Norwegian Meteorological Institute

United Weather Centres

ACCORD Research and Development

DestinE and Weather-induced Extremes - some thoughts about relevance, expectations, opportunities, impacts and dimensions seen from a national weather service and LAM community

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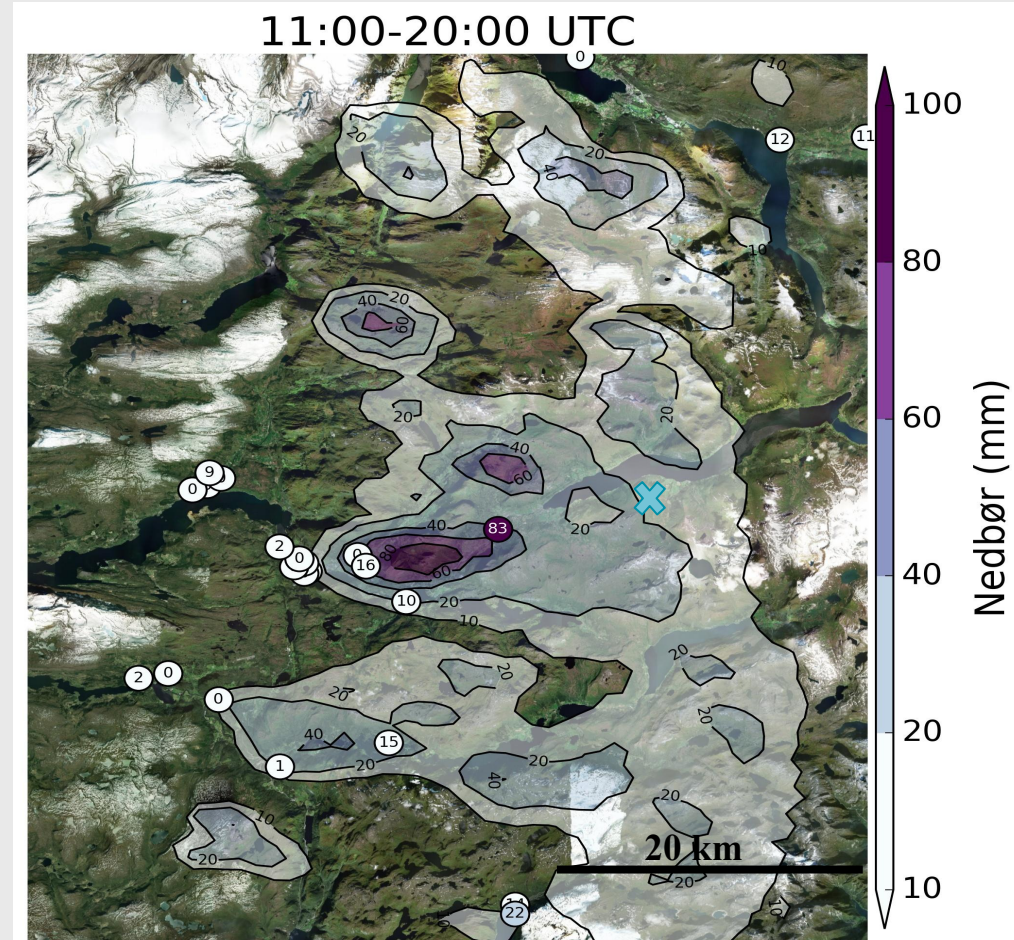
Norwegian Meteorological Institute

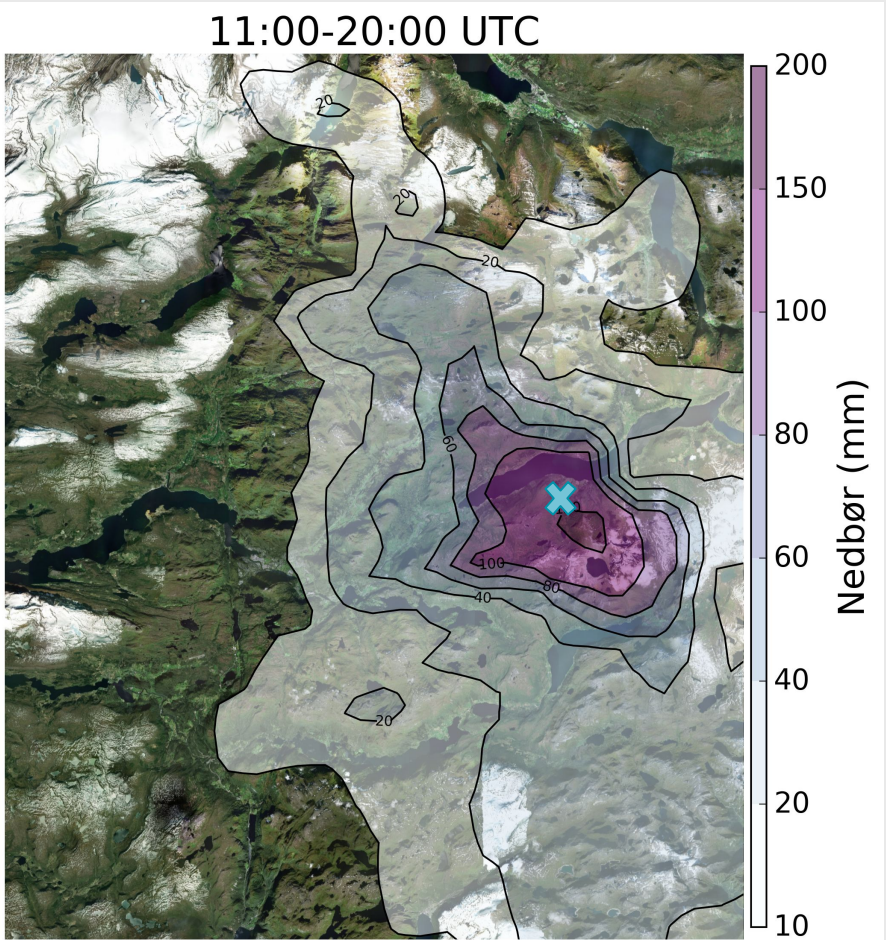
Destination Earth seminar series
11 May 2021

Vassenden 30 July 2019

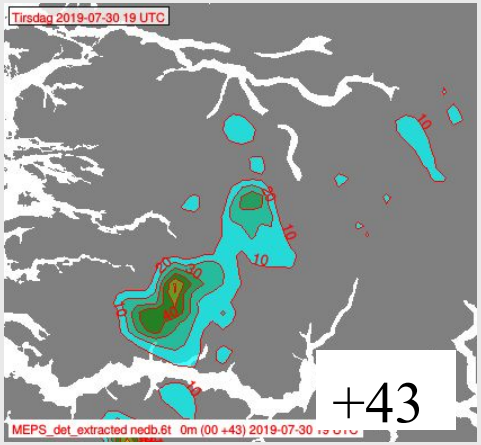
Estimated precipitation amount from different information sources

