# SnowApp climate service

## Providing reliable 4-week forecast on snowmaking conditions for ski resorts

Blue-Action Annual Meeting (online) 4 November 2020

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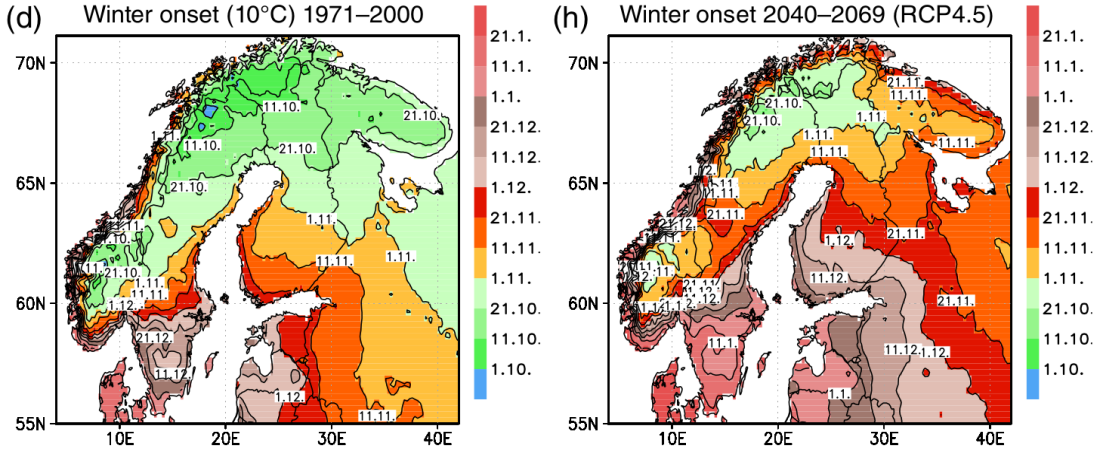
The Blue-Action project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 727852.

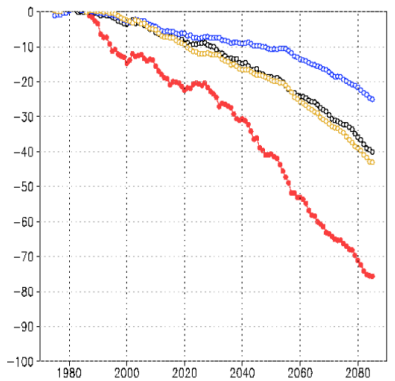
# Climate service for winter tourism industry

- Co-designed by the multidisciplinary and multiprofessional team consisting of Arctic Centre and Rukakeskus Ltd. experts in 2017-2020
- Goal: seasonal forecast on snowmaking conditions for ski resorts in Northern Finland, with replicability elsewhere
- Iterative co-design process, where end-user involvement has been a key principle and practice



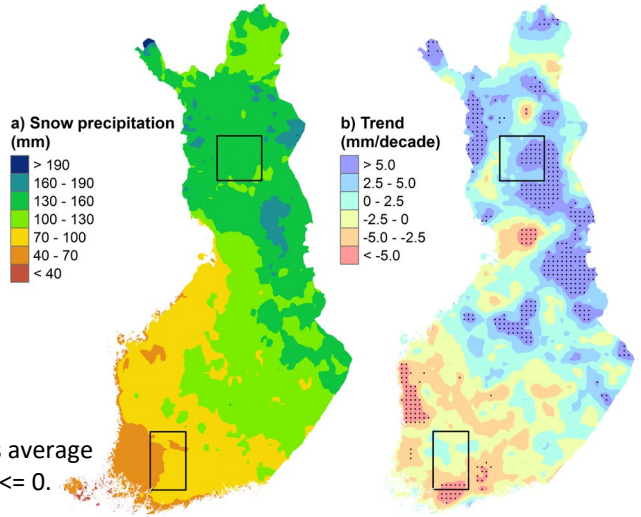

(Ruosteenoja et al. 2020)

**The decrease of snow cover days (%) in Northern Finland (appr. 67°N), A2 scenario**




(FMI 2010)

- Red: October
- Black: December
- Blue: February
- Yellow: April




Annual observed snow precipitation (mm) and its average change 1961-2014, Tmax <= 0. (Luomaranta et al., 2019)

