Probabilistic Forecasts of Snow Water Equivalent and Runoff in Mountainous Areas*

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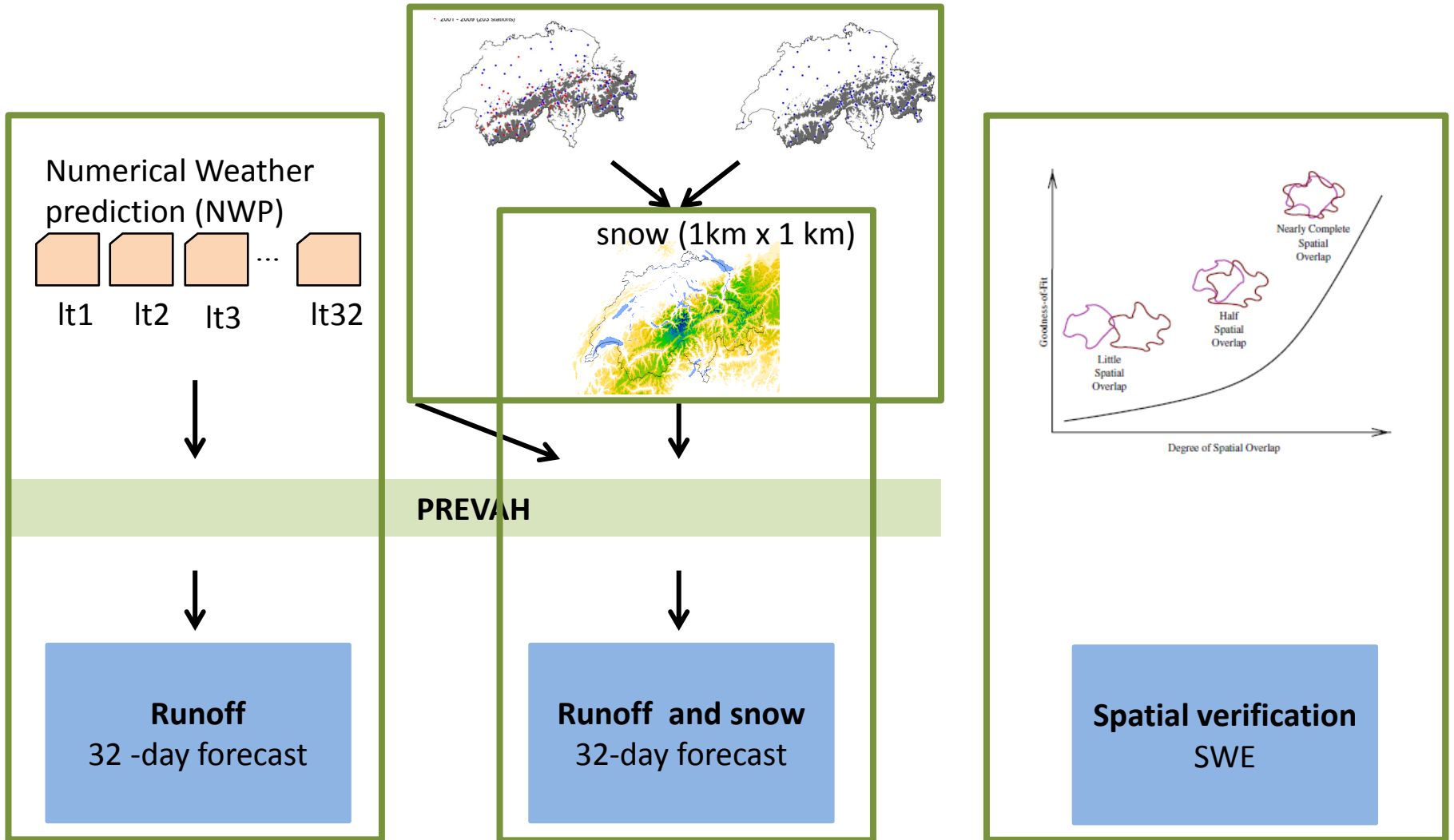
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Overview

Numerical Weather prediction (NWP)

lt1　lt2　lt3　...　lt32

snow (1km x 1 km)

PREVAH

Runoff
32 -day forecast

Runoff and snow
32-day forecast

Spatial verification
SWE

Goodness-of-Fit

Degree of Spatial Overlap

Little Spatial Overlap

Half Spatial Overlap

Nearly Complete Spatial Overlap

Study domains

3
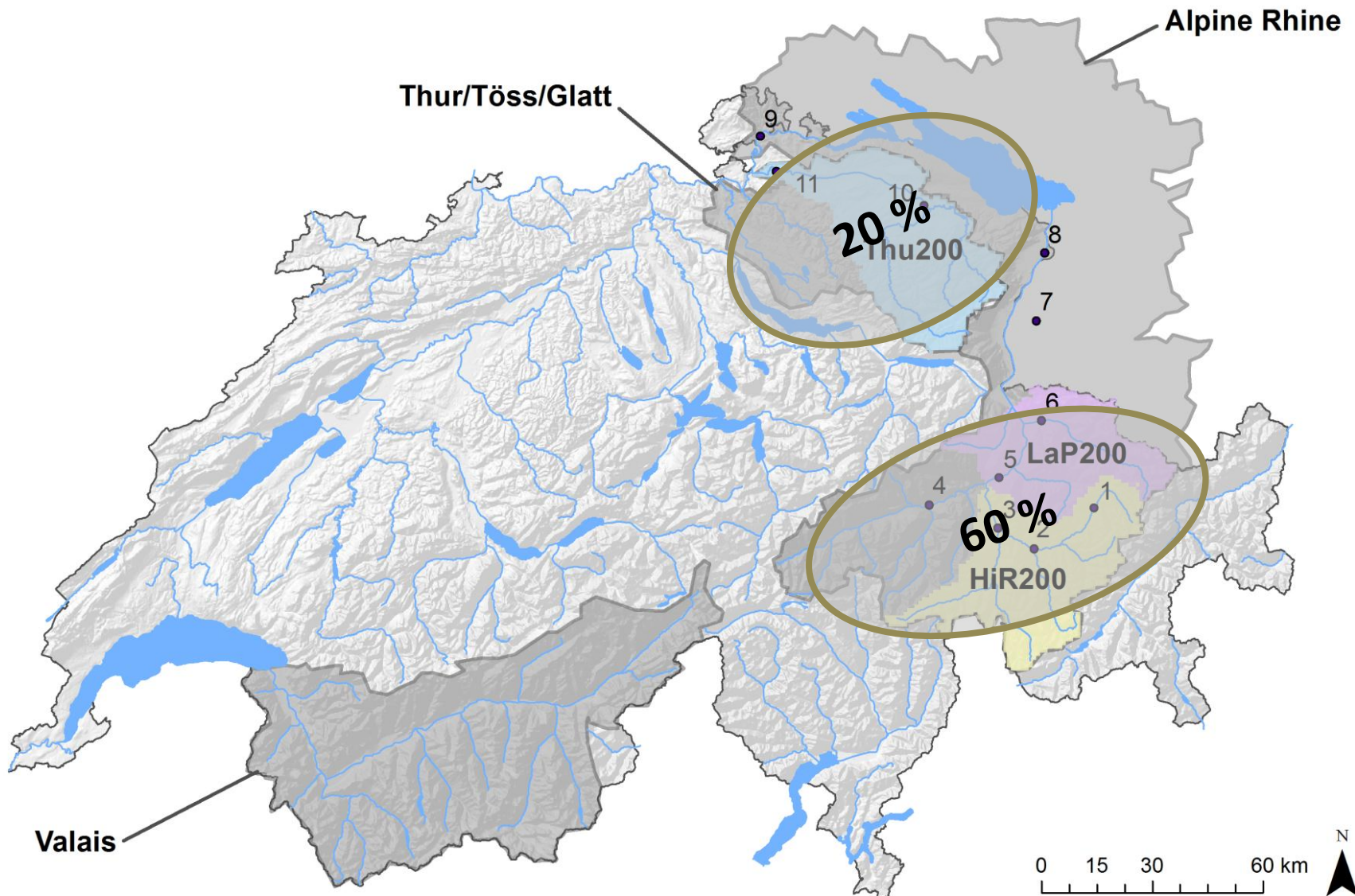
SWE maps

1) HS → SWE

$$SWE_{mod} = HS_{obs} * \rho_{mod}$$

(Jonas et al. 2009, Journal of Hydrology)

