OP-241 [Beekeeping Technology and Quality]
Wilder, Wetter, and Warmer: Leveraging Extended-Range Forecasts for Climate Adaptation Among Beekeepers in Western Norway

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BACKGROUND: Climate change is increasingly recognized as a significant threat to agriculture and food security due to the strong dependence on weather conditions. In this context, apiculture plays a vital role via pollination services, making it essential to understand how climate impacts could affect both beekeeping operations and agricultural productivity. The effects of climate change are most pronounced in northern regions like Norway, where beekeepers already face difficult weather patterns that are expected to become even wilder, wetter, and warmer.

PROBLEM DESCRIPTION: Adaptation is crucial for managing increasing climate risk. Extended-range weather forecasts, which extend several weeks beyond traditional weather forecasts, have emerged as promising tools for improving agricultural planning and supporting decision making under uncertainty. Despite their potential, these forecasts have however not been systematically utilized in the apiculture sector.

METHODOLOGY: This study applies long-term climate predictions and qualitative social science methodologies to investigate how beekeepers in Western Norway can integrate extended-range forecasts into their decision-making processes. Prior to the season, beekeepers were interviewed about the challenges and opportunities posed by the expected climate change and the potential benefit of applying long-term forecasts. Then, in monthly focus groups throughout the season, participants were provided tailored extended-range forecasts to explore how they can benefit their management practices in real time. Their experiences were finally discussed in a common workshop after the season.

RESULTS: Our findings reveal a strong demand for reliable extended-range forecasts among beekeepers to adapt to an increasingly variable climate. The study participants successfully used the information provided to plan operations, such as pollination preparation, choice of foraging areas, treatments, or the timing of winter preparations, highlighting the practical value of the forecasts.

PRACTICAL IMPLICATIONSs: By integrating extended-range forecasts into their decision-making processes, beekeepers are better equipped to optimize their strategies in accordance with seasonal weather variations, maximise their outcomes and enhance their resilience to climate variability and extreme events. Furthermore, the knowledge generated in this case study could be transferred to other settings and regions by applying similar forecasting tools tailored to local conditions, fostering a broader framework for resilience and sustainability in global beekeeping initiatives.

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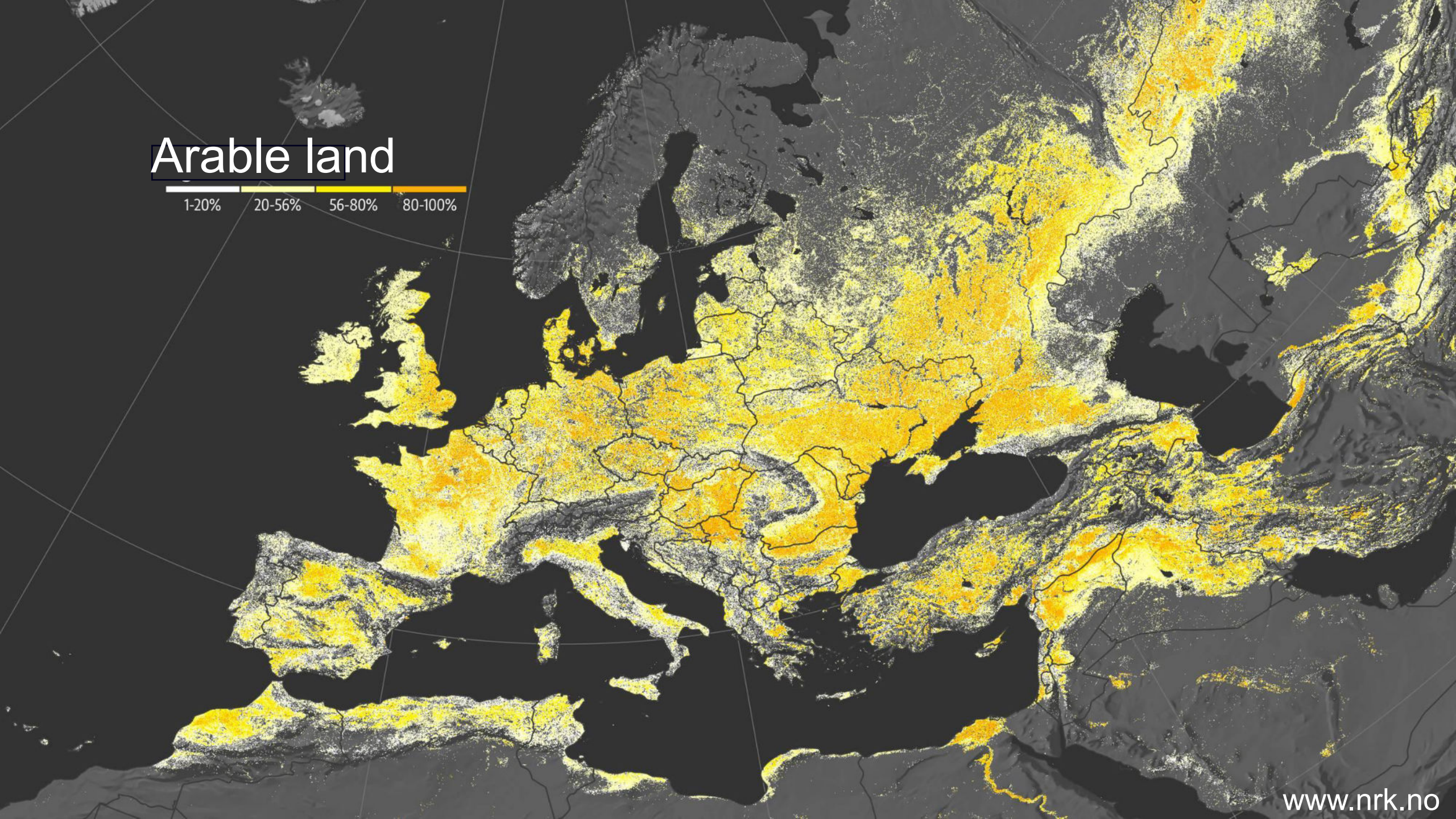
Arable land
1-20%
20-56%
56-80%
80-100%
www.nrk.no

Study Area

Pollination

Worst plum-season in 60 years: Nine of 10 plums disappeared

LOFTHUS (NRK): Det har vore ein elendig fruktsesong i Noreg, spesielt i Hardanger. Det får store konsekvensar også for siderprodusentane.

