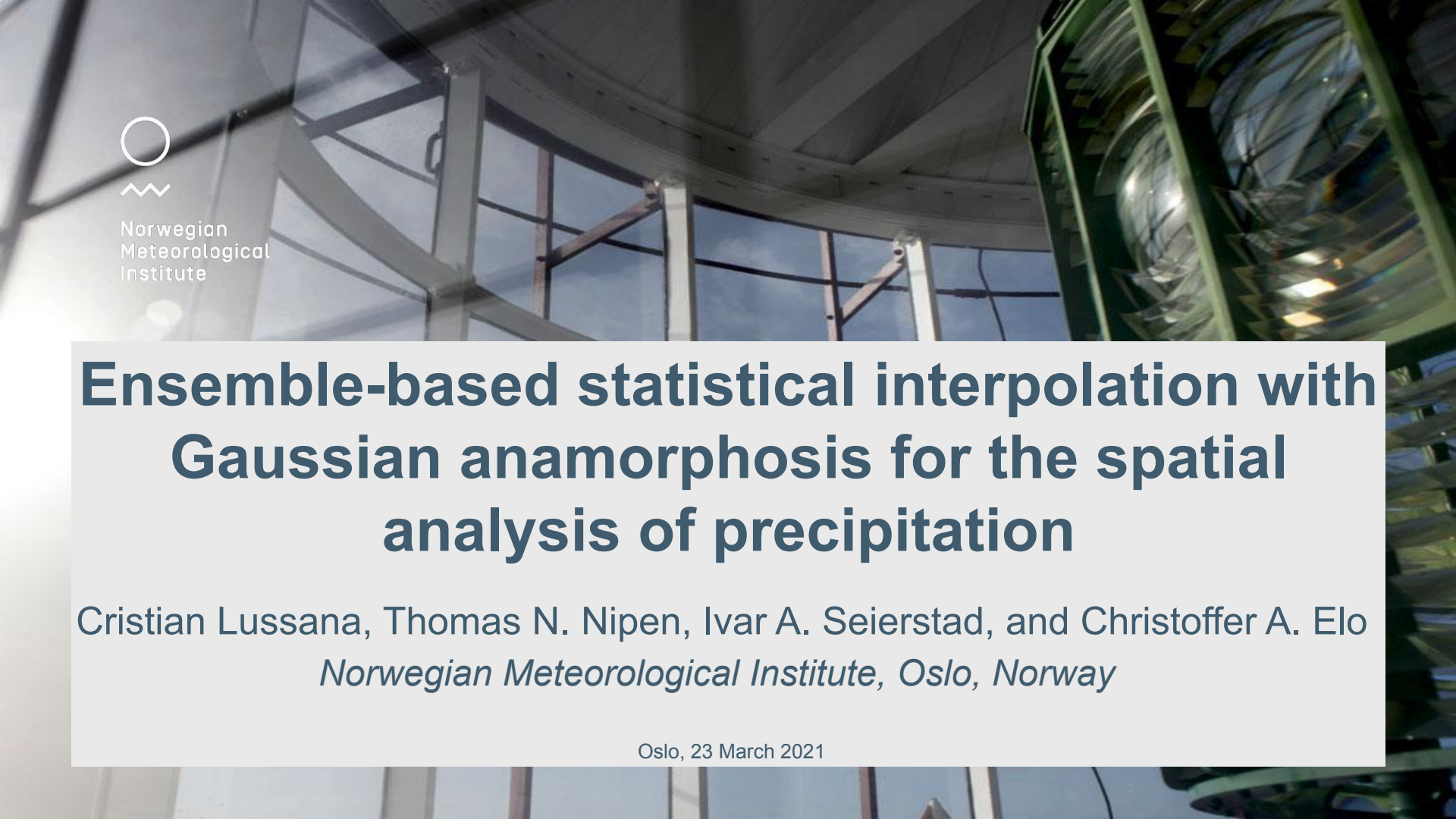


Norwegian Meteorological Institute

Ensemble-based statistical interpolation with Gaussian anamorphosis for the spatial analysis of precipitation