SWE (1 km x 1 km)
October - May

2) Mapping

i. detrending

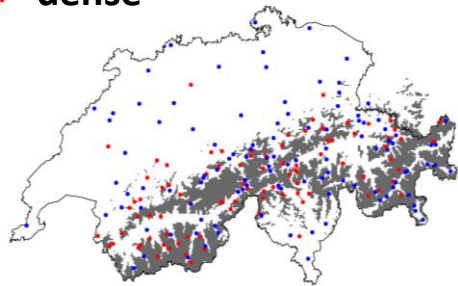ii. distance weighting

iii. retrending
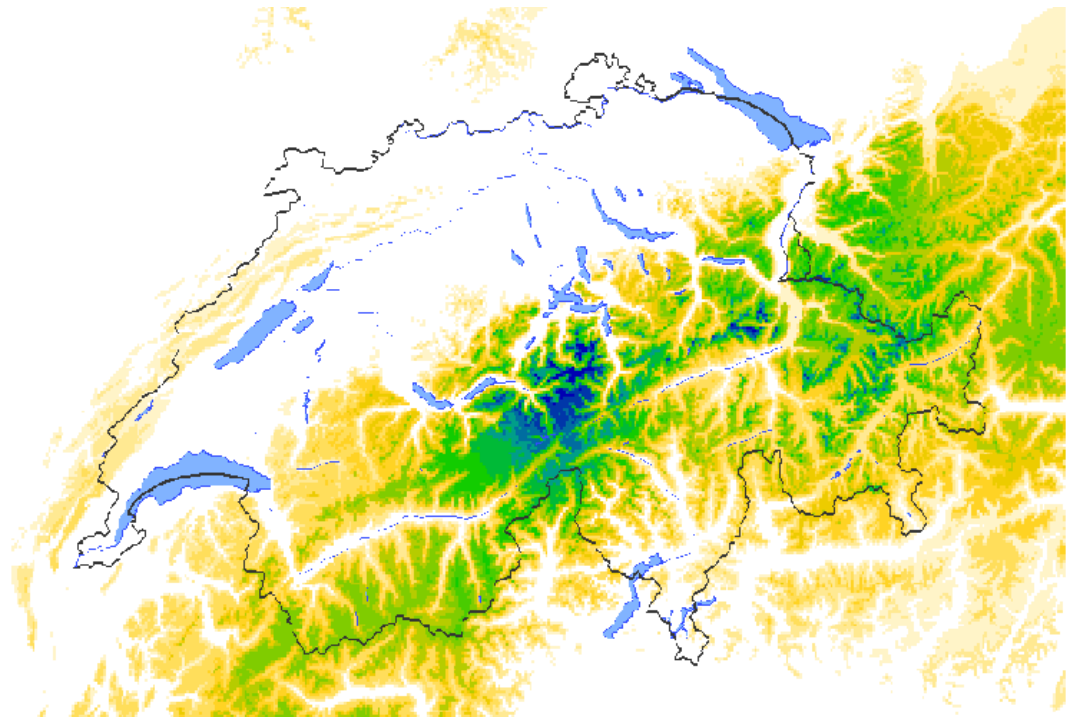
Homogenisation of SWE maps
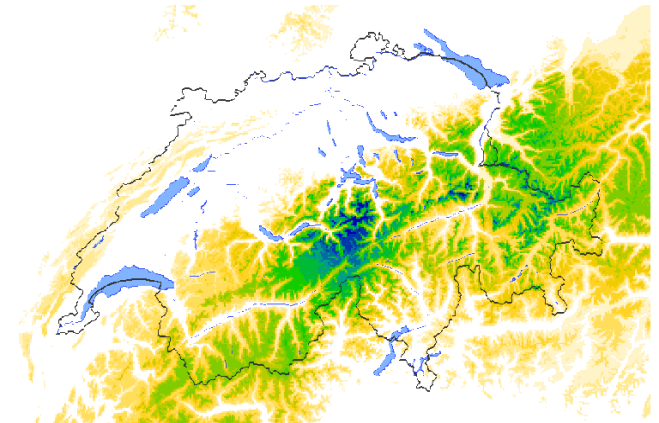
'sparse'
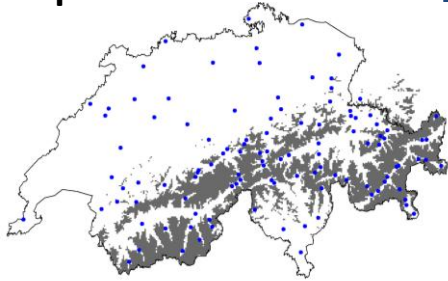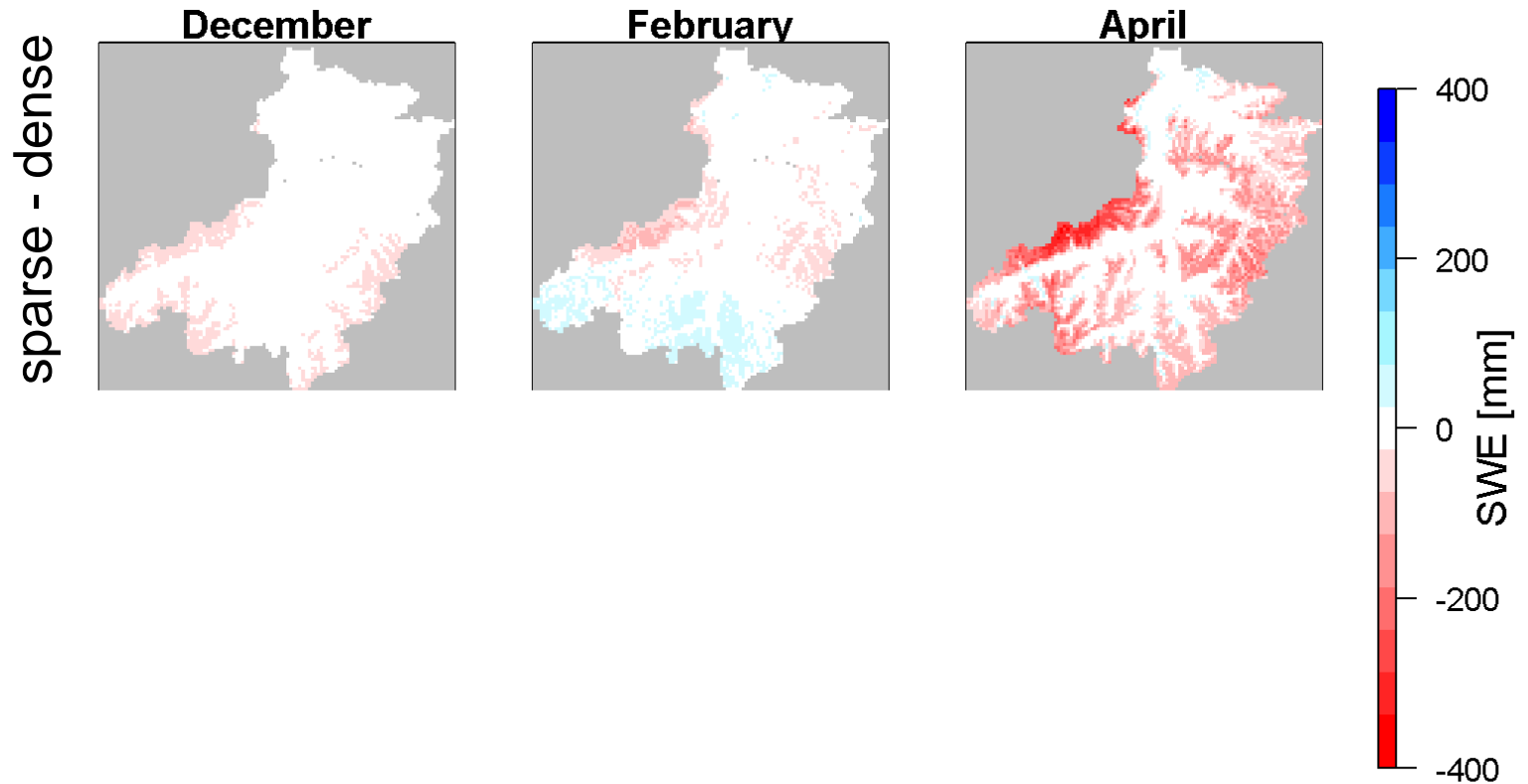

