Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Home Affairs FDHA
Federal Office of Meteorology and Climatology MeteoSwiss

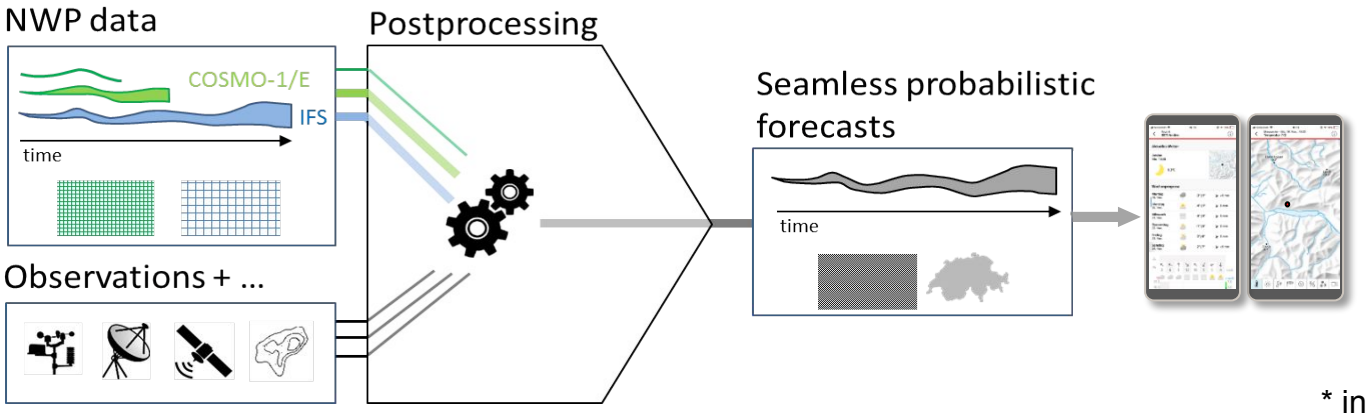
Multi-resolution postprocessing for precipitation

Jonas Bhend, Christoph Spirig, Jan Rajczak, Lionel Moret, Mark A. Liniger

Motivation

Christoph Spirig et al: EMS2022-377

Goal: probabilistic, seamless, **hourly** precipitation forecasts everywhere*



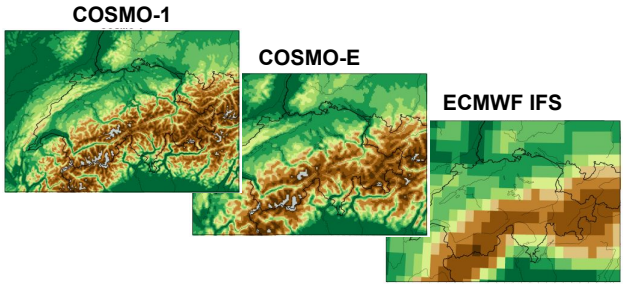
* in Switzerland

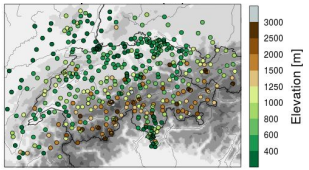
Method

Global Ensemble Model Output Statistics (gEMOS)

- Predictors:
  - Multiple NWP inputs from COSMO (hires) and ECMWF IFS (coarse)
  - Topographic predictors derived from DEM
- Left-censored logistic distribution
- Lead-time by lead-time

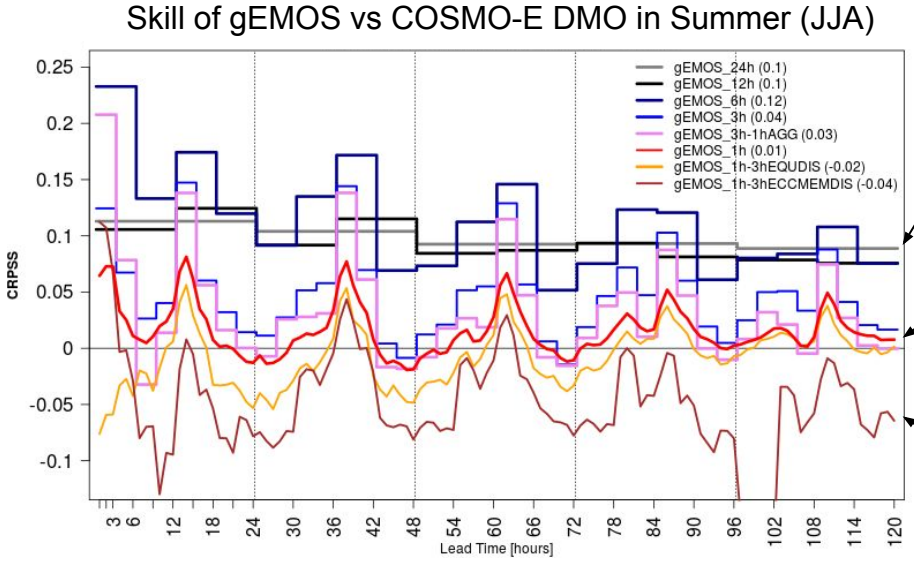
- Training with observations from ~ 700 stations