ELENDIG: Det blir ein sesong under normalen for fruktavlingane i år. Aller verst går det for plommene i Hardanger.

FOTO: TALE HAUSO / NRK

Tale Hauso
Joumalist

Jon Bolstad
Joumalist

Sjur Mikal Dolve
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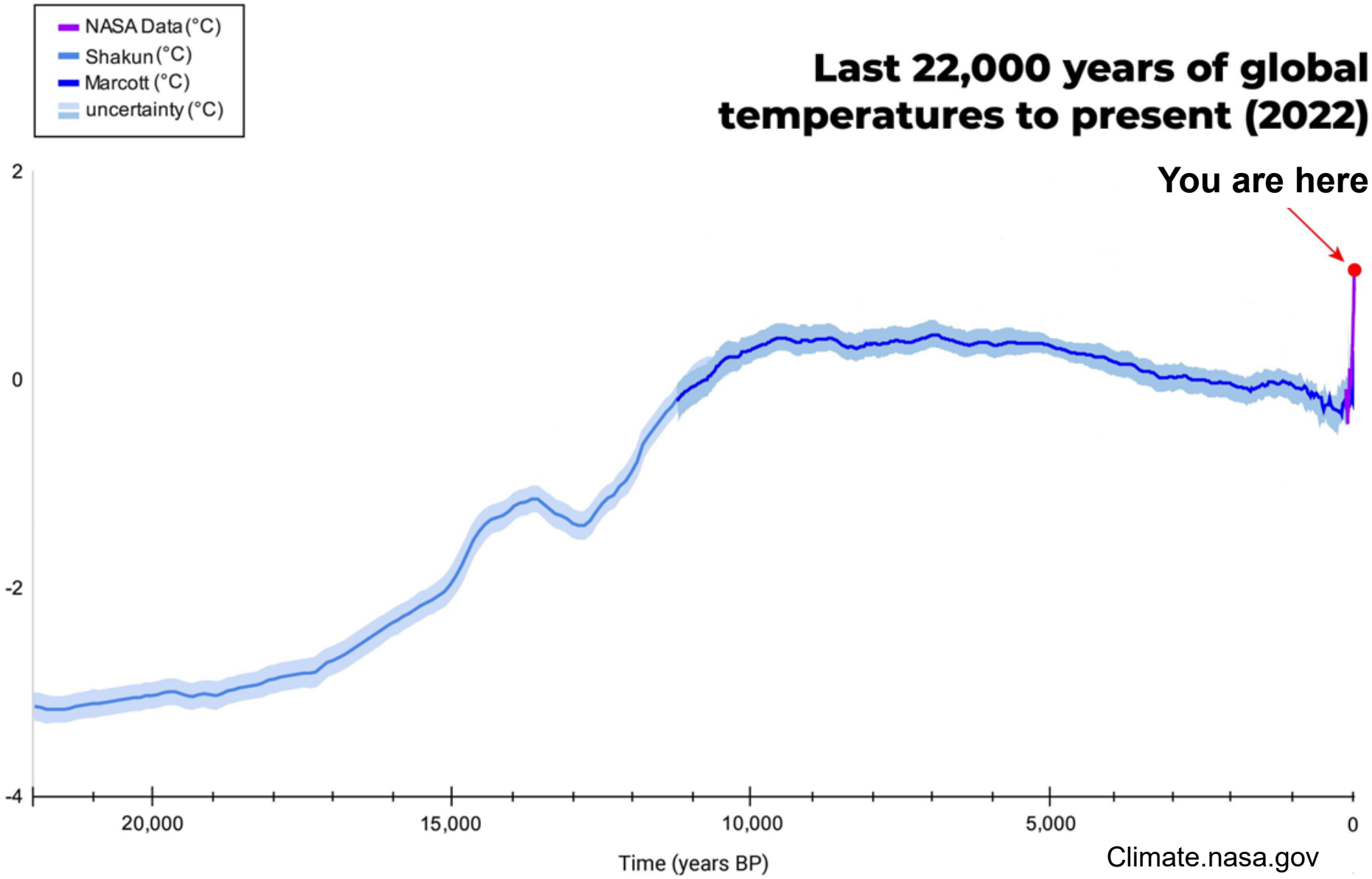
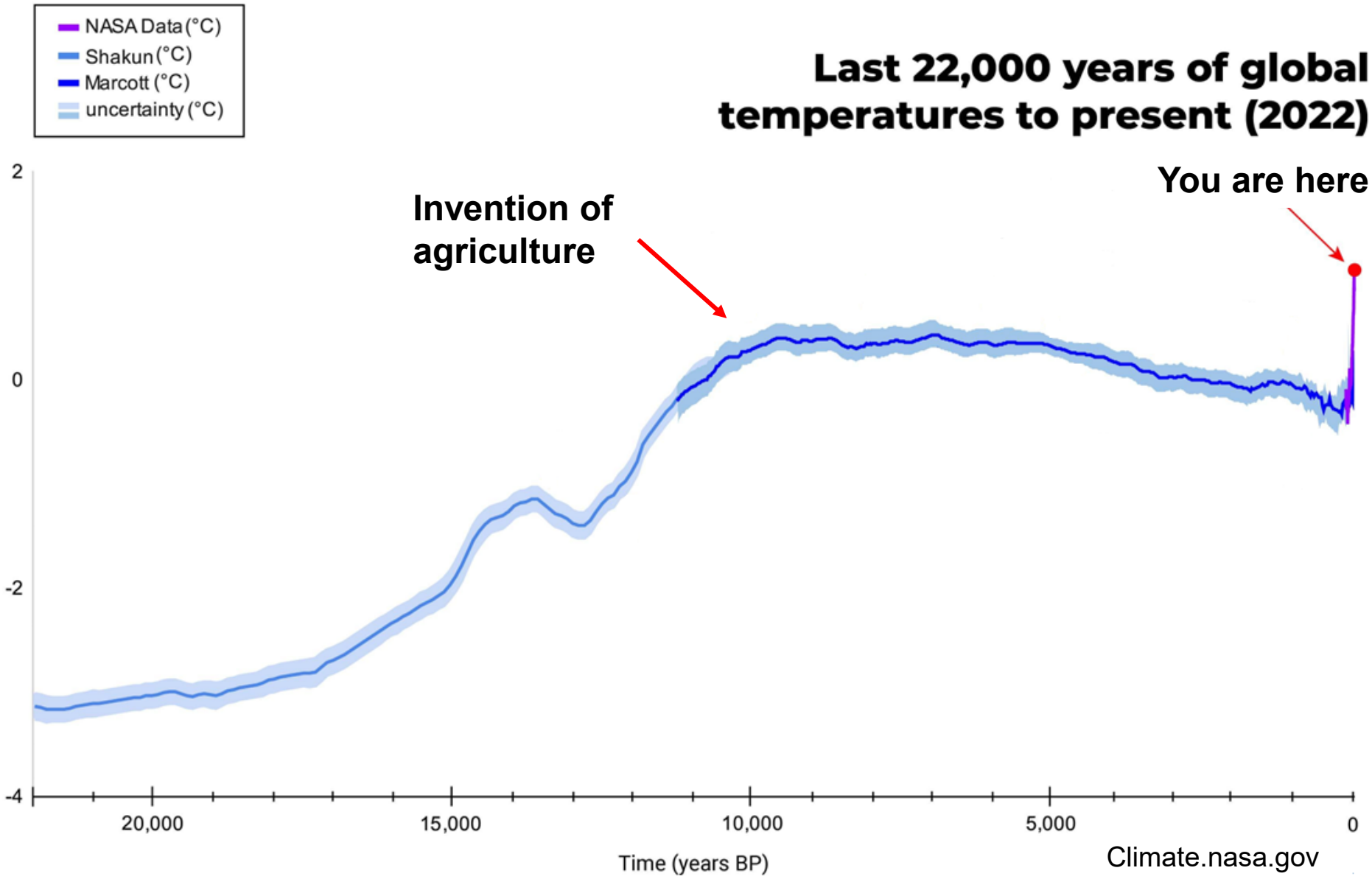
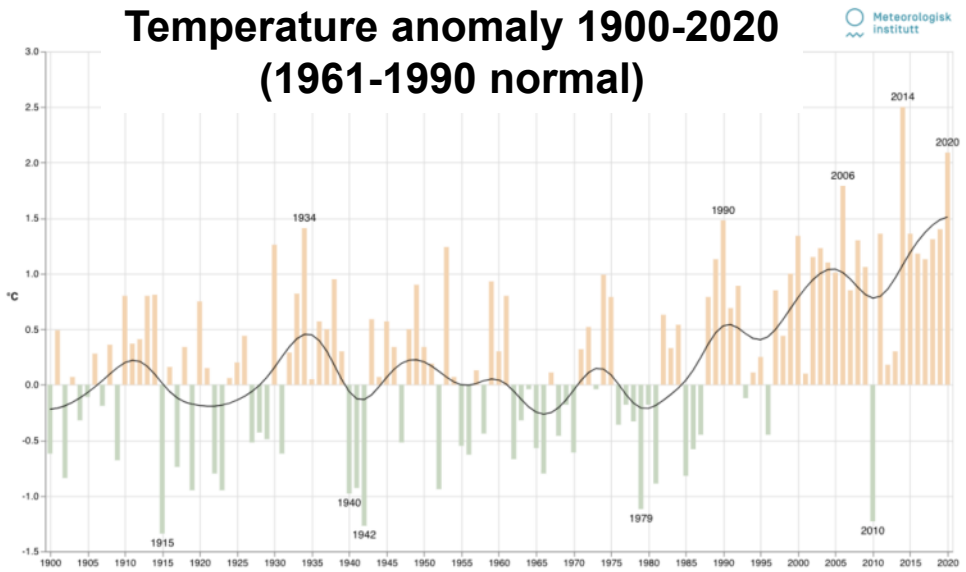
Global Temperature