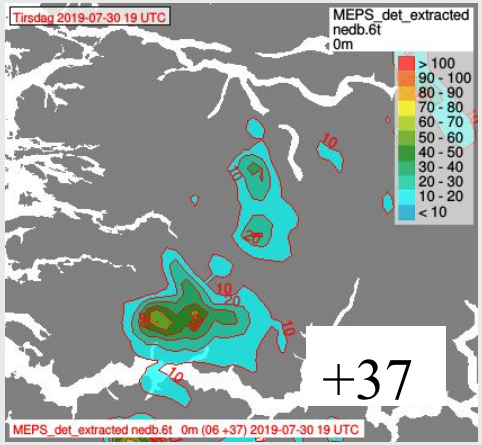
- citizen observations, in-situ, radar and NWP

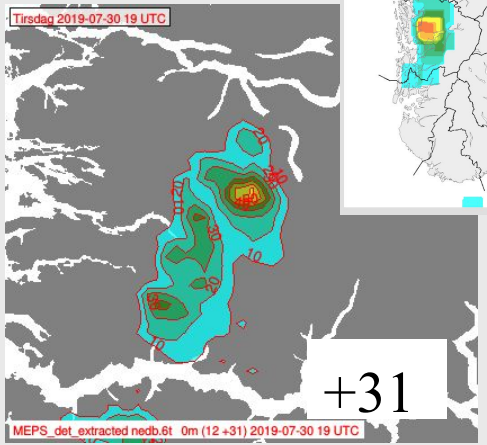


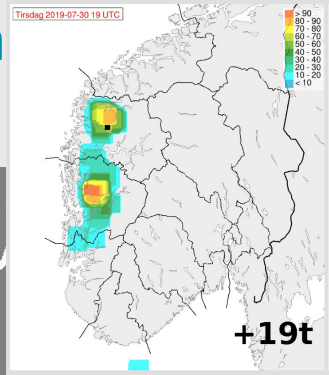


Consecutive precipitation forecasts for Vassenden area valid for 30 July 2019 1500-2100 CET

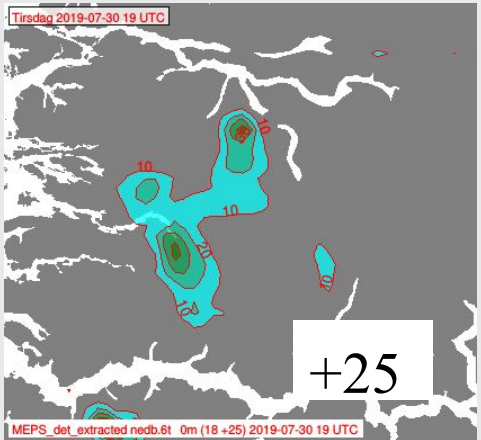


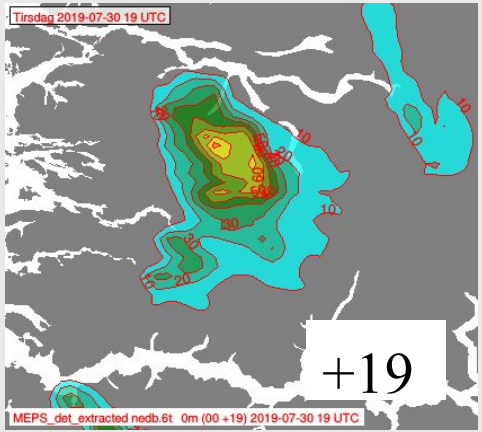


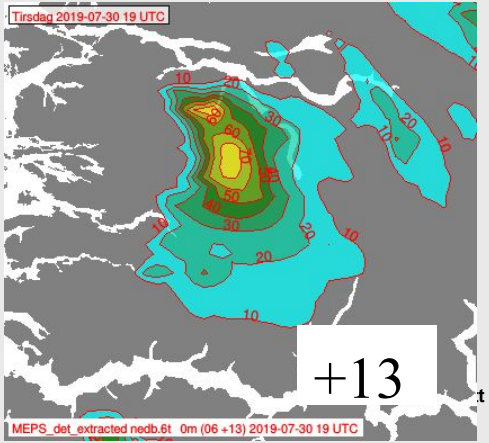




Forecast probability for precipitation amount above 50 mm per 6 hours for Vassenden area valid for 30 July 2019 1500-2100 CET







Figures: Morten Køltzow

Early snowfall, followed by the first autumn storm: downstream effects of snowmelt and precipitation in a Norwegian “dessert” 14 October 2018 - impact and consequences

Photos by Even Lusæter (NRK)

Glasopor is a light granular building material made of 20 % glass, and 80 % air.

Staten varsler millionkrav mot flomrammet bedrift

Da flommen rammet Skjåk-bedriften Glasopor AS høsten 2018, forsvant hele lageret i elva. Nå vil Miljødirektoratet kreve 16,5 millioner kroner i erstatning for oppryddingen. – Farlig sak for Distrikts-Norge, sier ordføreren i Skjåk.

Slik så det ut da flommen i Otta-vassdraget i 2018 tok med seg store mengder glasopor nedover i vassdraget.
FOTO: EVEN LUSÆTER / NRK

Anders Bakkerud Larsen
Journalist

Stine Bækkelien
Journalist

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Oppdatert 16. sep. 2020 kl. 16:50

