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Long term trends and seasonal snow cover in the Finnish Arctic region

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Snow seminar on day of Pyry – Helsinki, November 2, 2015

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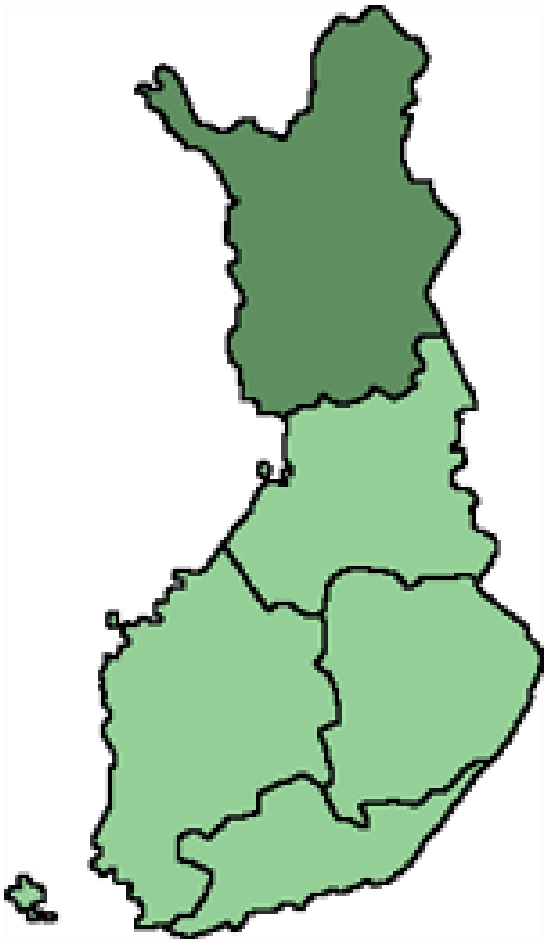
CLICHE project

FICCA

- Academy of Finland -

  IMPACTS OF CLIMATE CHANGE ON ARCTIC ENVIRONMENT, ECOSYSTEM SERVICES AND SOCIETY

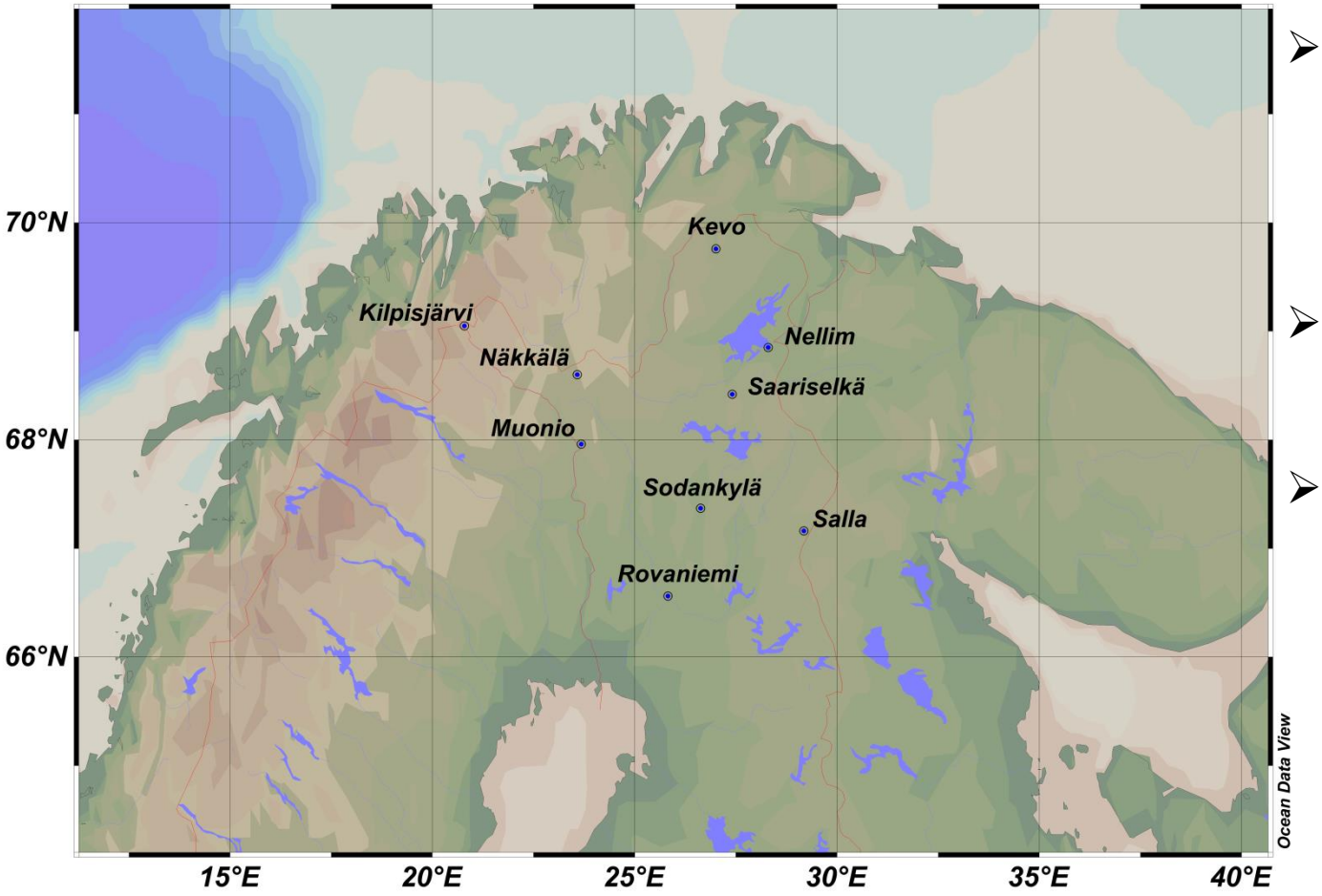
- WP4: Impacts of climate change on snow properties and snow cover