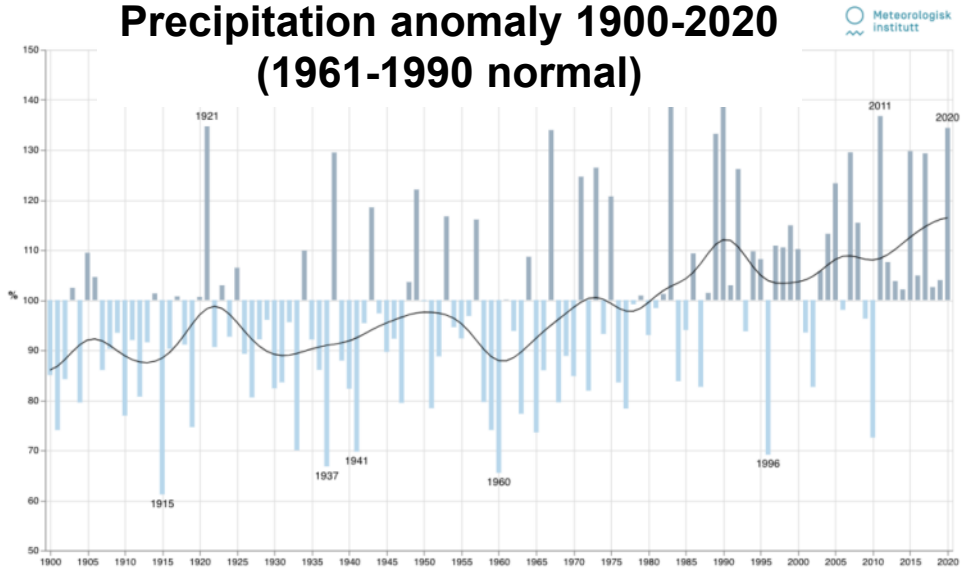


Global Temperature



Norway 1990 - 2020





Northern regions have experienced accelerated change

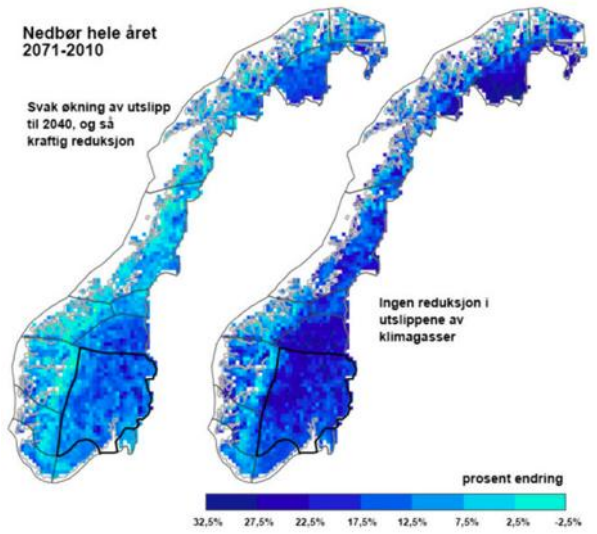
Western Norway:

- 15% more precipitation
- 1,5° temperature increase
- Dryer springs, wetter summers
- Increased climate variability

Forecasts

Weather forecasts

Climate projections



0 days | 10 days | 10 years | 100 years

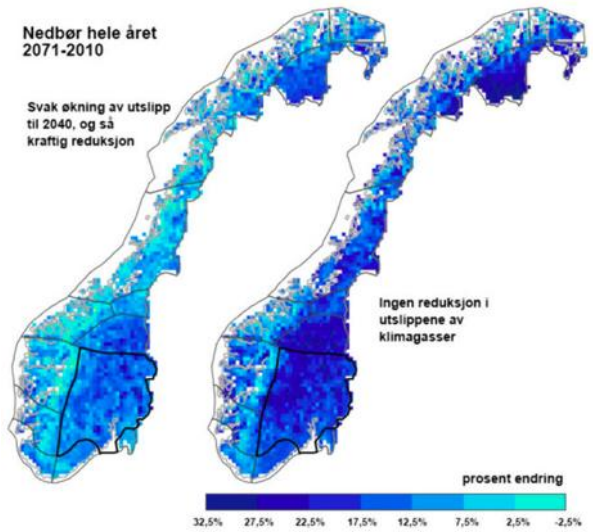
Time horizon

Forecasts

Weather forecasts

Subseasonal (2-6 weeks)
Seasonal (1-3 months)
Decadal (10 years)

