

尽管还难以达到百分之百的准确，我们仍要尽百分之百的努力。

We are not perfect, but we will do our best



***“Although it is not yet possible to achieve 100 % accuracy, we will continue to give 100 % in trying.”***

**Shanghai weather bureau, December 2008**

# **Approaches to process- and event-oriented verification of warnings**

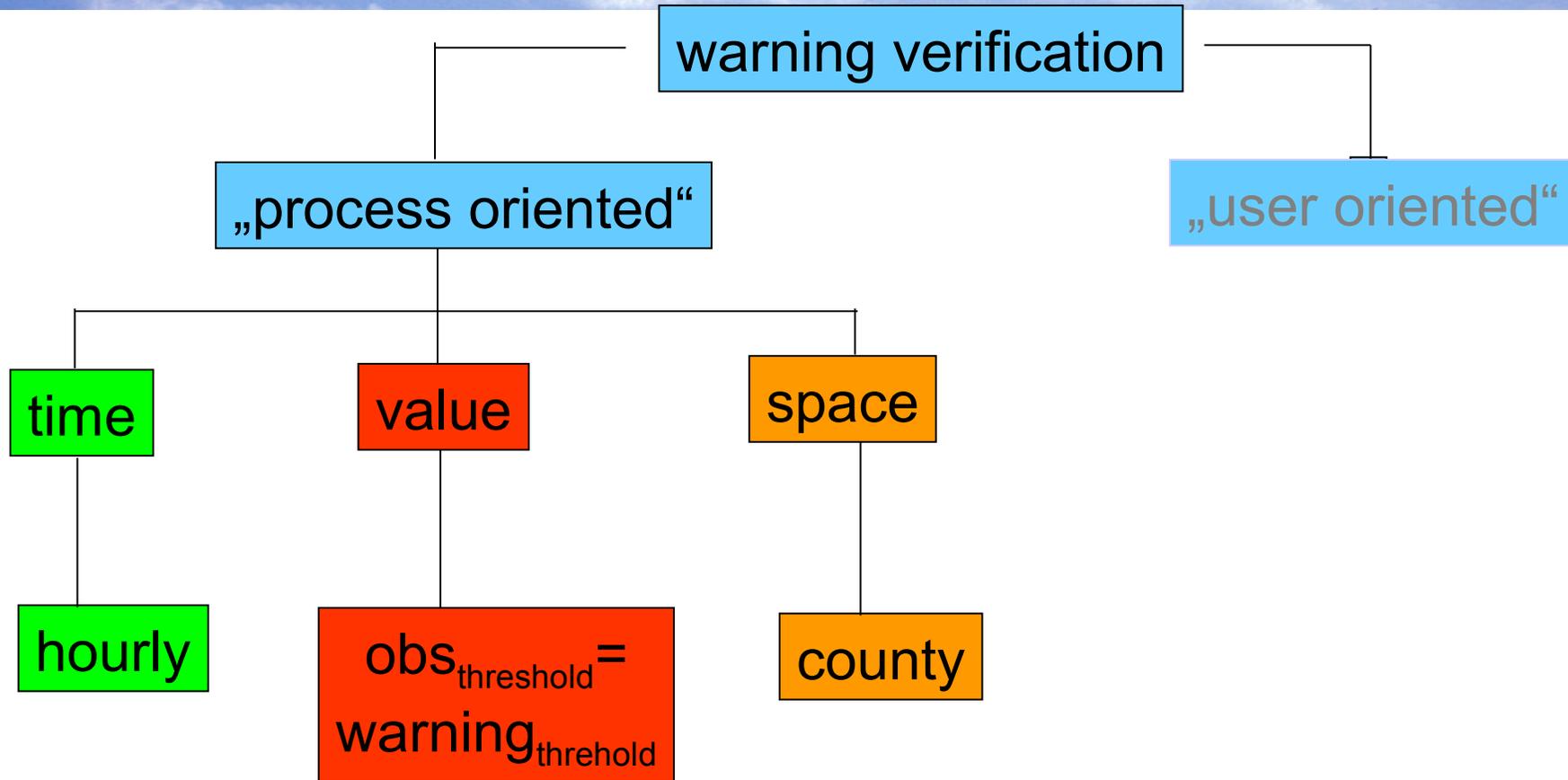
Martin Göber

Department Weather Forecasting  
Deutscher Wetterdienst DWD  
*E-mail: [Martin.goeber@dwd.de](mailto:Martin.goeber@dwd.de)*

Acknowledgements: T. Kratzsch, R. Kirchner, S. Tremmel, S. Schweigert

**Major issue in warning verification:**

**How do you match warnings and observations?**



user: operational control („single voice“)

## ***Area wide observations of thunderstorms:***

- *Siemens-BLIDS lightning detection system*

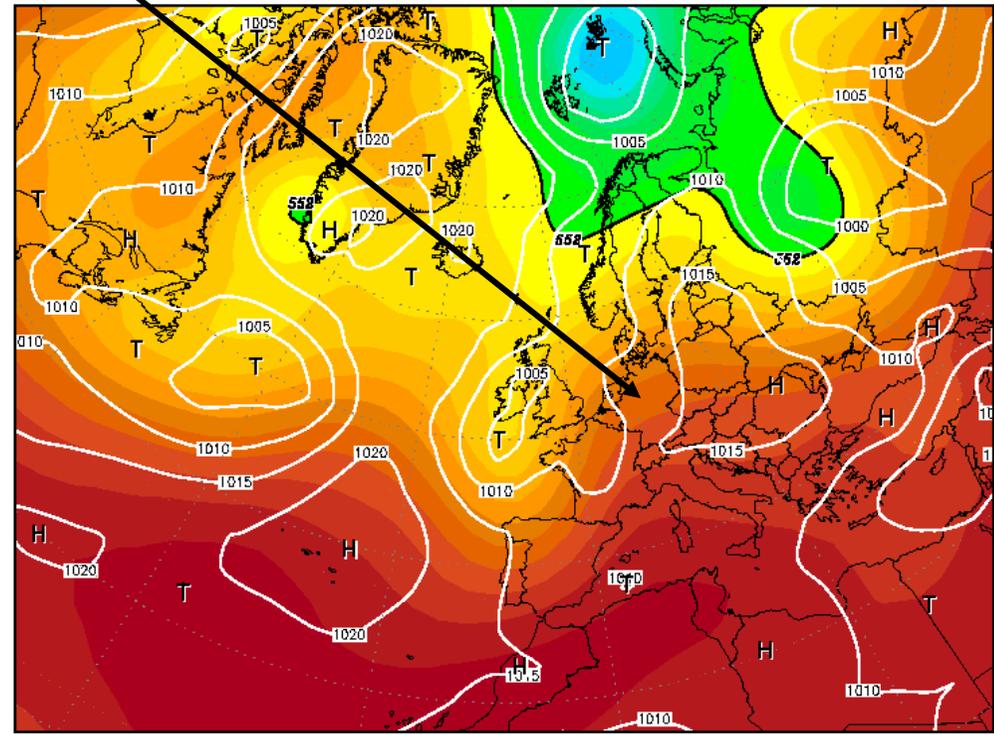
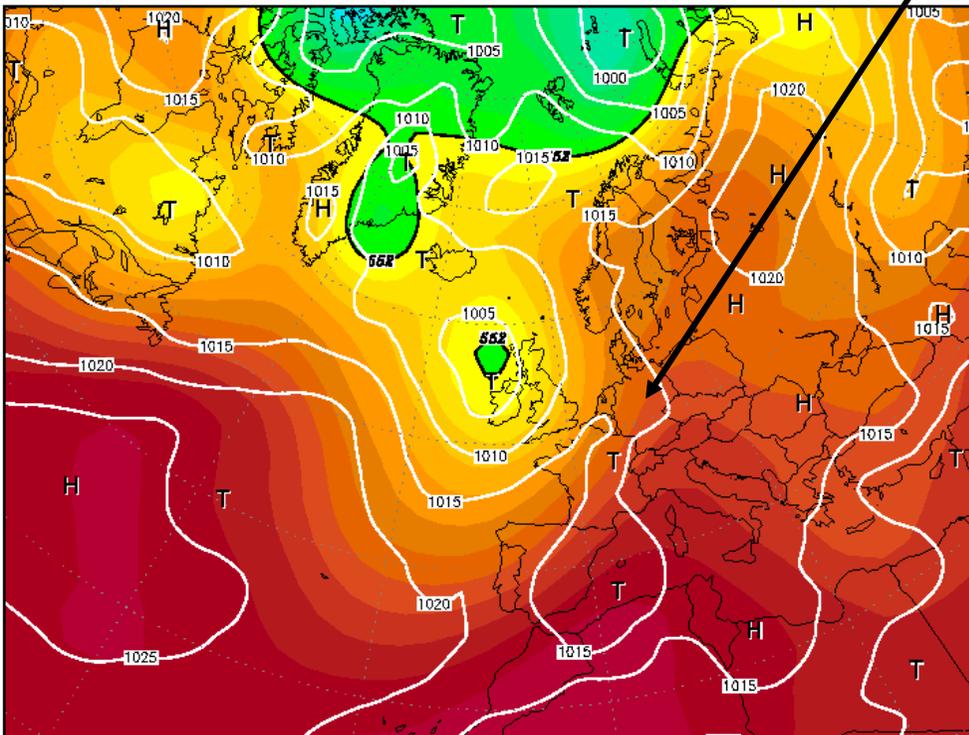
## ***Verification:***