Purpose of this work

- Weather station data across Lapland
- Examine long-term trends and seasonal variations of weather and snow properties
- Discuss the climate effects on physical, ecological and economical aspects of the Finnish Arctic region
- Essential information regarding environmental and touristic aspects in Northern Finland

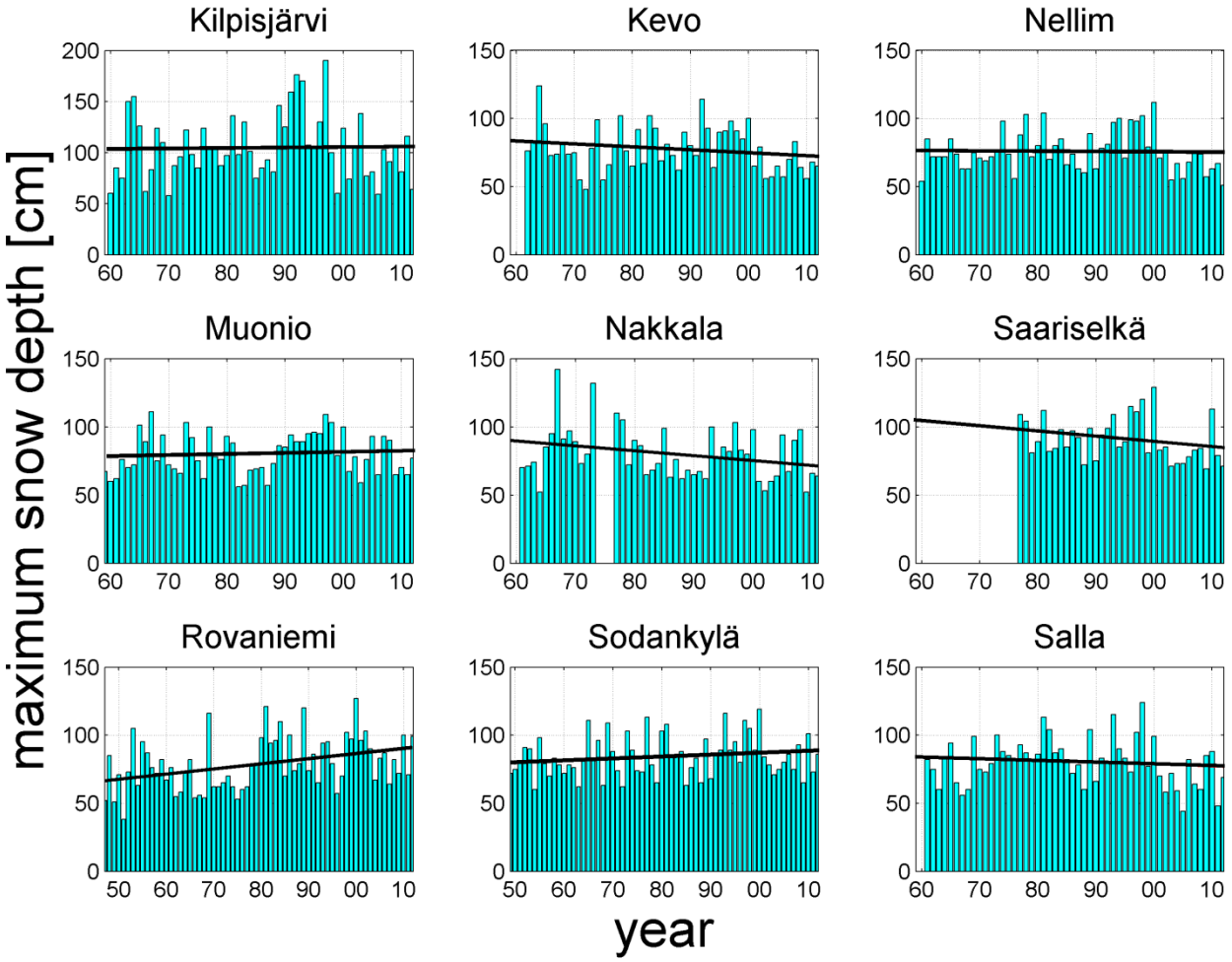
The area and the data



- Properties:
  air temperature
  snow depth
  precipitation
- Long-term trends from 1959
- Seasonal variations based in 10 years (2002-2011)