Cristian Lussana, Thomas N. Nipen, Ivar A. Seierstad, and Christoffer A. Elo

Norwegian Meteorological Institute, Oslo, Norway

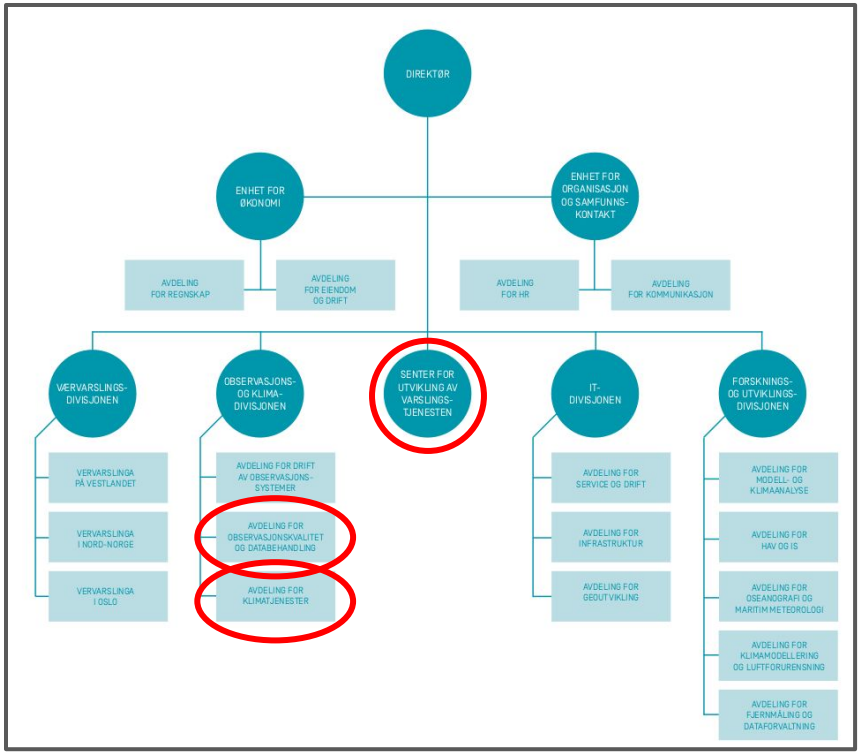
Oslo, 23 March 2021

Five Ws of journalism

… Which are actually six …

Who?

Cristian, Thomas, Ivar and Christoffer



Collaboration within researchers working at:

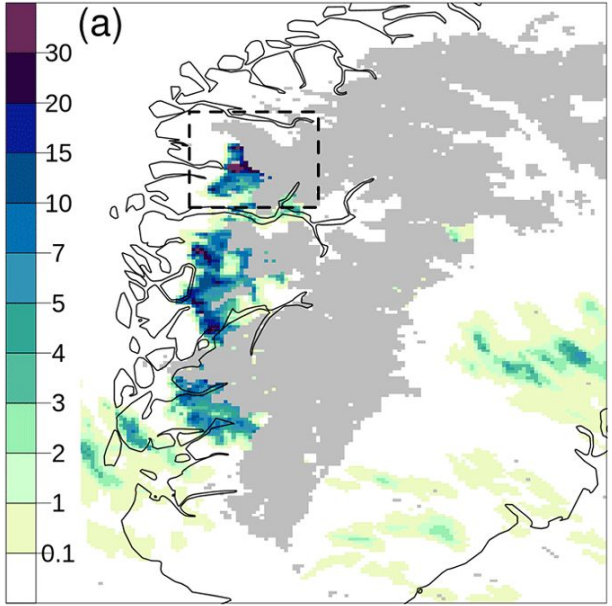
- *Klimatjenester*
  - Production of gridded datasets for the past by combining different data sources
- *SUV*
  - Post-processing of numerical models
  - Production of automatic weather forecast
- *Avdeling for observasjonkvalitet og databehandling*
  - Weather radar research and development

What?

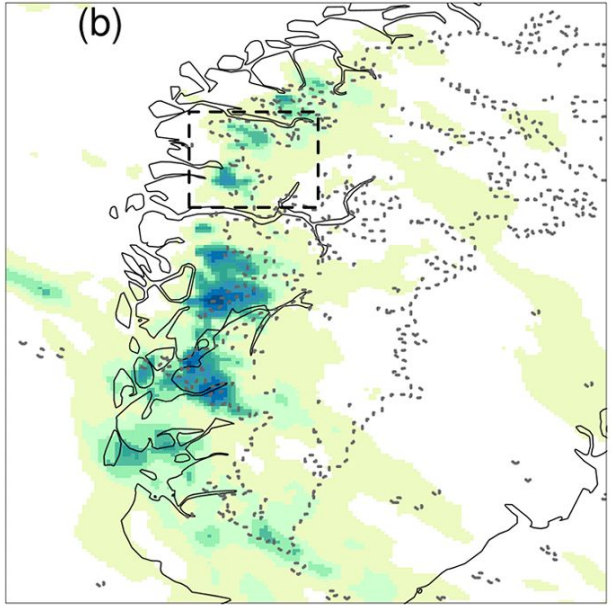
25-2019: Solfrid Agersten, Anne Solveig Håvelsrud Andersen, Anniken Celine Berger, Anita Verpe Dyrrdal, Morten Køltzow, Ketil Tunheim, med bidrag fra Laila Sidselrud, Thomas Nipen, Lars Grinde med flere.
Intense byger med store konsekvenser i Sogn og Fjordane 30. juli 2019