- ***hourly***
- *at county level*
- *summer 2006*

Germany

21. July 2003

7. August 2008



Daten: Reanalysis des NCEP  
(C) Wetterzentrale  
[www.wetterzentrale.de](http://www.wetterzentrale.de)

Daten: Reanalysis des NCEP  
(C) Wetterzentrale  
[www.wetterzentrale.de](http://www.wetterzentrale.de)

500 hPa geopotential + sea level pressure

## Verification of thunderstorm warnings against lightning observations YES / NO

### observation

 NO

 YES

### warning

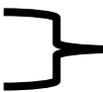
 NO

 moderat

 e  
strong

 severe

### verification

  correct NO

  hit

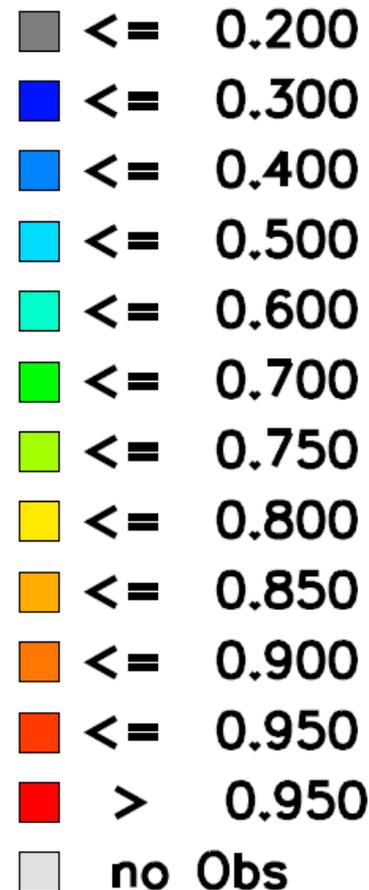
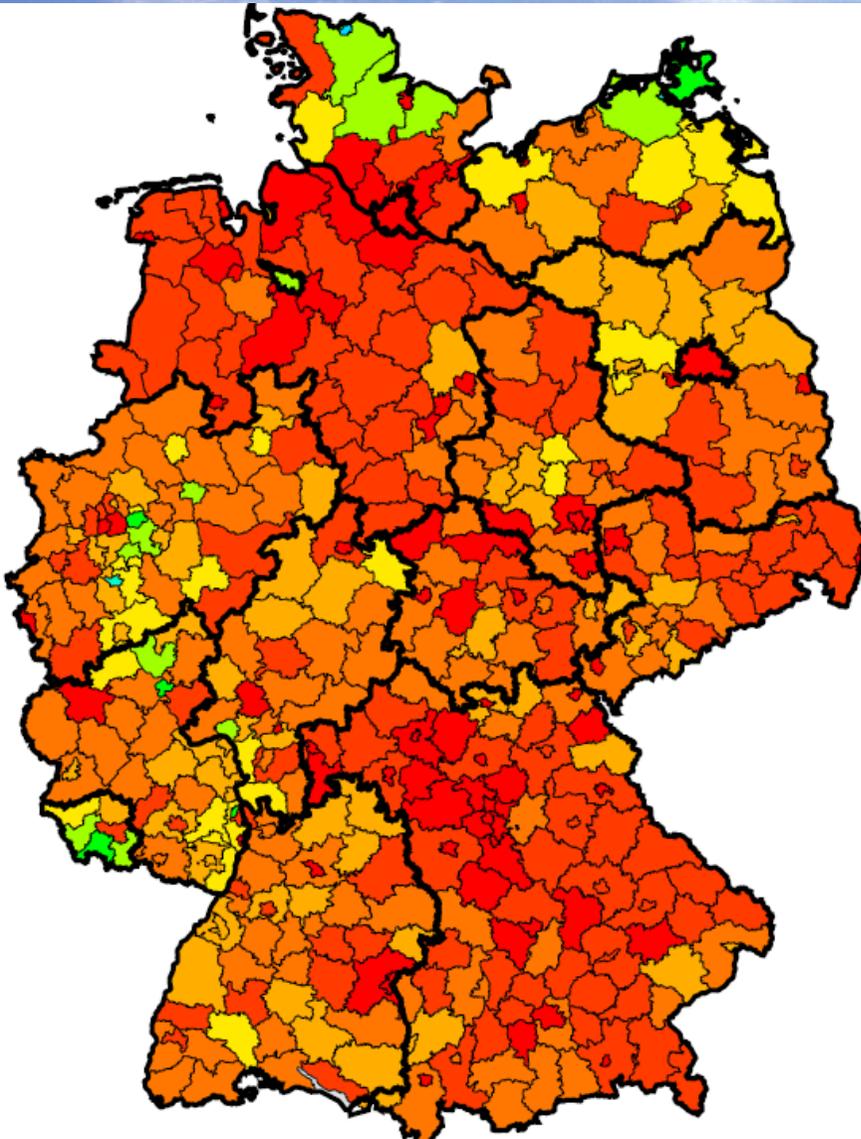
  hit

