FINNISH METEOROLOGICAL INSTITUTE

Users' perspectives on climate data

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2nd User Workshop of the UERRA regional reanalysis project
Tarragona, Spain, 30 November 2017

Outline

- Users' needs regarding reanalysis data
- Examples of applications of reanalysis data
- Summary

Core Climax
European Commission
Copernicus Europe's eyes on Earth
Climate Change Service
ACADEMY OF FINLAND
SAFIR2018

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Core Climax

European Commission

http://www.coreclimax.eu/

In FP7 CORE-CLIMAX* we conducted a worldwide survey of user needs regarding reanalyses

- > 2500 respondents
- 91% of the respondents used ECMWF reanalyses; but also NCEP, NASA, JMA, etc.
- => information about obstacles that may hinder the use of reanalyses
- (Also opinions regarding climate service tasks and activities)

* COordinating Earth observation data validation for RE-analysis for CLIMAte ServiceS (2013-2015)

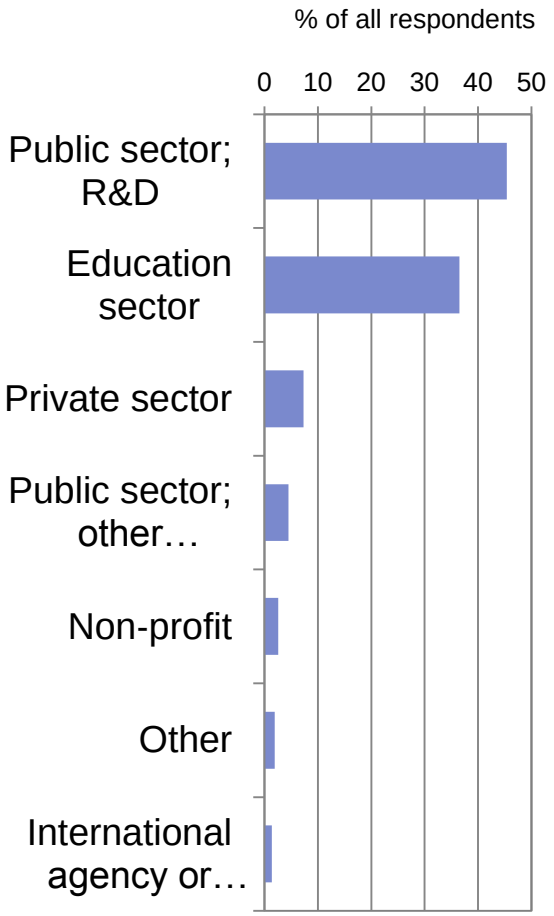
DWD

ECMWF

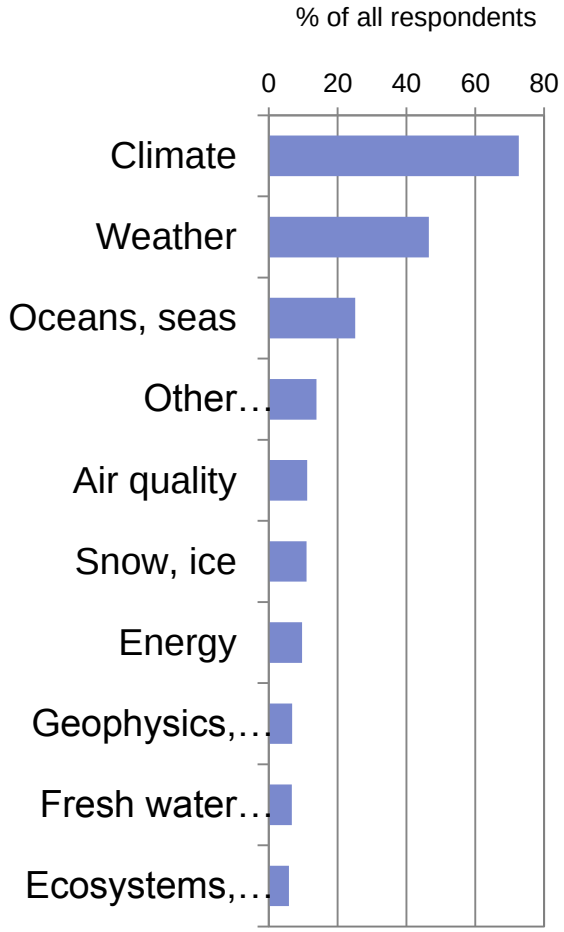
Gregow et al. (2016) doi:10.1175/BAMS-D-14-00271.1

