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# A flood alert system for Switzerland based on integrated vapour transport

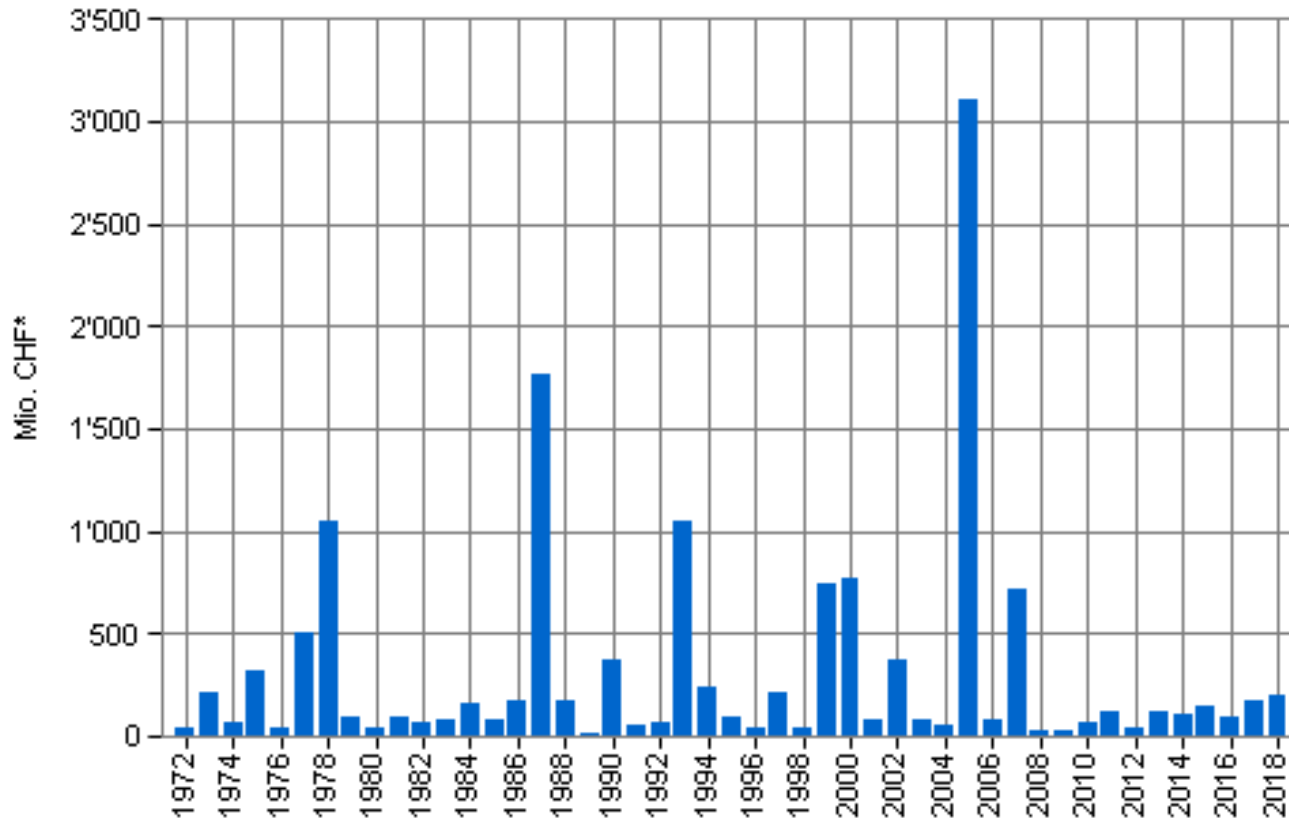
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# Natural hazards cause damage



