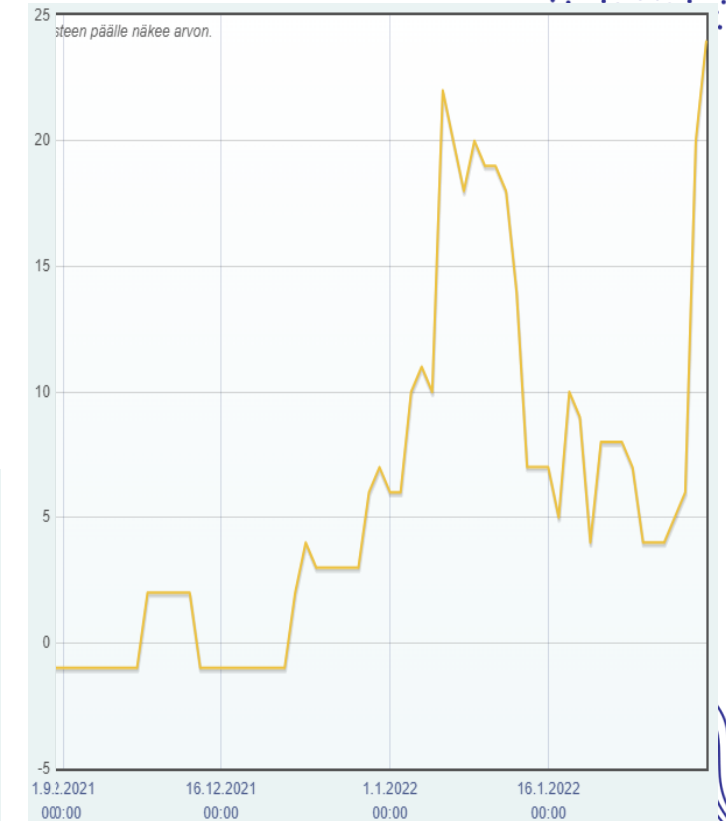
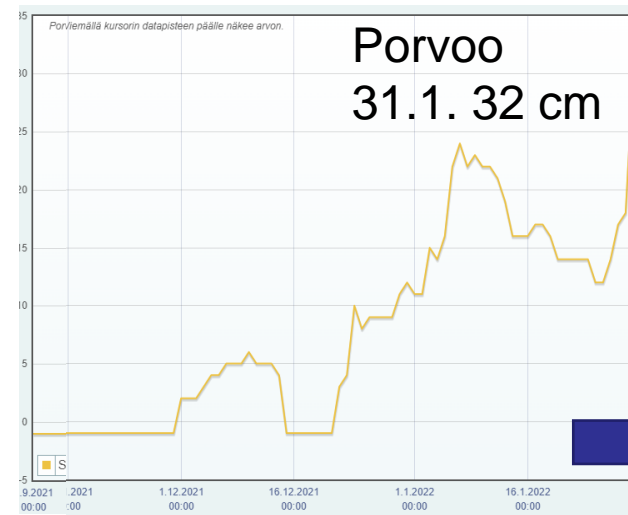
#Valtteri 2022  
Helsinki  
snow depth  
25 cm



**Nordic News** @Nordic\_News · 30 Jan  
Blizzard rages in Finland.  
Helsinki: 'Time to ski along streets'  
[#valtteri](#) [#malik](#)  
[is.fi/kotimaa/art-20...](https://is.fi/kotimaa/art-20...)



1 24 138

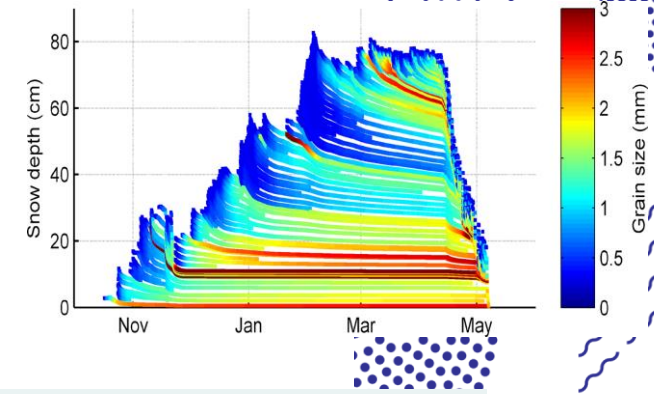


WHERE TO STORE?