  false alarm

  false alarm

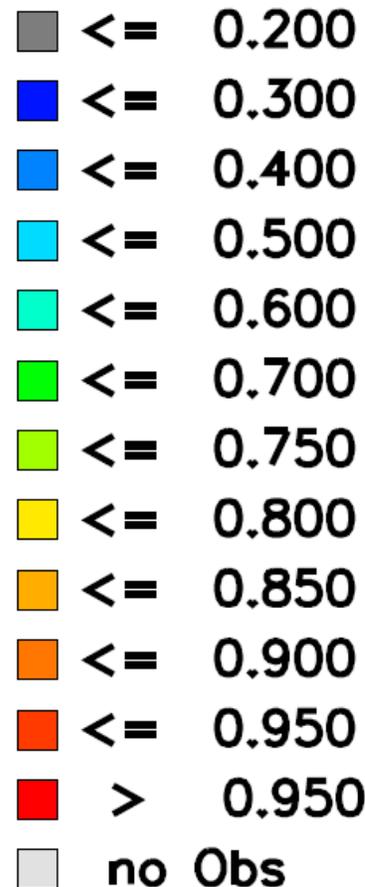
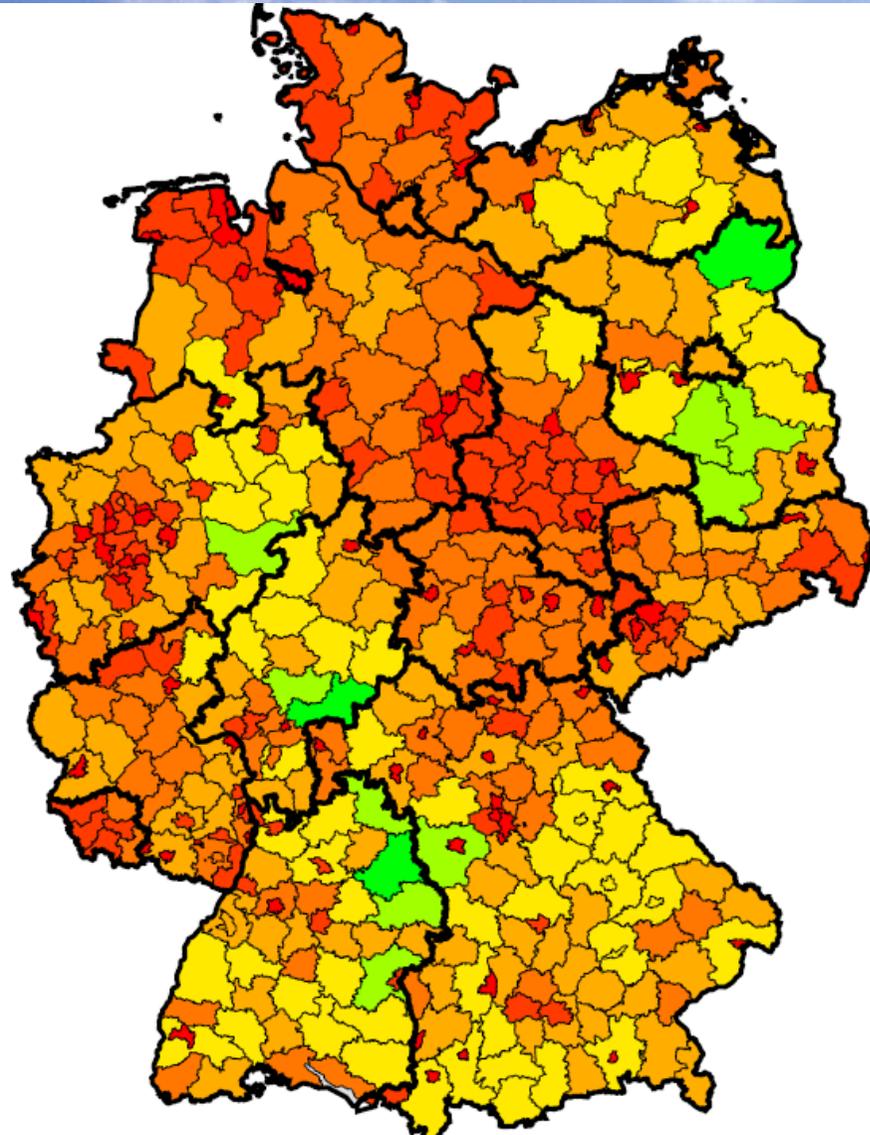
  miss

  miss



*hit rate* (2008)