# Data from GCFS2.0

1) All data are six months

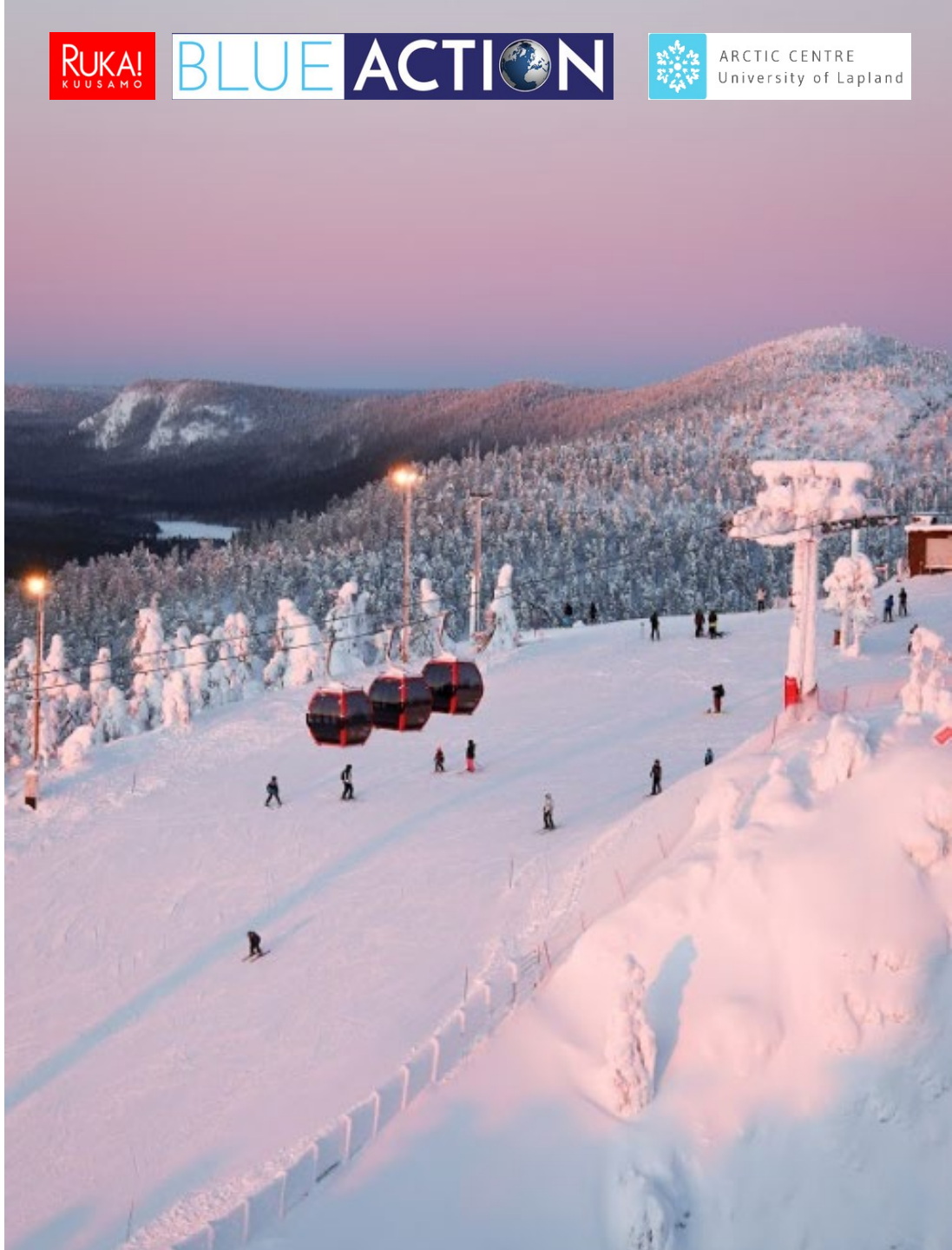
2) All data is 6 hourly

3) Each dataset has a grid 15 x15 (225) geographic cells centred on RUKA – i.e. cell(8,8) contains the lat. and lon. of RUKA 66° 11'N 29° 06'E