Background of the respondents

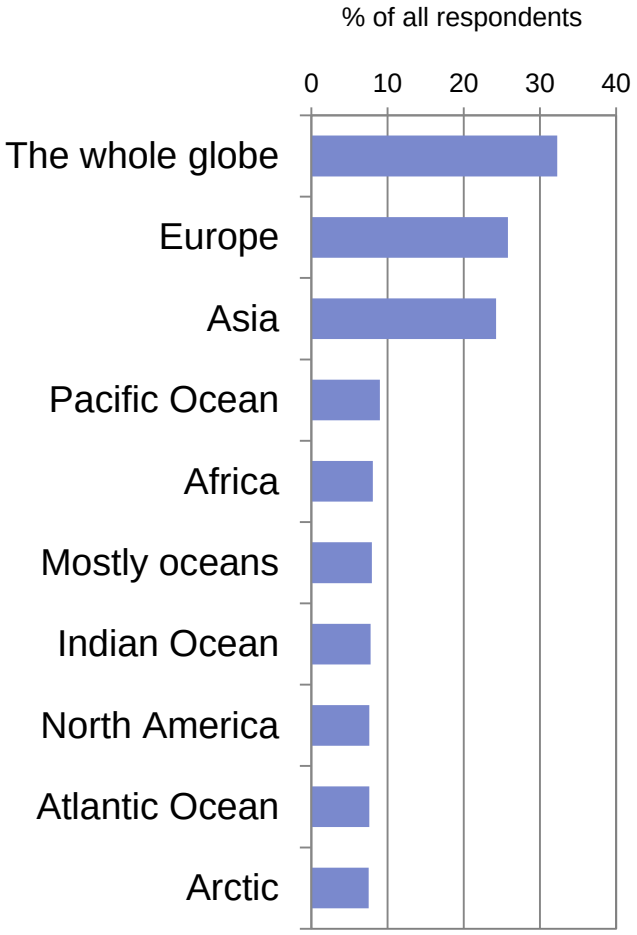
Sector of work



Field or subject of work TOP10



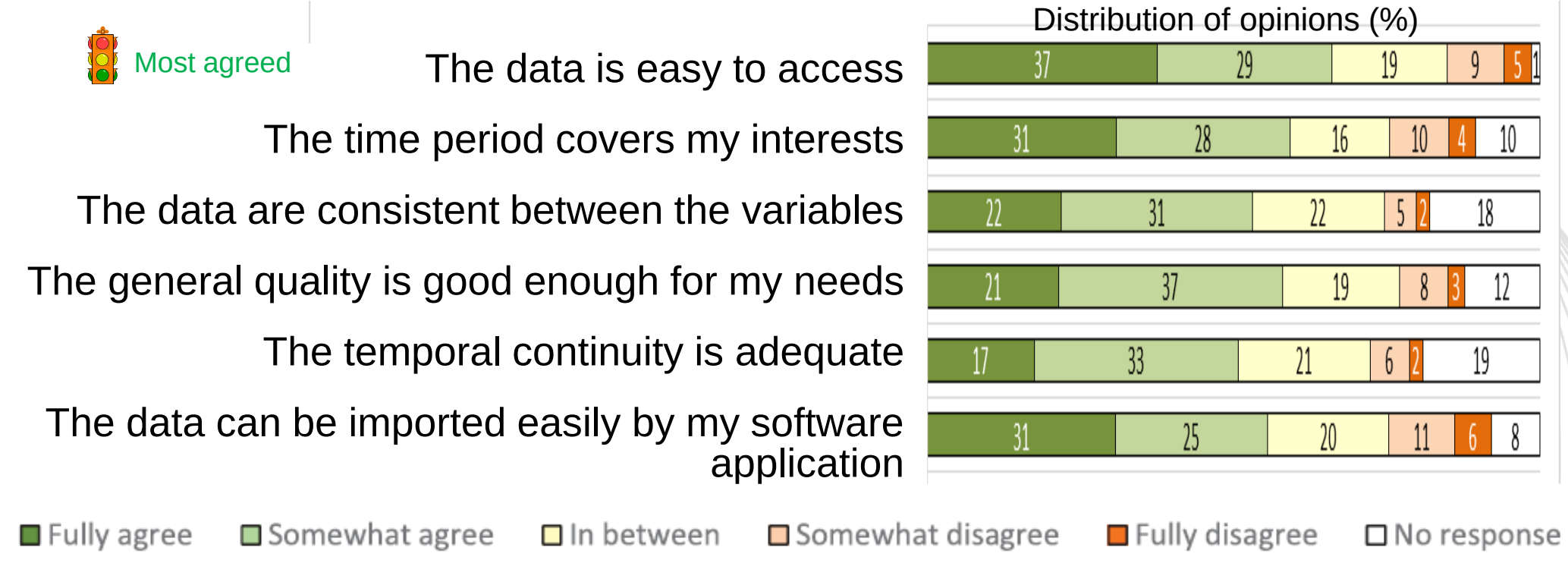
Regional focus of work TOP10



Opinions of the respondents regarding the characteristics of reanalysis data

- Altogether 23 statements
- Six statements that were most **strongly agreed** with:

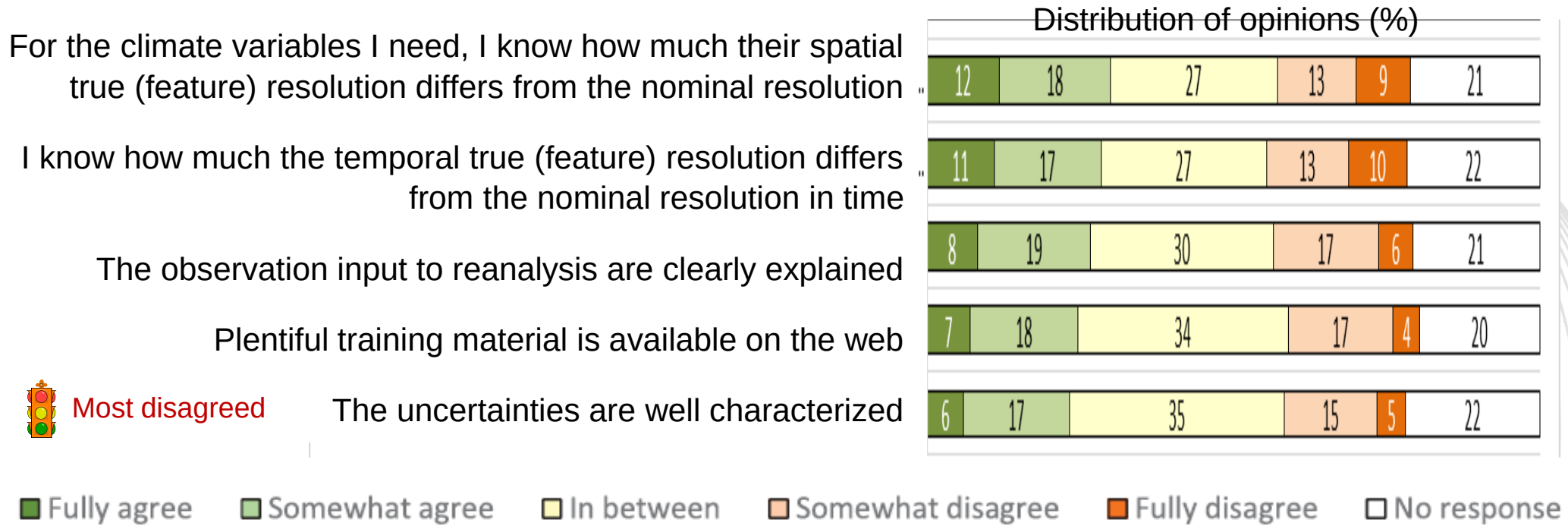
Most agreed



Gregow et al. (2016) doi:10.1175/BAMS-D-14-00271.1

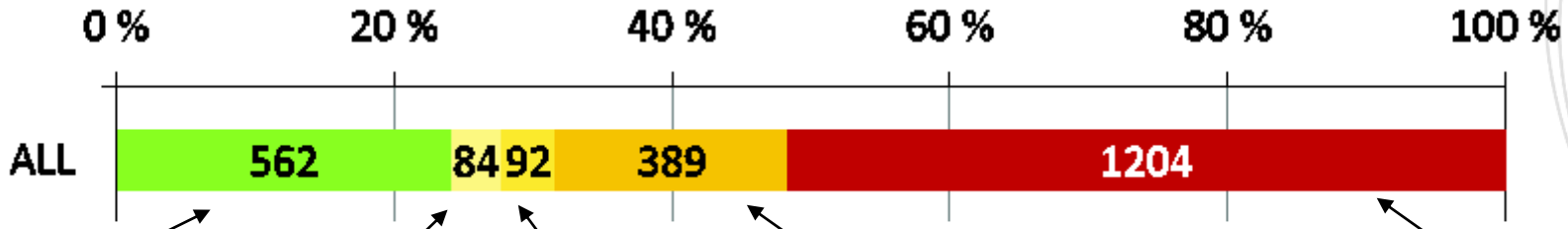
Opinions of the respondents regarding the characteristics of reanalysis data

- Altogether 23 statements
- Five statements that were most **weakly agreed** with:



Gregow et al. (2016) doi:10.1175/BAMS-D-14-00271.1

Rather low use of reanalysis input observations and feedback data



24%: I have used it to …

4%: I could not find it

17%: I have had no time or resources or interest to look into it

52%: I don't know what it is about

4%: I have not used it because …

- assess the reanalysis data using observations as a reference
- as above but the other way around
- merge the observations and reanalysis data together to create an improved product
- understand how the observations had been used by reanalysis

- the data files are too big
- the data formats are too complicated
- **there is no easy interface to get these data**

Gregow et al. (2015) doi:10.5194/asr-12-63-2015

The CORE-CLIMAX survey of user needs regarding reanalyses

The expressed desire for reanalysis development covered:

i. training and online plotting tools
ii. more frequent updates
iii. explanations about uncertainties
iv. smaller biases
v. less restrictive data policy
vi. higher temporal and spatial resolution

- Distribution of agreement in regard to propositions about characteristics of reanalysis data.
- Free form comments concerning use of reanalyses.