*proportion of hits  
on all YES events*



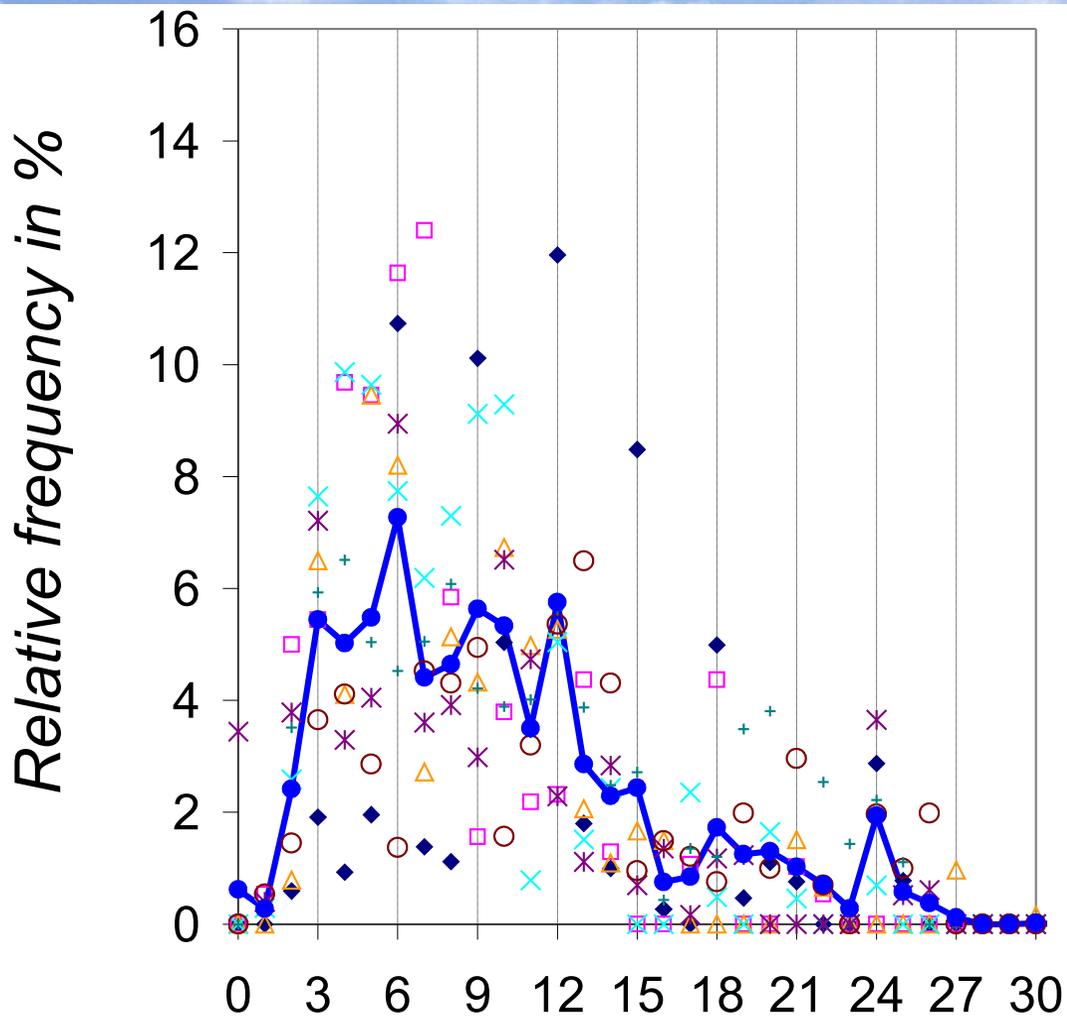
***false alarm ratio***

*proportion of false alarms  
on all YES forecasts*



# Deutscher Wetterdienst

× OF 0-1   ○ SU 0-1   + MS 0-1   ● DWD 0-1



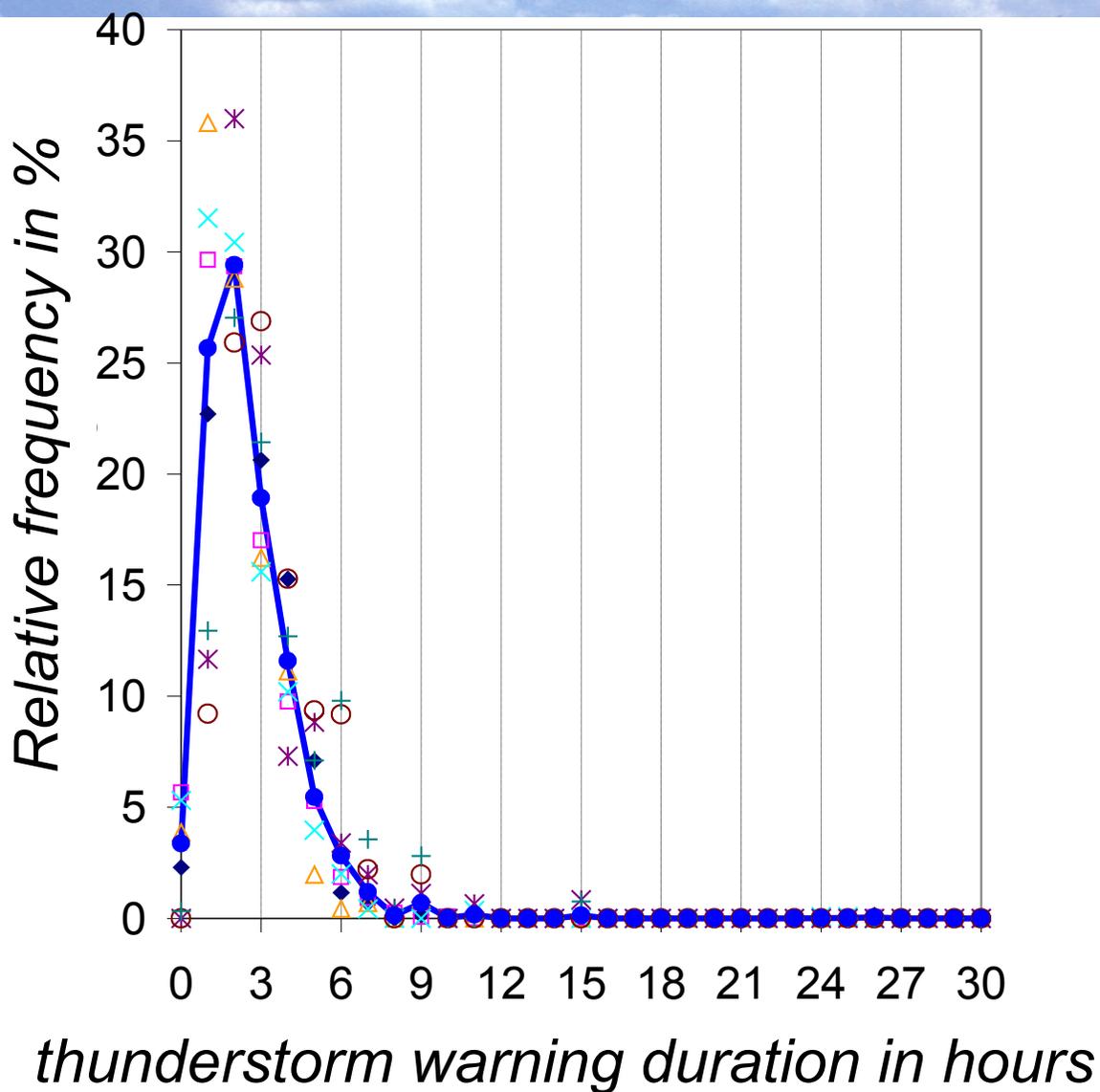
**2003**

*thunderstorm warning duration in hours*



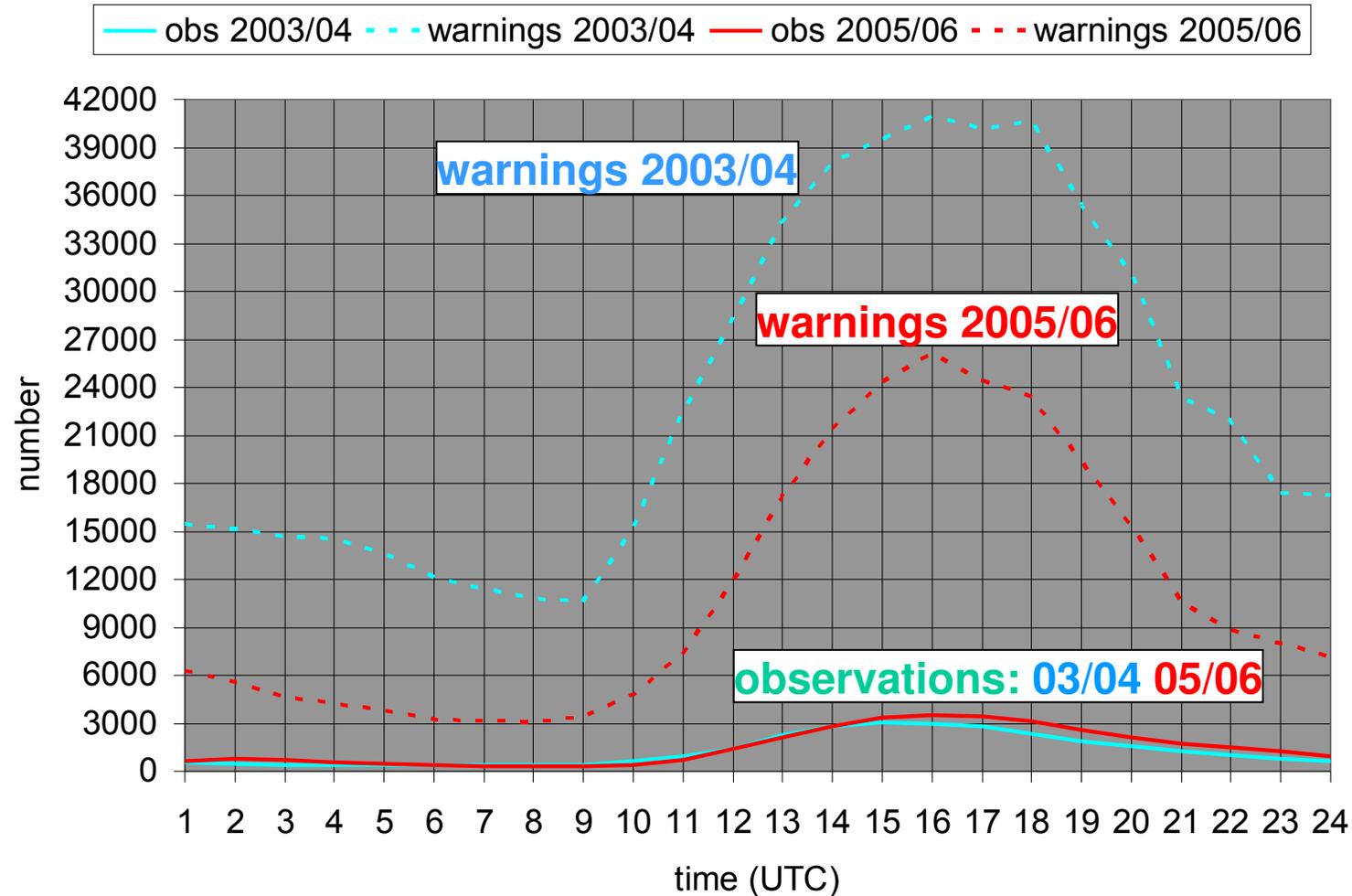
# Deutscher Wetterdienst

× OF 