

Probabilistic Forecast of Daily Areal Precipitation focusing Extreme Events

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EGU in Vienna

NH 1.02: Diagnosis, Modelling and Forecasting of Meteorological and Hydrological Hazards produced by Extreme Weather and Climate Change

by

Jan Bliefernicht and András Bárdossy

Institute of Hydraulic Engineering
 Department of Hydrology and Geohydrology
 Prof. Dr. rer. nat. Dr.-Ing. András Bárdossy
 Pfaffenwaldring 61, 70569 Stuttgart, Germany www.iws.uni-stuttgart.de

Universität Stuttgart

Motivation

Operational Flood Forecasting

Precipitation fields with a high temporal and spatial resolution are required
 (< 10 km x 10 km)

Global weather forecast model

Precipitation fields with a more coarse spatial resolution
 (~0.5° x 0.5° = 30 km x 30 km)

Solution of the gap:
 downscaling (dynamical or statistical)

Dynamical Downscaling

Global Weather Forecast Model

Regional Weather Forecast Model

Downscaling

P → high spatial resolution

Statistical Downscaling

global weather forecast model

statistical model

e.g. analogue method (Lorenz, 1969)

operational since 30 years in France!!!

forecast variables (predictor)

$f(x)$

P

Objectiv

- operational forecast system for daily areal precipitation using the analogue method (AM)
- comparison of three approaches:
 - (1) AM using euclidian distance (AME)
 - (2) AM using pearson correlation (AMP)
 - (3) AM using euclidian distance + pearson correlation (AMEP)
- optimisation for extreme events

Analogue Method

precipitation forecast

- (1) identification of a past weather situation, which is similar to the current one
- (2) precipitation of the past weather situation is used as forecast

predictor

- Geopotential height, specific humidity, u-/v-windcomponents
- specific humidity flux

NCEP/NCAR-Reanalyse-Project

Test of the system under ...

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Analogue Method (3 Approaches)

imax LHG

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Objective Function

Ranked Probability Skill Score RPSS (Murphy, 1971):

↳ describes the cumulative distribution function of the forecast variable

- ranges between $-\infty$ and 1
- HSS < 0: → not better than a reference forecast
- HSS ~ 1: → perfect forecast
- **Optimisation for extreme events possible**

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Prün
area: 600 qm²
P: 1000 mm/yr

Sieg
area: 750 qm²
P: 1100 mm/yr

Nahe
area: 2500 qm²
P: 800 mm/yr

Validation

- daily areal precipitation (5 km x 5 km)
- period: 44 years (1958 – 2001)
- jackknife-method

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Comparison of methods

RPSS [-]

AMEP

AME AMP

Euclidian Distance Pearson Correlation

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Comparison of test sites

RPSS [-]

AMEP

AME AMP

Euclidian Distance Pearson Correlation

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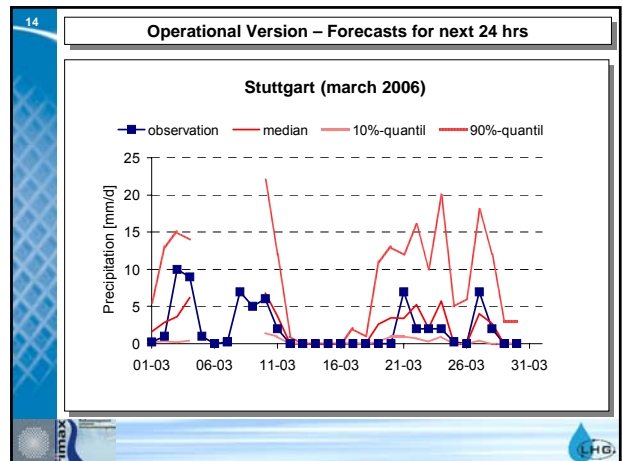
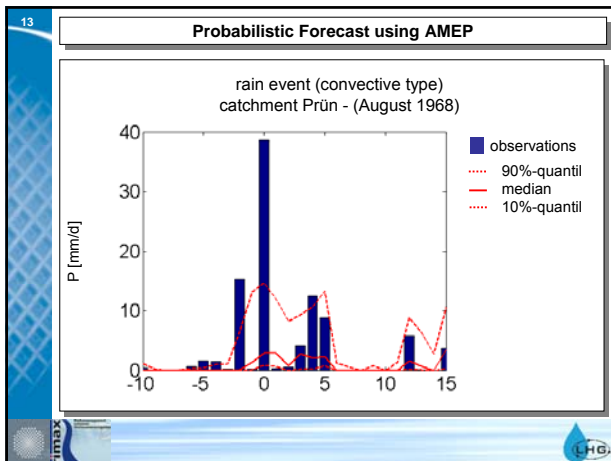
Probabilistic Forecast using AMEP

rain event (advective type)
catchment Prün – december 1989

P [mm/d]

- observations
- 90%-quantil
- median
- 10%-quantil

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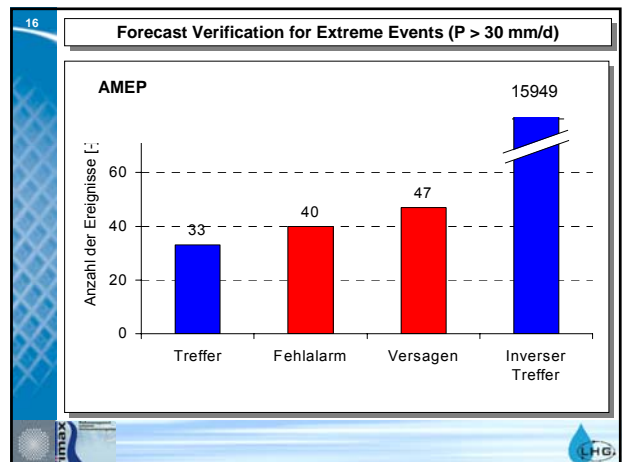


Probabilistische Vorhersage des täglichen Gebietsniederschlages unter besonderer Berücksichtigung extremer Ereignisse

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 Tag der Hydrologie in München
 von
 Jan Bliefernicht und András Bárdossy

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Forecast Verification: Binary

		Observation	
		Yes	No
Forecast	Yes	Hit	False Alarm
	No	Failure	Hit

Two Errors !!!

Heidke Skill Score HSS (Heidke, 1929)

- ranges between -1 and 1
- HSS < 0: → not better than a reference forecast
- HSS ~ 1: → perfect forecast