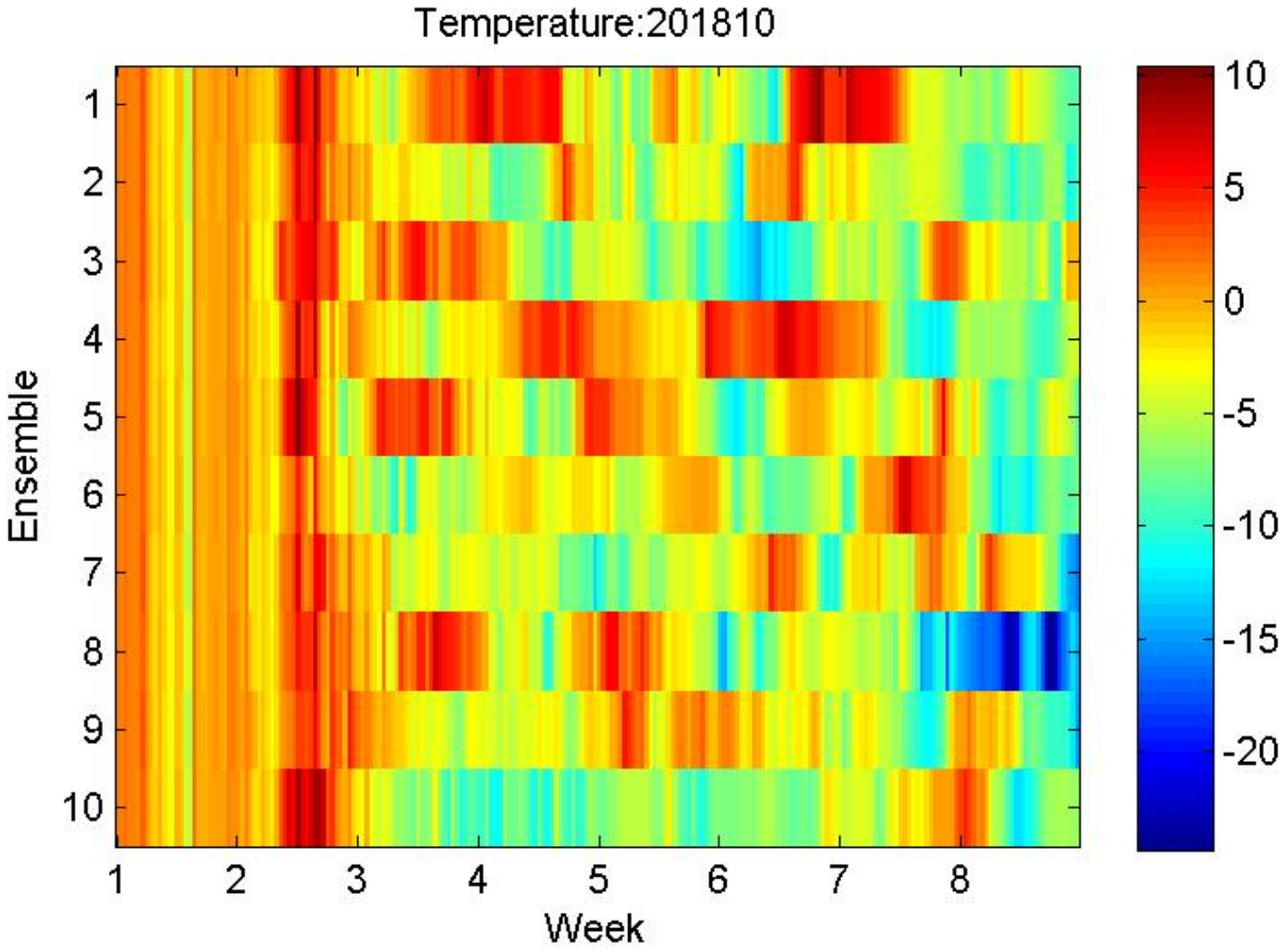
4) For each cell we have:

   Surface temp,
   2m temp,
   100kPa humidity,
   windspeed (as two orthogonal vectors u, v)