Global to local, and medium-range to short-range

APPLICATE.eu
Advanced prediction in polar regions and beyond

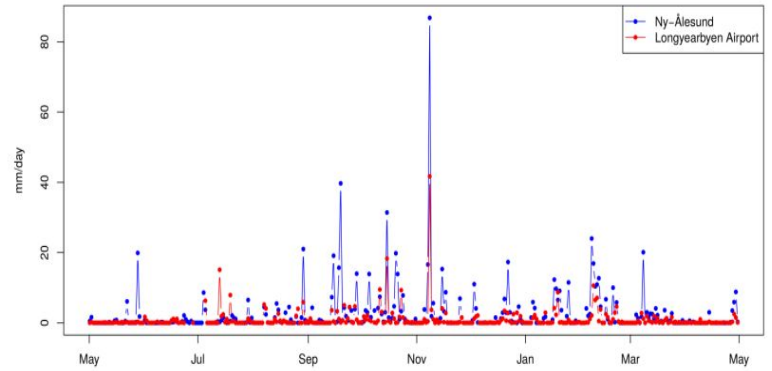
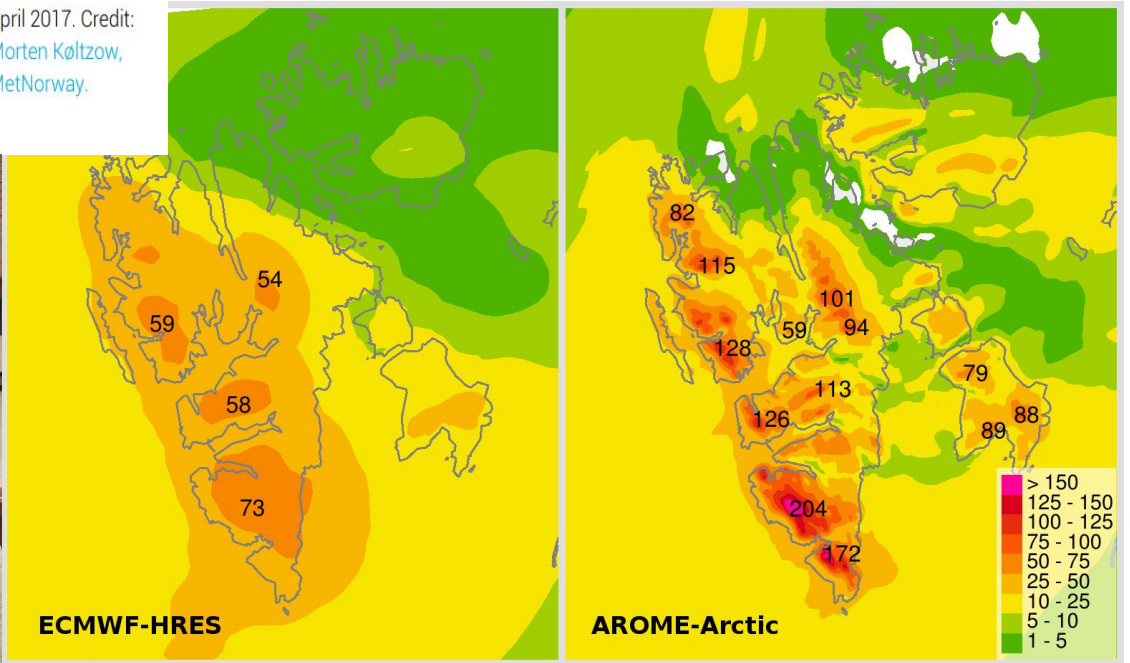


Fig.2. Observed daily precipitation from Ny-Alesund (blue) and Long-yearbyen (red) from May 2016 to April 2017. Credit: Morten Køltzow, MetNorway.

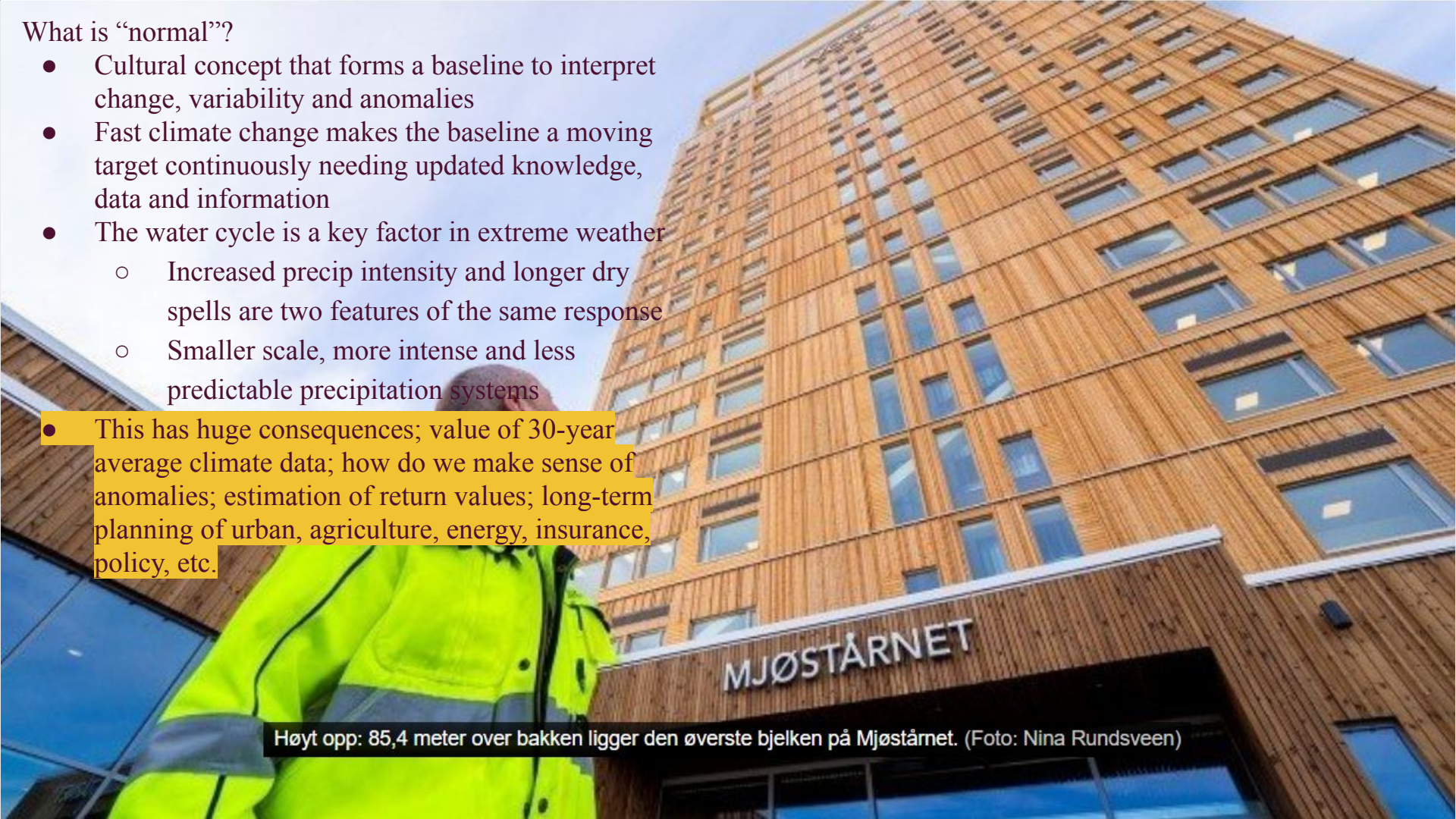
Svalbard-precipitation: moist air transport northward

Accumulated precipitation in 24 hours (mm/24 hr) predicted on **7 November 2016** using the ECMWF HRES (~ 9 km grid spacing) (left) and AROME-Arctic (2.5 km grid spacing) (right) models.



What is “normal”?