Schäden durch Hochwasser,  
Murgänge, Rutschungen und  
Sturzprozesse



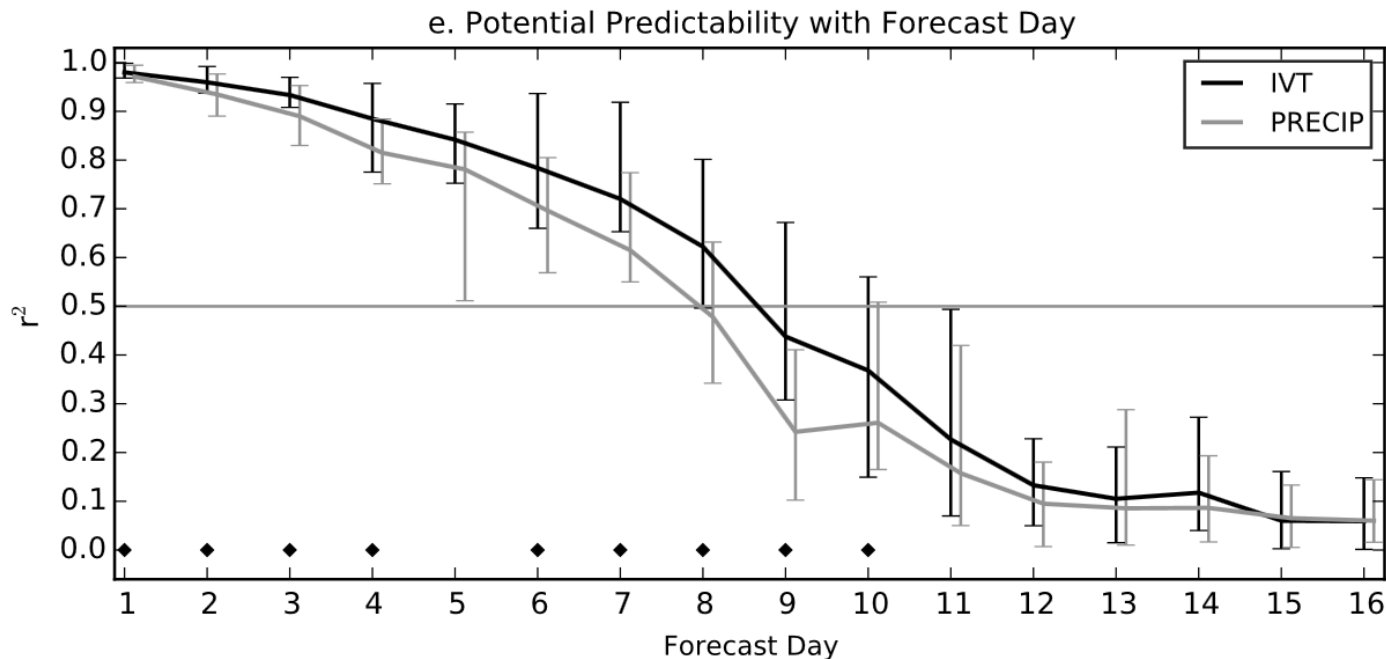
August 2005





# Integrated vapour transport

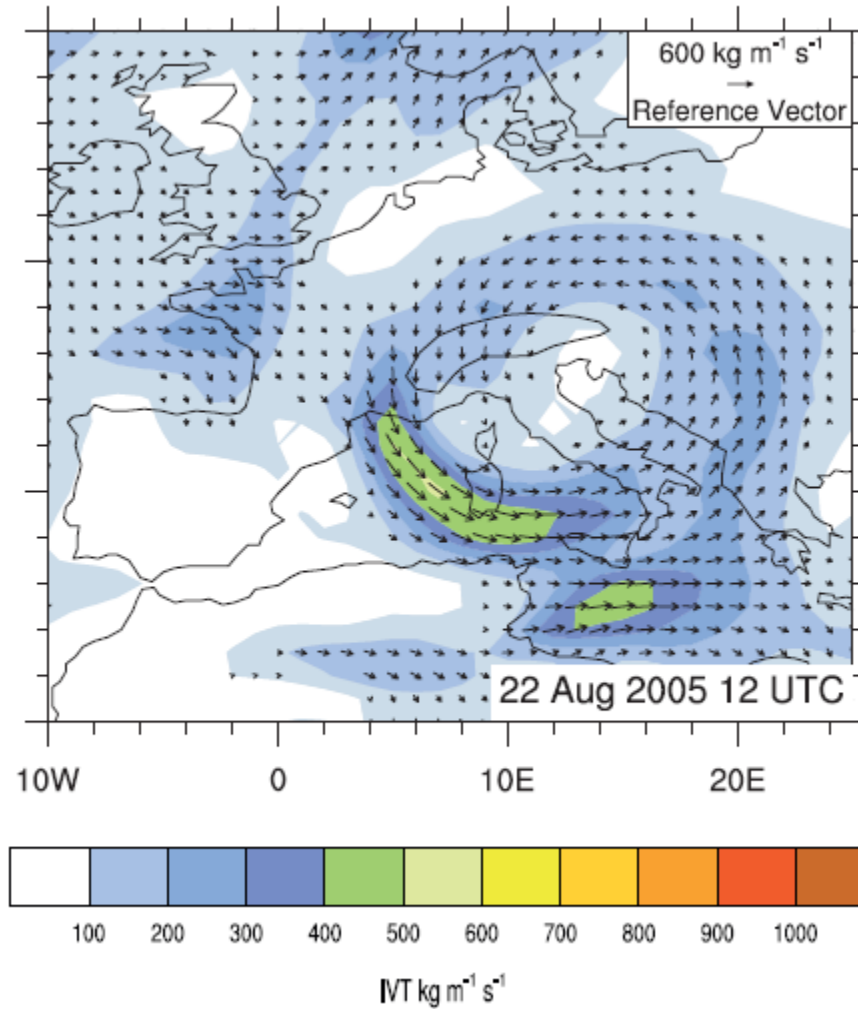
- IVT as an integrated, large-scale quantity better predictable than precipitation directly



Lavers et al. (2016)