5) Each of these comes as an ensemble of 10 realizations



# Internal Variation



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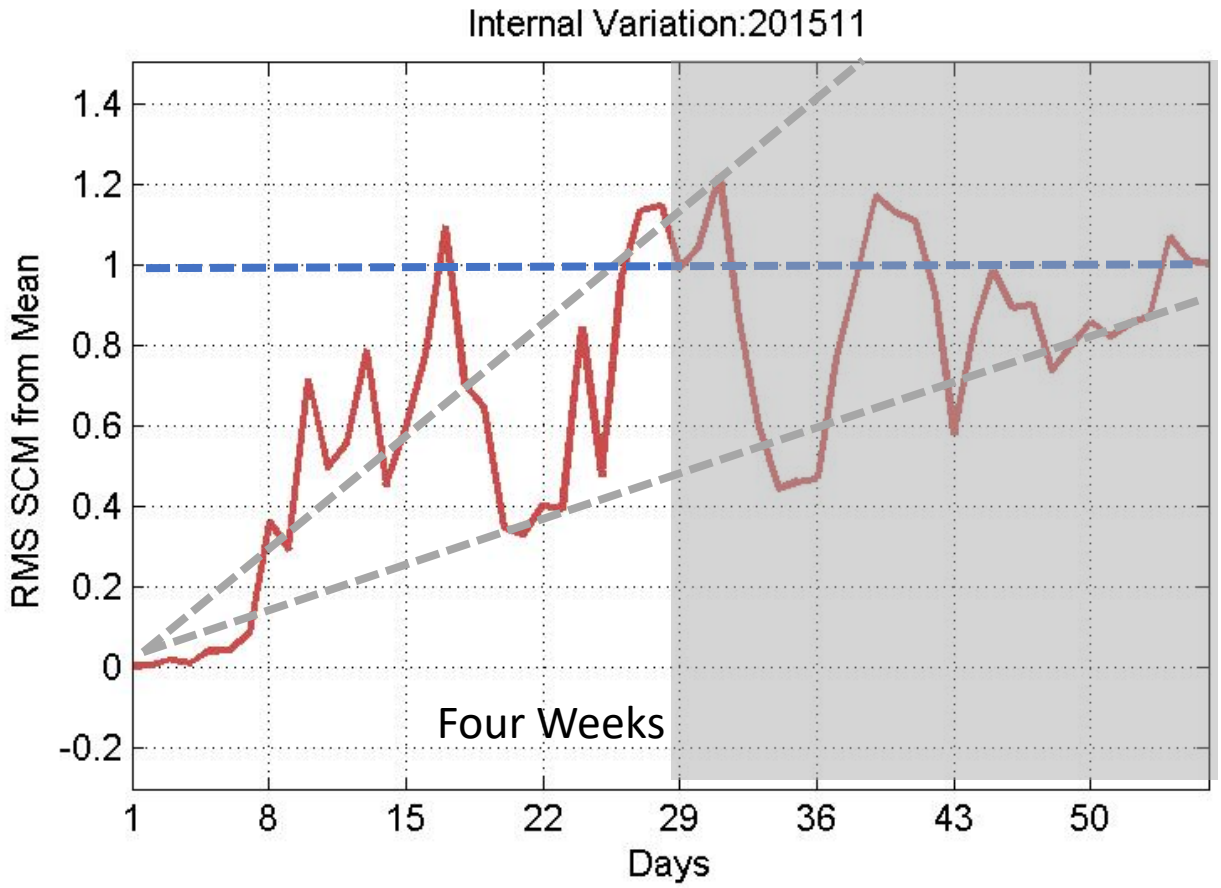
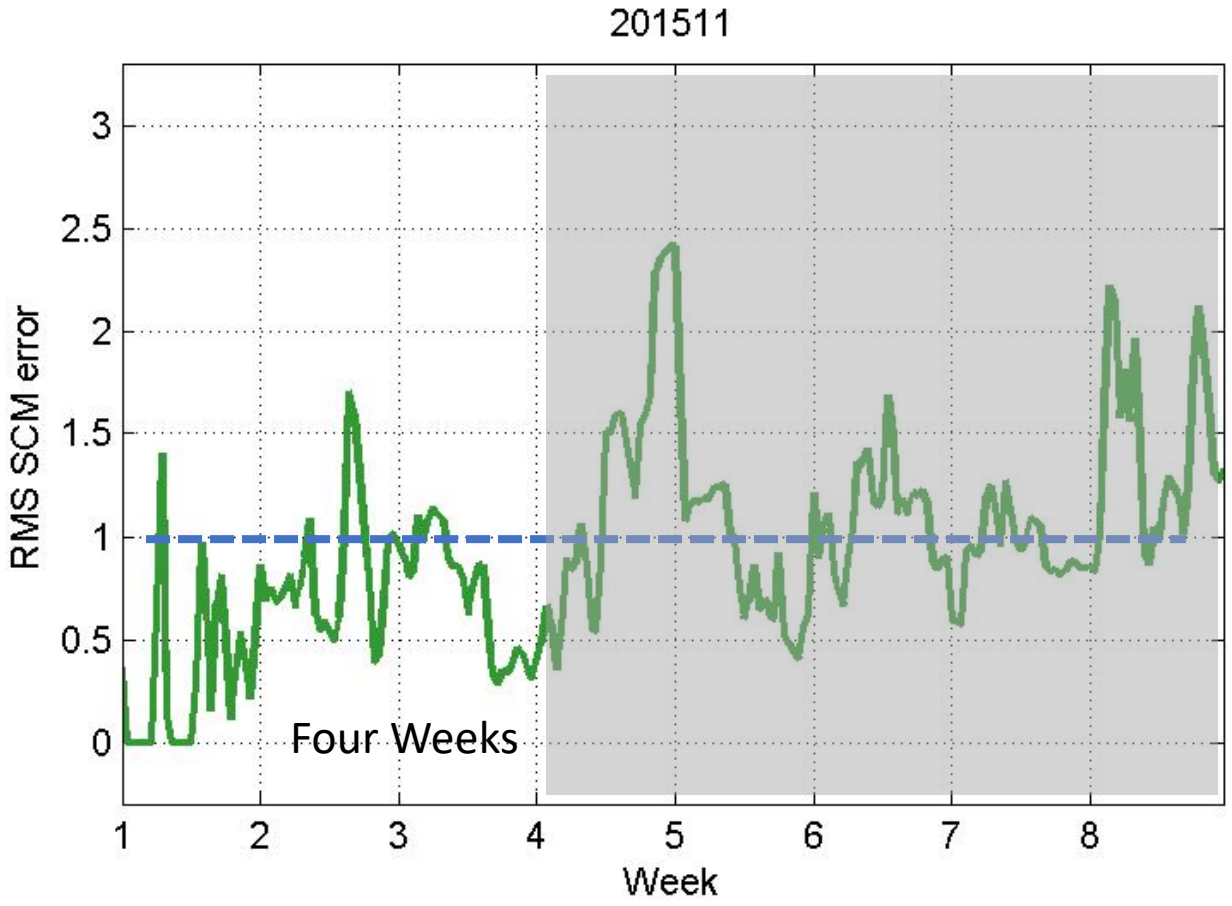