'dense'

Quantile mapping

calibrated SWE maps
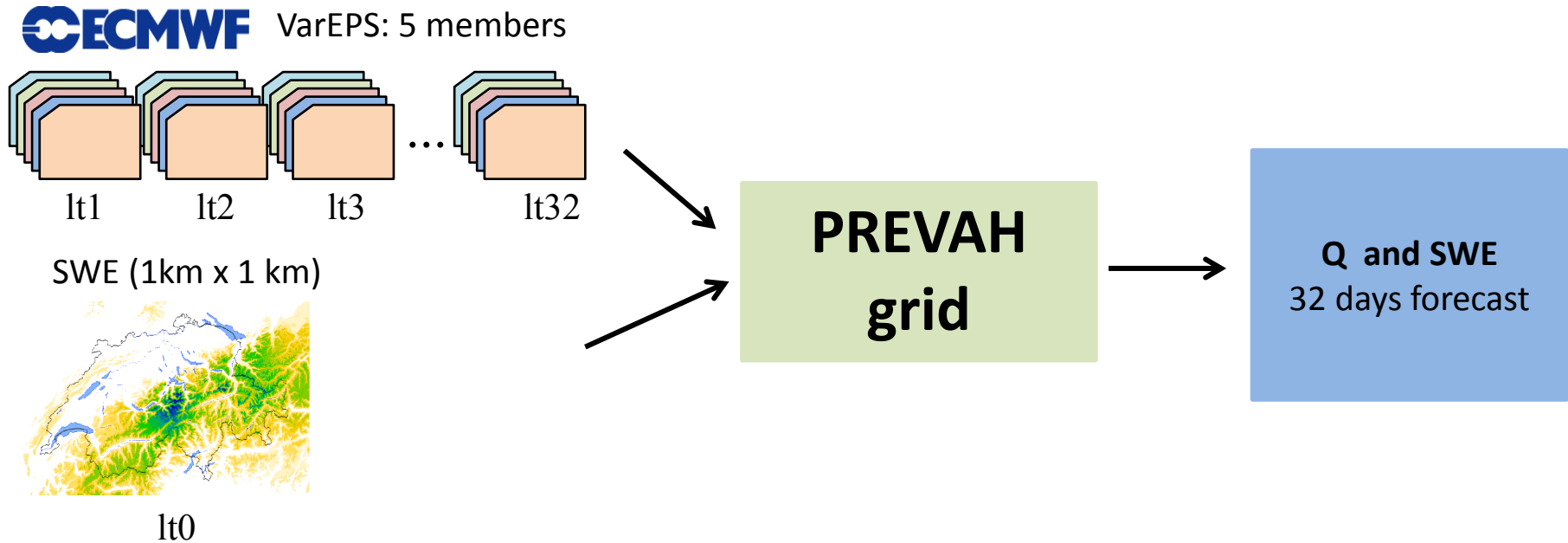1971 - 2009

(Jörg-Hess et al. 2014, The Cryosphere)

Validation at catchment scale

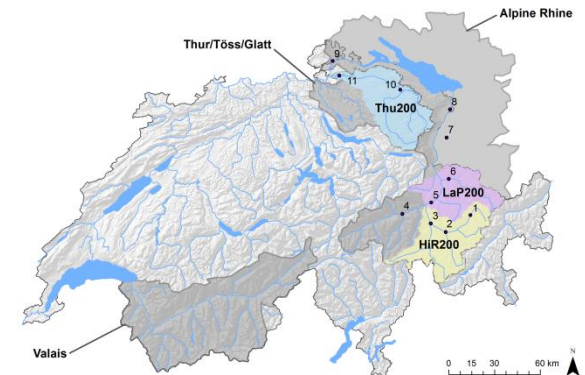mean difference per grid cell (2001-2009)