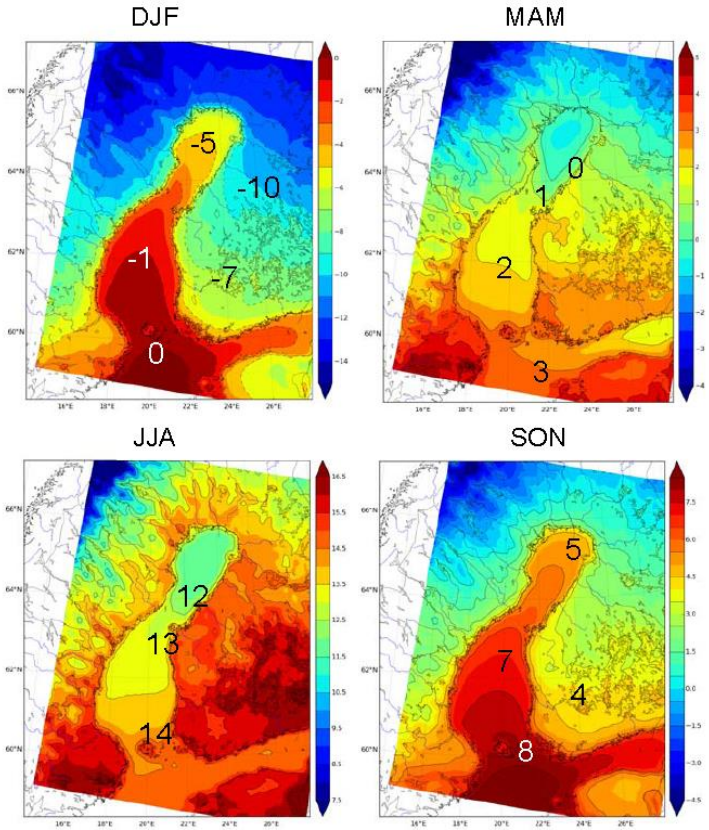
Gregow et al. (2016) doi:10.1175/BAMS-D-14-00271.1

Examples of applications of reanalysis data

- Climate change assessments for Finland & the Gulf of Bothnia
- Estimates of freezing rain climatology over Europe
- Verification of six-week forecast products with reanalysis data
- Risk of large-scale fires in boreal forests of Finland under changing climate
- Decadal storm damage assessment studies
- Number of melt days in Greenland

Topic: Climate change assessments for i) Finland
ii) the Gulf of Bothnia (a part of the Baltic Sea)

Use of reanalysis: Long-term climatology and trends (mean, variability, indices)



Sea-land differences in the seasonal mean temperatures (℃) in 1961-2015 (based on UERRA)

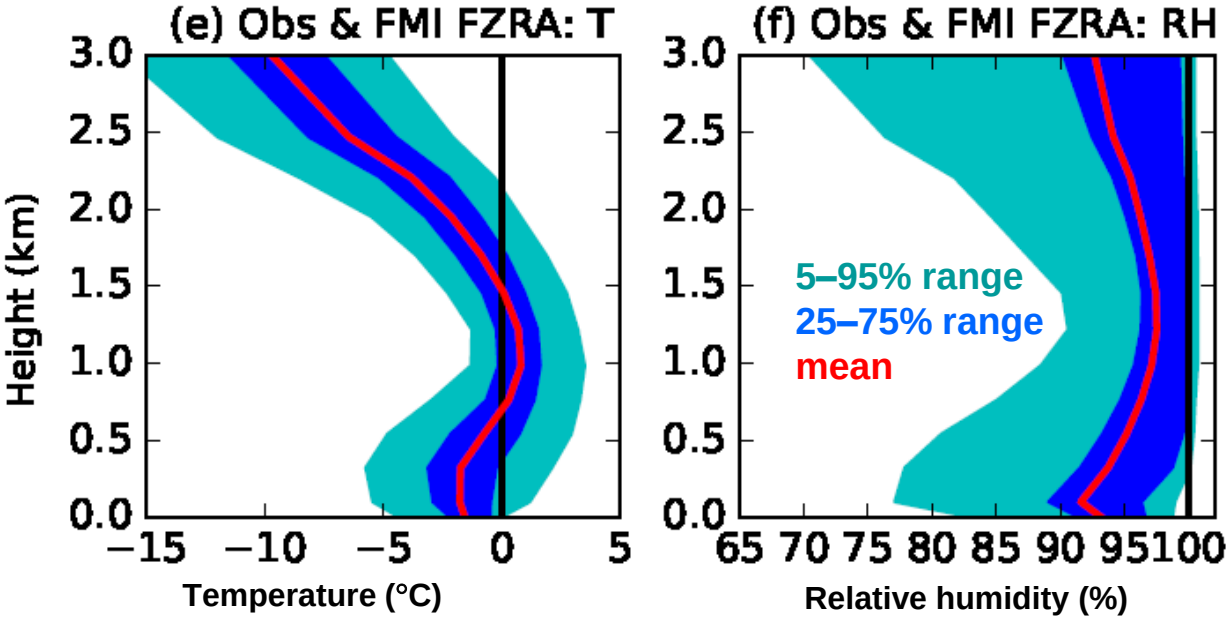
Beneficial in reanalysis data:

- Data over the sea areas
- Spatial continuity across the whole study region
- Data is consistent between variables
- The data cover a time period that is long enough for climatological considerations

Thanks to Semjon Schimanke, SMHI (7 July 2017)

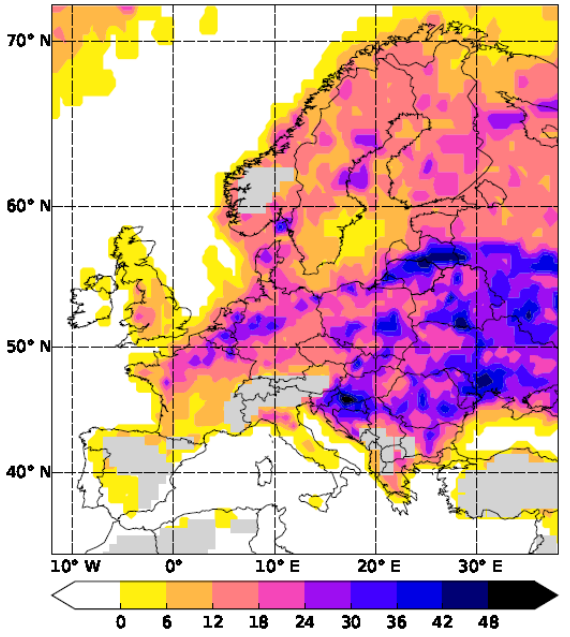
Topic: Estimates of freezing rain climatology over Europe

Use of reanalysis: Identification algorithm (FMI_{CLIM}) of freezing rain needs precipitation and vertical profiles of air temperature and relative humidity



ERA-Interim profiles at weather station locations for those 6-hour intervals when both the FMI_{CLIM} algorithm and synop observations indicated freezing rain (2300 events).

Maximum duration (h) of events in the 1979–2014 study period



Beneficial in reanalysis data:

- ❖ Sub-daily 3D variables

Kämäräinen et al. (2017) doi:10.5194/nhess-17-243-2017

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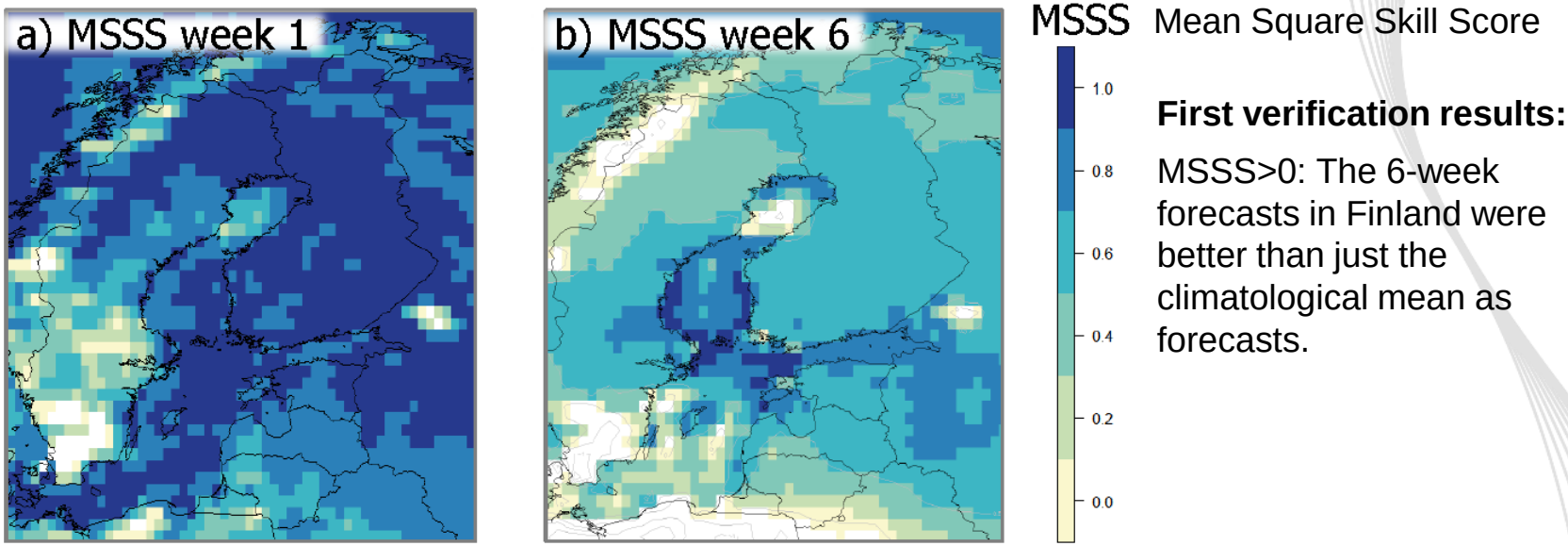
CLIPS project (CLImate services supporting Public activities and Safety
clips.fmi.fi/?lang=en