Jan Rajczak

What strategy should we pursue?



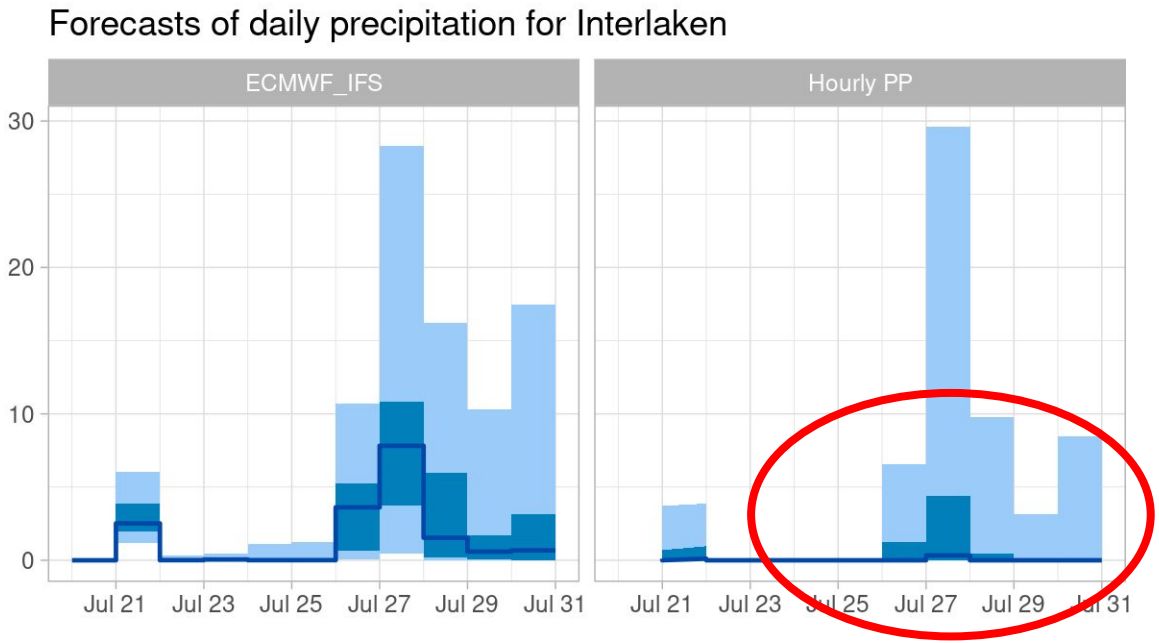
Postprocessing on daily and sub-daily aggregations