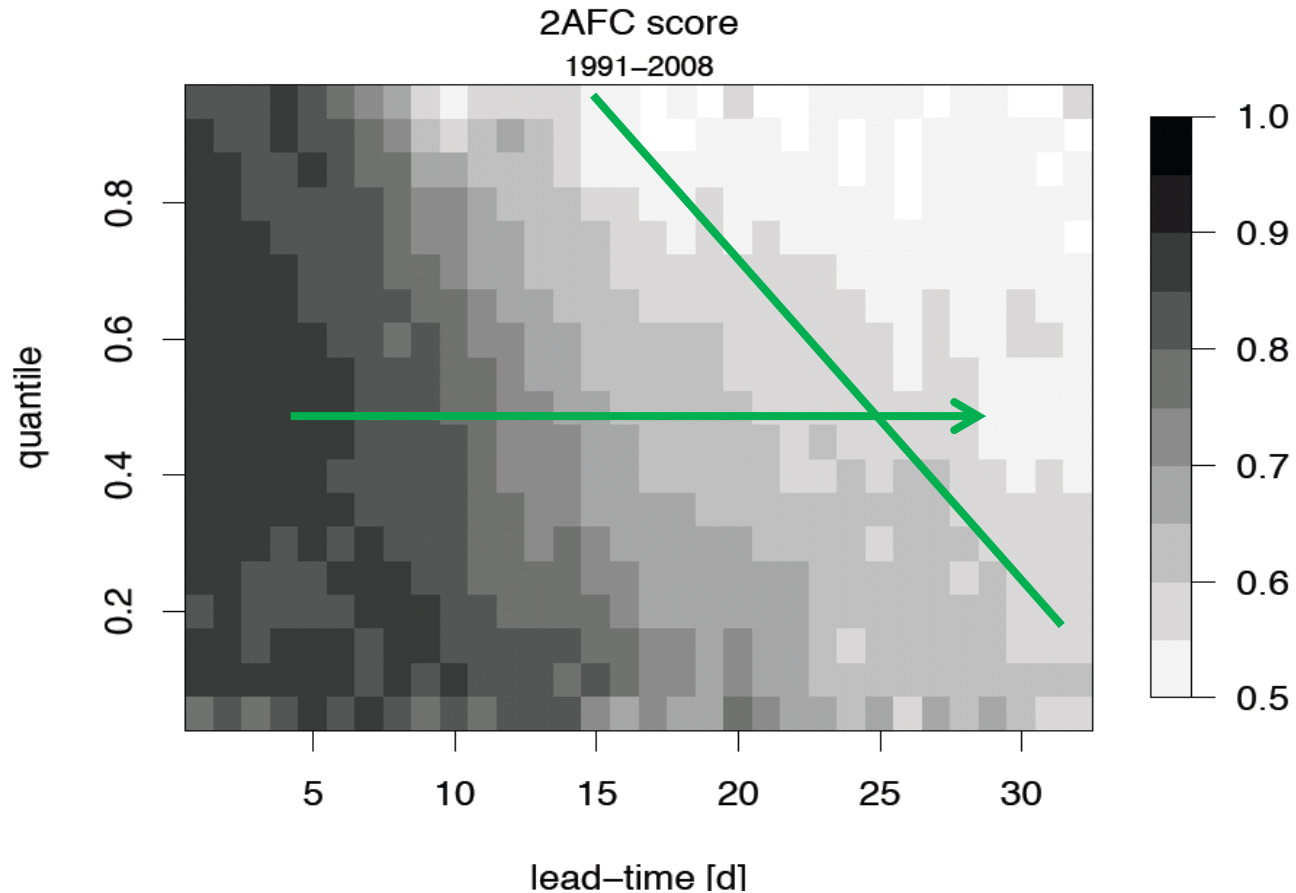# Snow water equivalent as model input

ECMWF VarEPS: 5 members

lt1   lt2   lt3   ...   lt32

SWE (1km x 1 km)