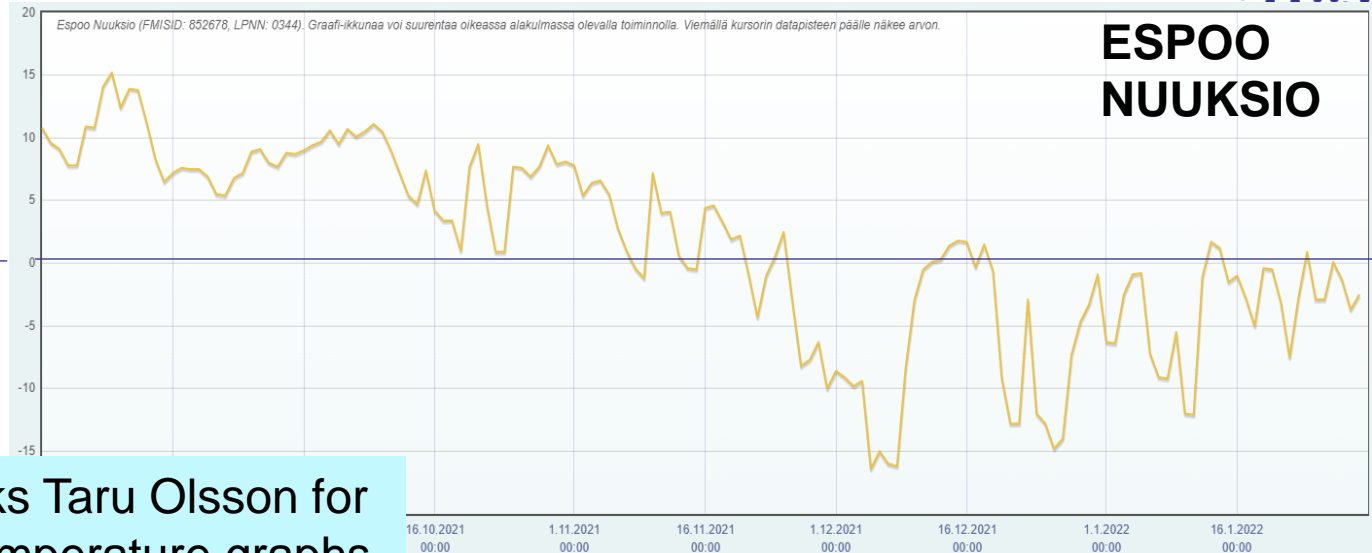


# Predictability needs to be improved on all scales to help in preparing for the changing conditions, risks and benefits

- It is not only snow that needs to be predicted but also other parameters such as, wind, humidity and the frequency of crossing the T2m 0 C-line – to know what happens with the snow pack.