0-1    ○ SU 0-1    + MS 0-1    ● ALLE 0-1

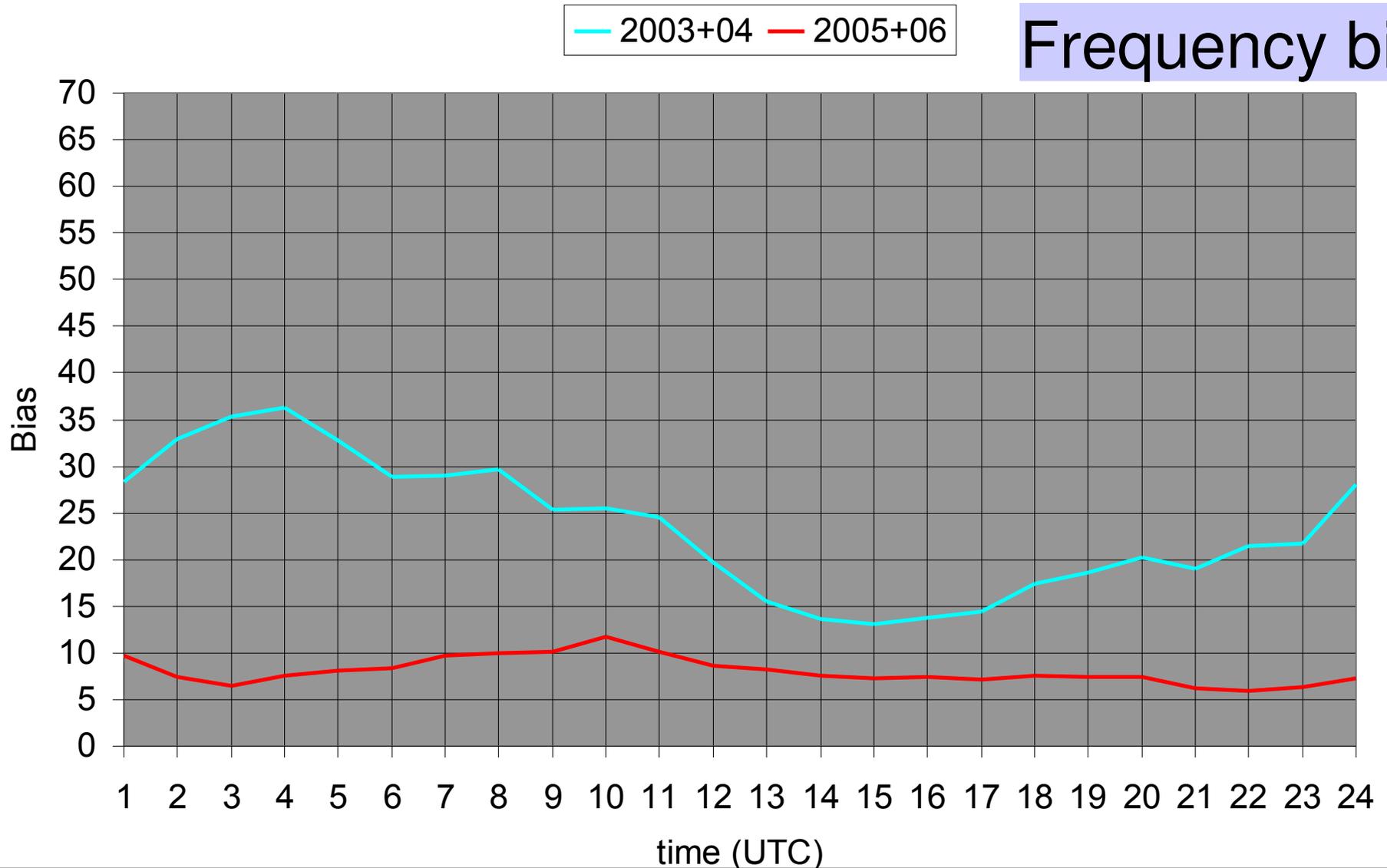


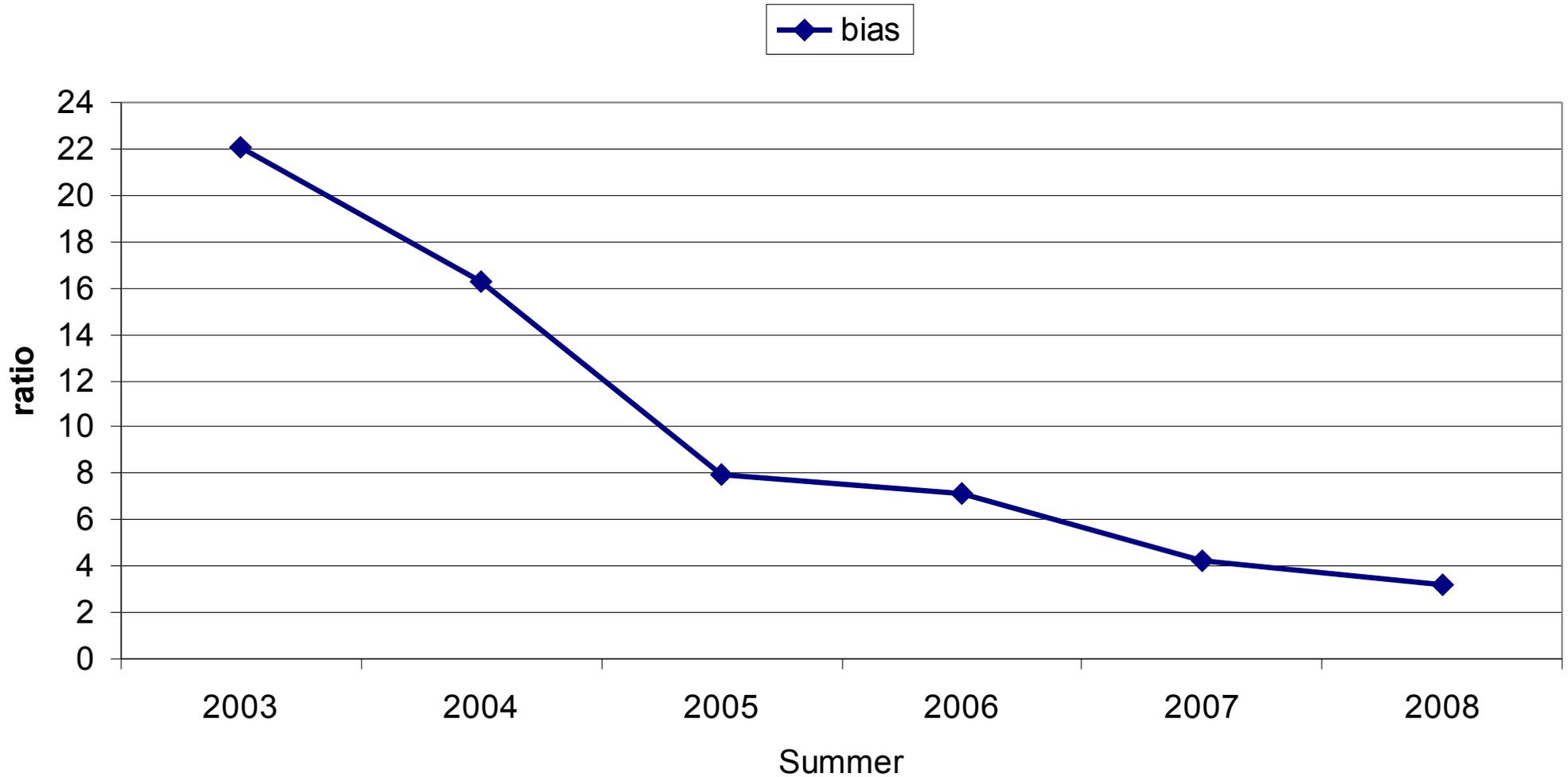
**2006**

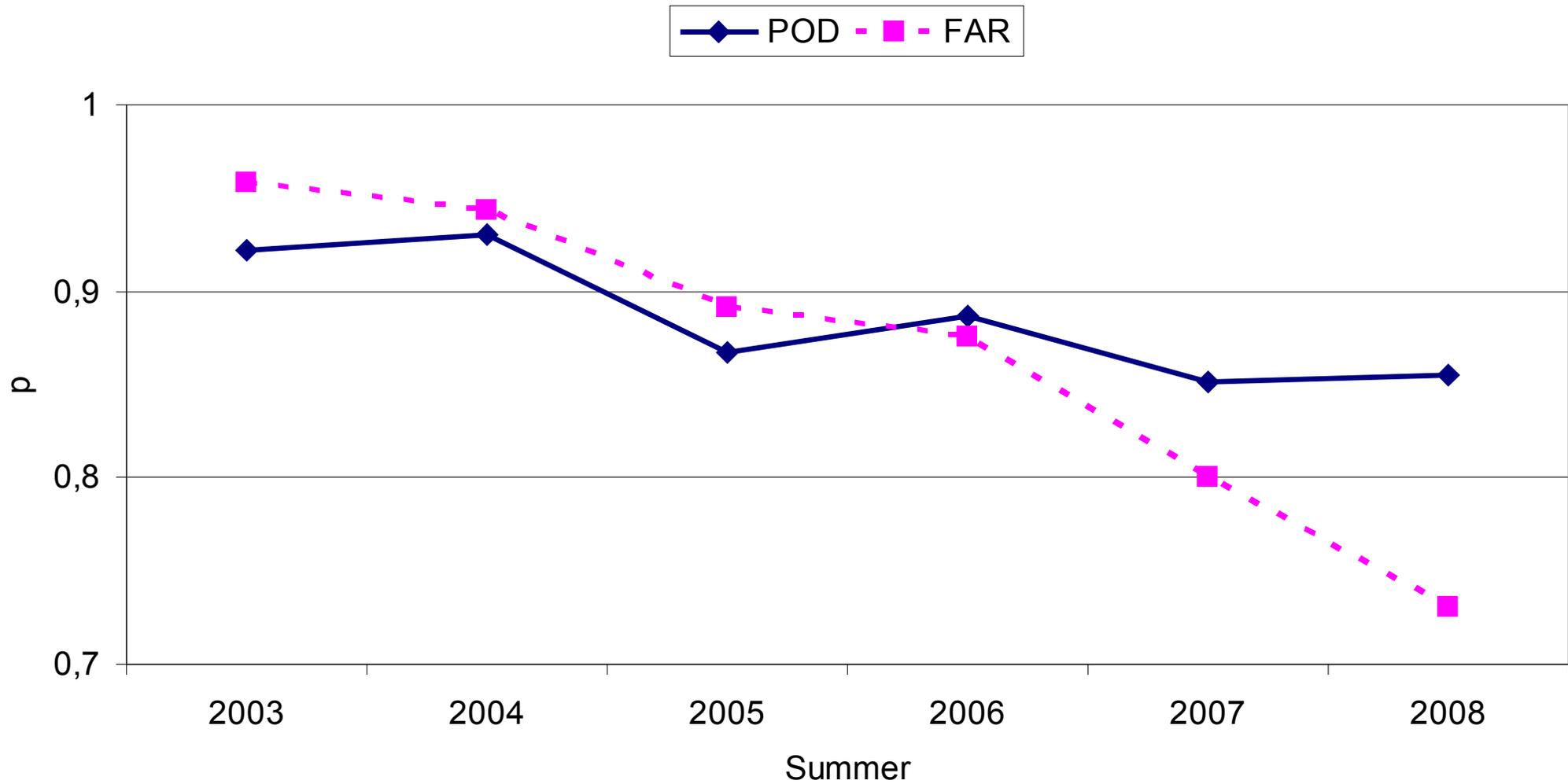
## daily cycle of ...