# IVT 22 August 2005

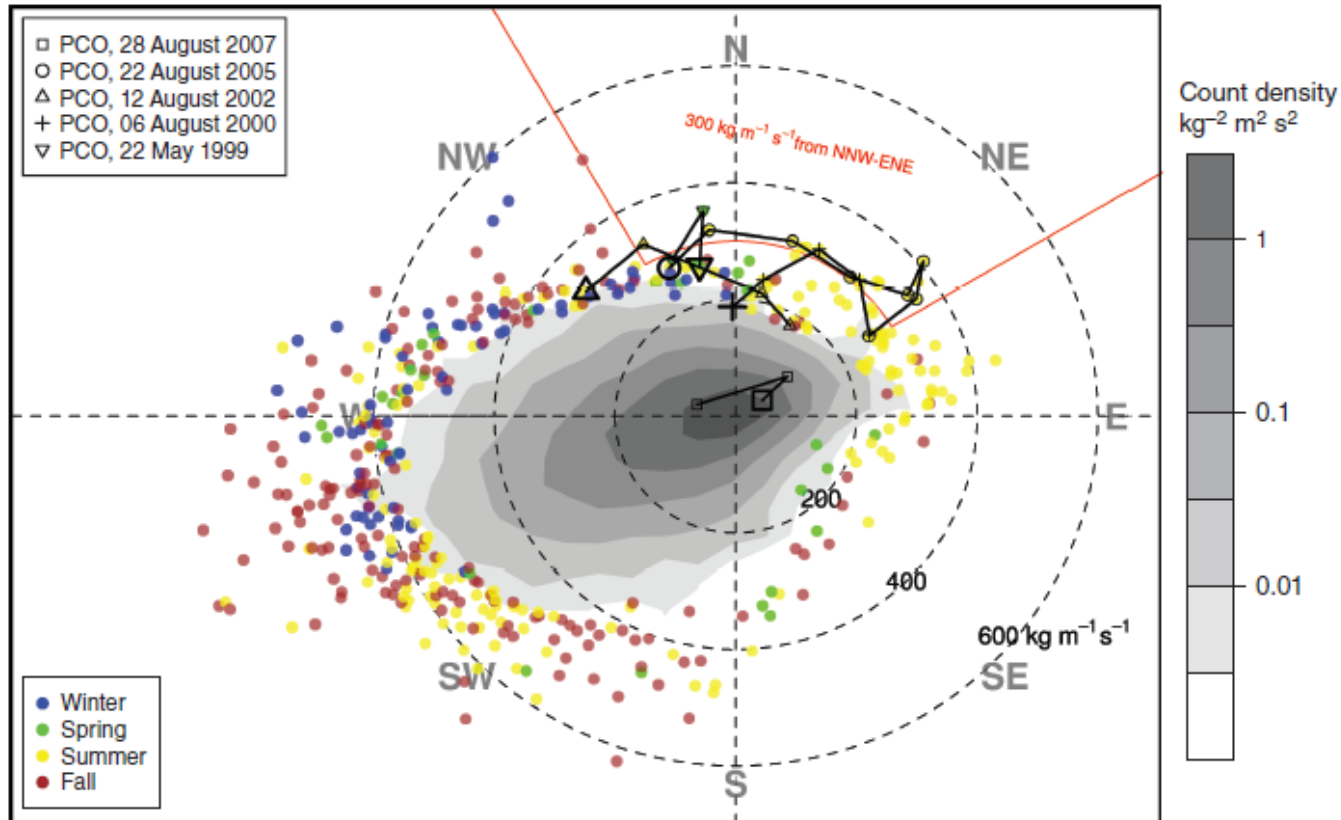






# Flooding linked to IVT

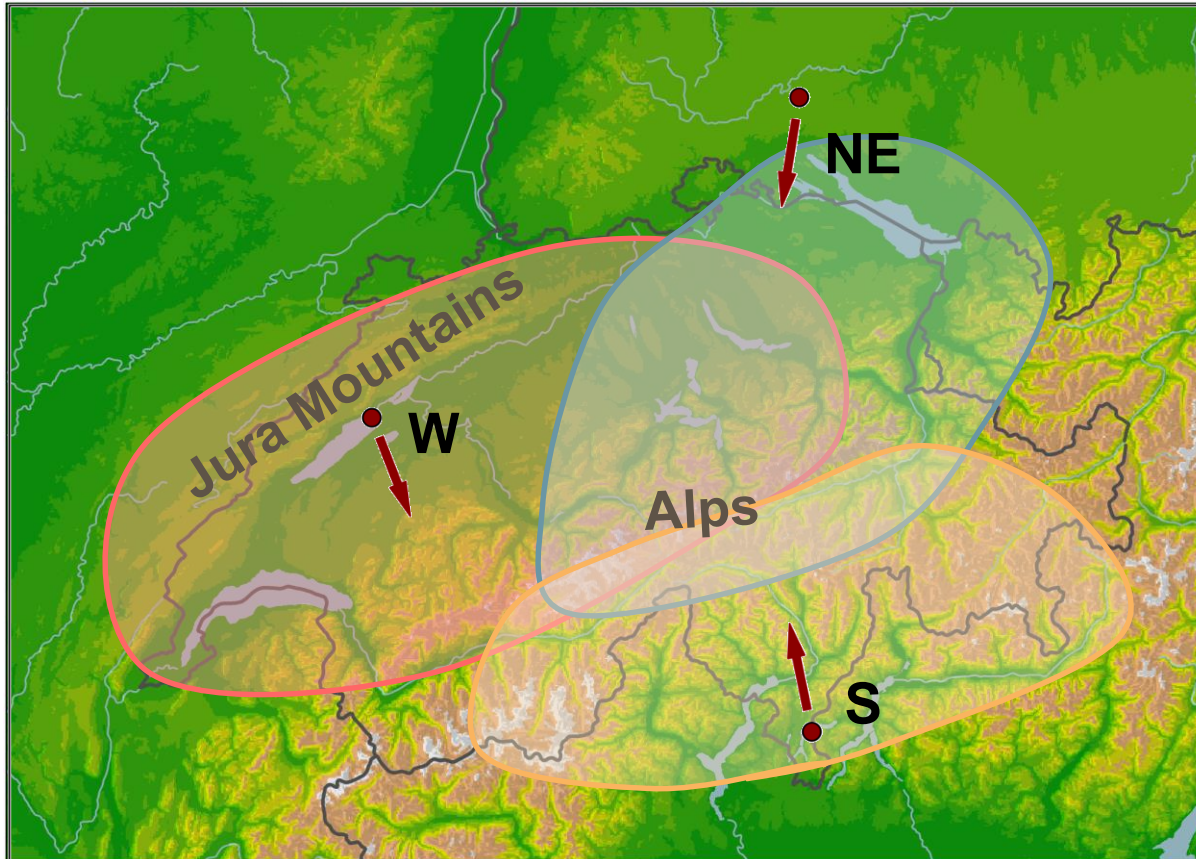