Postprocessing directly on hourly values

Disaggregated values from postprocessing on 3-hourly averages

Jan Rajczak

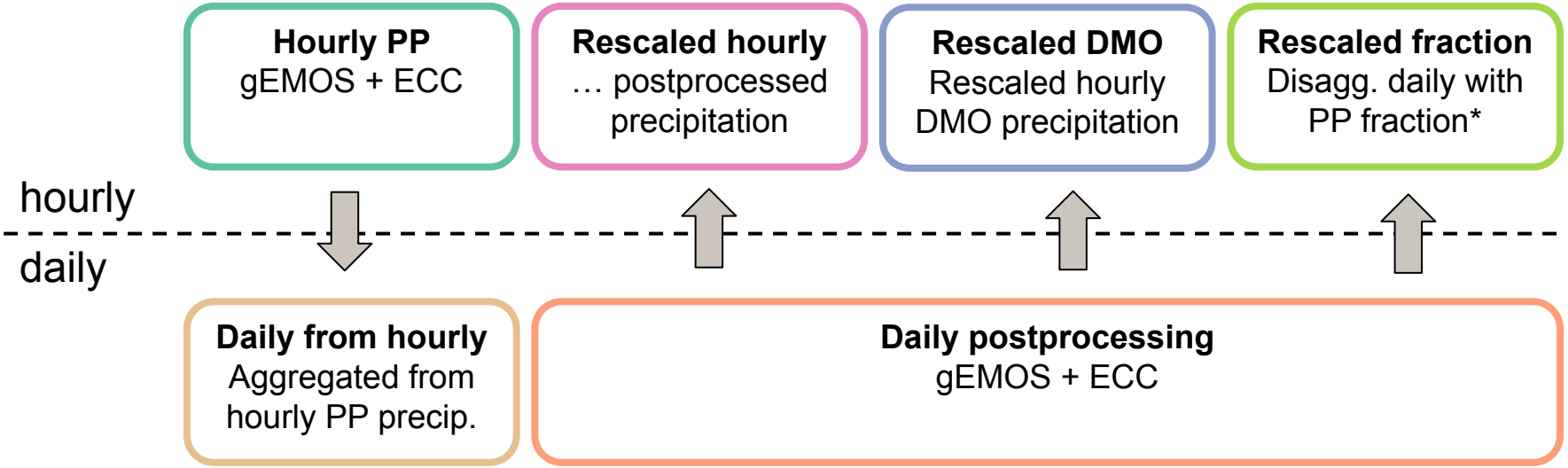
Hourly postprocessing works, but …



… we are losing precipitation

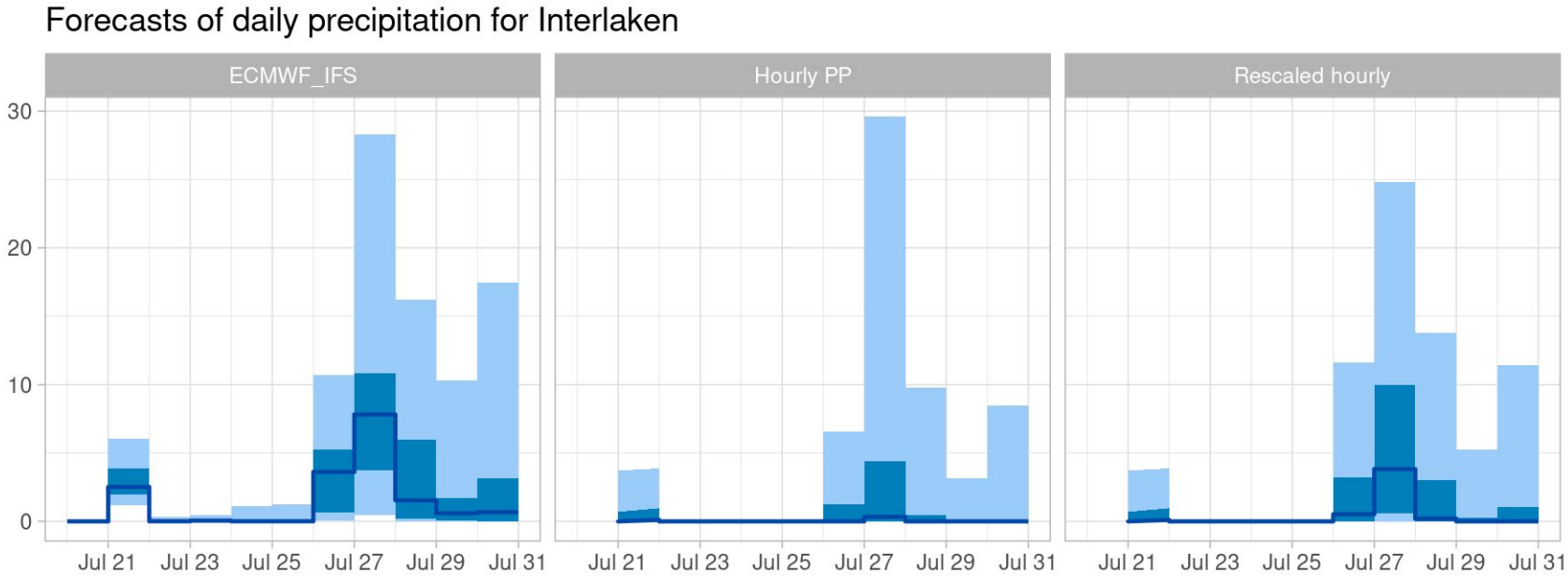
Alternative approaches

based on univariate gEMOS

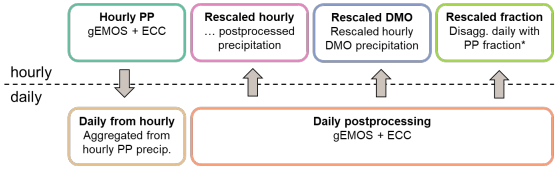


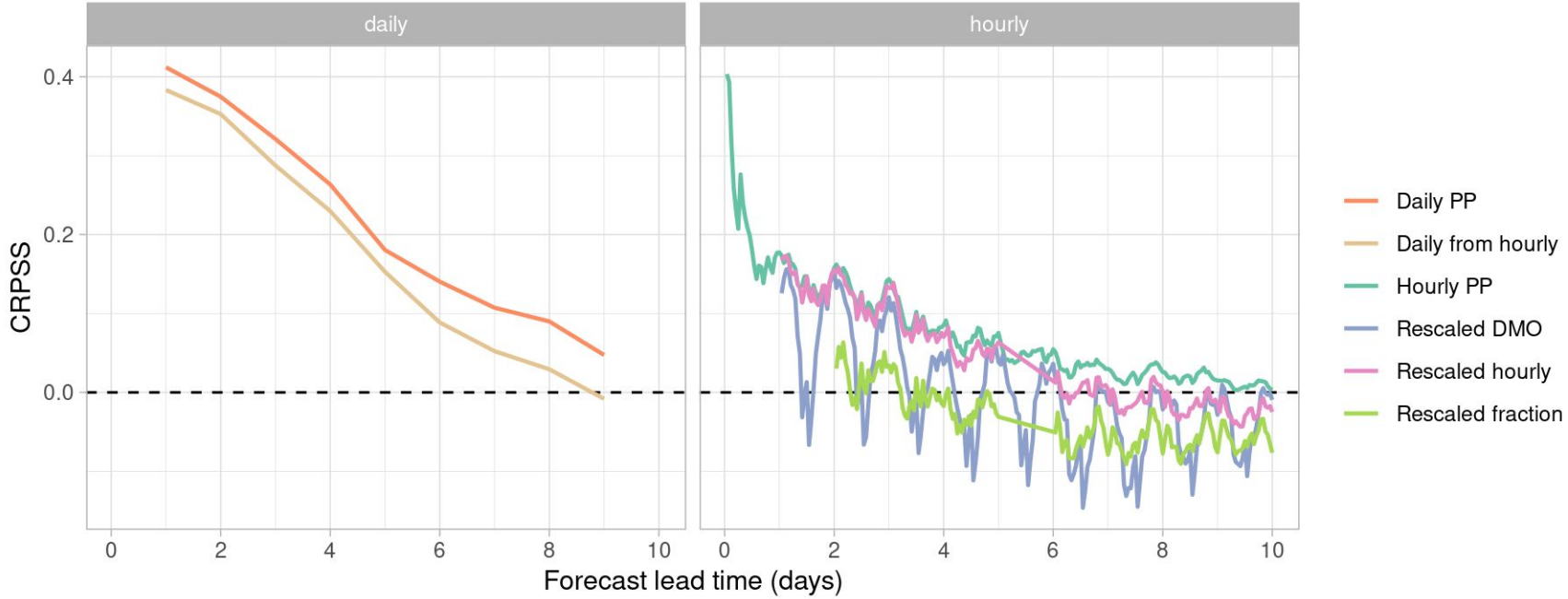
* see slide in appendix

Hourly postprocessing works, but …

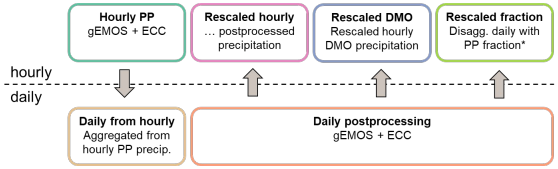


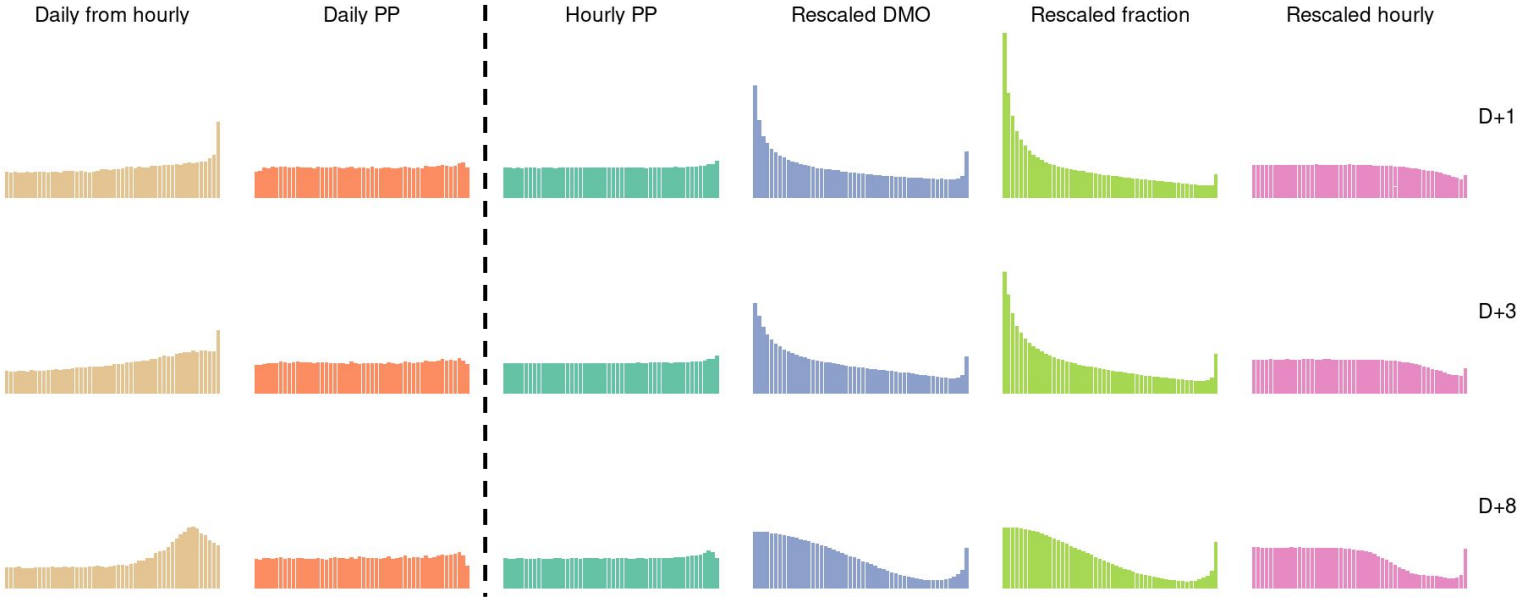
Skill (CRPS)


Hourly PP
gEMOS + ECC
Rescaled hourly
… postprocessed precipitation
Rescaled DMO
Rescaled hourly DMO precipitation
Rescaled fraction
Disagg. daily with PP fraction*
hourly
daily
Daily from hourly
Aggregated from hourly PP precip.
Daily postprocessing
gEMOS + ECC


daily
hourly
CRPSS
0.4
0.2
0.0
0
2
4
6
8