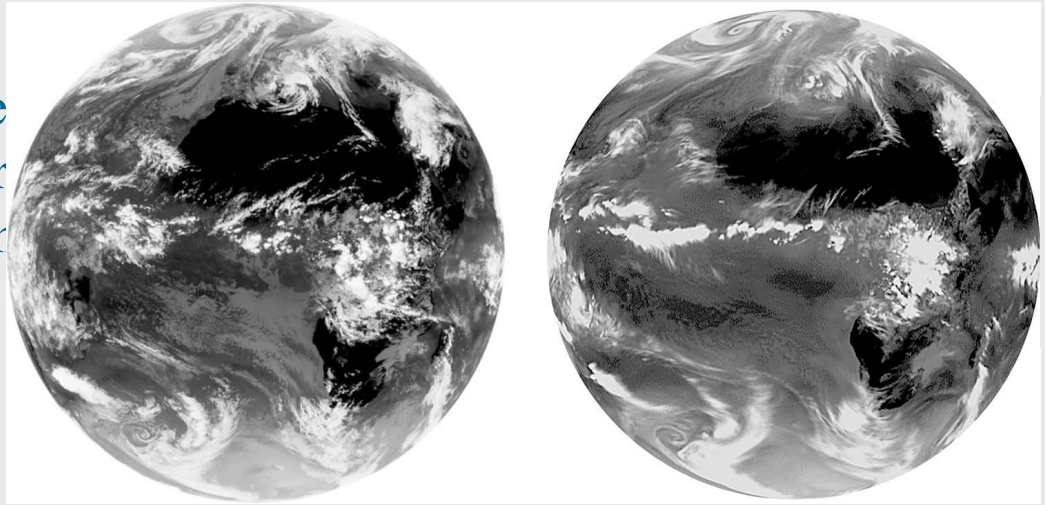
- Cultural concept that forms a baseline to interpret change, variability and anomalies
- Fast climate change makes the baseline a moving target continuously needing updated knowledge, data and information
- The water cycle is a key factor in extreme weather
  - Increased precip intensity and longer dry spells are two features of the same response
  - Smaller scale, more intense and less predictable precipitation systems
- This has huge consequences; value of 30-year average climate data; how do we make sense of anomalies; estimation of return values; long-term planning of urban, agriculture, energy, insurance, policy, etc.



Høyt opp: 85,4 meter over bakken ligger den øverste bjelken på Mjøstårnet. (Foto: Nina Rundsveen)

We, the National Meteorological and Hydrological Services (NMHSs), must, in order to stay relevant and be seen as authoritative on weather predictions and warnings, and disaster risk reduction - SGDs are becoming more important, constantly identify new areas of investigation and new directions for interdisciplinary and joint research

Advancing involve
broader and deeper
embracing game ch

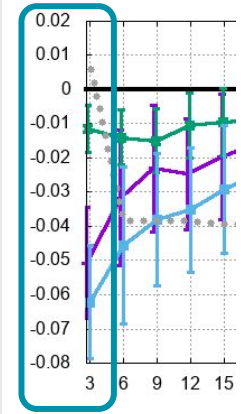


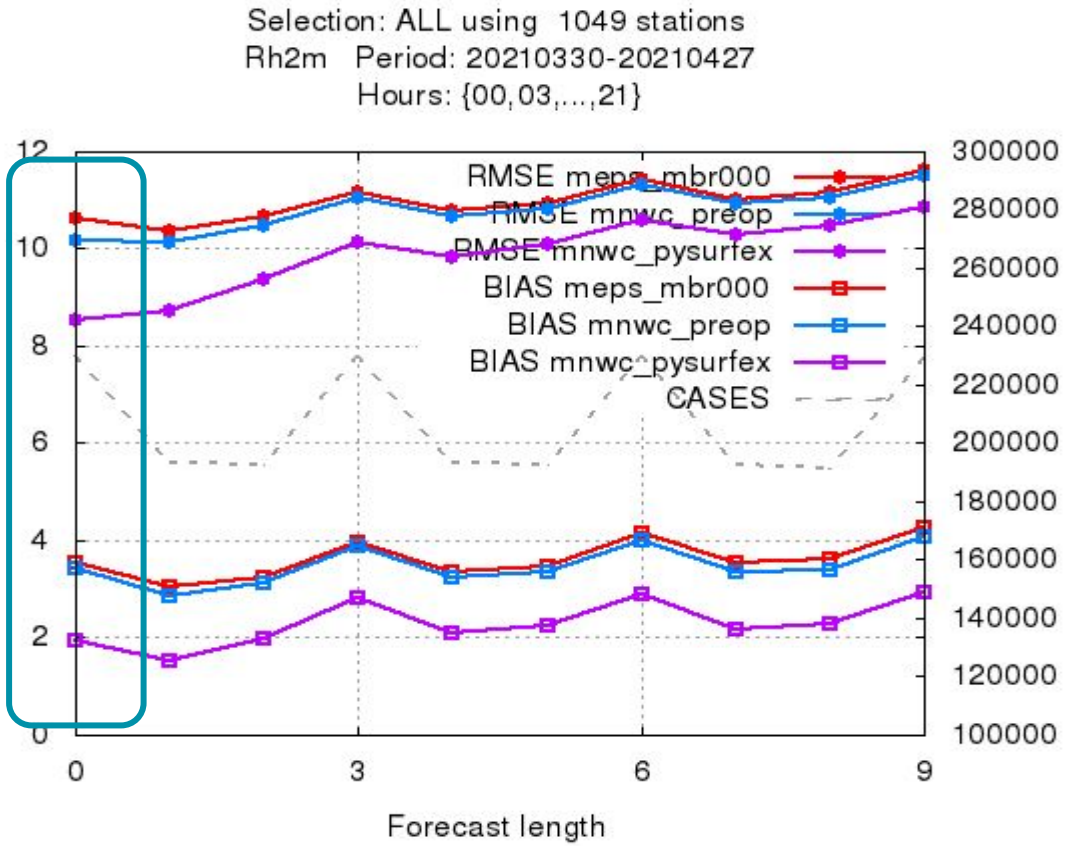
Meteosat Second Generation (left) and and ECMWF IFS @ at 1 km (right)
Bauer et al. (2021)

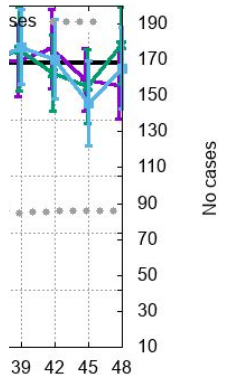
Synergetically combining high-resolution global and local on-demand hyper-resolution physics-based simulation models or digital twins to grasp the causes of change at appropriate spatial and temporal scales and explore options for future adaptation and mitigation actions

Ex.
OSEs
YOPP
SOP1

Fusion of physical models and real-time data into usable products - existing and emerging observations