# Hindcast Analysis



# SnowApp climate service for winter tourism centres

ARCTIC CENTRE
University of Lapland

RUKA!
SKI RESORT

BLUE ACTION

- 4-week reliable forecast on snowmaking conditions
- A decision-support tool for ski resort management
- Particularly suitable for forecasting periods of critical or too warm conditions, like the early season 2018
- With optimization based on better foresight on snowmaking conditions, emissions and costs can be reduced, and additional income can be gained
- Designed by Ruka and Arctic Centre in 2017-2020
- Applicable in other ski resorts too

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# The SnowApp

sn❄wApp

**Date range:**

2020-10-01 to 2021-03-17

**Language:**

English

**Key to conditions:**

- Good
- Borderline
- Poor
- Impossible

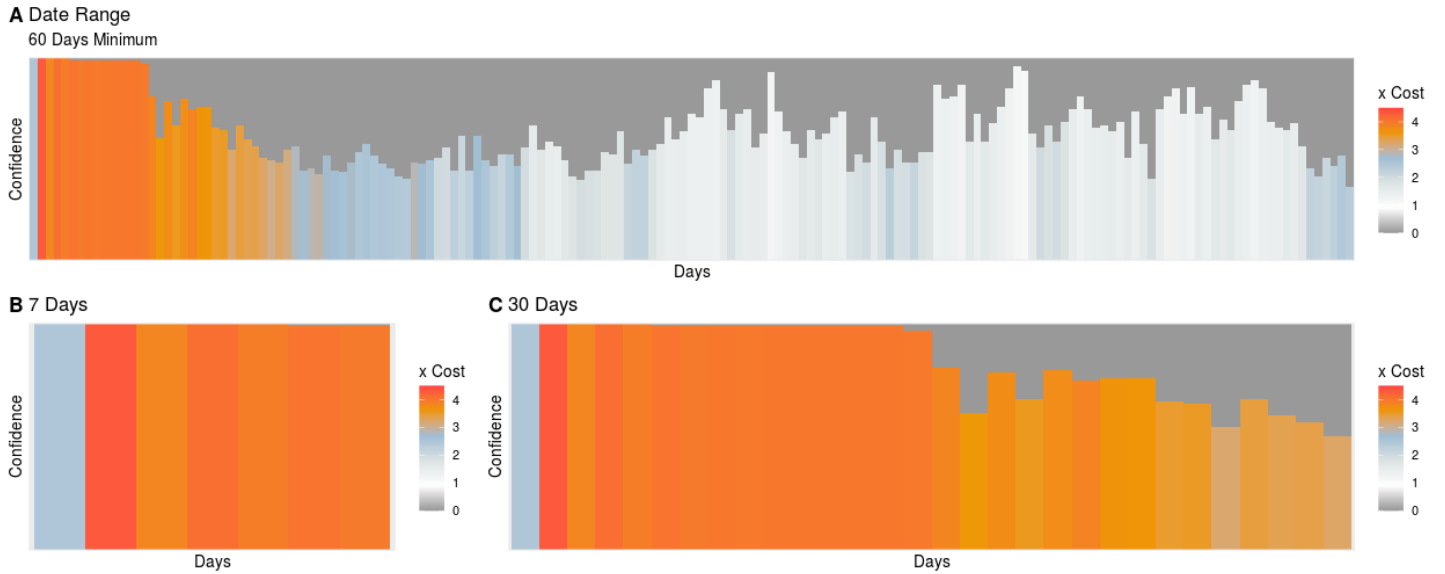
BLUE ACTION

European Union, Horizon 2020, Grant: 727852

Version 3.018

Main | Wind | Help | About

All Displays start 2020-10-01 Main Display 167 Days



# sn❄wApp

**Date range:**

2020-11-01 to 2020-12-31

« November 2020 »