## North-eastern Switzerland



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*



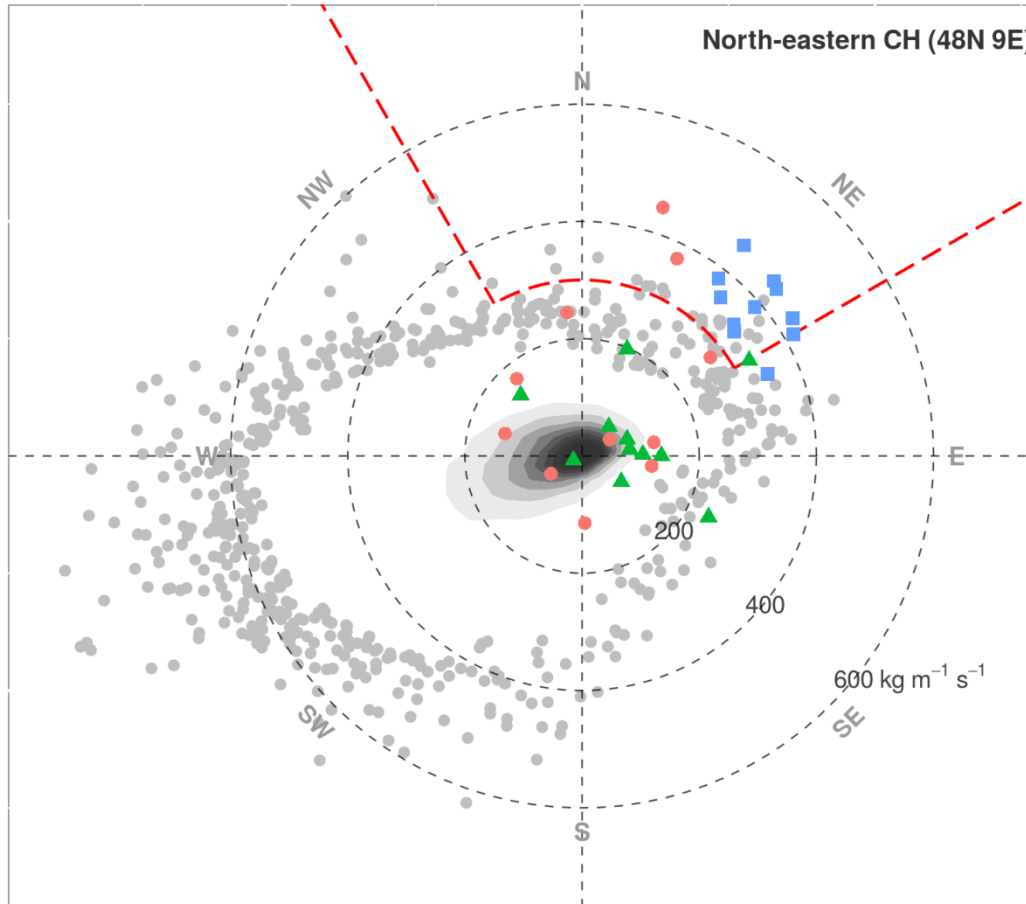
# Flood alert system

- 