lt0

PREVAH grid

Q and SWE
32 days forecast

- Period 1981 – 2008

- Fully distributed

- 200 m
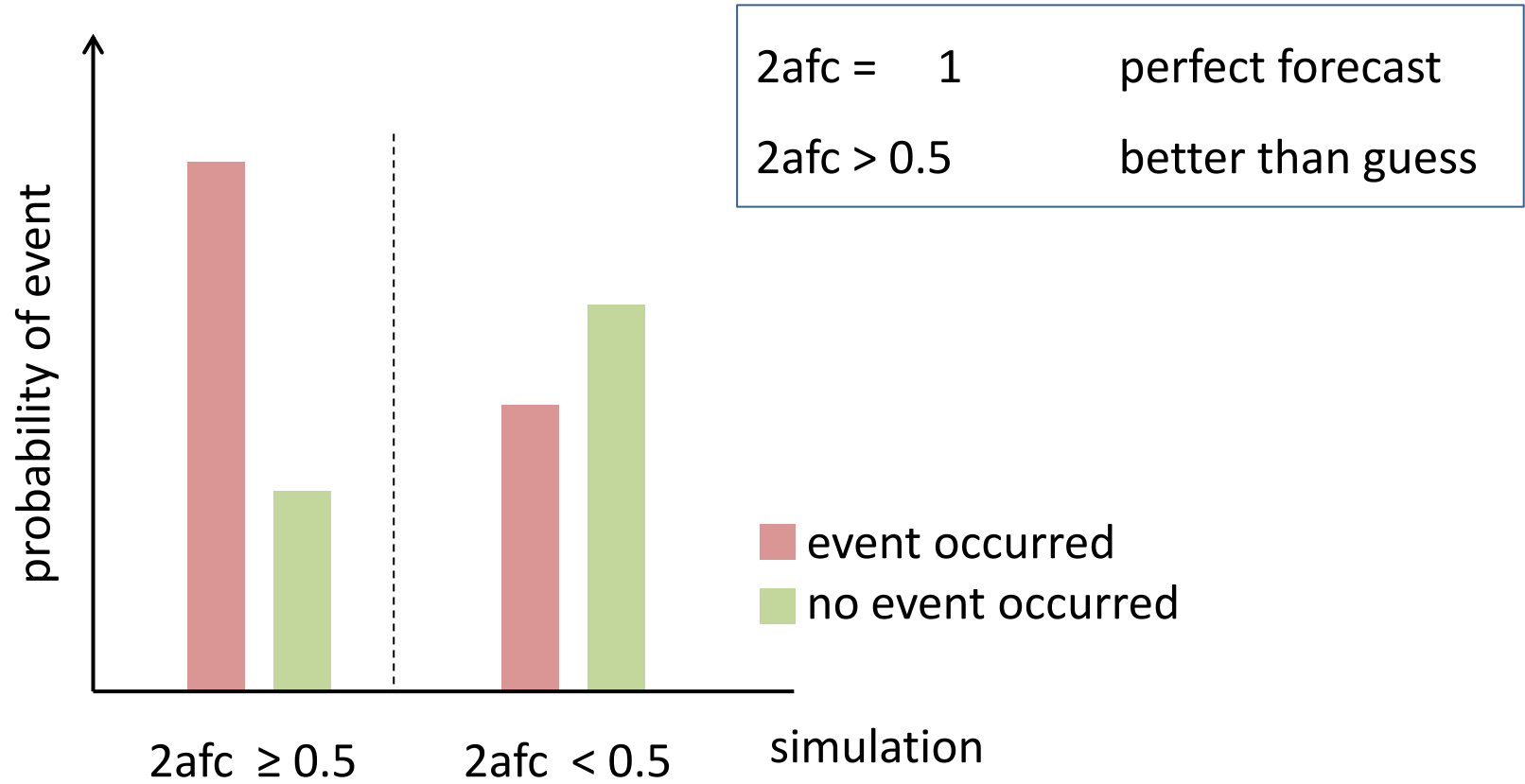
Runoff predictions with VarEPS

2AFC score
1991–2008

| 2afc = 1 | perfect forecast |
| 2afc > 0.5 | better than guess |

2afc score

2afc = 1	perfect forecast
2afc > 0.5	better than guess

probability of event

2afc ≥ 0.5   2afc < 0.5   simulation

event occurred
no event occurred