Topic: Developing seasonal forecast products to support public activities and safety

Use of reanalysis: Verification of six-week forecast products with reanalysis data



Mean Square Skill Score

First verification results:

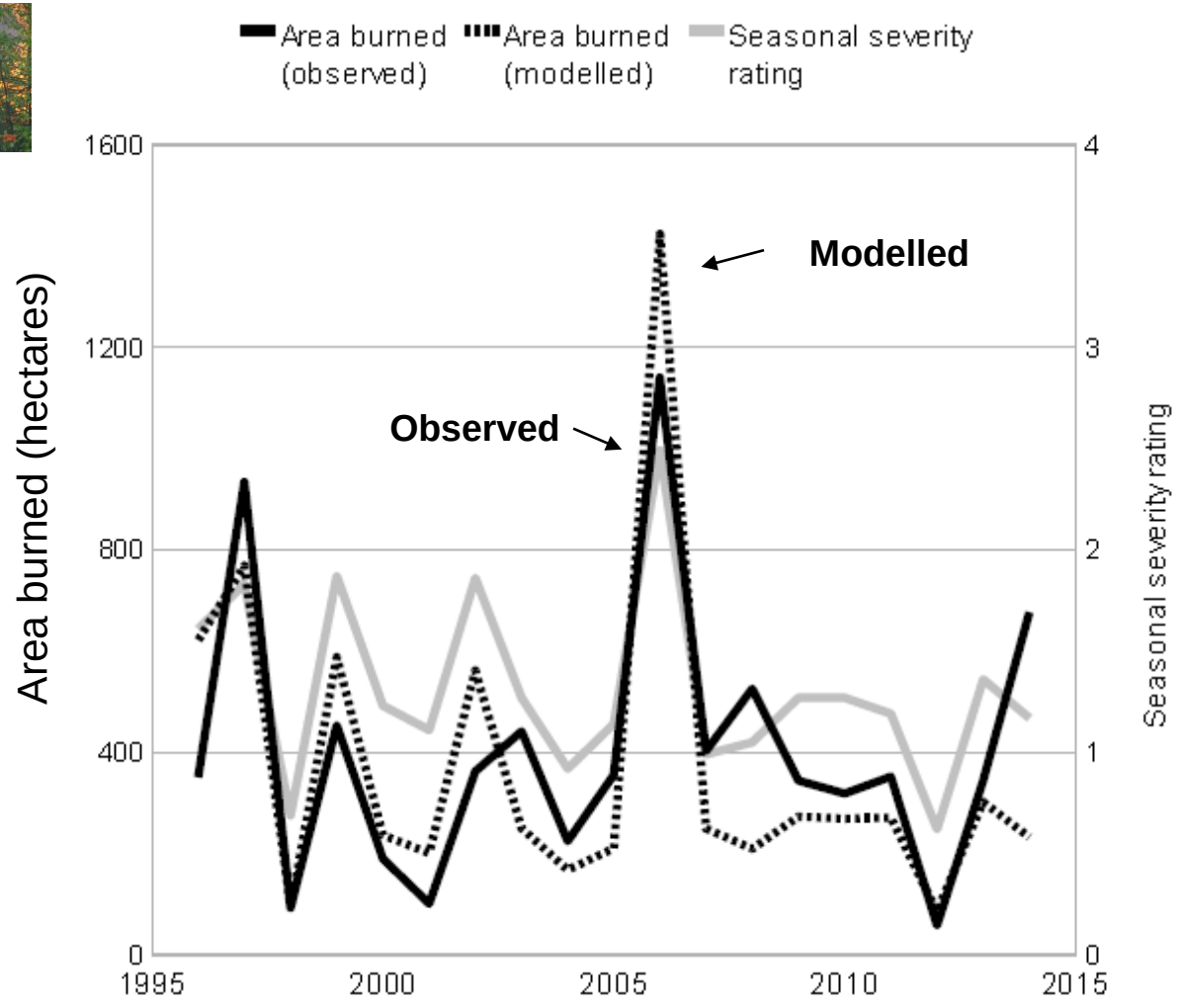
MSSS>0: The 6-week forecasts in Finland were better than just the climatological mean as forecasts.

Performance of 6-week ECMWF ensemble mean forecasts for the weekly mean temperature over Finland in June-July 2017: verification of the forecasts with ERA-Interim (we will use ERA5 when feasible)

To examine the accuracy and usability of the developed products, an essential part of the work is the verification of the forecasts for which the ECMWF reanalysis data plays an important role.