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

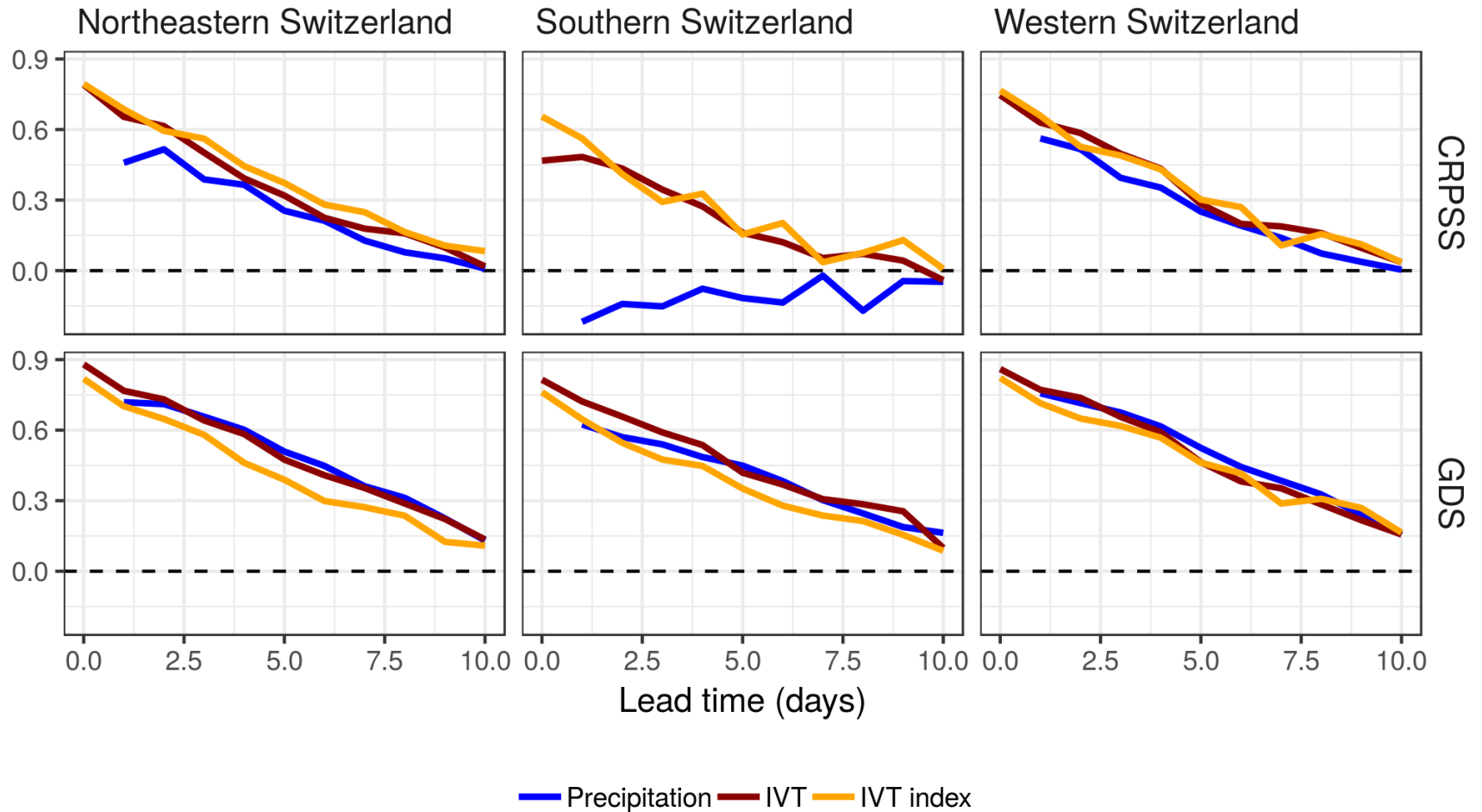


Forecast  
initialization date

- 2005-08-15
- ▲ 2005-08-18
- 2005-08-22

