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

STEFANIE JÖRG-HESS
Swiss Federal Institute for Forest, Snow and Landscape Research (WSL), Birmensdorf, Switzerland

NENA GRIESSINGER
WSL Institute for Snow and Avalanche Research (SLF), Davos, Switzerland

MASSIMILIANO ZAPPA
Swiss Federal Institute for Forest, Snow and Landscape Research (WSL), Birmensdorf, Switzerland

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Overview

Numerical Weather prediction (NWP)

lt1  lt2  lt3  lt32

PREVAH

Runoff
32 -day forecast

Runoff and snow
32-day forecast

Spatial verification
SWE
Study domains
SWE maps

1) HS → SWE

\[ \text{SWE}_{\text{mod}} = \text{HS}_{\text{obs}} \times \rho_{\text{mod}} \]


2) Mapping
   i. detrending
   ii. distance weighting
   iii. retrending

SWE (1 km x 1 km)
October - May
Homogenisation of SWE maps

Quantile mapping

'sparse'

'generic'

'Intense'

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

- Period 1981 – 2008
- Fully distributed
- 200 m

VarEPS: 5 members

lt0

lt1 lt2 lt3 lt32

SWE (1km x 1 km)

PREVAH grid

Q and SWE 32 days forecast
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

- event occurred
- no event occurred

Graph: 2afc ≥ 0.5 vs 2afc < 0.5

- Simulation

Probability of event
Added value of importing SWE: runoff prediction
Impact of Q15 forecasts
SWE predictions
Impact on SWE forecast
Added value of importing SWE: SWE prediction

Thur

Landquart

2afc

Added value of SWE maps
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/