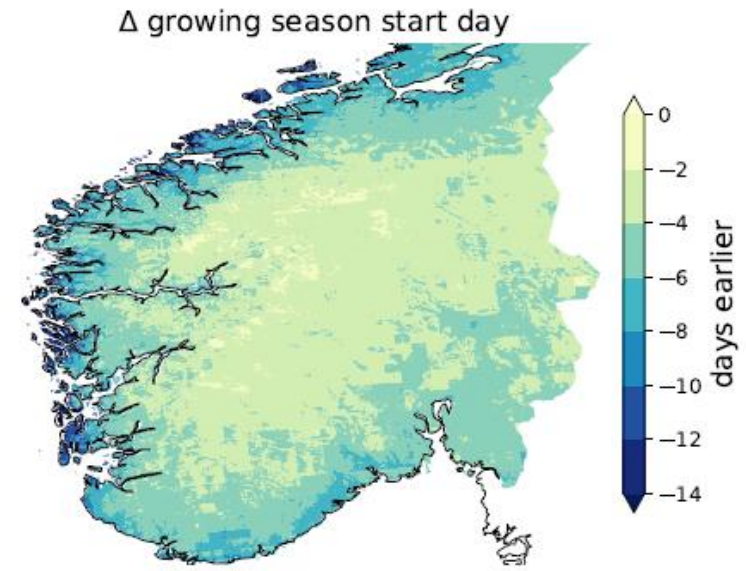
Climate projections

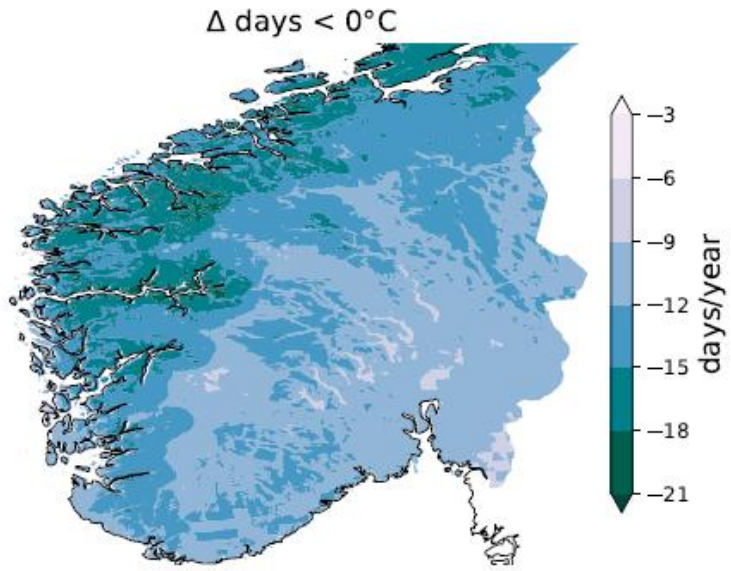


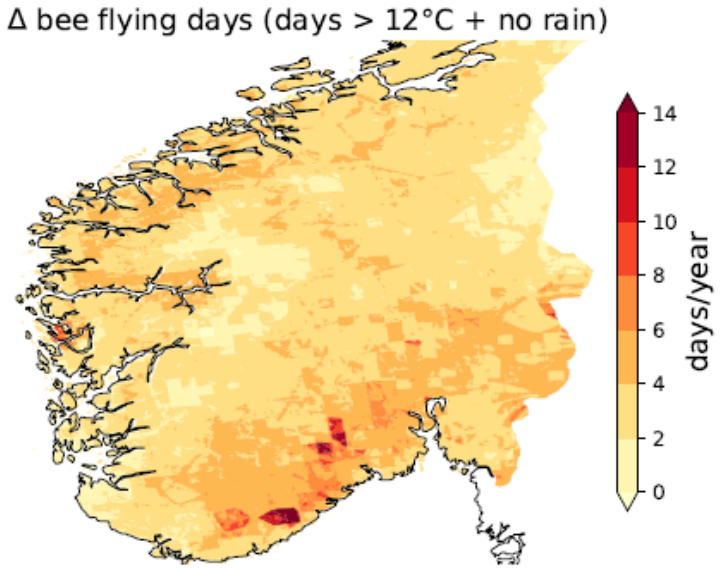
0 days | 10 days | 10 years | 100 years

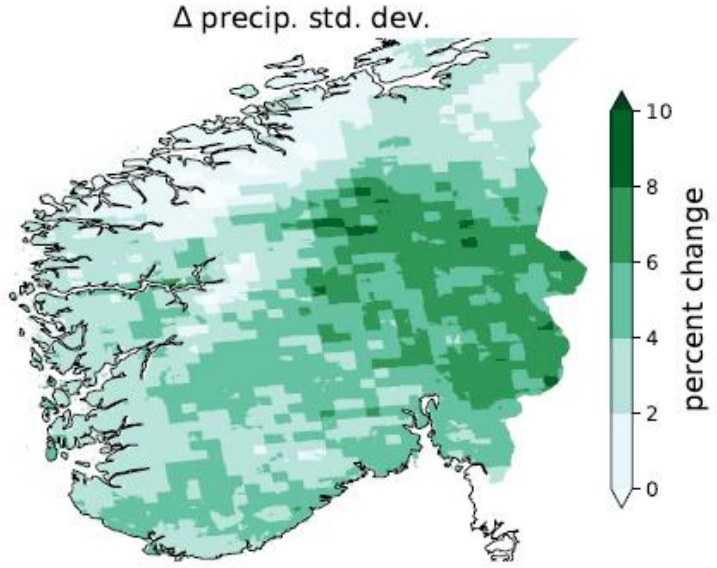
Time horizon

Bee-Parameter Projections for 2050









We analyzed bee-specific climate parameter projections for the next 30 years in southern Norway

On average annually up to:

- 2 weeks earlier growing season
- 21 less frost days
- 2-6 more flying days
- Increasing variability

Significance for Beekeeping

Early spring

- Increased risk for frost during bloom
- Bees and blooms are “out of sync”

Shorter/milder winters

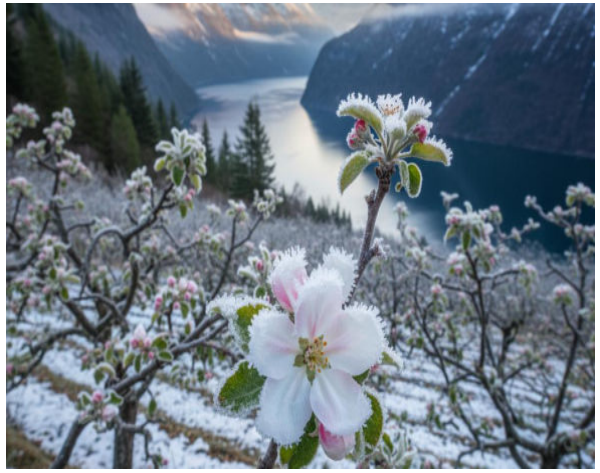
- Longer brood season -> Increased Varroa pressure
- Increased winter food consumption