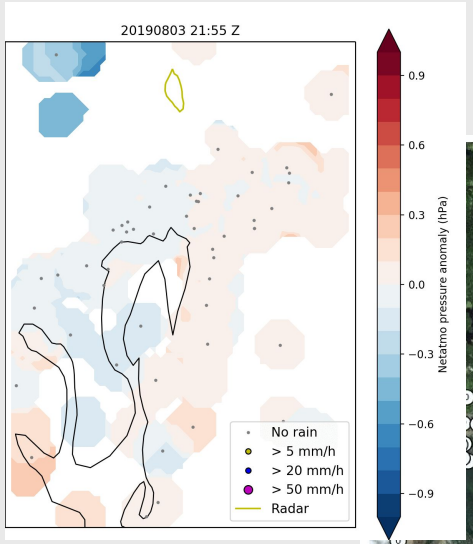


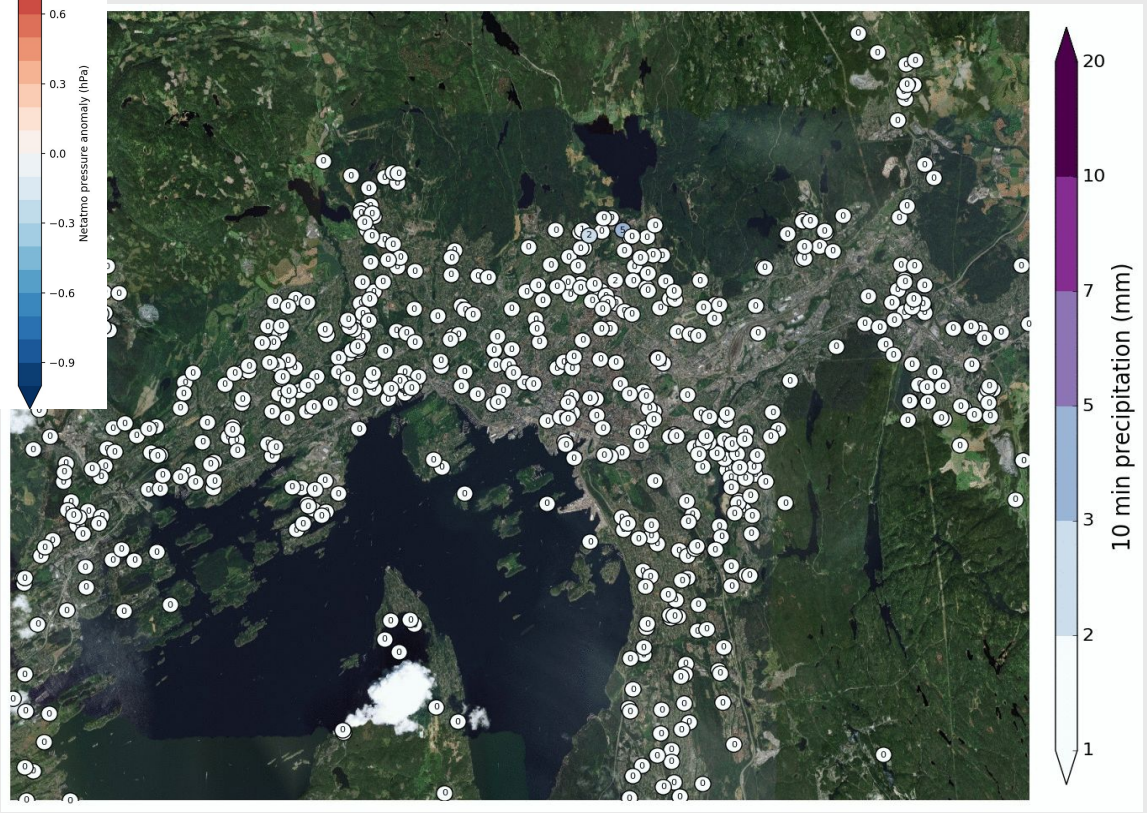




Use of IoT observations for weather timescales: ~50k Netatmo T2m and RH2m in SURFEX (Harmonie-AROME surface) [First results - Trygve Aspelien and MetCoOp MNWC group]

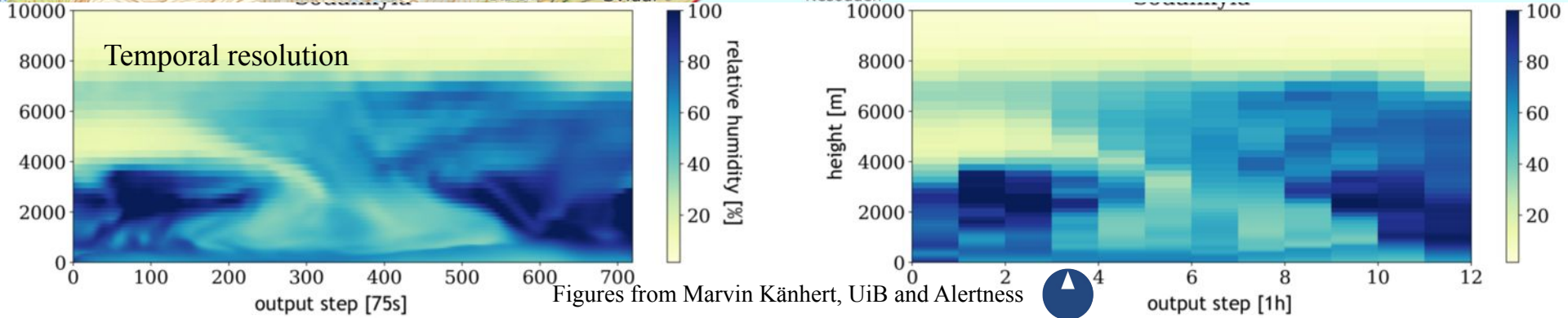
High-frequency updates, predictions and observations



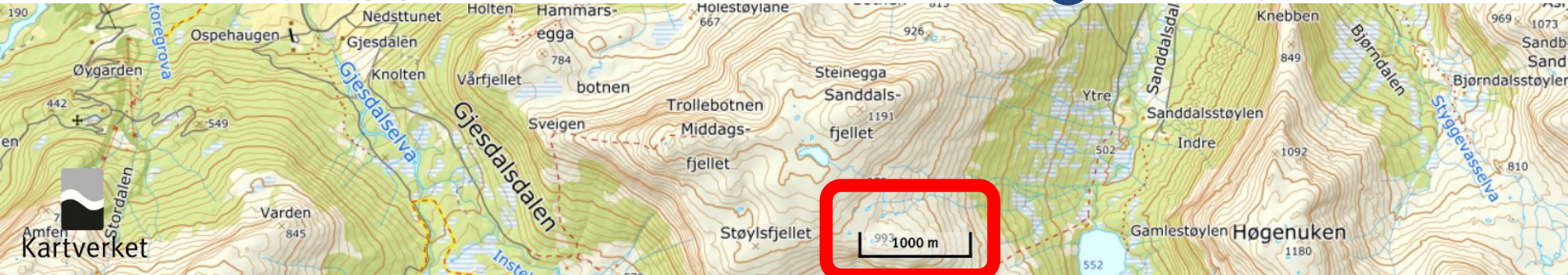


Oslo 4 August 2019 (right) 10-min snapshots of Netatmo rainfall (left) same as right but also with Netatmo MSLP anomalies (shaded) and radar precip intensity (contours) (from Roel Stappers and Thomas Nipen)