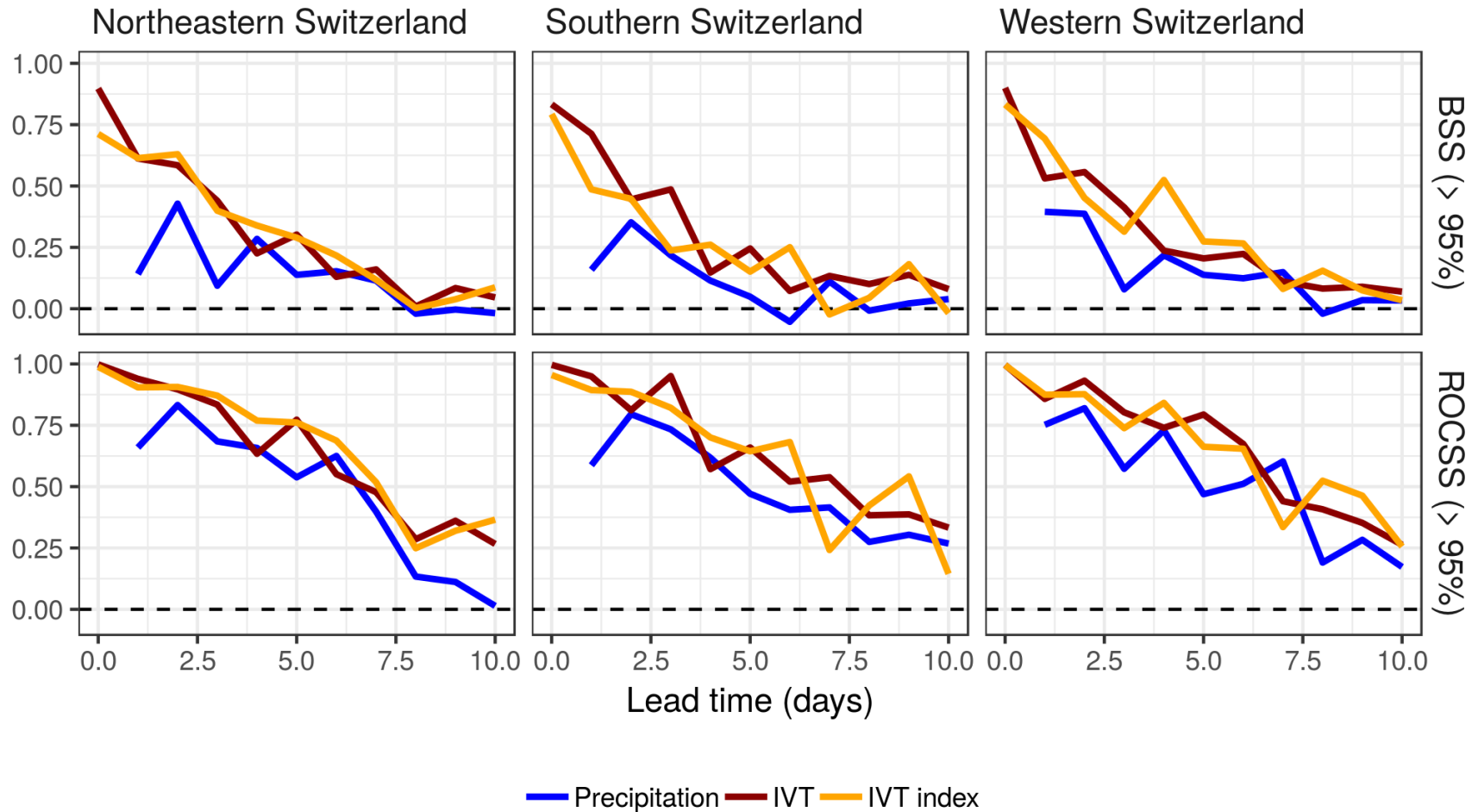


# Skill of forecasts in JJA





# Skill of forecasts > 95<sup>th</sup> percentile in JJA

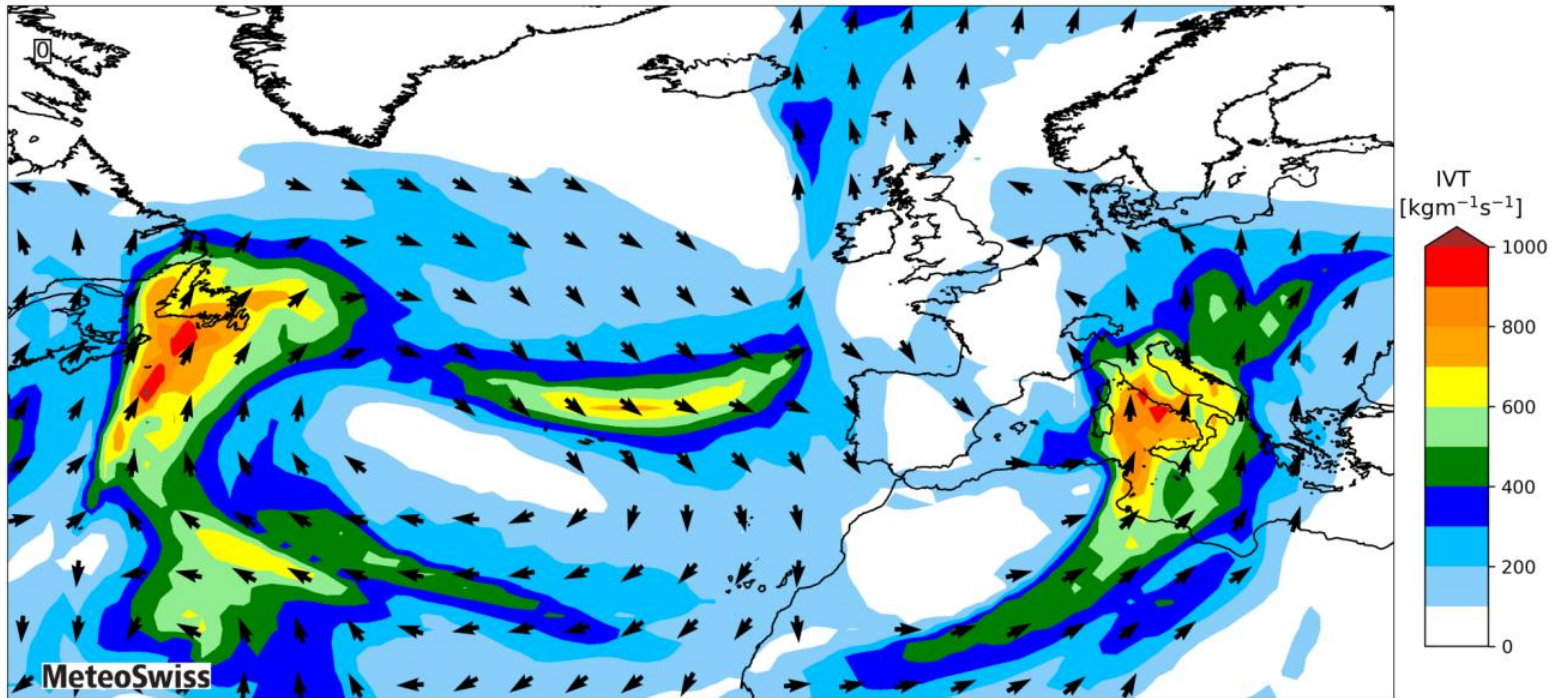