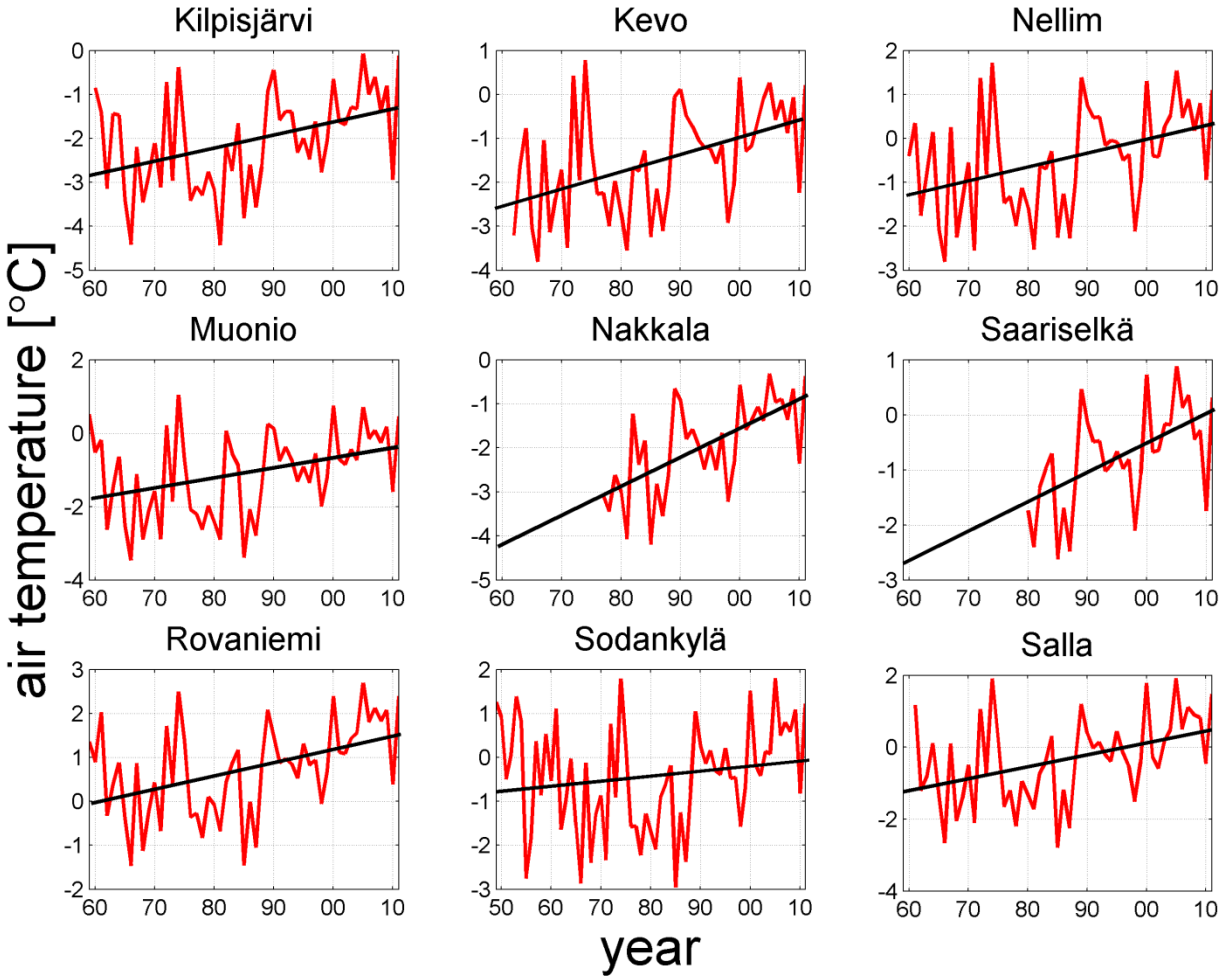
Long-term trends

Snow depth



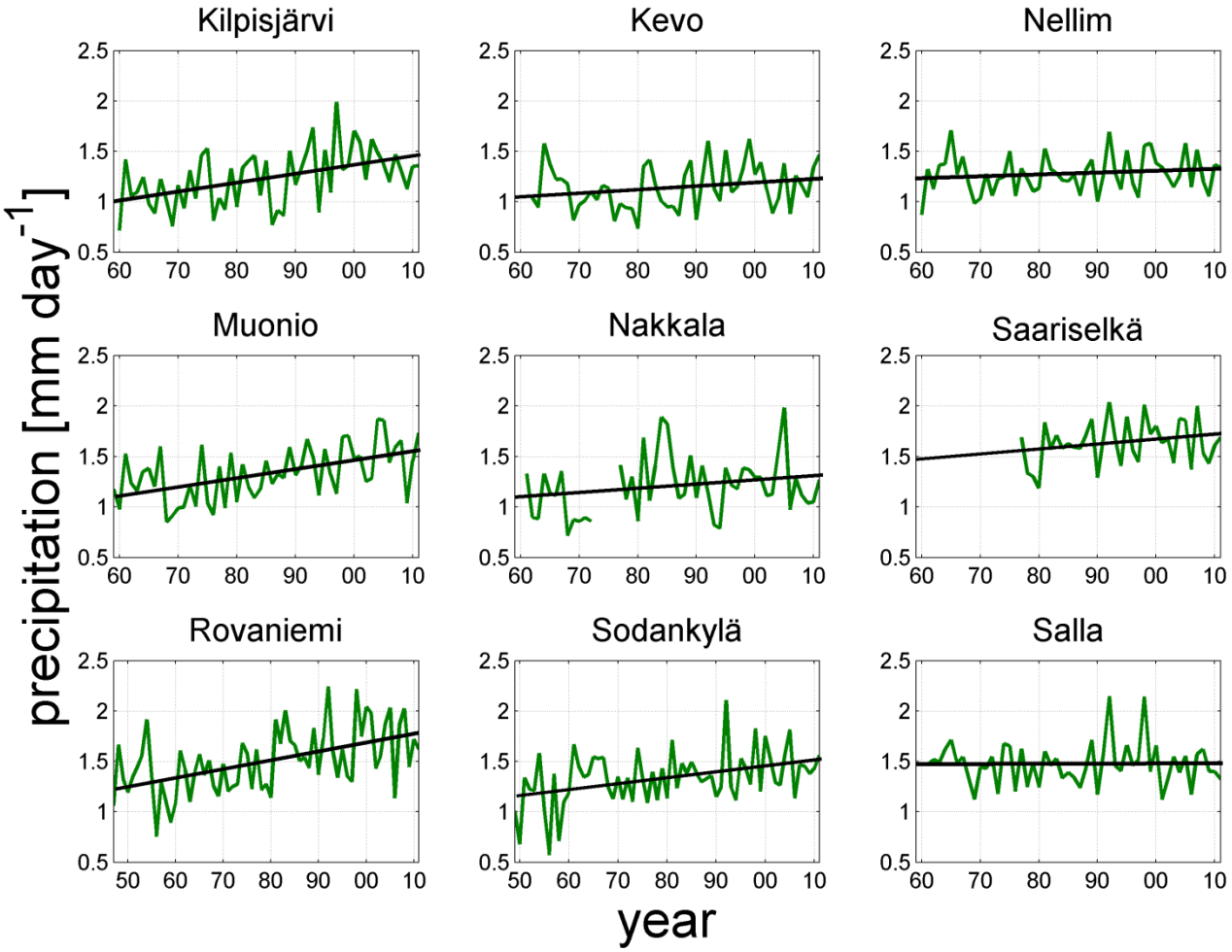
- Trends varied depending on location / mostly not statistically significant
- Increase in Rovaniemi (+24 cm) / Decrease in Nakkala (-29 cm)
- Highest variations observed in Kilpisjärvi

Air temperature



- Increasing trend 1.4 °C (Muonio) – 2.2 °C (Nakkala)
- Maximum increase in Saariselkä and Näkkälä, 1970 onwards / large increase in Kevo (1.9 °C)