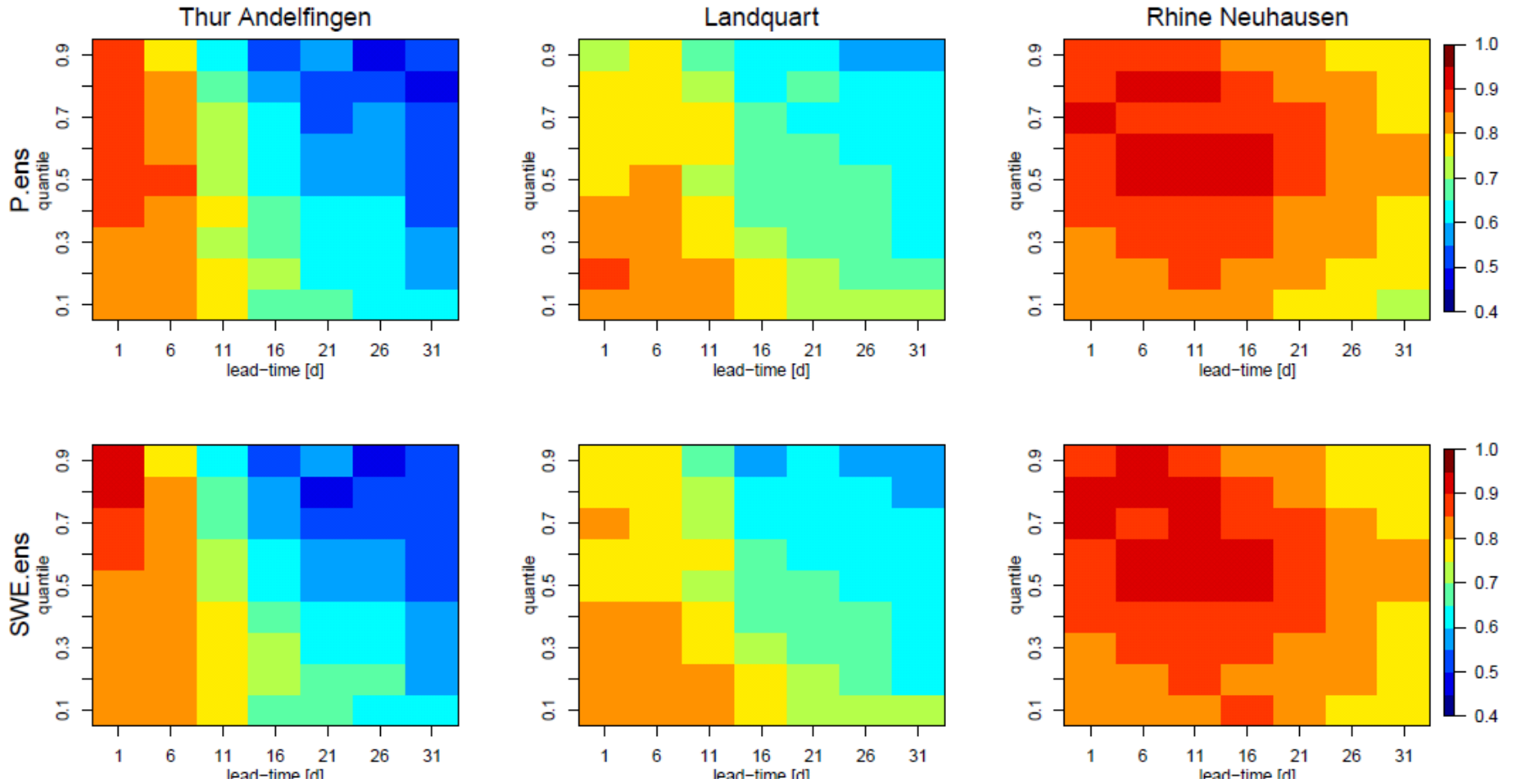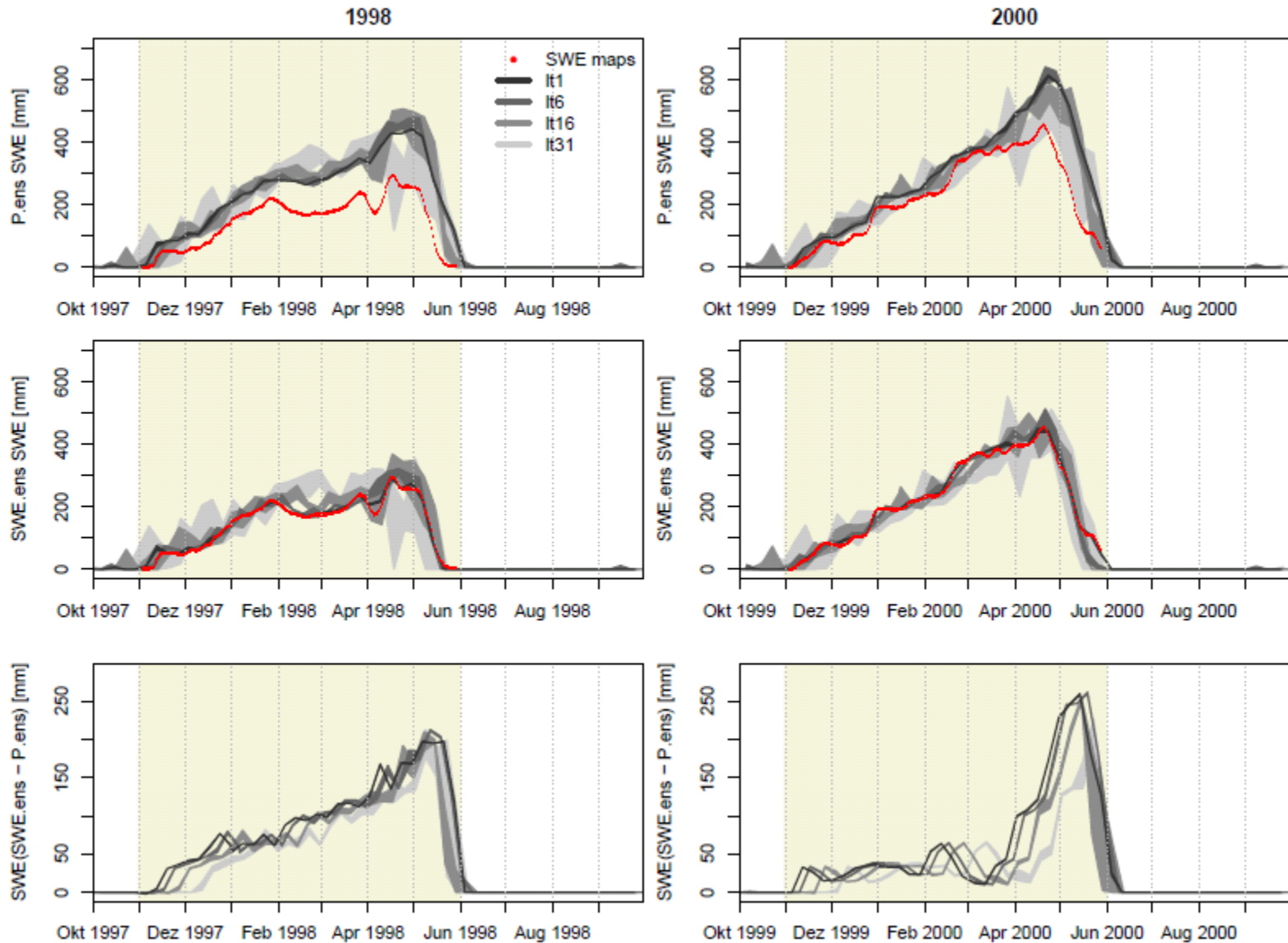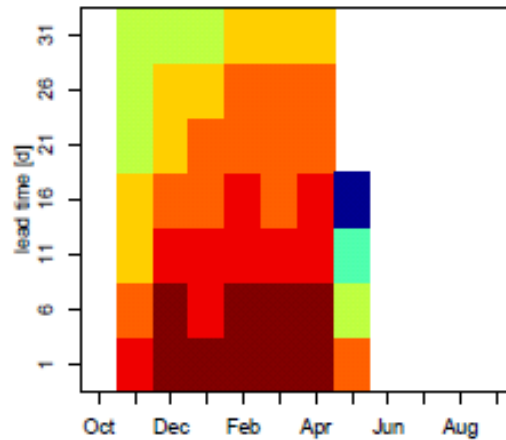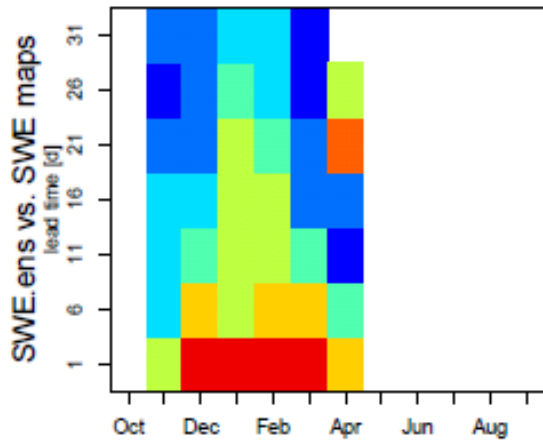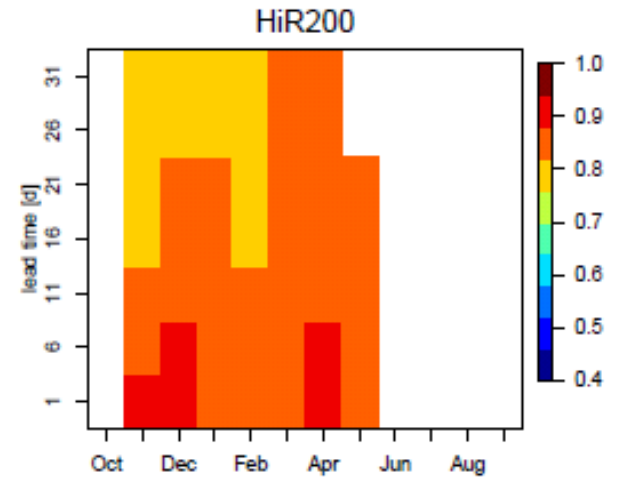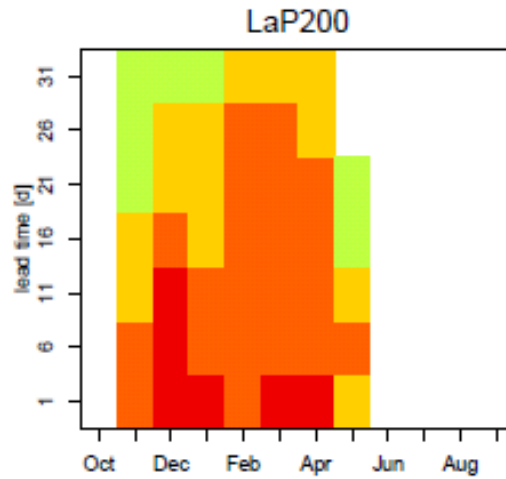
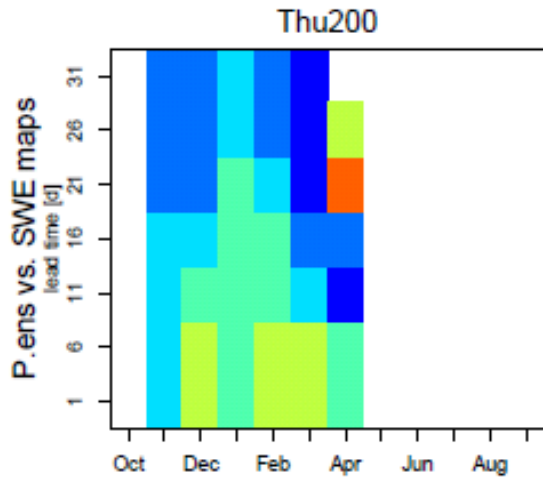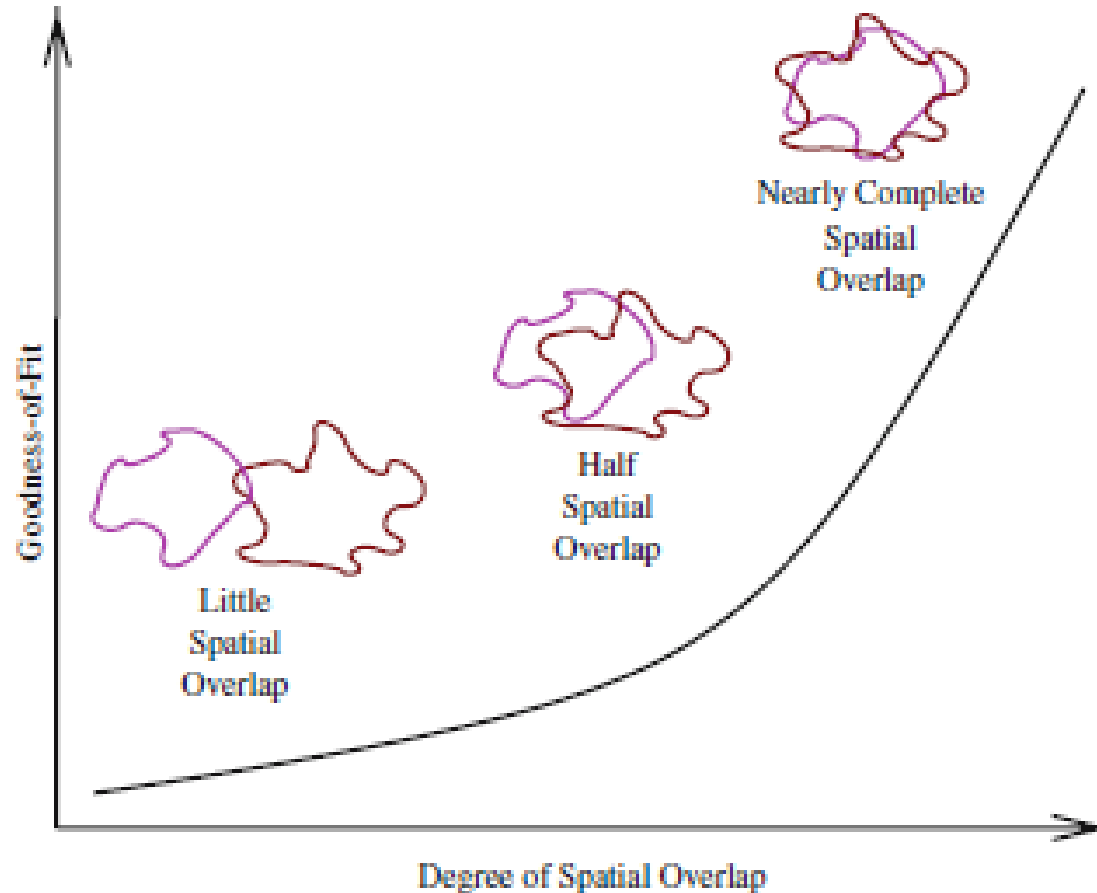# Added value of importing SWE: runoff prediction
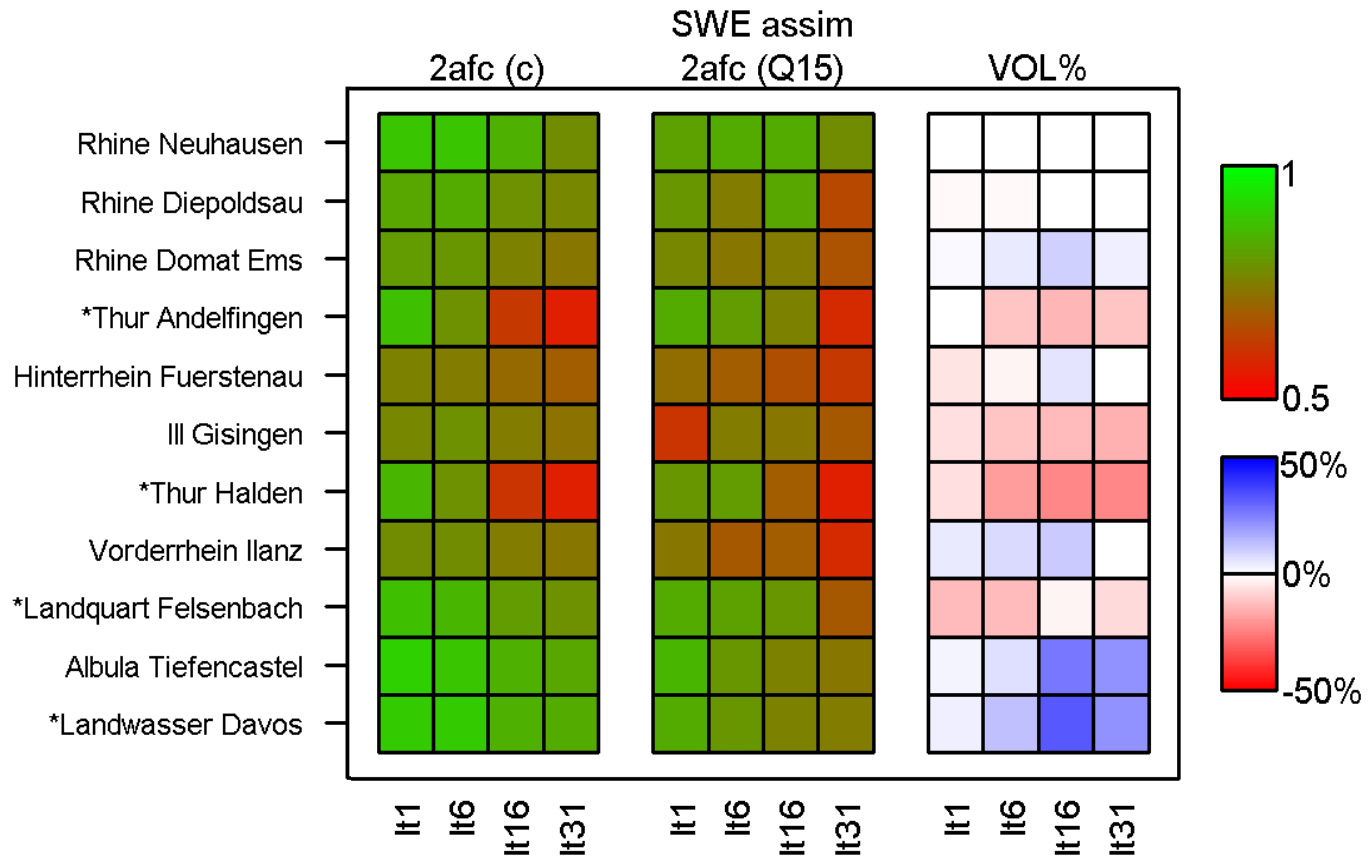
Impact of Q15 forecasts

