A flood alert system for Switzerland based on integrated vapour transport

Jonas Bhend\textsuperscript{1}, Irina Mahlstein\textsuperscript{2}, Marco Rohrer\textsuperscript{2}, Christoph Spirig\textsuperscript{1}, Olivia Martius\textsuperscript{2}, Mark Liniger\textsuperscript{1}

\textsuperscript{1} Federal Office of Meteorology and Climatology MeteoSwiss, Zurich, Switzerland
\textsuperscript{2} Institute of Geography, University of Bern, Bern, Switzerland
Natural hazards cause damage

Schäden durch Hochwasser, Murgänge, Rutschungen und Sturzprozesse
August 2005
Integrated vapour transport

- IVT as an integrated, large-scale quantity better predictable than precipitation directly

Lavers et al. (2016)
IVT 22 August 2005
Flooding linked to IVT

North-eastern Switzerland

Froideveaux, P. and O. Martius (2016). Exceptional integrated vapour transport toward orography: an important precursor to severe floods in Switzerland. *QJRMS*
IVT + orographic forcing

Froideveaux, P. and O. Martius (2016). Exceptional integrated vapour transport toward orography: an important precursor to severe floods in Switzerland. *QJRMS*
Flood alert system

- Flood alert system based on ECMWF ENS

- Study to assess skill of the system with ECMWF EXT hindcasts for 1997-2016 verified against ERA-Interim
  - Case studies for flooding events
  - Assess IVT and precipitation forecasts

- Products developed in collaboration with hydrologists from the Federal Office of the Environment
Forecasts for 22 August 2005

Forecast initialization date
- 2005-08-15
- 2005-08-18
- 2005-08-22
Skill of forecasts in JJA

Northeastern Switzerland

Southern Switzerland

Western Switzerland

Lead time (days)

CRPSS

GDS

Precipitation
IVT
IVT index
Skill of forecasts > 95th percentile in JJA

Northeastern Switzerland

Southern Switzerland

Western Switzerland

BSS (> 95%)

ROCSS (> 95%)

Lead time (days)

Precipitation

IVT

IVT index
IVT overview plot
Track forecast evolution

MeteoSwiss

ECMWF IFS EPS
IVT boxplot Ticino

Fri 26 Oct 18 00UTC

Valid time

© ECMWF 04/19 bhj
• Direction-weighted IVT is a good indicator for flooding in CH

• Skill of IVT slightly enhanced compared to precipitation

• Various products necessary to convey full information (i.e. general situation, direction, magnitude, and forecast uncertainty)

• Products to be used operationally starting April 2019
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
EFI for IVT (magnitude only)