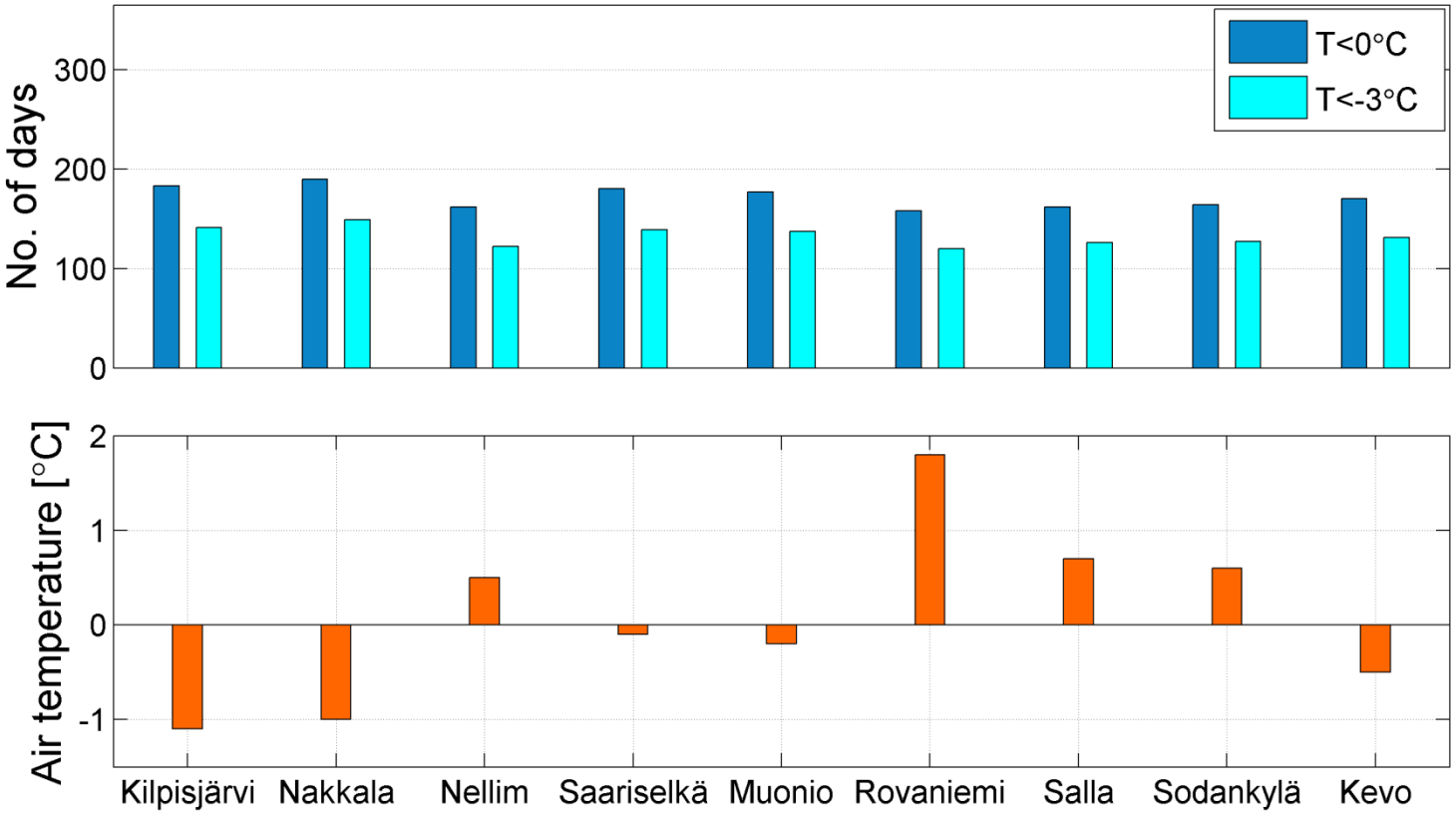
Precipitation



- Increasing trends 0.1-0.6 mm/day
- Only western Lapland trends were statistically significant
- Highest precipitation rates & largest trend in Rovaniemi