SWE predictions

Impact on SWE forecast
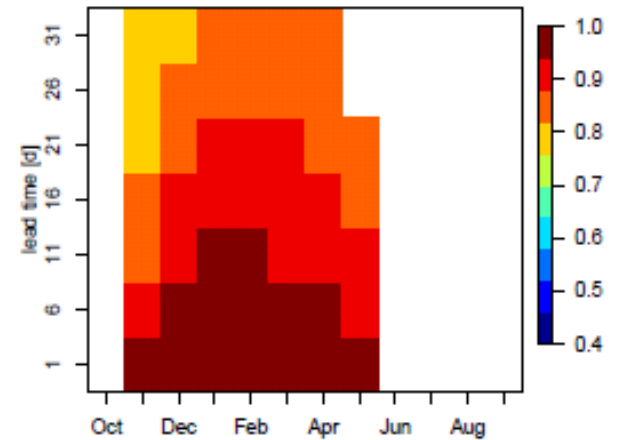
Added value of importing SWE: SWE prediction
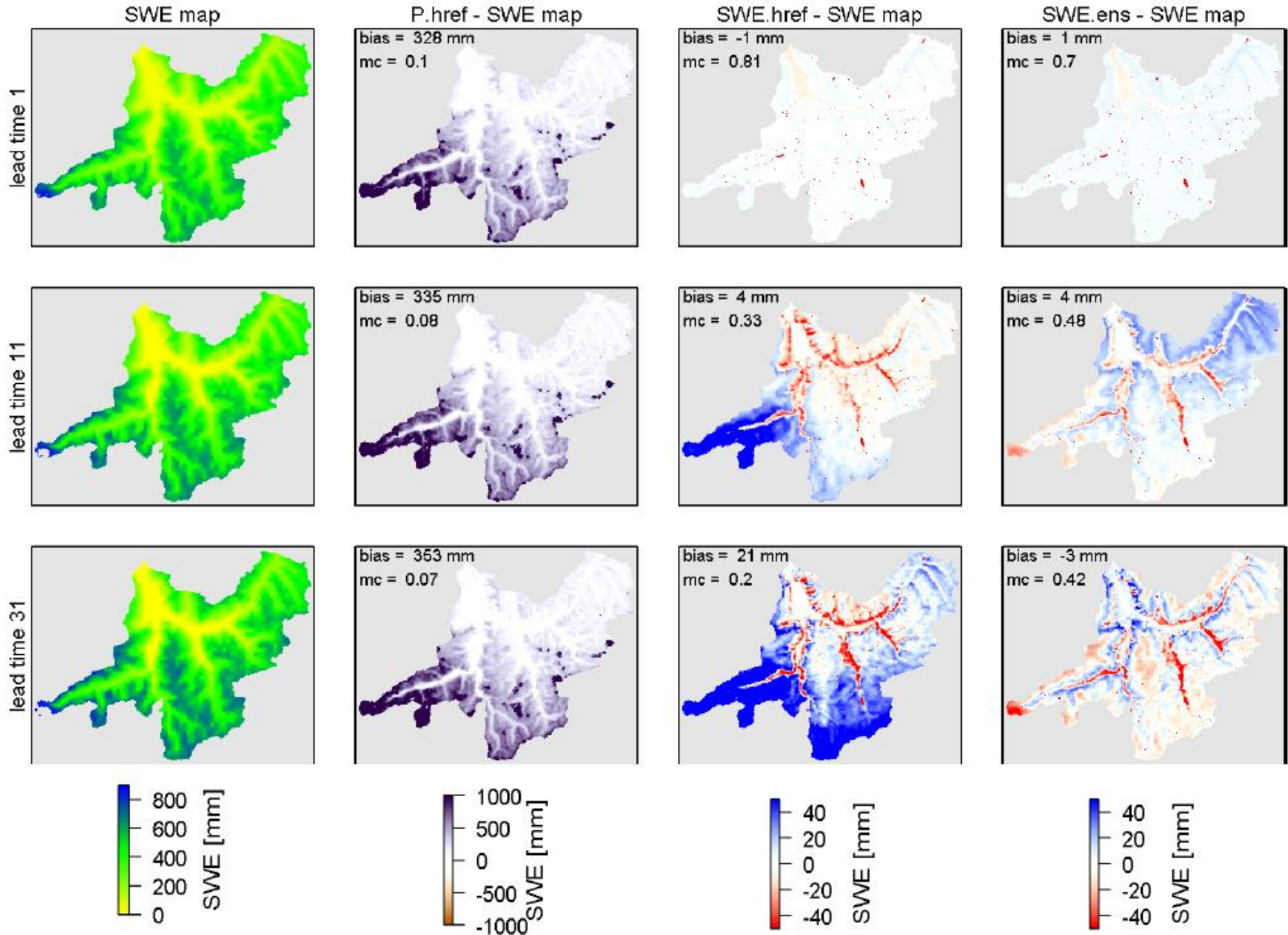