Korhonen N. et al.: Poster in 5th International Conference on Reanalysis (ICR5) in Nov 2017
More information: clips.fmi.fi/?lang=en

Use of reanalysis: Homogenous gridded daily data for wind speed



Area burned in Finland during 1996–2014

Topic: Risk of large-scale fires in boreal forests of Finland under changing climate

↓

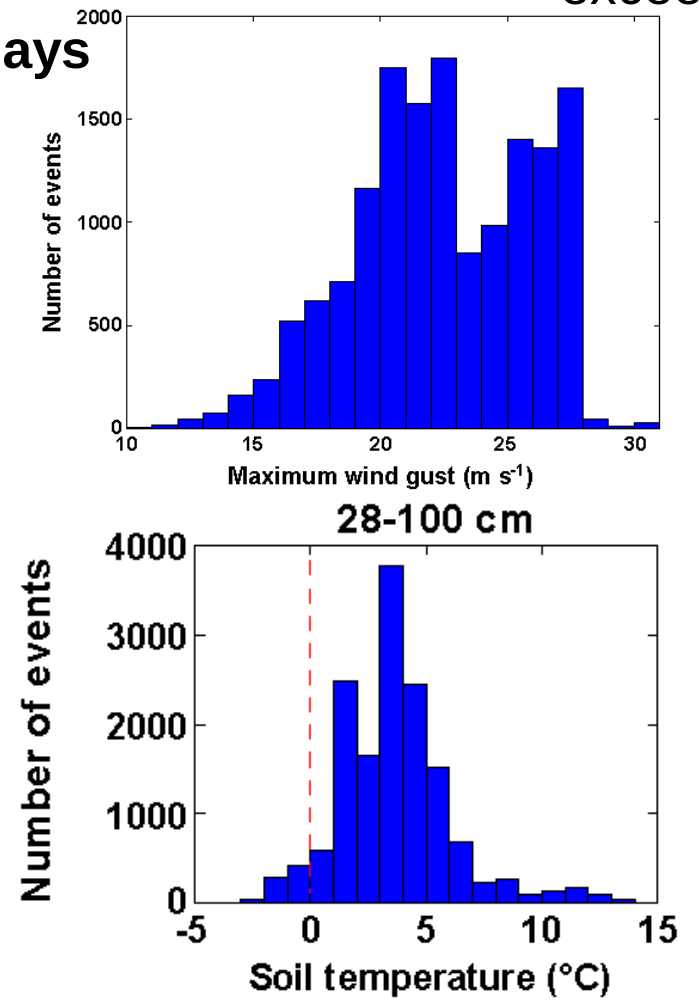
Strong winds enhance the evaporation and drying of the soil and continue to make forest fuels easily flammable.

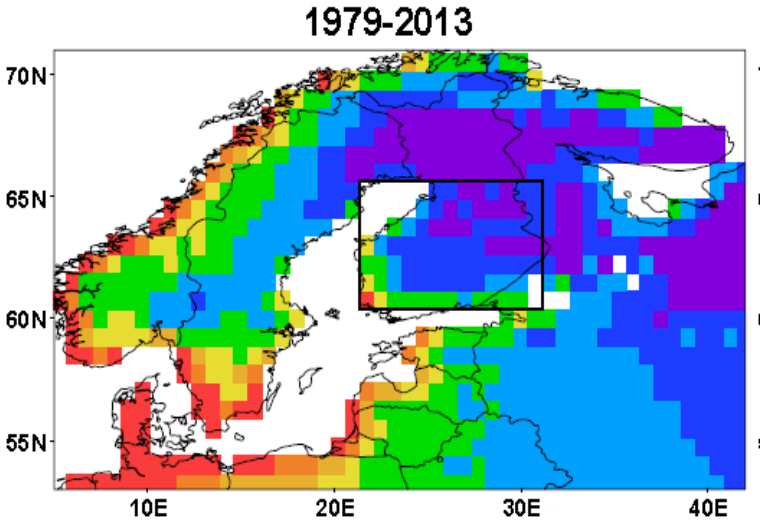
Lehtonen et al. (2016), doi:10.5194/nhess-16-239-2016

Topic: Decadal storm damage assessment studies

Use of reanalysis: wind gusts and soil temperatures from reanalysis
+ Emergency rescue data

=> exceedance thresholds for **potential forest damage days**





Above: Potential forest damage days per year (days when the threshold levels are met or exceeded) in ERA-Interim during 1979–2013

Left: ERA-Interim a) maximum simulated wind gusts and b) soil temperatures in 28-100 cm depth during observed forest damages.