10
Forecast lead time (days)
Daily PP
Daily from hourly
Hourly PP
Rescaled DMO
Rescaled hourly
Rescaled fraction

Calibration





Summary

- Postprocess predictable features
- Mean scores are not the whole story
- Simple ECC doesn’t solve the ‘aggregation’ problem
- Decomposition is an *ad hoc* way out at best and doesn’t generalize well

Better alternatives?

A paradigm shift towards

- Multivariate postprocessing (time series of forecasts)
- Scenarios (members) rather than distributions
- Multi-objective optimization (jointly optimize hourly and daily scores)

Related work on generative approaches:

- Stephan Hemri et al.: EMS2022-427
- Sebastian Lerch and Jieyu Chen: EMS2022-195

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Home Affairs FDHA
Federal Office of Meteorology and Climatology MeteoSwiss

MeteoSwiss
Operation Center 1
CH-8058 Zurich-Airport
T +41 58 460 91 11
www.meteoswiss.ch

MeteoSvizzera
Via ai Monti 146
CH-6605 Locarno-Monti
T +41 58 460 92 22
www.meteosvizzera.ch

MétéoSuisse
7bis, av. de la Paix
CH-1211 Genève 2
T +41 58 460 98 88
www.meteosuisse.ch

MétéoSuisse
Chemin de l'Aérologie
CH-1530 Payerne
T +41 58 460 94 44
www.meteosuisse.ch

PP of fraction of daily precipitation

To disaggregate postprocessed daily precipitation, we postprocess hourly fraction of daily precipitation

- Same gEMOS + ECC approach as used for hourly precipitation (with slightly different predictors)
- Doubly truncated normal distribution to limit values to [0,1]
- Additional postprocessing step at disaggregation to ensure that fractions sum to 1 (in the absence of non-zero fractions, precipitation is distributed equally)

- Training with observations from ~ 700 stations for days with precipitation > 1 mm