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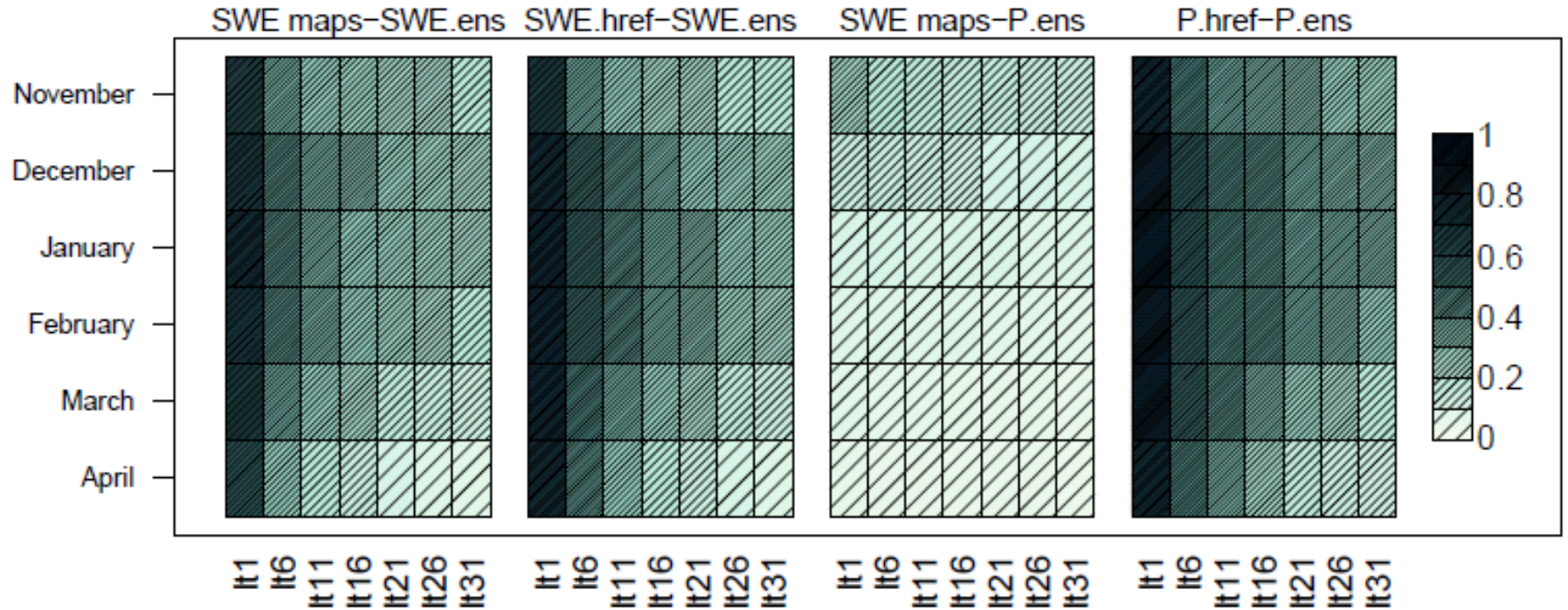Added value of SWE maps
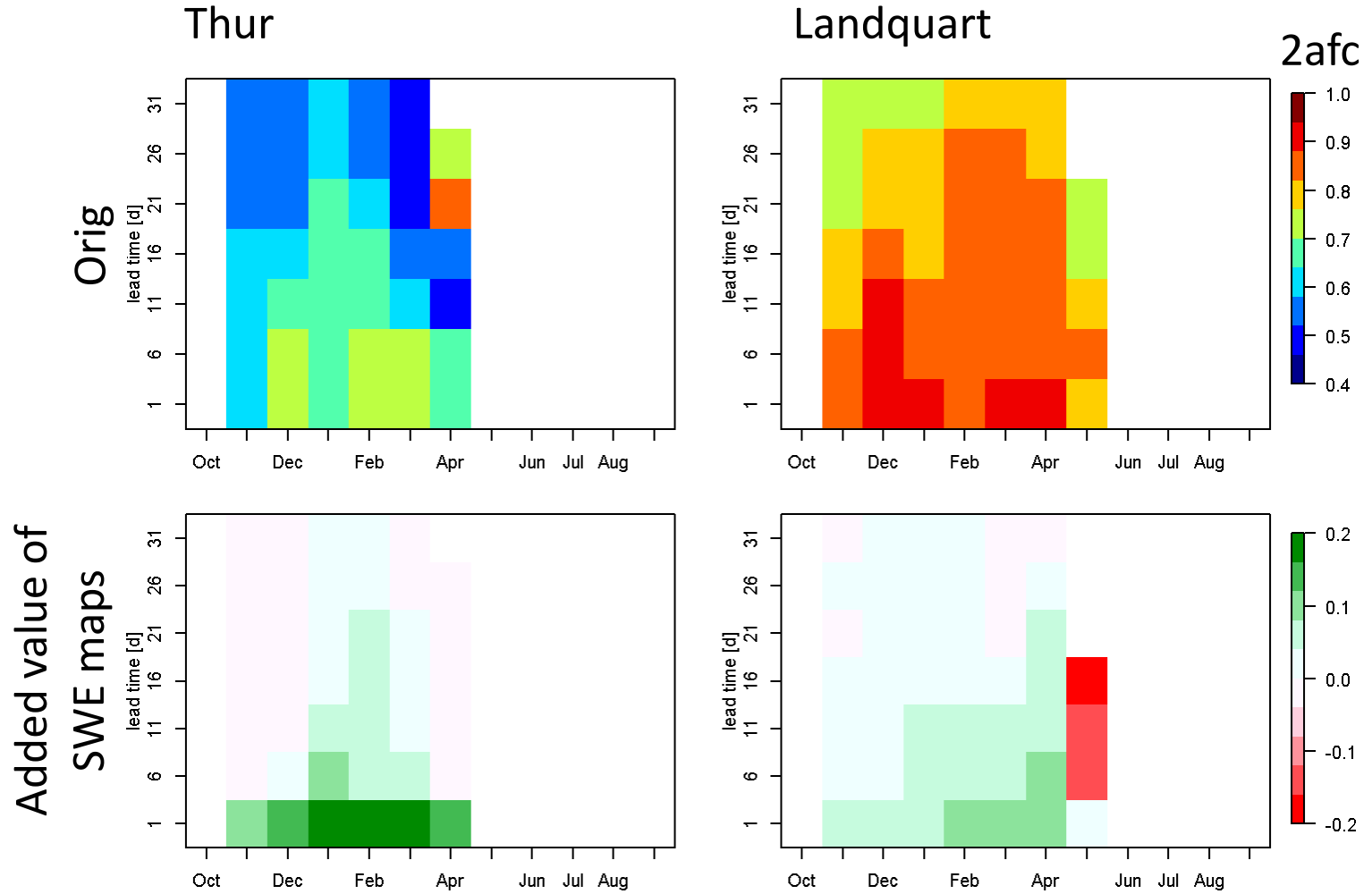
NOVELTY! Spatial verification: Basics

Hargrove, W. W., F. M. Homan, and P. F. Hessburg, 2006: Mapcurves: a quantitativemethod for comparing categorical maps. Journal of Geographical Systems, 8 (2), doi: 10.1007/s10109-006-0025-x.

Spatial verification : Added value of importing SWE

Spatial verification: Findings

Summary

- Challenging conditions in high mountains and small basins

- Low-flow predictions initialized with numerical weather predictions provide skilful forecasts

- The import of SWE observations at initialisation
  - improves the predicted runoff volume
  - improves SWE prediction for lead times up to ~ 20 days

- Verification against Q and SWE

- Spatial verification metrics are useful

- Next: See posters on HEPS4Power

"The Böögg Bang Theory"

http://hepex.irstea.fr/boogg-bang/