EnSI-GAP: a **method** for statistical interpolation of hourly precipitation

2019-07-30 15:00 UTC. Radar & insitu

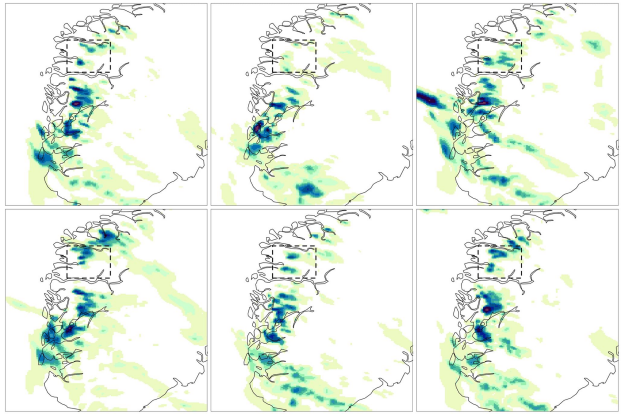


MEPS ensemble mean



Input

MEPS ensemble members

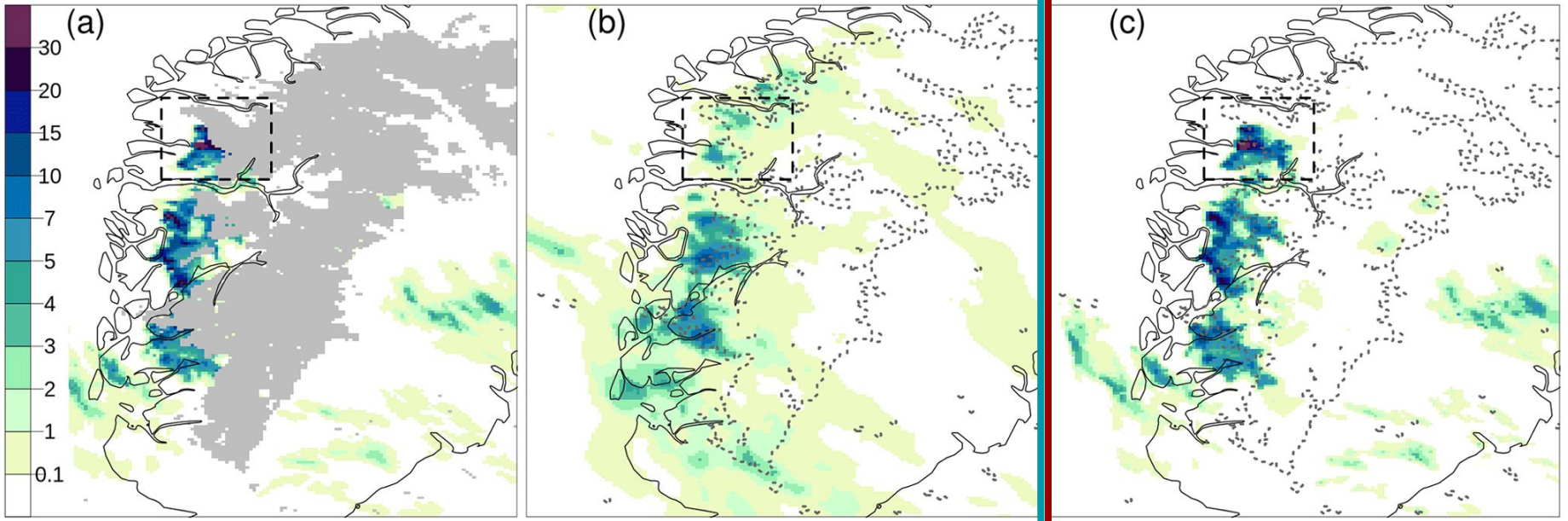


What?

EnSI-GAP: **MET Nordic analysis** is the final product

2019-07-30 15:00 UTC. Radar & insitu **Input** MEPS ensemble mean

Output



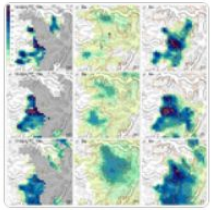
When? Where?

Developed within RadPro 2019-2020. Published in 2021.