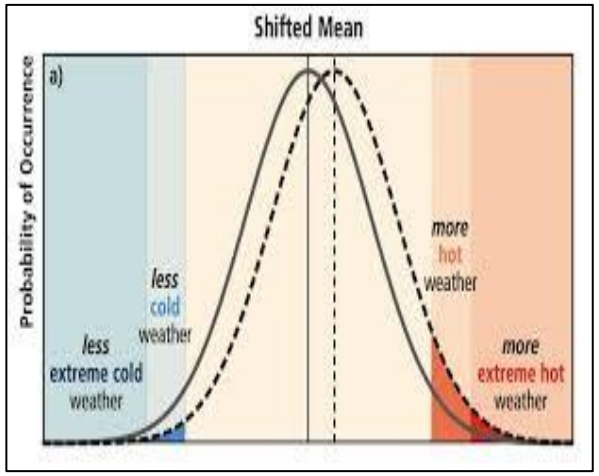
Warmer & wetter

- Higher risk for droughts
- Higher risk for continuous rain

Greater Variability

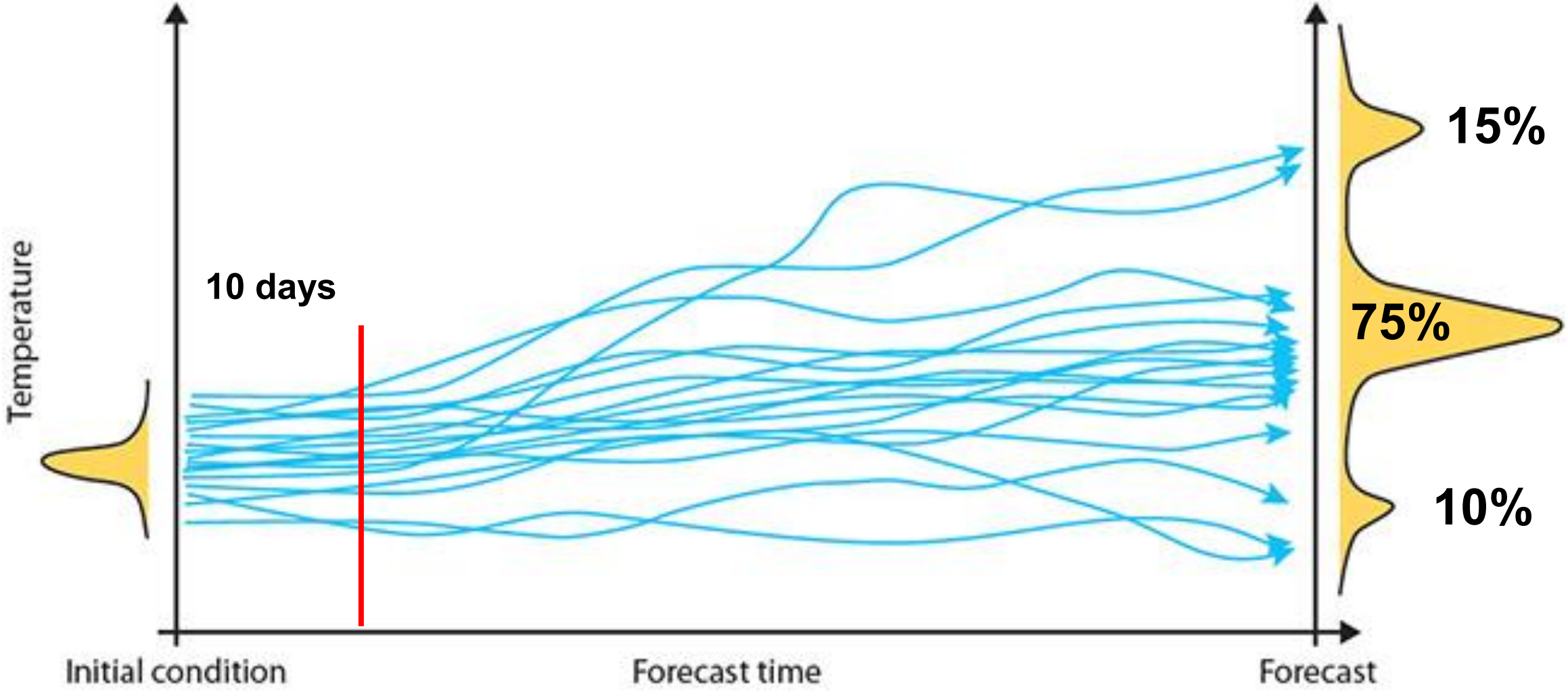
- More extreme events
- No more “normal” seasons
- Harder to anticipate the weather