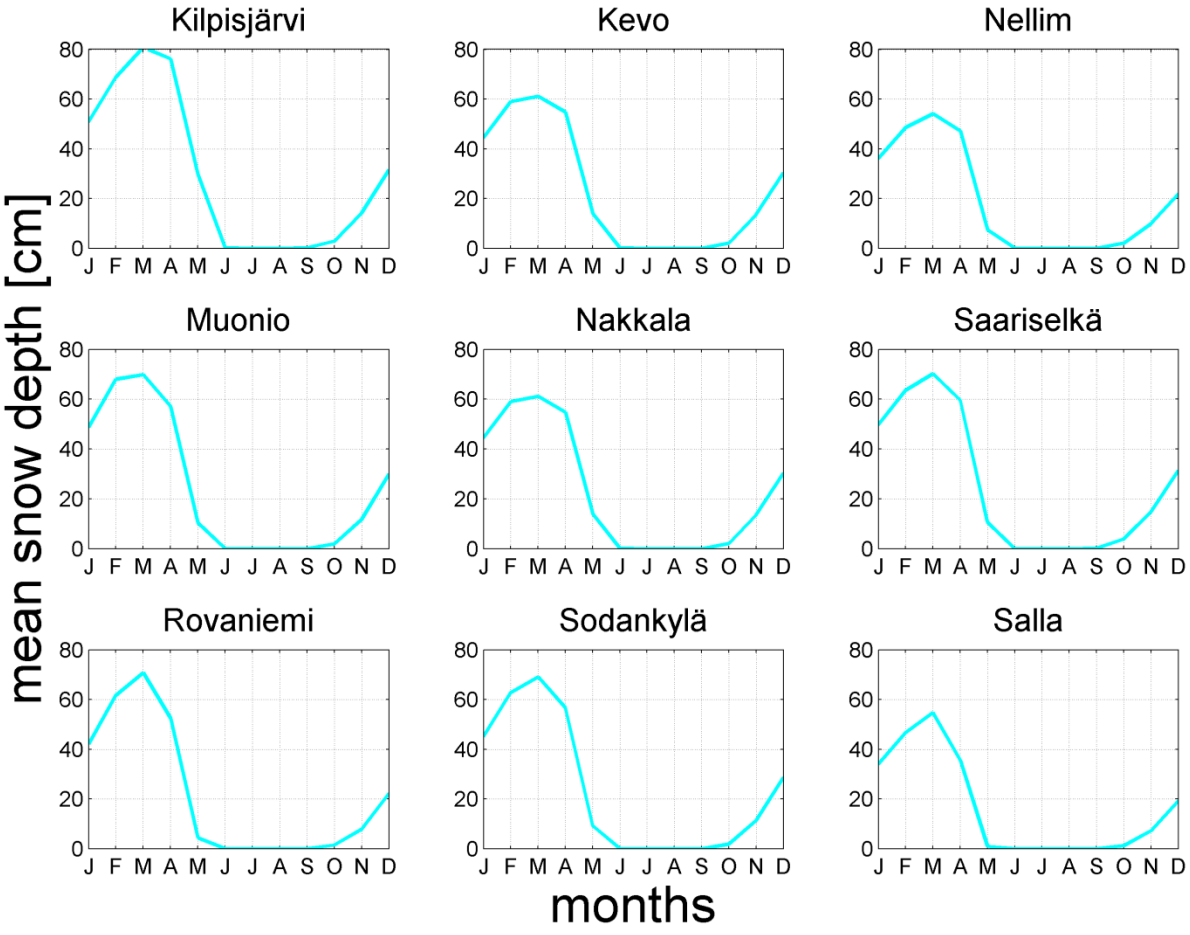
Seasonal Variations

Air temperature



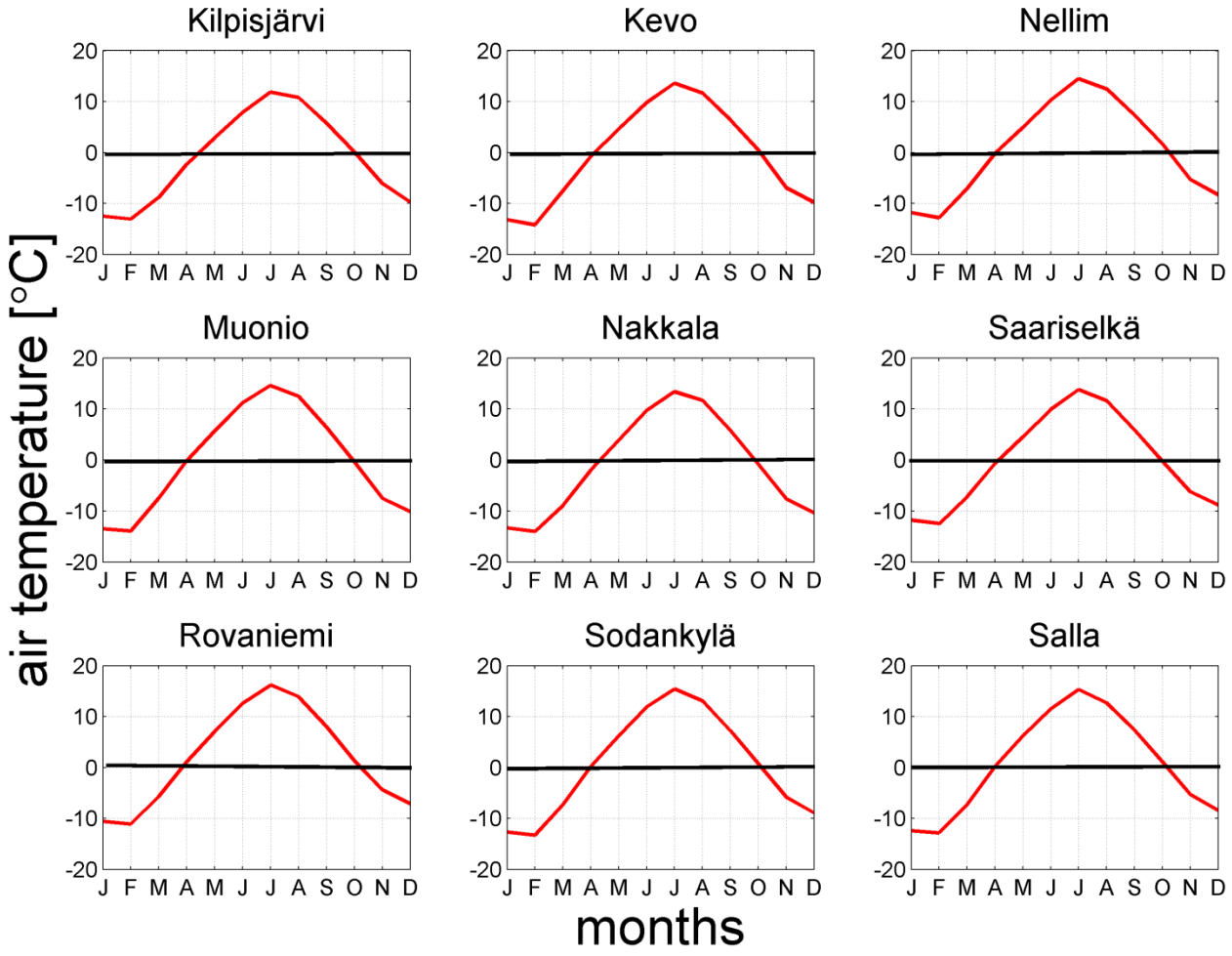
- 170 days air temperature is below 0 °C
- 130 days air temperature is below -3 °C