| Su | Mo | Tu | We | Th | Fr | Sa |
|---|---|---|---|---|---|---|
| 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 29 | 30 | 1 | 2 | 3 | 4 | 5 |

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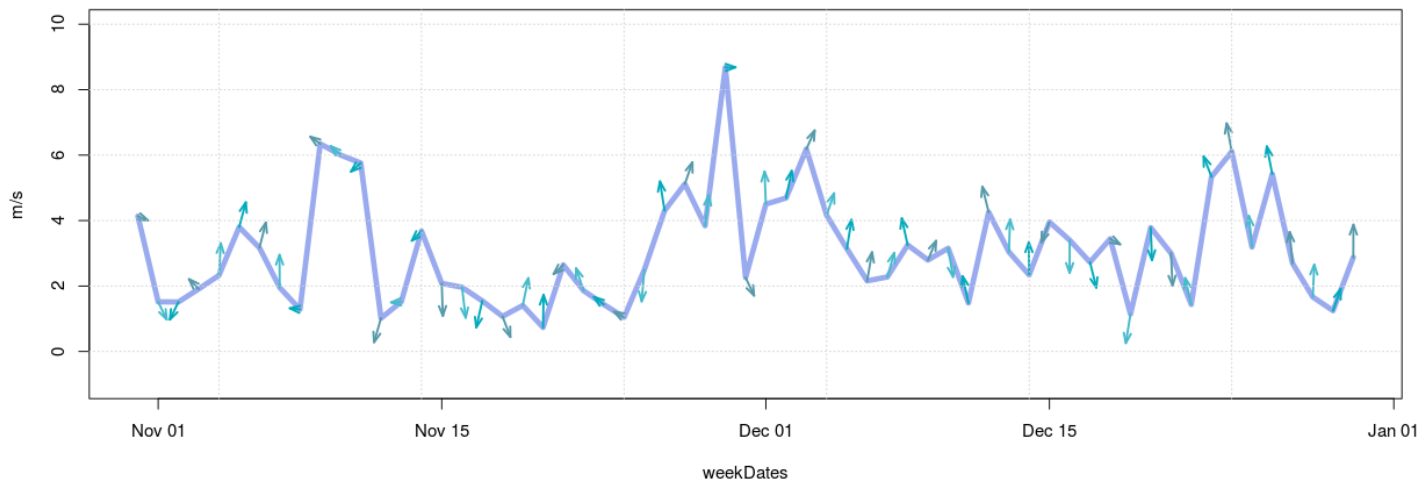
Main | Wind | Help | About

