Conditional QPF verification using synoptic weather patterns:
A COSMO-7 hindcast climatology
Overview

- Motivation
- Description of datasets for 2000-2002
- Production of weather classes
- Verification methods
- Evaluation of flow classes
- Evaluation of forcing classes
- Summary
Motivation

Typical QPF errors

Annual rainfall sum

Obs. vs. Model

x2
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Description of datasets for 2000-2002

**COSMO-7 hindcast** (LM3.16)

- Own assimilation cycle
- Initialization each day at 00UTC with 30 forecast hours
- Configuration similar to operational setup of MeteoSwiss
- Perfect boundary conditions from ECMWF analysis
- Up-to-date model version:
  - prognostic precipitation scheme
  - prognostic treatment of TKE
  - multilayer soil model with daily merge of ECMWF soil water
  - SLEVE split of height coordinate
  - 2nd order leapfrog time discretization
  - Tiedtke convection parameterization

**Observational analysis**

ca. 450 measurements monthly

Gridded daily amounts with fine-scale structure

Effective resolution of 15-25 km

Evaluation of sums 06UTC-06UTC
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Production of weather classes

a) **Flow classes**: Discrimination of **flow directions** over Switzerland

b) **Forcing classes**: Identification of precipitation forcings in a quasi-objective way: **low-level weather fronts**, **CAPE**

[+ upper-level PV streamers, surface cyclones]

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1) Jenkner et al. (2008): Detection and climatology of fronts in high-resolution fields over the Alps
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Verification methods

1.) SAL 1)

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<th>Location</th>
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<td>-2 &lt; A &lt; 2</td>
<td>0 &lt; L &lt; 2</td>
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1) Wernli et al. (2008): SAL - a novel quality measure for the verification of Quantitative Precipitation Forecasts

2.) Quantile-based contingencies 2)

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<tr>
<td>observed no</td>
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</table>

Quantile difference + Peirce skill score (QD) (PSS)

Bias

Pixel overlap

2) Jenkner et al. (2008): Quantile-based short-range QPF evaluation over Switzerland
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Evaluation of flow classes

S component

A component

L component

Precipitation

COSMO User Meeting 04/03/2008

Johannes Jenkner
Evaluation of flow classes

Obs. 80% quantiles
Evaluation of flow classes
Evaluation of flow classes

80% PSS

Flow NW

Flow N

Flow NE

Flow W

Flow CM

Flow E

Flow SW

Flow S

Flow SE
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Evaluation of forcing classes

Fronts and CAPE

COSMO User Meeting  04/03/2008  Johannes Jenkner
Evaluation of forcing classes

Cold fronts from NW

Warm fronts from NW

Comparison of bias

CF NW – WF NW

QD 90%
Evaluation of forcing classes

Cold fronts from NW

Warm fronts from NW

Comparison of pixel overlap

CF NW – WF NW

PSS 90%
Evaluation of forcing classes

Comparison of bias

Flow CM with CAPE – Flow
CM without CAPE

QD 80%
Evaluation of forcing classes

**CAPE over 75J/kg**

**CAPE under 75J/kg**

Comparison of pixel overlap

Flow CM with CAPE – Flow CM without CAPE

PSS 80%
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1.) Significant overestimation of rainfall for northerly flow directions

2.) Strongest regional bias contrasts for flow directly from the south

3.) Pattern overlap best for northeasterly directions

4.) Significant overestimation for warm fronts in the interior of the Alps

5.) Strong degradation of skill and low predictability in convective settings

6.) Underestimation of light rainfall intensities in convective events