# IVT overview plot

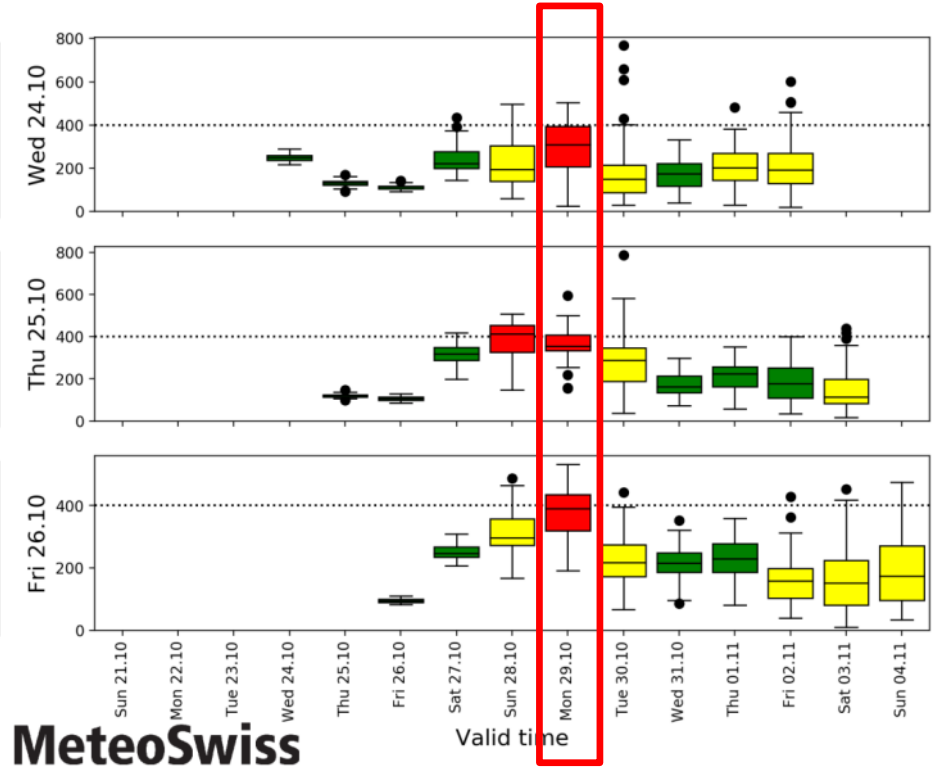
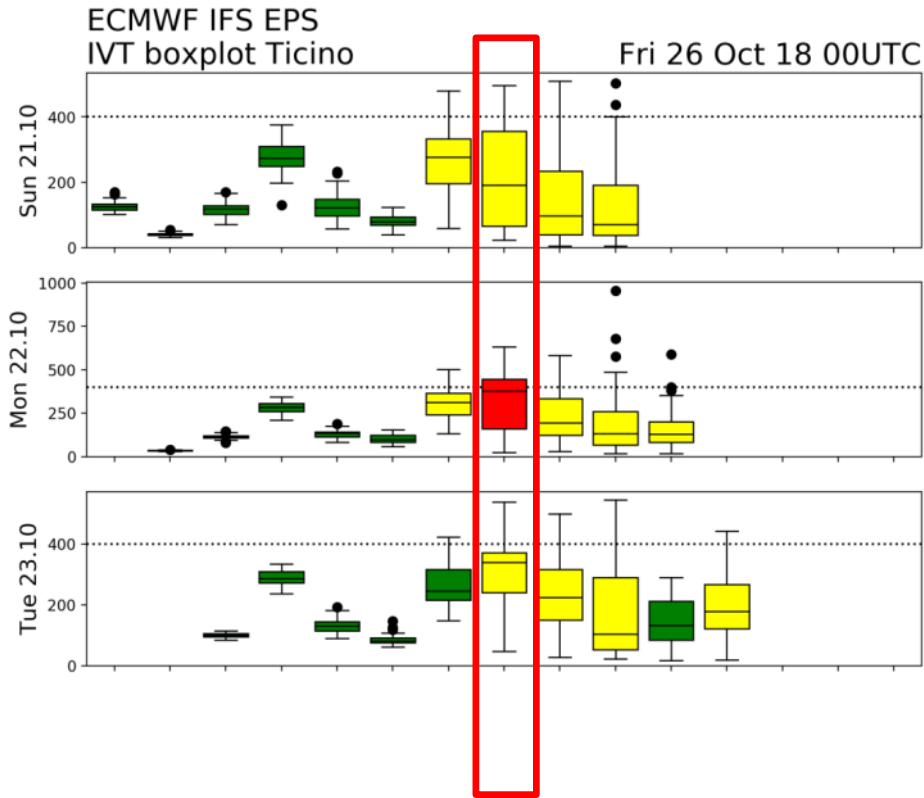
ECMWF IFS EPS  
IVT overview