Jokinen et al. (2015), doi:10.5194/asr-12-97-2015

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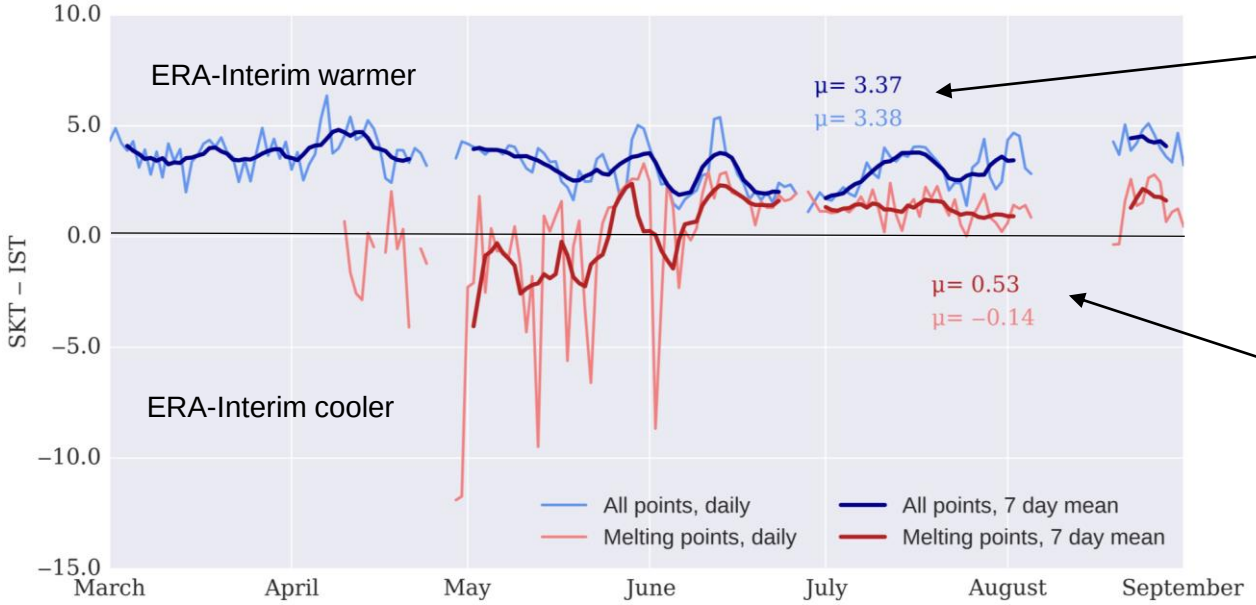
Topic: Effect of weather and climate on the dynamics and thermodynamics of snow and ice in the Polar Regions => Number of melt days in Greenland in 2000-2014

Use of reanalysis: ERA-Interim surface temperature (SKT) instead of MODIS based product on sea ice surface temperature (IST), if the latter is missing (due to clouds)

Difference between ERA-Interim and MODIS surface temperatures on Greenland ice sheet in March-August 2000



- In spring and summer ERA-Interim surface temperature is on average higher than MODIS ice surface temperature
- Bias between ERA-Interim SKT and MODIS IST is smallest when the surface temperature is close to the melting point

Upcoming: Välisuo, I., Vihma, T., Pirazzini, R., and Schäfer M.: *Seasonal scale interannual variability of atmospheric conditions and surface melt in Greenland in 2000-2014.*

Välisuo et al.: poster in the 5th International Conference on Reanalysis (ICR5) in 2017

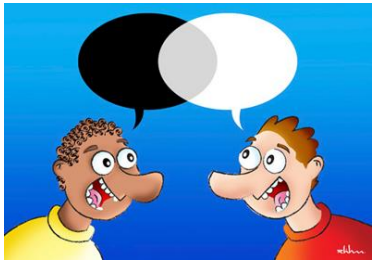
Summary

- Many advantages in reanalysis data
- Information on the **quality** of the reanalysis data
  (e.g. uncertainty, limitations, performance compared to observations)
  plays an important role in users' works

- A wish list:
  - training and online plotting tools
  - more frequent updates
  - explanations about uncertainties
  - smaller biases
  - less restrictive data policy
  - higher temporal and spatial resolution

- A variety of applications of reanalysis data exits

  ….. could be further added



- Important to have close collaboration with potential users and stakeholders: wishes and requirements of users vary

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More information:

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- Gregow H., K. Jylhä, H. M. Mäkelä, J. Aalto, T. Manninen, P. Karlsson, A.K. Kaiser-Weiss, F. Kaspar, P. Poli, D.G.H. Tan, A. Obregon; Z. Suet, 2016. Worldwide survey of awareness and needs concerning reanalyses, and respondents views on climate services. Bull. Amer. Meteor. Soc., 97, 1461–1473. doi:10.1175/BAMS-D-14-00271.1

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- Kämäräinen, M., Hyvärinen, O., Jylhä, K., Vajda, A., Neiglick, S., Nuottokari, J., and Gregow, H.: A method to estimate freezing rain climatology from ERA-Interim reanalysis over Europe, Nat. Hazards Earth Syst. Sci., 17, 243-259, doi:10.5194/nhess-17-243-2017, 2017.

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- Reanalysis User and Application Survey. http://www.coreclimax.eu/sites/coreclimax.itc.nl/files/documents/Deliverables/WP_Reports/Deliverable-D552-CORECLIMAX.pdf

- Välisuo et al., 2017: Number of melt days in Greenland in 2000-2014. Poster in the 5th International Conference on Reanalysis (ICR5) 13.-17.11.2017

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Thank you for listening!

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