Nonlin. Processes Geophys., 28, 61–91, 2021
https://doi.org/10.5194/npg-28-61-2021

Research article

22 Jan 2021



Ensemble-based statistical interpolation with Gaussian anamorphosis for the spatial analysis of precipitation

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Norwegian Meteorological Institute, Oslo, Norway

Correspondence: Cristian Lussana (cristianl@met.no)

Received: 10 Jun 2020 – Discussion started: 19 Jun 2020 – Revised: 10 Nov 2020 – Accepted: 27 Nov 2020 – Published: 22 Jan 2021

Nonlinear Processes in Geophysics

EGU publication

- Open access
- Interactive public peer review

Review statement. This paper was edited by Alberto Carrassi and reviewed by two anonymous referees.

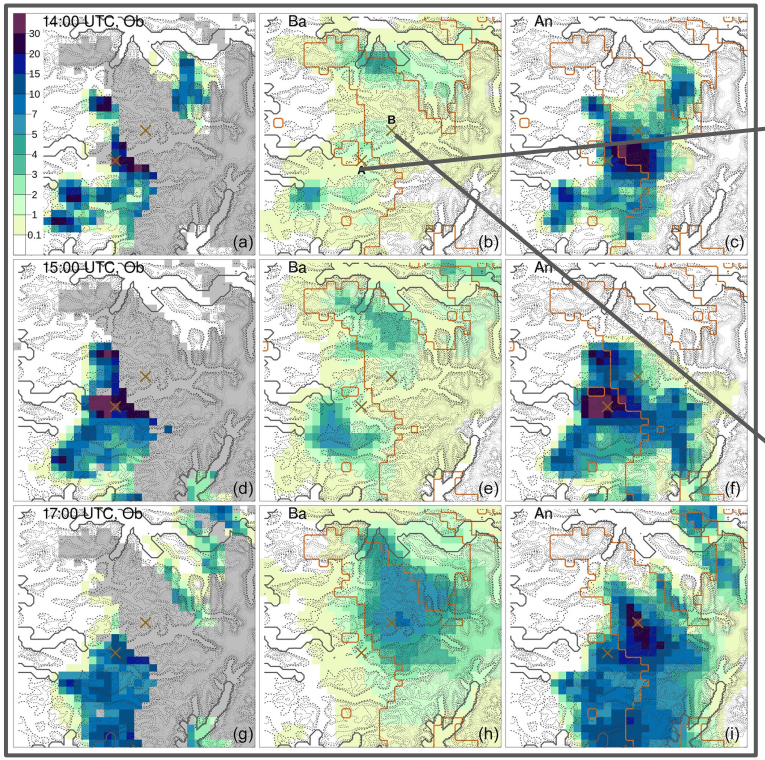
Executive Editor: Stephane Vannitsem

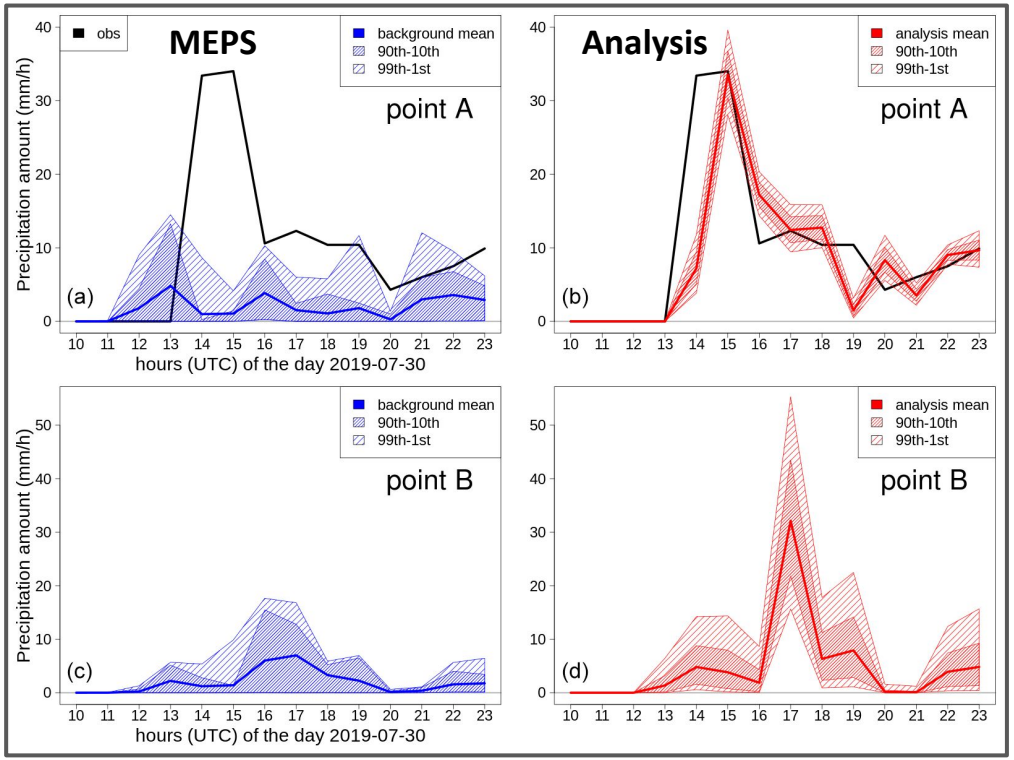
Why?