## Frequency bias





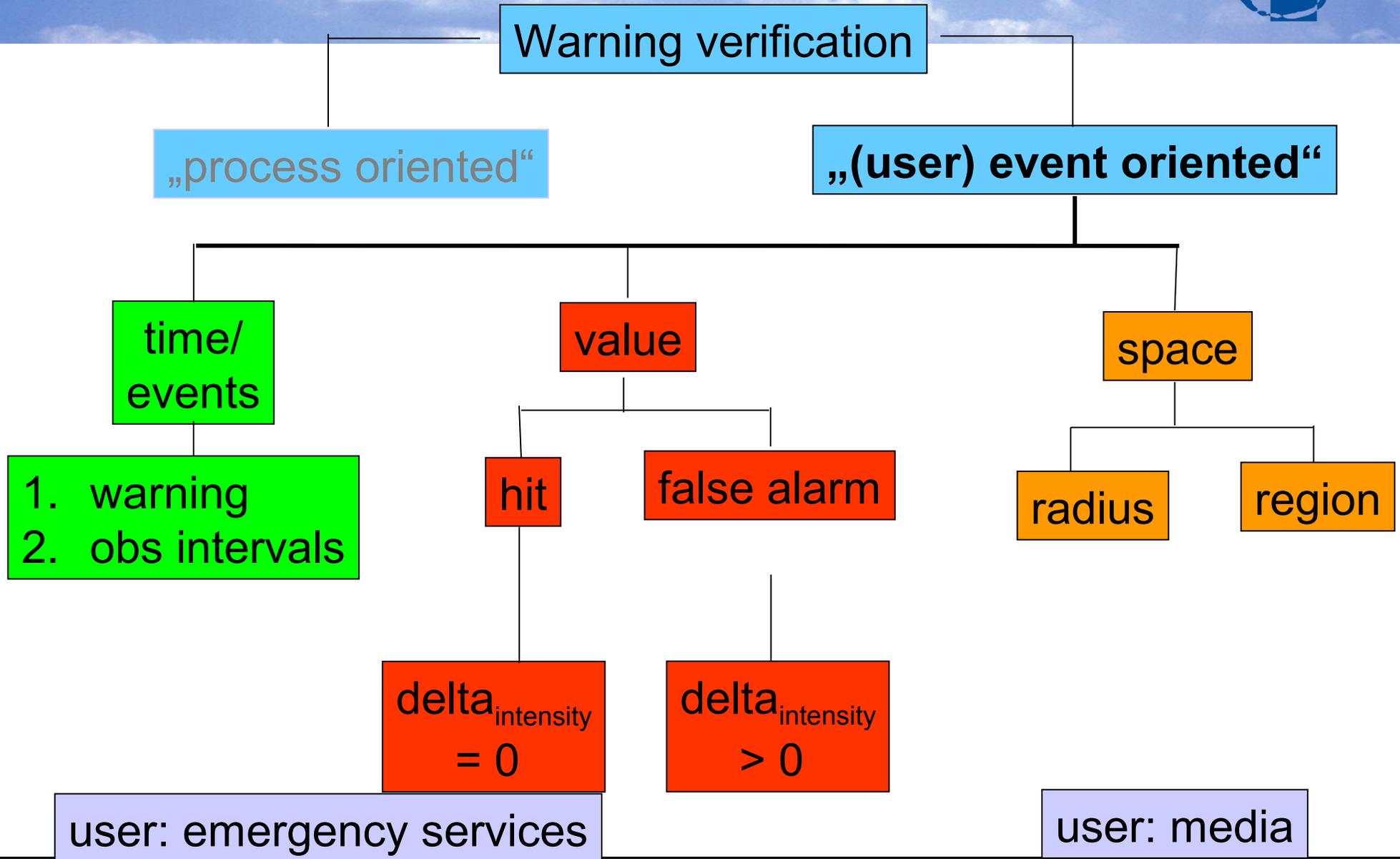


## Summary for process oriented verification

- thunderstorm warnings on a small spatial and temporal scale can be skillful
- greatest improvements in the quality have and will come from the reductions in false alarms
- „simple“ organisational measures can improve forecasts already substantially

## Motivating (user) “event – oriented” warning verification

- Users are not interested in the ups and downs of the weather during a severe event (within certain limits) → event should be verified en bloc.
- An „event“ comprises homogenised observations and / or warnings.
- Evaluation of the intensity of a warning should be somewhat tolerant.



## Choice of parameters for verification of thunderstorms YES / NO

1. Warning YES/NO against lightning measurements
2. False alarm:
  - No lightning during warning
  - additionally: at least **3 consecutive hours** without lightning, i.e. considerably too long
  - Required lead times for a hit: 0 or 1 hours



**hit**

time	15	16	17	18	19	20	21
observation			1				
warning		1	1	1	1		
time of issue		X					

hourly, "process oriented" verification      "event oriented" verification  
 1 hit      1 hit  
 3 false alarms

**miss (too late)  
 or  
 hit (still useful)**

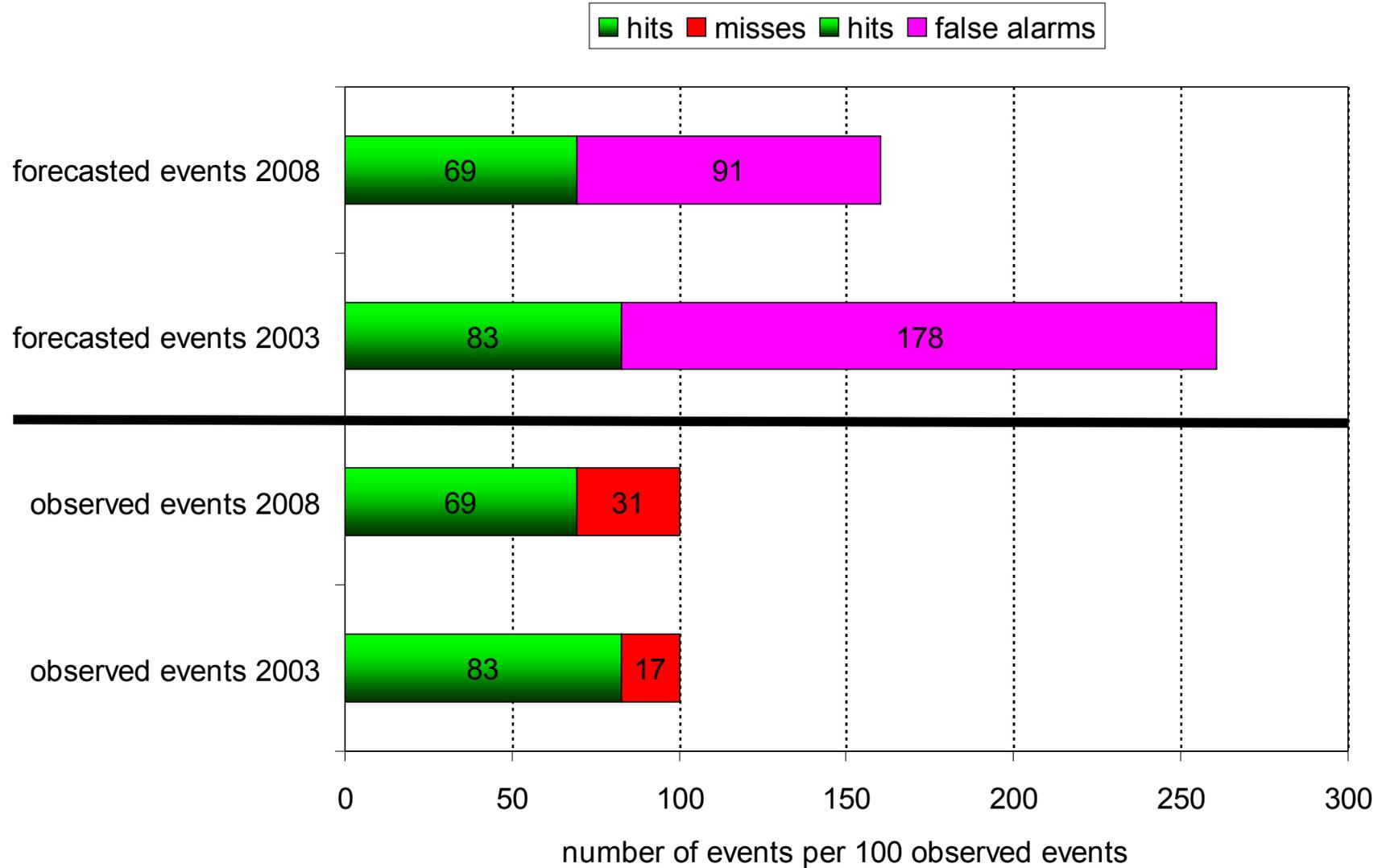
time	15	16	17	18	19	20	21
observation		1					
warning		1	1	1			
time of issue		X					

hourly, "process oriented" verification      "event oriented" verification  
 1 miss (or hit)      1 miss  
 2 false alarms

**hit  
 +  
 false alarm  
 (too long)**

time	15	16	17	18	19	20	21
observation			1				
warning		1	1	1	1	1	
time of issue		X					

hourly, "process oriented" verification      "event oriented" verification  
 1 hit      1 hit  
 2 false alarms      ( including 1 false alarm )