Mon 29 Oct 18 12UTC  
26.10.18 00UTC +84h





# Track forecast evolution







# Conclusions

- 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



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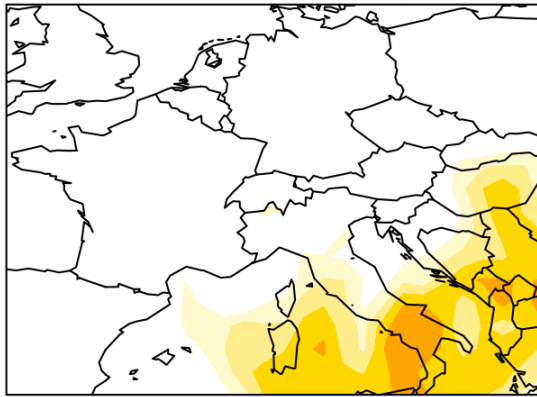
[www.meteosuisse.ch](http://www.meteosuisse.ch)

**MeteoSwiss**

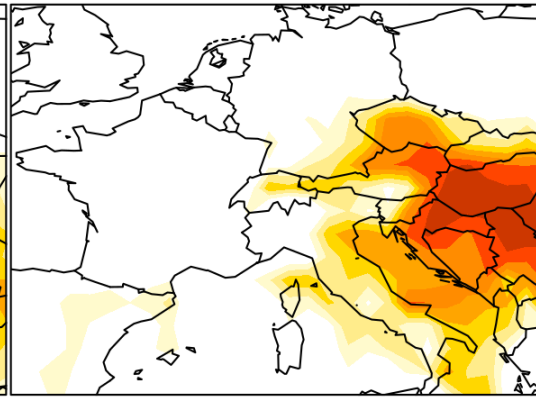
© ECMWF 04/19 bhj

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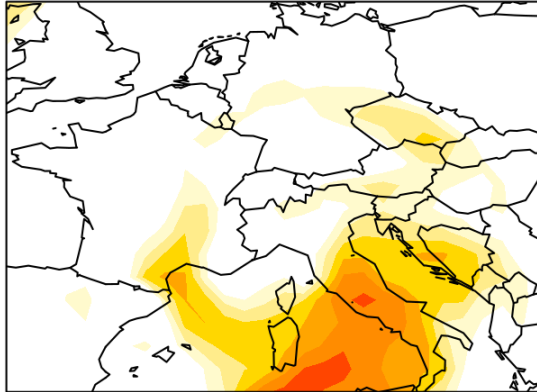
a) EFI of IVT +168h



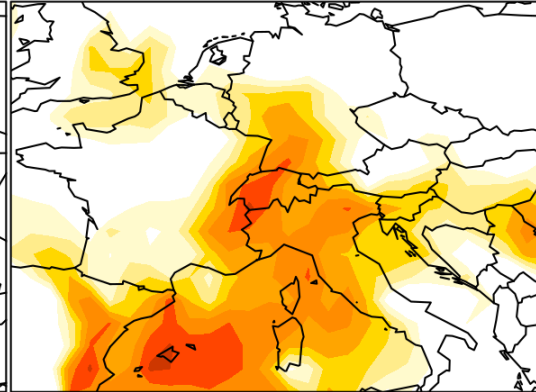
b) EFI of Precipitation +192h



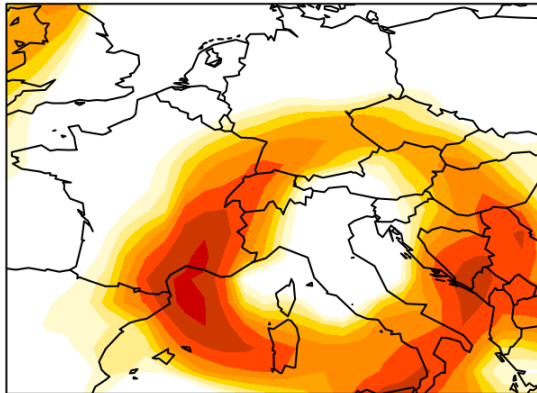
c) EFI of IVT +96h



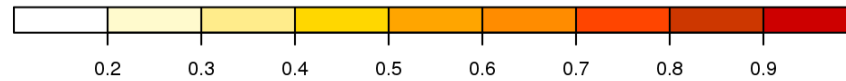
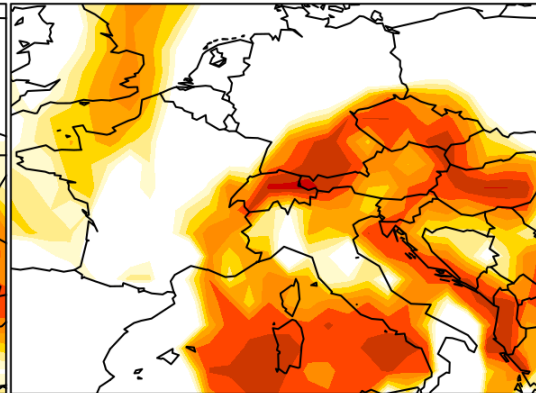
d) EFI of Precipitation +120h



e) EFI of IVT +0h



f) EFI of Precipitation +24h





# EFI for IVT (magnitude only)