Combine the advantages of different sources and mitigate their limitations

- Fill-in the gaps in observations
- Improve accuracy of precipitation fields

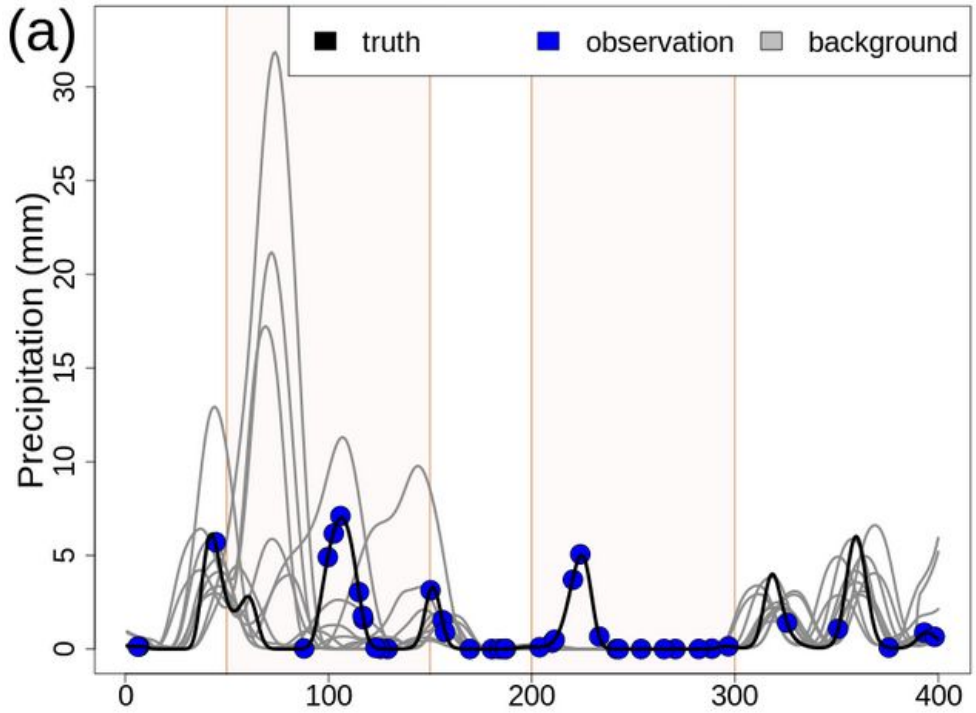
Observations **MEPS** **Analysis**





How?

- Algorithm is given in the paper using pseudo-code language
- 1D example



Begin

At each point, precipitation follows a Gamma distribution

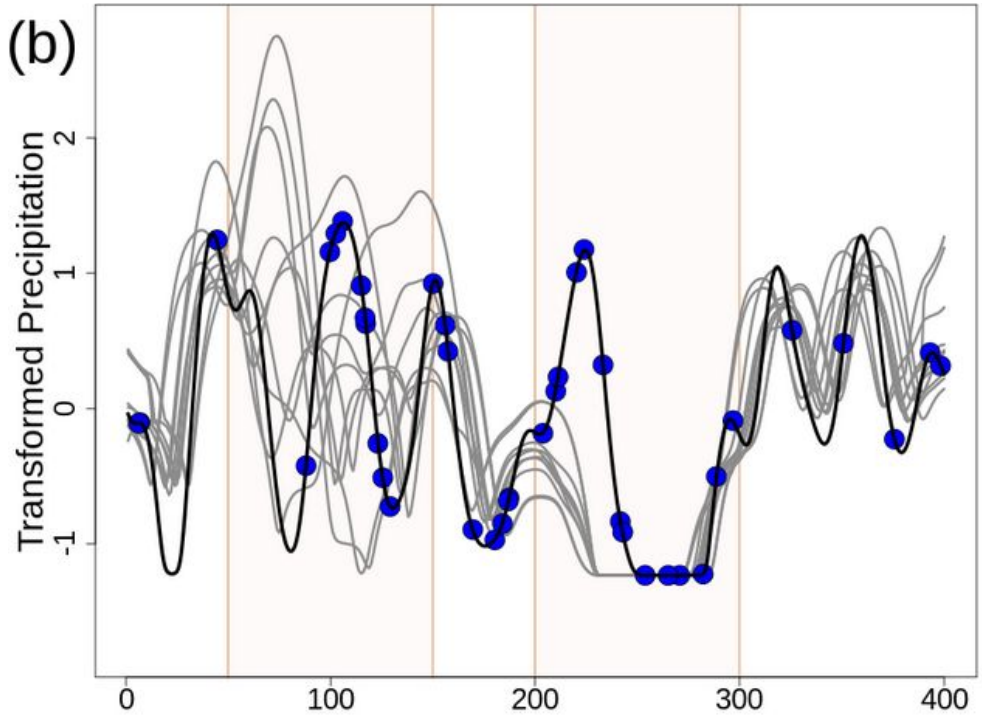
RR = Gamma(shape, rate)