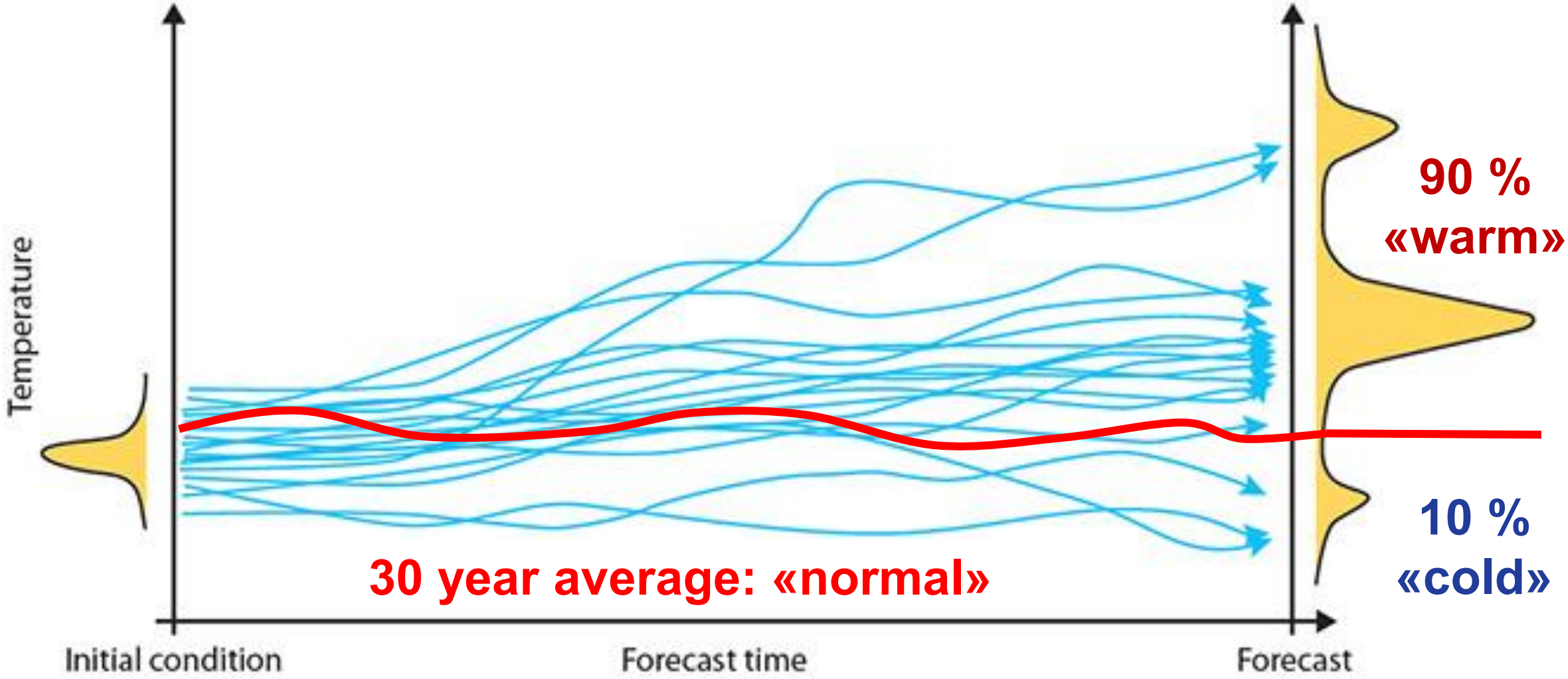


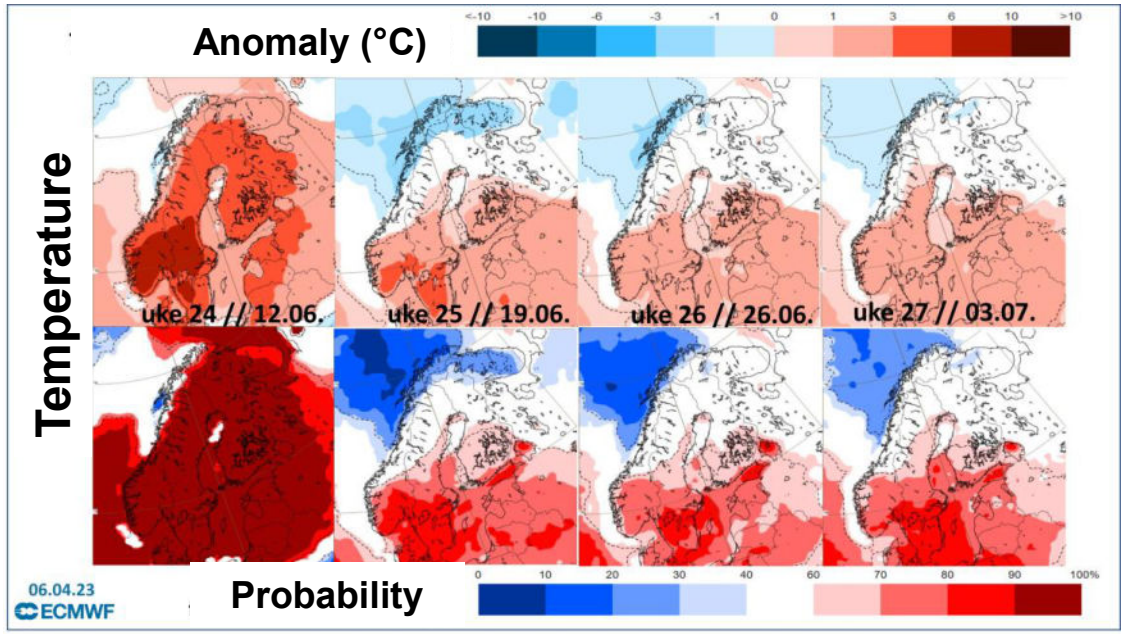
“I no longer know what a normal season is around here”

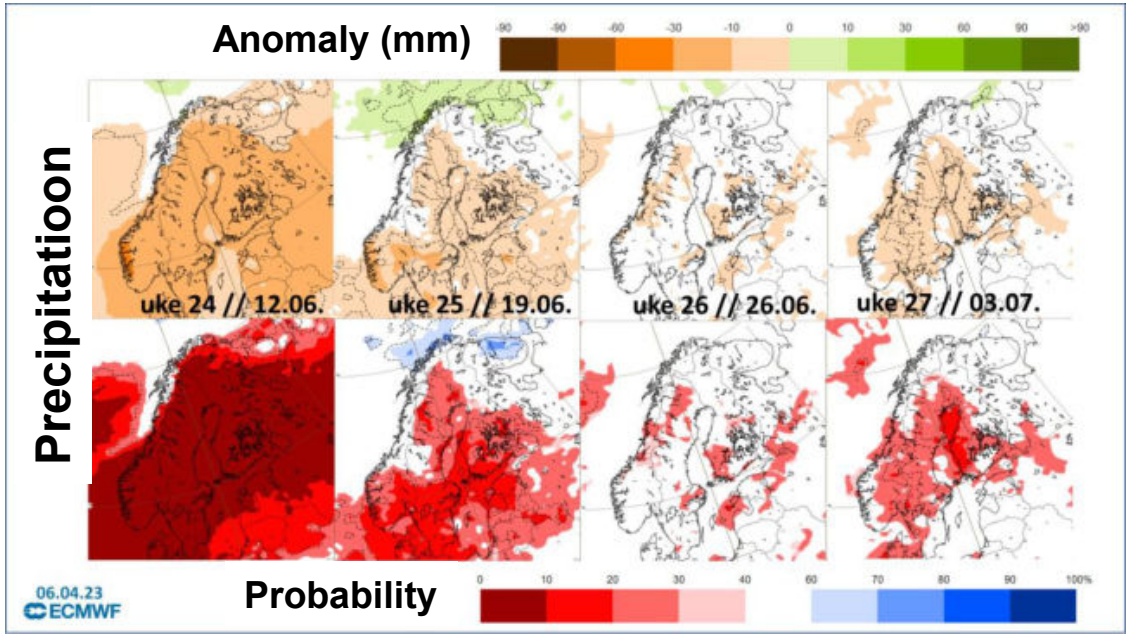
Ensemble Forecasting



Ensemble Forecasting



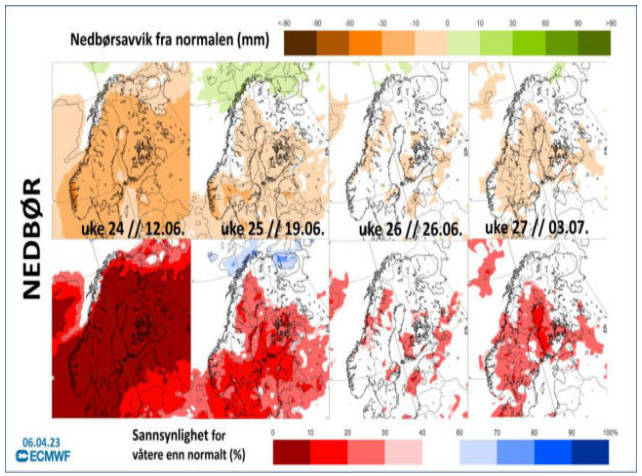




Extended range Forecasts

- Probabilistic information on the likelihood of certain scenarios
- Proven skill in forecasting extreme events (2018 drought)
- More and more applied in agriculture