# Deutscher Wetterdienst





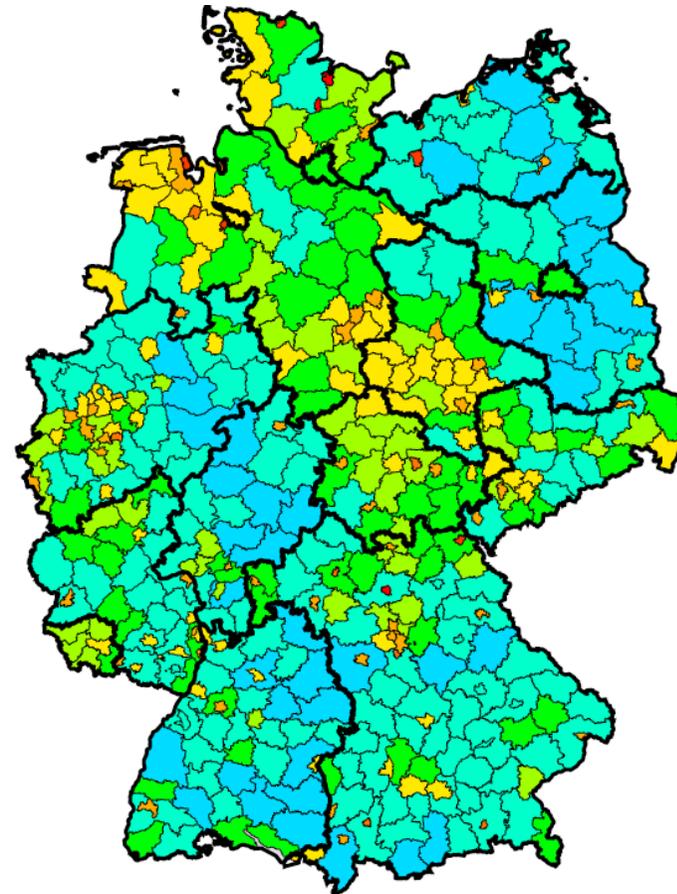
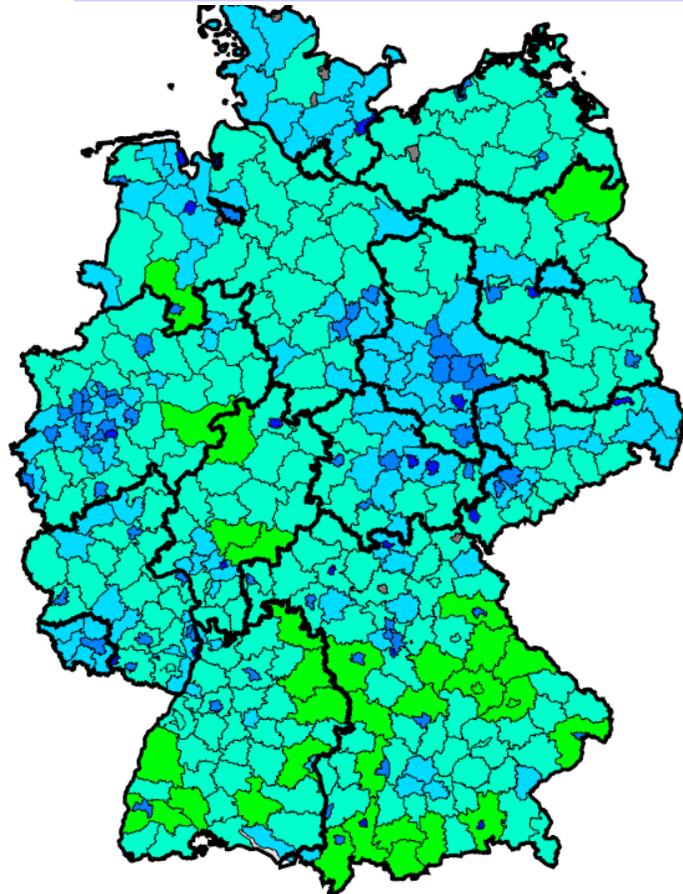
## Summary for event oriented verification

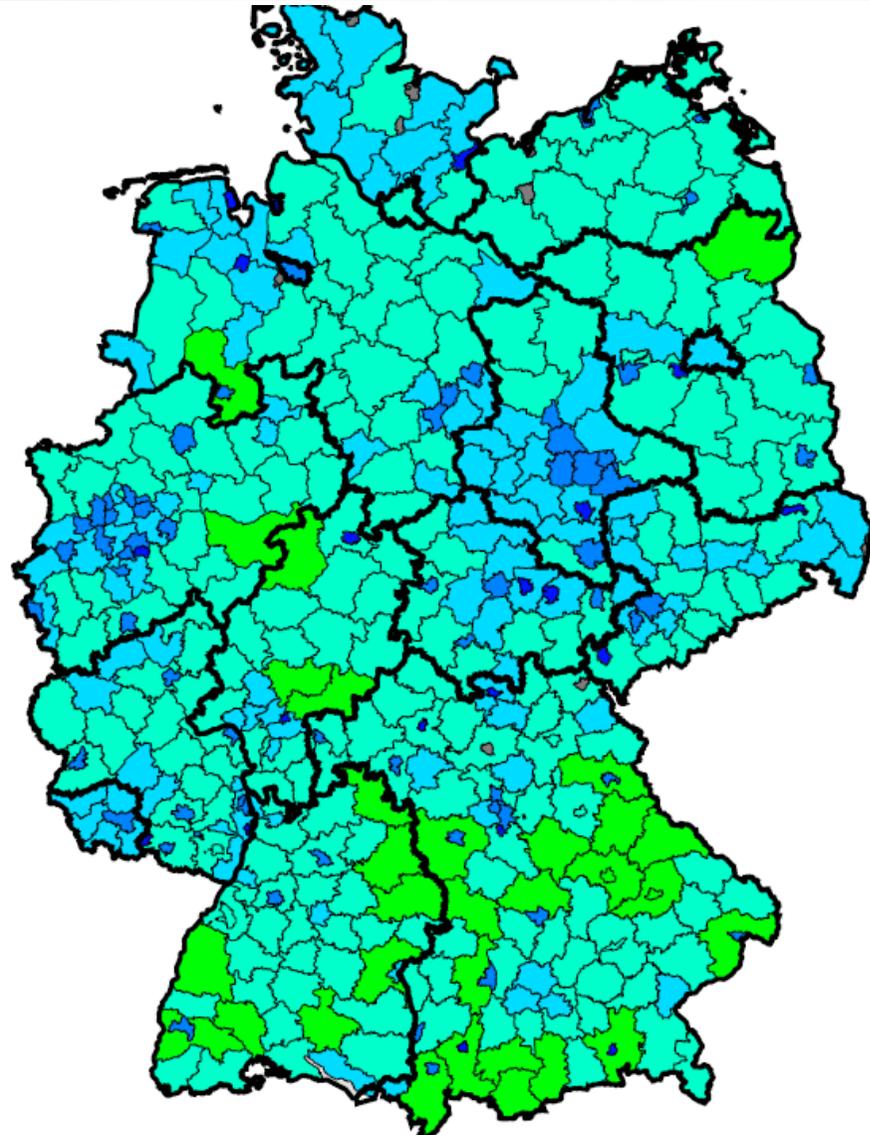
- warnings have become spatially and temporarily detailed
- there have been only few events, which were completely unwarned
- half of the warnings were perfect
- excessive warning has been substantially reduced

## Thunderstorms

base rate 1/hour

bias





*relative frequency  
of thunderstorms  
in a county*