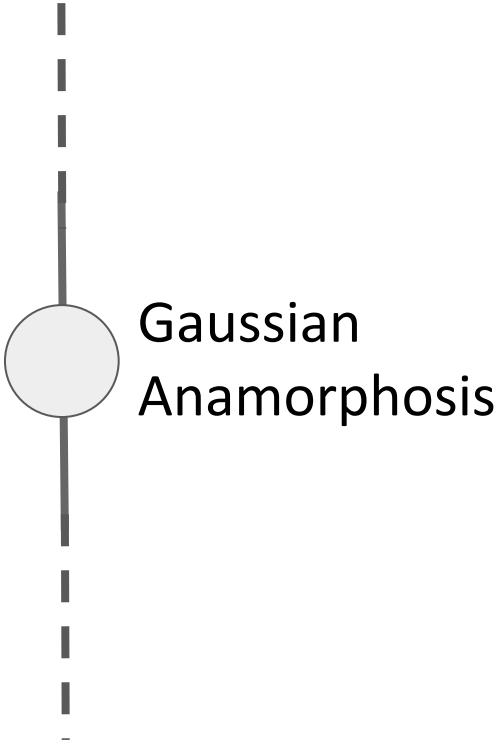
? = find the values of shape and rate

----> obtain the precip statistics needed for the application (mean, 99th percentile, …)

How?

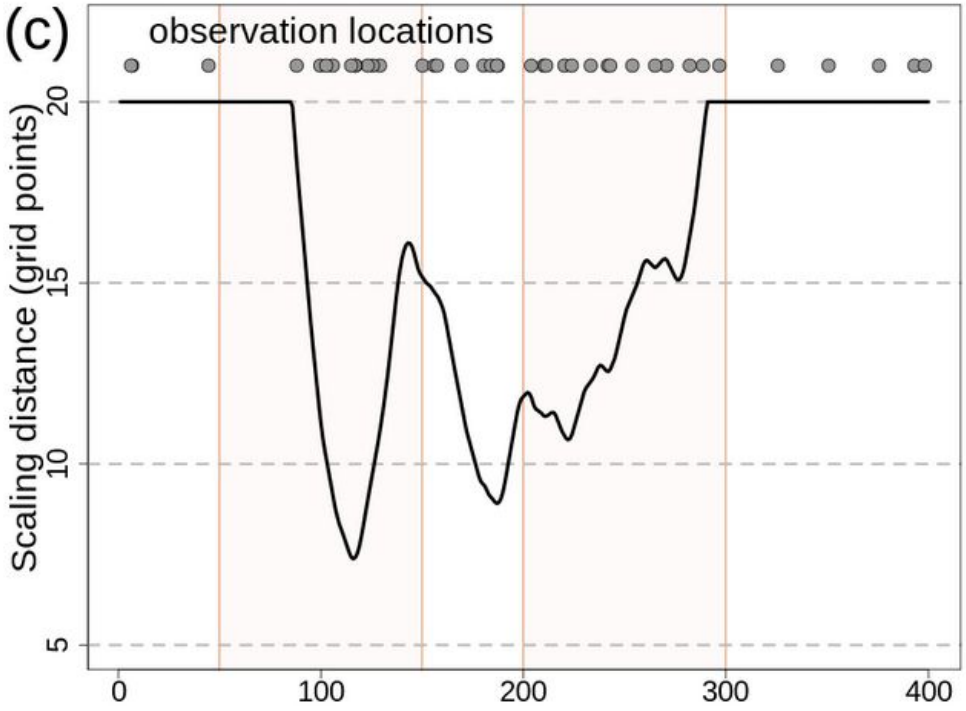
- Step 1: Data Transformation
  - Statistical interpolation works better for “Gaussian” variables





How?