Spatial detail/resolution



Figures from Marvin Känhert, UiB and Alertness



Hectometric-scale HARMONIE@DMI

Operational 750-m model (Dec 2018-)

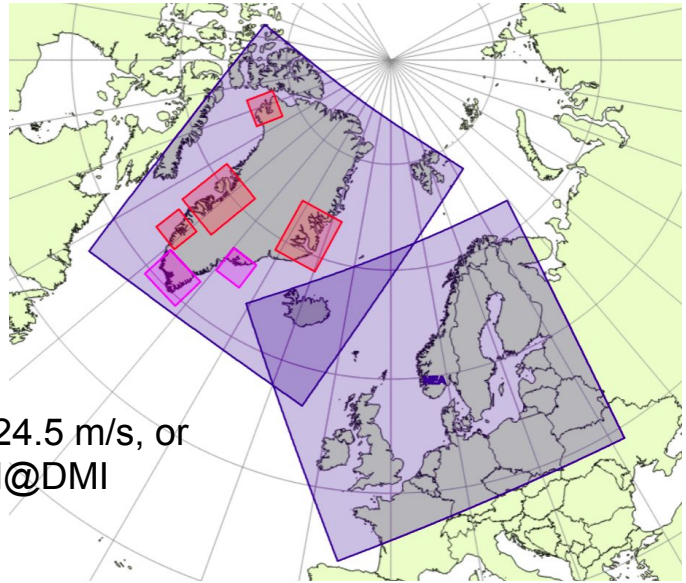
Tasillaq
South Greenland coast

Operational On-demand (Jan 2021-)

Nuuk 750m
Diskobugt 1km
Scoresbysund 1km
Qanaaq 750m

On-demand (event-driven):

- Harmonie-2.5 wind forecast > 24.5 m/s, or
- Duty forecasters for Greenland@DMI



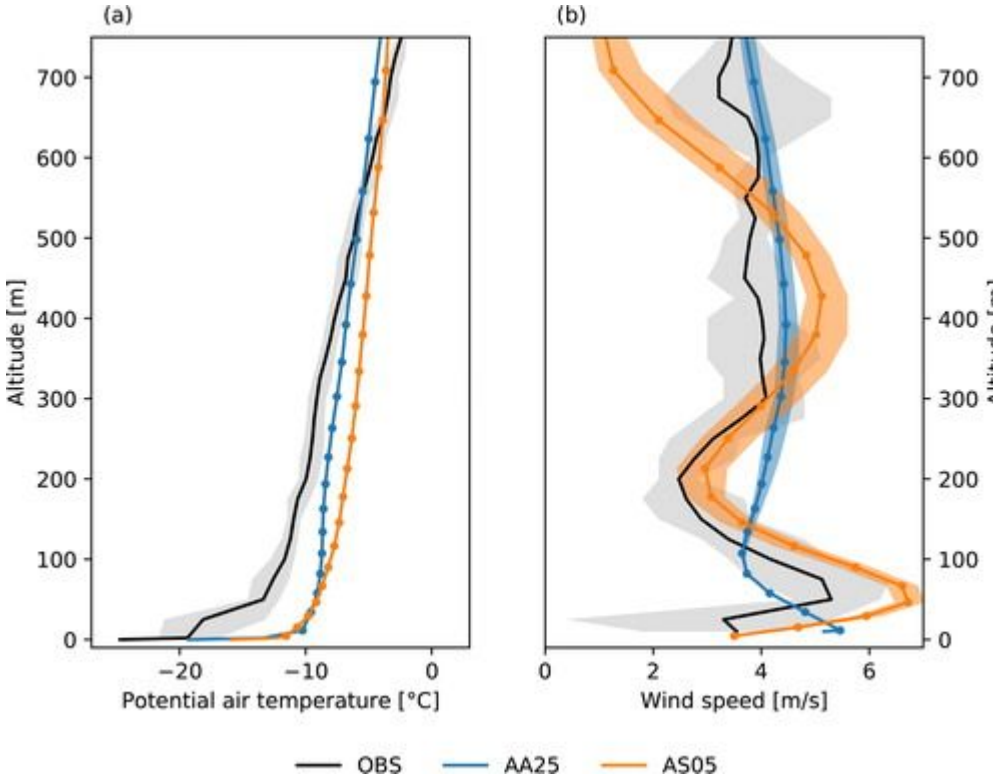
Background:

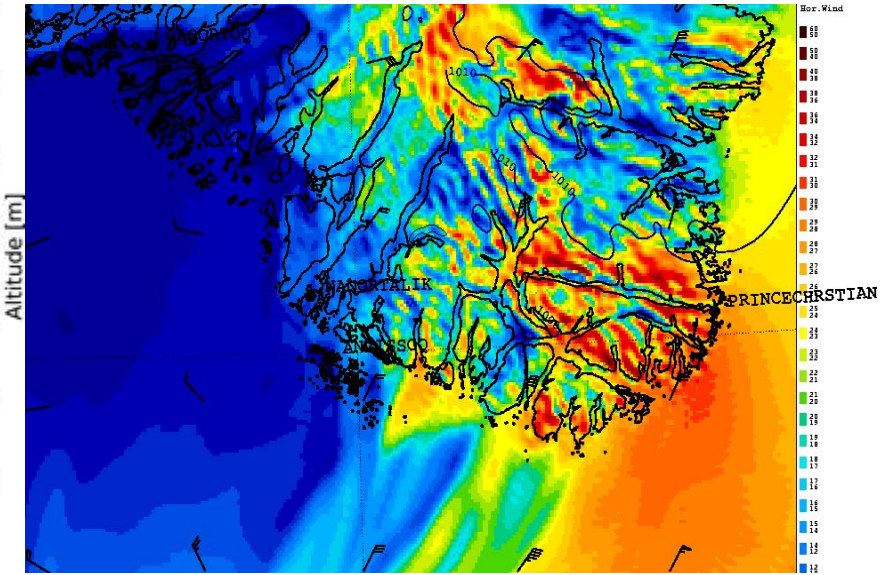
Some of the populated regions along Greenland coast suffer frequent storms throughout year;