Thanks Taru Olsson for  
the temperature graphs

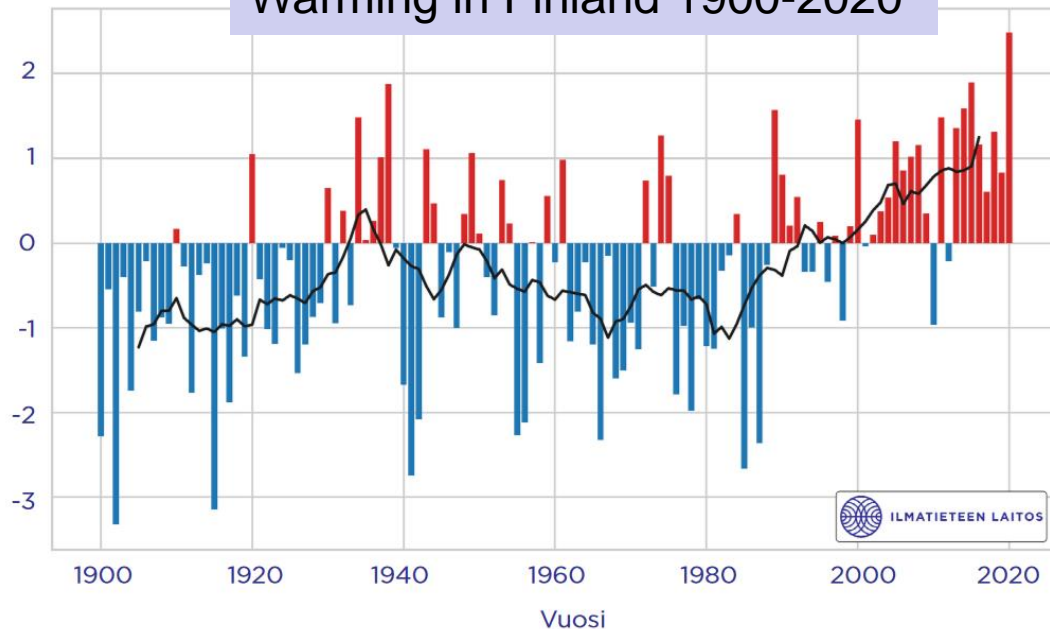


# Summary 1: Climate change impacts snow and skiing in many ways

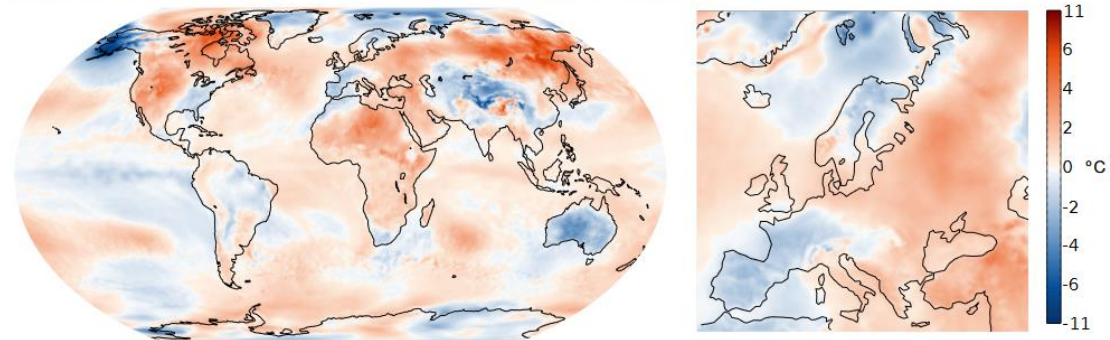
Depending on where you live, snow can arrive too early or too late, disappear anomalously early or late, snow pack can develop unfavorably.

**Finland as an Arctic country deals with these issues more and more often.**

Warming in Finland 1900-2020



KESKILÄMPÖTILAN POIKKEAMA MARRASKUUSSA 2021 JAKSON 1991-2020  
KESKIARVOSTA MAAILMALLA (VASEMMALLA) JA EUROOPASSA (OIKEALLA).



## LISÄTIETOA

<https://www.ncdc.noaa.gov/sotc/global/202111>  
<https://climate.copernicus.eu/climate-bulletins>

Lähde: NOAA/NCDC  
Copernicus Climate Change Service  
Suomennos: Ilmastokatsaus-toimitus

ILMASTOKATSAUS 11/2021 | 7

<https://www.ilmastokatsaus.fi/tag/2021/>

# Summary 2: new decision support tools and collaboratively created services are needed

Based on the lecture experience and what happened after the lecture, it is clear that we need to help in various decision time scales:

1. **Short (current season):** should we make snow already now or next week or next month?
2. **Middle (1-10 years):** should we invest in snow making equipment and other services, what about the logistics and other facilities?
3. **Long (10-30 years):** what can we do to keep skiing culture alive in the current areas, or do skiing conditions end?



# **Summary 3: all of these aspects are important when living with the benefits and risks related to skiing**

- ✓ **Improving forecasts** – short and long for decision making
- ✓ **Communication** – make news about skiing possibilities
- ✓ **Store snow and recycle it better than now**
- ✓ **Offer sports facilities for people where they live**
- ✓ **City planning** – make cities climate neutral and healthy
- ✓ **Socio-economic issues** – help to afford equipment even for occasional skiing – help to recycle
- ✓ **Schools and skiing culture** – help schools to react and plan sports with artificial snow if no natural snow





# Remember to order Ilmastokatsaus if the past month statistics interest you

ETUSIVU

DIGILEHTI

RESEARCH LETTERS ▾



DIGILEHTI

## Ilmastokatsaus-digilehti joulukuu 2021

20.01.2022



ILMATIETEEN LAITOS  
METEOROLOGISKA INSTITUTET  
FINNISH METEOROLOGICAL INSTITUTE

<https://www.ilmastokatsaus.fi/2022/01/20/ilmastokatsaus-digilehti-joulukuu-2021/>

### Sähköpostimuistutus

Saat ilmoituksen uudesta  
Ilmastokatsauksen numerosta  
sähköpostiisi!

**Nimi**

**Sähköposti\***

TILAA

# References:

- Gregow, H., Mäkelä, A., Tuomenvirta, H., Juhola, S., Käyhkö, J., Perrels, A., Kuntsi-Reunanen, E., Mettiäinen, I., Näkkäläjärvi, K., Sorvali, J., Lehtonen, H., Hildén, M., Veijalainen, N., Kuosa, H., Sihvonen, M., Johansson, M., Leijala, U., Ahonen, S., Haapala, J., Korhonen, H., Ollikainen, M., Lilja, S., Ruuhela, R., Särkkä, J. & Siiriä, S-M., 2021. Ilmastomuutokseen sopeutumisen ohjauskeinot, kustannukset ja alueelliset ulottuvuudet. Suomen ilmastopaneelin raportti 2/2021.
- Luomaranta, A, Aalto, J, Jylhä, K., 2019, Snow cover trends in Finland over 1961–2014 based on gridded snow depth observations. Int J Climatol.; 39: 3147– 3159. <https://doi.org/10.1002/joc.6007>

# Acknowledgements:

Vierumäki Sports Institute  
Academy of Finland:  
CLIMCOMP



Ympäristöministeriö  
Miljöministeriet  
Ministry of the Environment



**ACCC**  
CLEAN AIR. SAFE CLIMATE.



ILMATIETEEN LAITOS  
METEOROLOGISKA INSTITUTET  
FINNISH METEOROLOGICAL INSTITUTE



**Hilppa Gregow**  
@HilppaGregow

You can contact:

[Hilppa.Gregow@fmi.fi](mailto:Hilppa.Gregow@fmi.fi)