- Step 2: Prepare for statistical interpolation
  - Resolution changes with the observation density

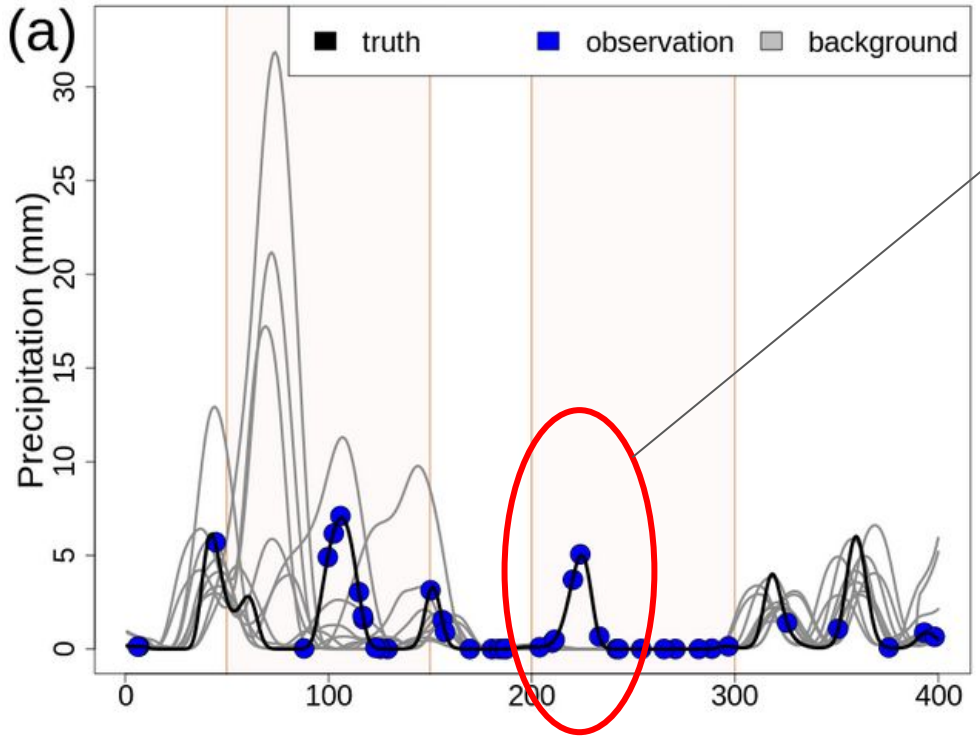


More observations = more details in the field

How?

- Step N: Statistical interpolation & Inverse Data Transform
  - For each point returns Gamma distribution parameters

End

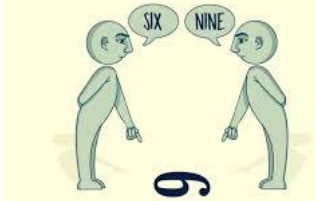


Ensemble says
- No-rain, definitely

Observations say
- It's raining

Statistical Interpolation based on weather-dependent interpolation methods
- can fail in this case

Rashomon effect



Solution:

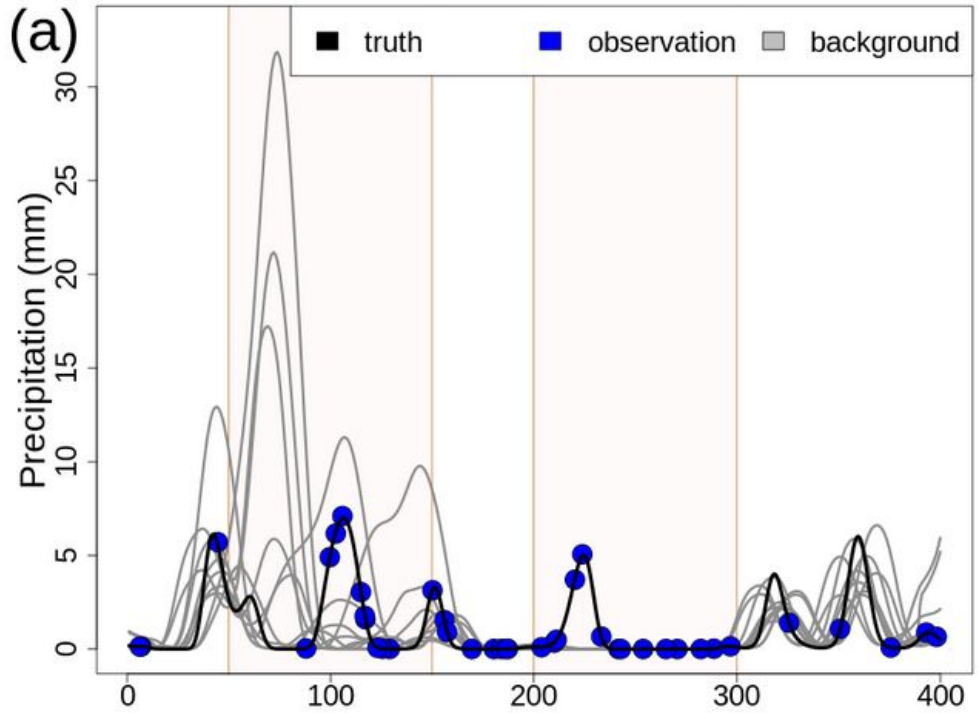
$$\overset{i}{\mathbf{P}}^{\mathrm{b}} = \overset{i}{\mathbf{\Gamma}} \circ \mathbf{P}^{\mathrm{f}} + \overset{i}{\sigma}_u^2 \overset{i}{\mathbf{\Gamma}}^{\mathrm{u}}.$$