HARMONIE-2.5 tends to overpredict storms due to insufficient representation of complex coastal landscape

Xiaohua Yang, DMI

Orographically induced small scale flow variability

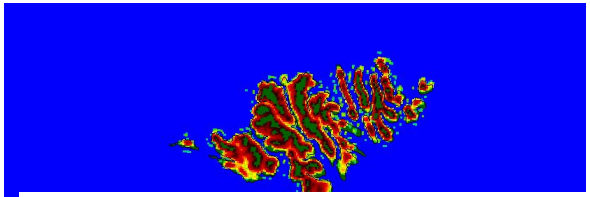




Harmonie@ **750** m

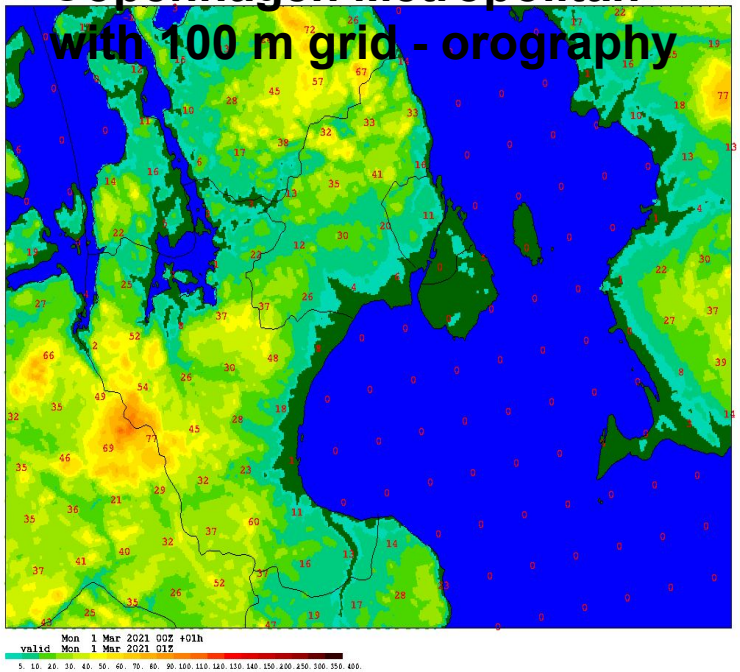
Valkonen et al. 2020

Adventdalen-Svalbard. 16 February between 17:34 and 19:12 UTC. Solid lines indicate the average of the profiles and the range is shown with shading.



Faroe Islands

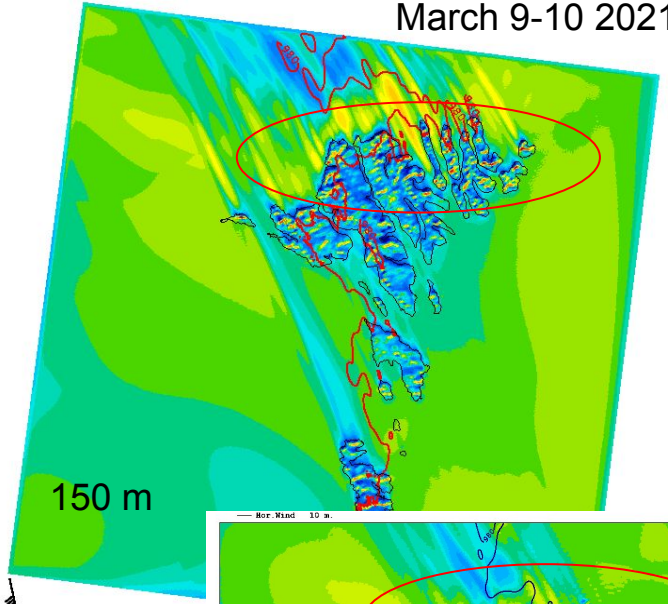
Copenhagen Metropolitan with 100 m grid - orography



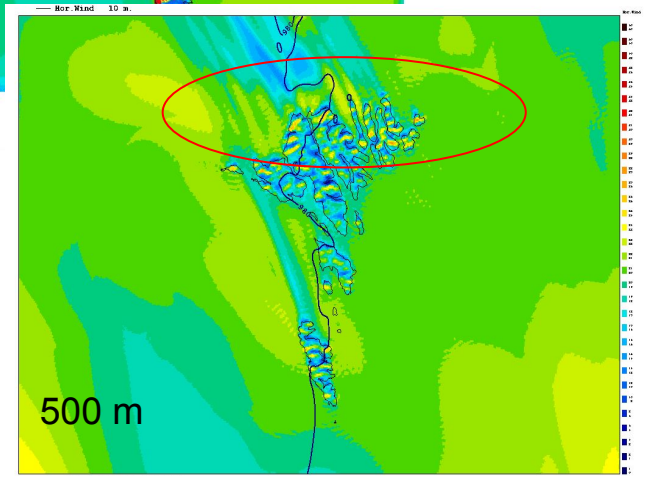
500m grid

Figures from
Xiaohua Yang DMI

Exp w Harmonie-Arome
March 9-10 2021



Wind speed

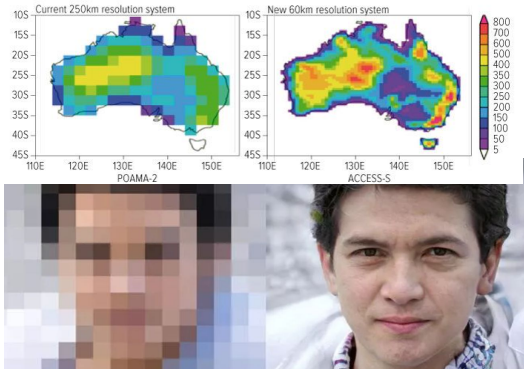


Societal integration *(in/of)*

Trends

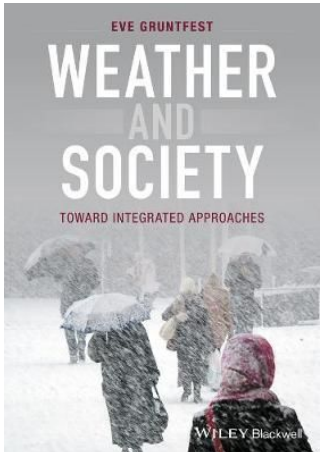
1. **Higher resolution information**
   - Availability =/ Usability
   - Accuracy =/ Trust

   ⇒ ***Increasing demand for 'high resolution' knowledge of user contexts***



2. **Hybridization of disciplines as response to societal complexity**
   - 'Integrated approaches, 'Synergistic research', 'Cross-cutting themes' 'Co-production'
   - Blurred lines between expert and public

   ⇒ ***New distribution of (shared) competencies and responsibilities to increase socio-technical resilience (Henderson, 2018)***



https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/r-i_strategy_full_version_sml.pdf