All Displays start 2020-11-01 Wind display 60 Days



# snowApp

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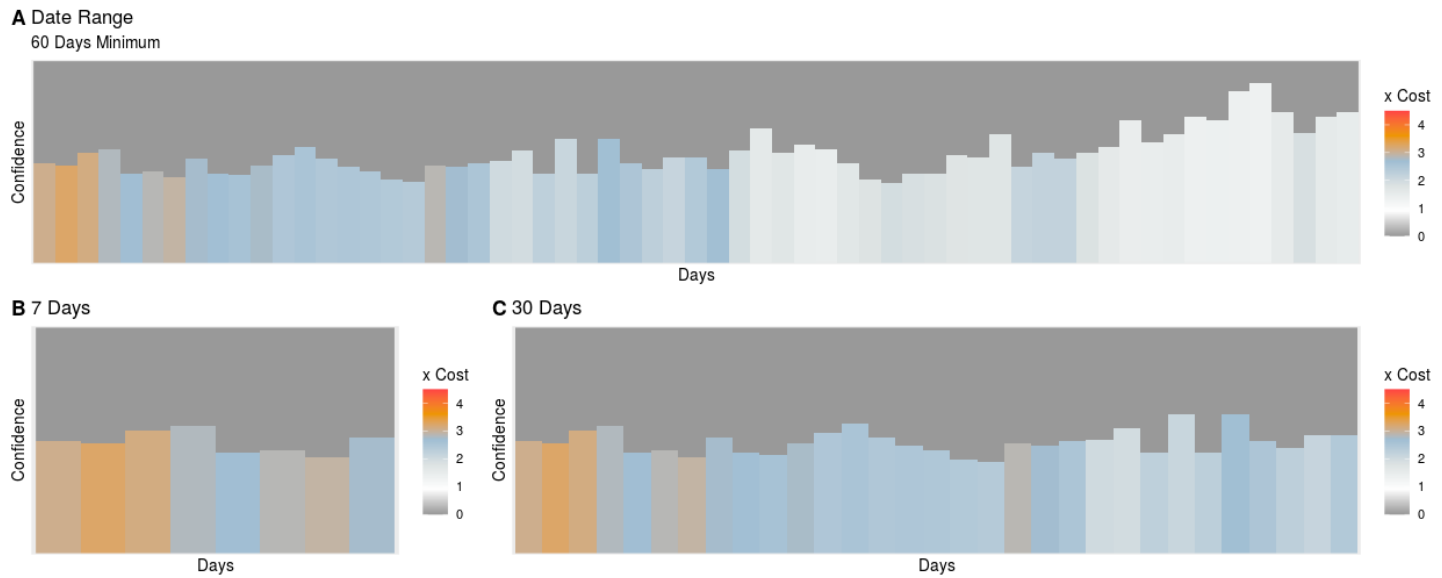
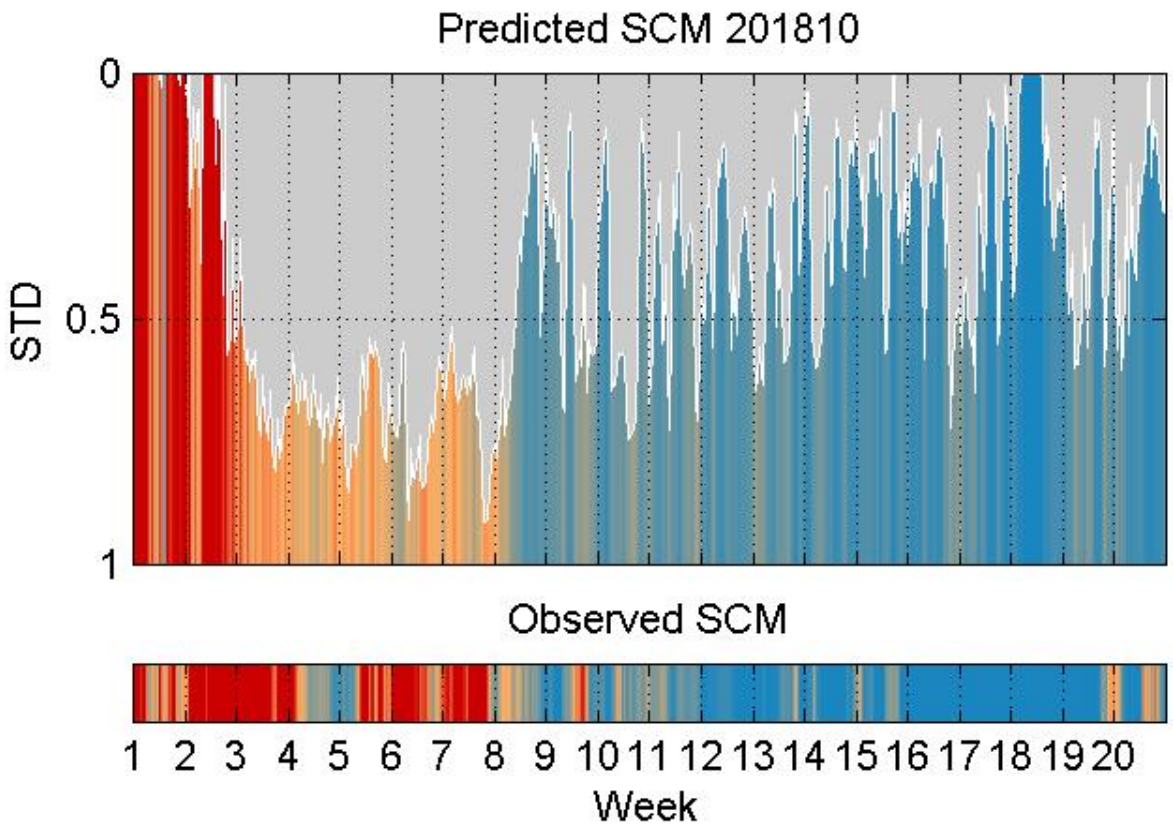