BUT: So far not systematically introduced to apiculture



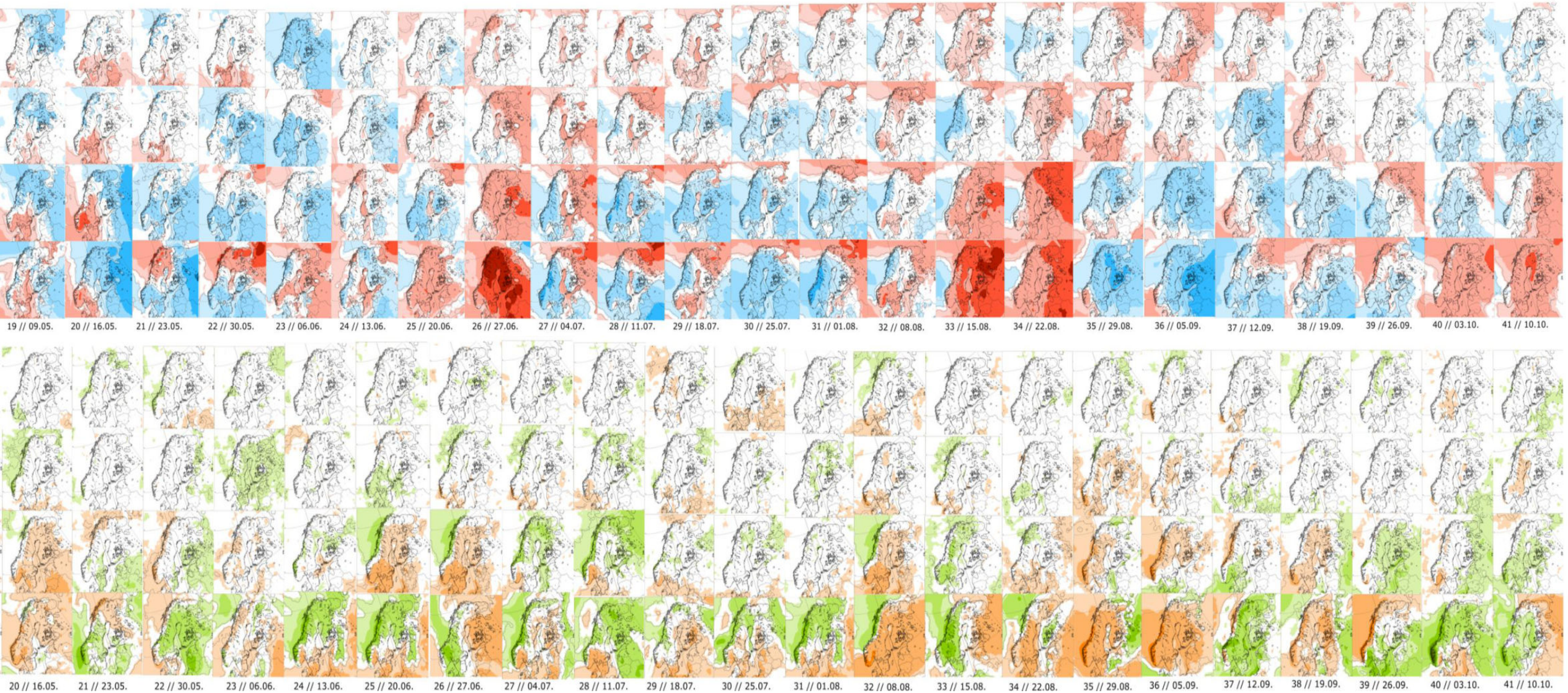
BeeWare Project

Goal: Investigate the utility of extended range forecasts for beekeeping

Methodology

- Climate modelling
- Extended range forecasts
- Interviews
- Focus Groups
  - Beekeepers
  - Fruit growers
- Workshops
- Fieldtrips

Season long collaborations



- Weekly extended range forecasts have been provided to beekeepers throughout the season
- Utility has been discussed in monthly focus-group sessions

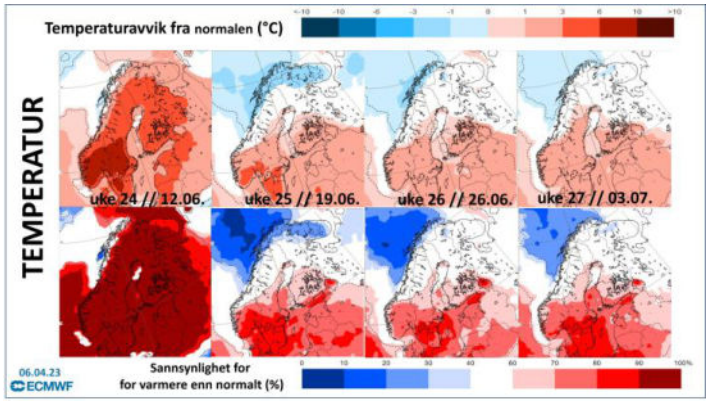
Finding 1: A Strong Demand for Better Foresight

- Many decisions in beekeeping have time horizons extending a 10 day weather forecast.
- Consensus that weather patterns are increasingly unreliable
- Beekeepers are eager to adapt
- The provided forecasts could anticipate an early spring, cold spells and rainy periods 2-3 weeks in advance

Finding 2: From Forecast to Action

- **Pollination**
  - Anticipation of bloom onset
  - Stimulous feeding building up to pollination
- **Colony Management**
  - Boosting/Slowing to sync strength with the expected bloom
  - Added supers expecting favourbale foraging conditions
  - Provision of food/pollen expecting unfavourable foraging conditiions
- **Winter preparation**: Timely feeding before cold spells
- **Migration:** Informed choice of most promising destination

Summary



- Increasing climate variability imposes increased risk to beekeeping
- Extended-range forecasts have promising skill!
- Integrating long-term forecasts empowers beekeepers to optimize strategies and buffer against climate shocks
- This supports increased resilience contributing to colony health, food security and economic stability

"I am still betting on the weather, but at least now the odds are stacked in my favor"

THANK YOU!

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