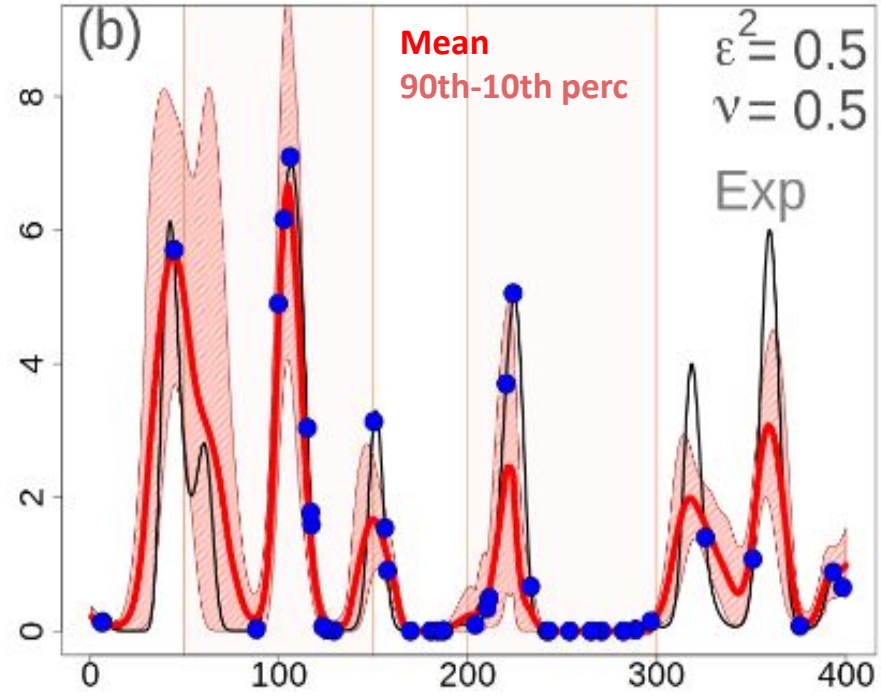
Hybrid specification of the error covariance matrix.
- Partly, EnKF
- Partly, OI

How?

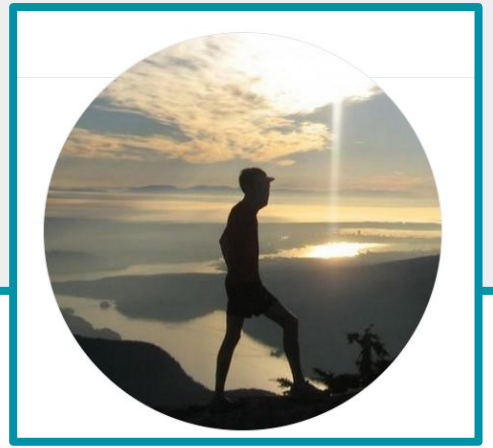
- Step N: Statistical interpolation & Inverse Data Transform
  - For each point returns Gamma distribution parameters

End





Now?



Implement EnSI-GAP in GridPP

Gridded post-processor

"Latest release" C/C++ CI passing

Gridpp a is post-processing tool for gridded weather forecasts. It consists of a **library** of commonly-used methods and a **command-line tool** that applies these methods to forecast fields in NetCDF files.

Gridpp is written in C++ but offers python bindings to the functions in the library. The tool is used at MET Norway to produce operational weather forecasts for Yr (https://www.yr.no).

Gridpp is currently under active development and the current version is a prototype for testing. Feedback is welcome, either by using the issue tracker in Github, or by contacting Thomas Nipen (thomasn@met.no).

Environments 1

github-pages Active

Languages

C++ 80.6% **Python** 8.3%
C 7.6% **CMake** 1.8%
SWIG 1.7%