Snow depth



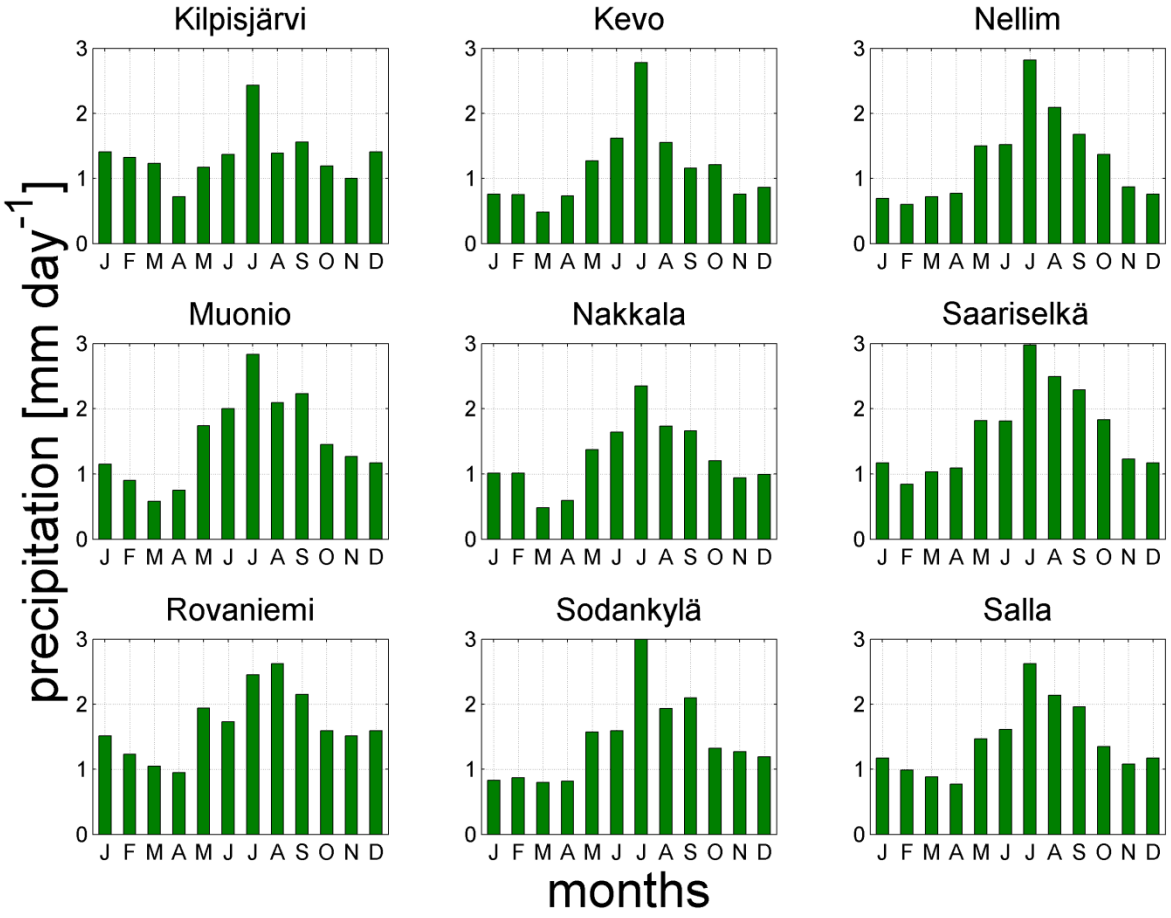
- First snow month: October
- Last snow month: May
- Average duration: 8 months
- Month of maximum snow depth: March
- Annual maximum depth: 60-100 cm
- Average number of snow days: 200