# SnowApp climate service – summary (1/2)

- Reliable forecast on snowmaking conditions for 4 weeks
  - Provides a remarkable improvement to the current 3-4 days weather forecasts
  - Data can be updated monthly
- A decision-support tool for ski resort management
  - 4-week forecast enables managerial decisions
  - Not meant for customer interface
  - Not a weather forecast, no element of natural snowfall
  - Snowmaking conditions =/= skiing conditions
  - Doesn’t enable snowmaking in impossible conditions
- Particularly useful in predicting long periods of poor snowmaking conditions, like the early season in 2018
- Serves primarily snowmaking but can have also other uses through the management system in the ski resort
  - Slopes (and x-country skiing tracks) are the basis for all other functions in the resorts in the skiing season

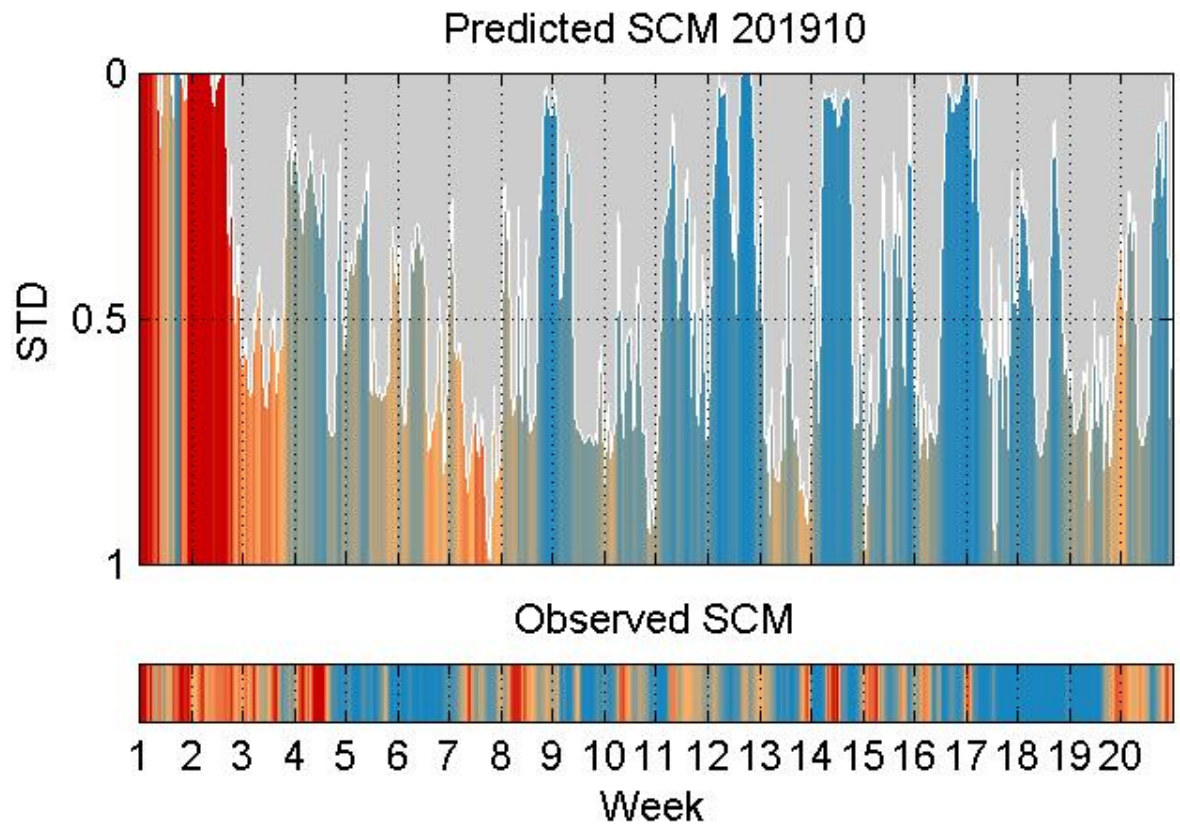
**Skiing season 2018/2019**

*”the worst early season in 30 years”*




**Skiing season 2019/2020**

*”the best early season in 30 years”*



# SnowApp climate service – summary (2/2)

- Potential commercialisable product: 6-month subscription September-February each year
- Replicability of the climate service to winter tourism business potentially in all snowy countries
- Signs of a high commercial importance
  - Two ski resorts expressed interest towards the SnowApp after our final seminar
  - Probably more valuable for resorts in less favourable snow conditions than those in Northern Finland
- Supporting sustainability of snowmaking as an adaptation strategy in ski resorts: our climate service can also be used to minimize extra costs and GHG emissions by optimization

# Thank you for your attention!

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