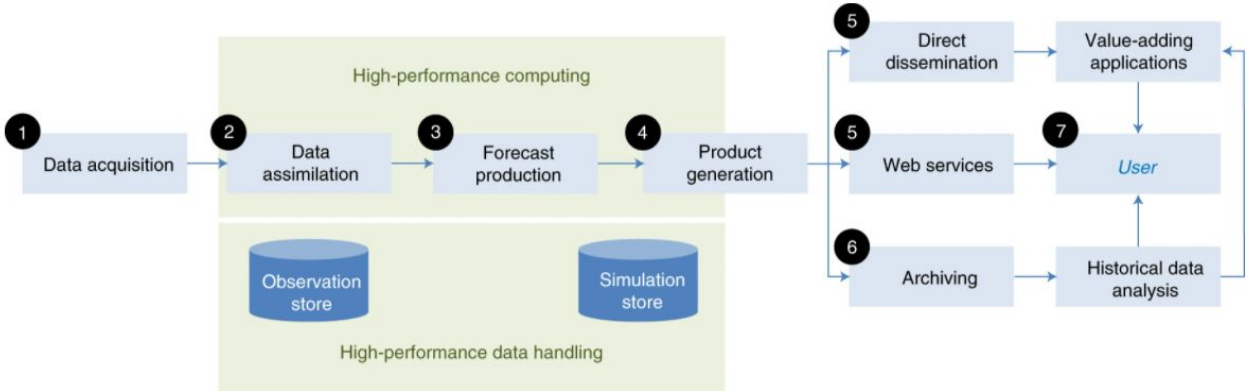
Slide from Jelmer Jeuring

R2O and O2R - enabling technologies, infrastructures and cultures

The operational NWP value chain structure enables an efficient transformation of research results and infrastructures into operations and better informed decision making for users of weather information, and vice versa …

Fig. 1: Typical production workflow in operational numerical weather prediction.

From: The digital revolution of Earth-system science



(1) High-volume and high-speed observational data acquisition and pre-processing; (2) data assimilation into models to produce initial conditions for forecasts; (3) forecast production by Earth-system simulation models; (4) generation of output products tailored to the portfolio of weather and climate information users; (5) direct dissemination of raw output and web-products; (6) long-term archiving for reuse in statistical analyses and performance diagnostics; (7) user-specific applications and data-driven analytics.

... providing guidance well beyond traditional NWP and climate monitoring applications; “To build an information system in support of policy- and decision-making, the workflow shown in Fig. 1 needs to be **extended** to weather- and climate-dependent **applications** like energy, food, water and disaster management and to add **flexibility** for testing both scientific and socio-economic scenarios. “ Bauer et al. (2021)

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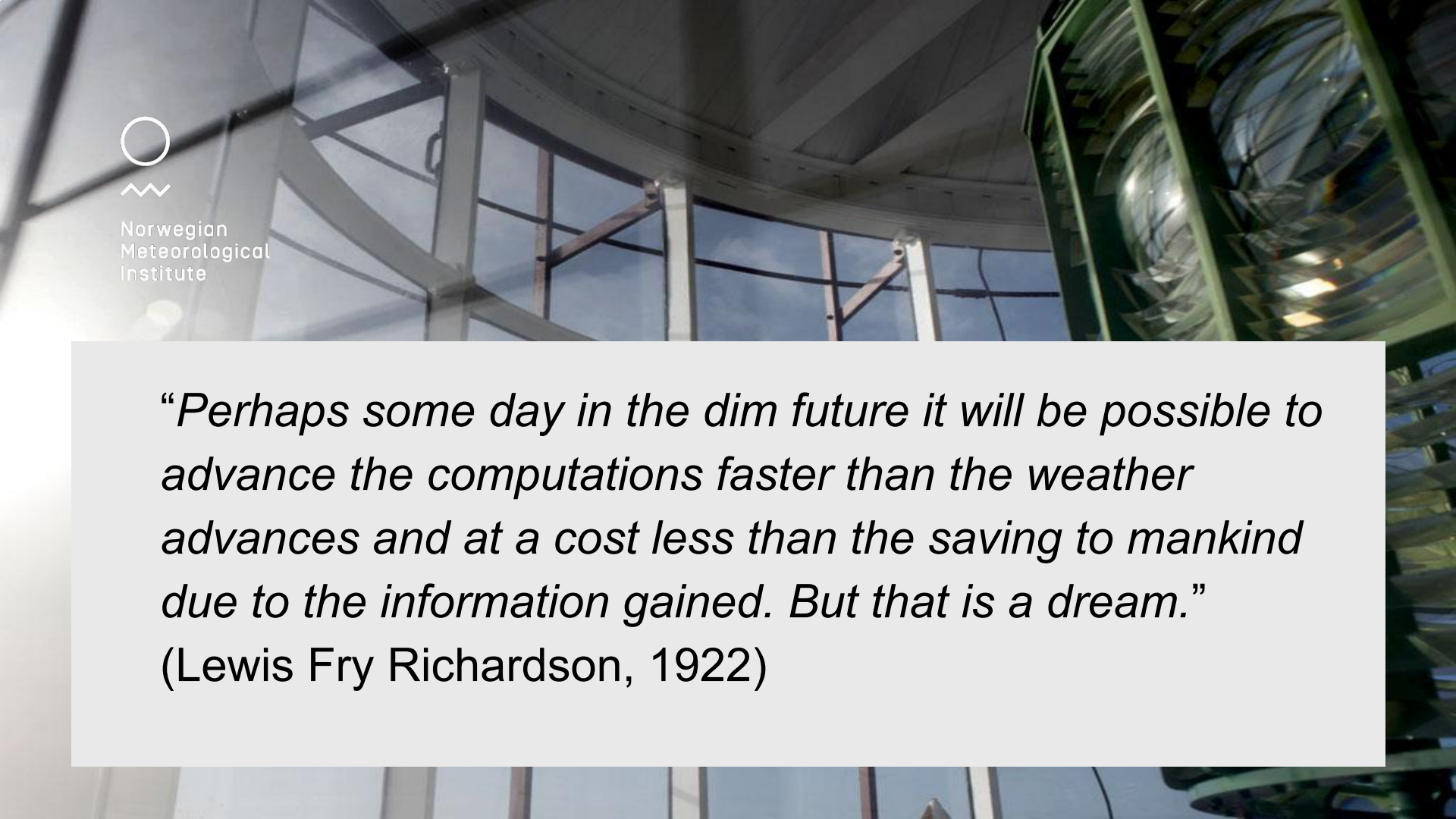

"*Perhaps some day in the dim future it will be possible to advance the computations faster than the weather advances and at a cost less than the saving to mankind due to the information gained. But that is a dream.*"
(Lewis Fry Richardson, 1922)

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