Air temperature



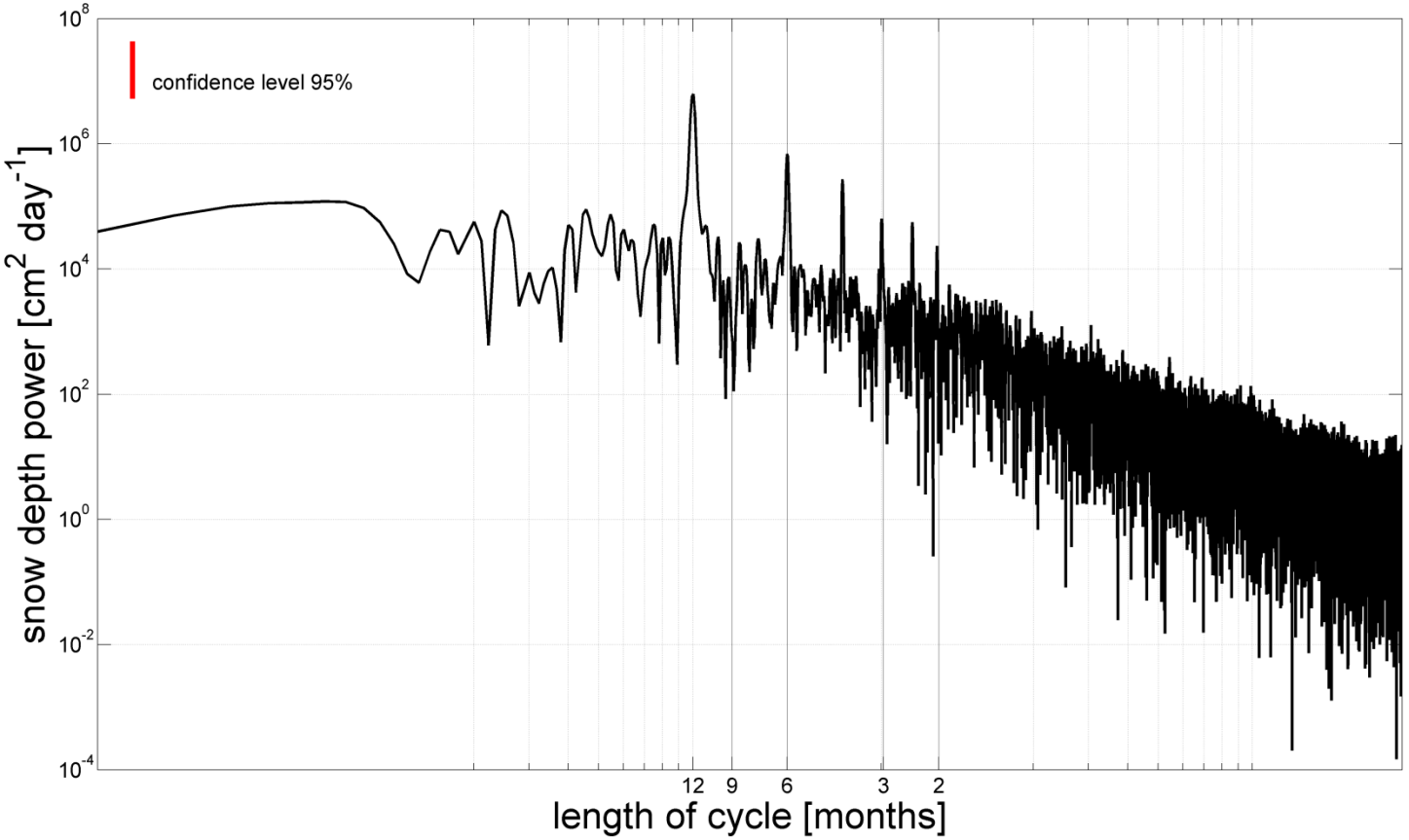
- Average air temperature ~0°C
- Number of months with negative air temperature ~6
- Number of months with air temperature <-3°C ~5

Precipitation



- Average precipitation rate: 1.4 mm/day
- Maximum precipitation month: July
- Minimum precipitation months: March – April

Snow depth


confidence level 95%
snow depth power [cm^2 day^{-1}]
10^8
10^6
10^4
10^2
10^0
10^{-2}
10^{-4}
12
9
6
3
2
length of cycle [months]

Automatic stations

- Two snow stations in Kilpisjärvi and Pallas
- October– July 2012 and 2013
- Snow temperature evolution during the winter
- Temperature gradient in the snow pack
- Heat flux between the snow surface and the atmosphere

Conclusions

- In the last >50 years air temperature increased significantly by 1.5-2 °C
- Precipitation increasing significantly by 0.5 mm/day in west Lapland
- Snow cover season in 2002-2011 decreased by ~10 days compared to the long-term average
- No significant trends of snow depth, however the quality of the snow-pack is possibly affected
- Average snow duration 8 months
- Number of months with air temperature < -3°C ~ 5

******* thank you *******