

# Towards a Reprocessing of Surface-based Radar Data

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Jörg Schulz, EUMETSAT

on behalf of

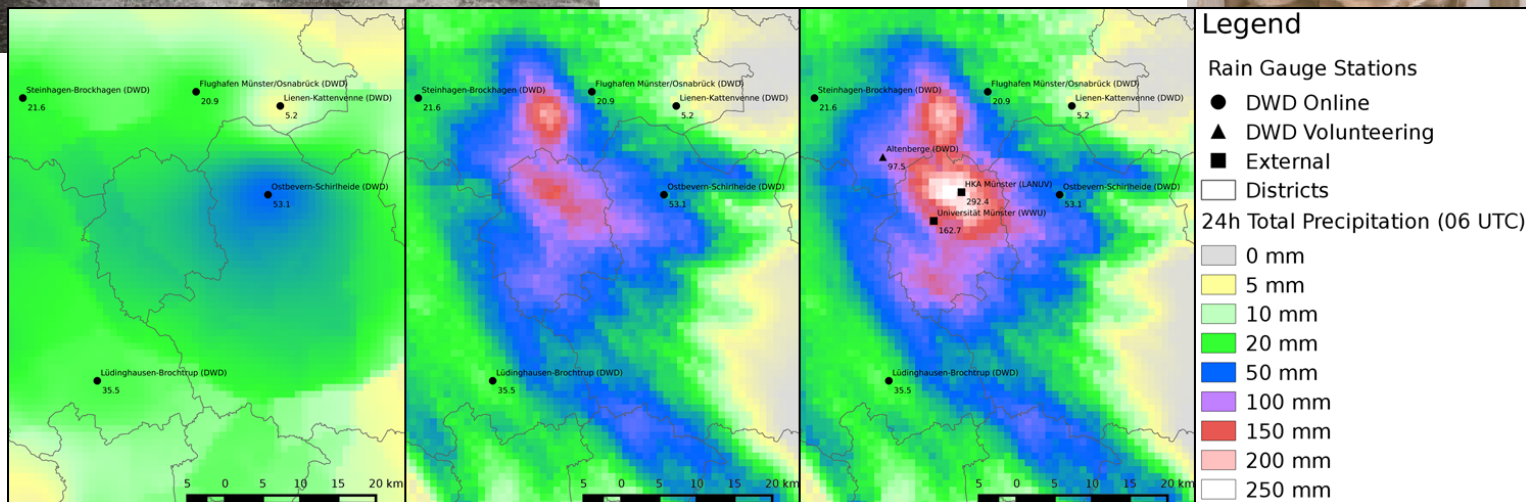
Andreas Becker (DWD) and Brian Nelson, NOAA-NCEI

Credits to many more that have worked on radar data

## Extreme Precipitation - A new Challenge



- Münster, July 2014
- total precipitation:  
293 mm / 12h and  
264 mm / 2h



Rain gauge

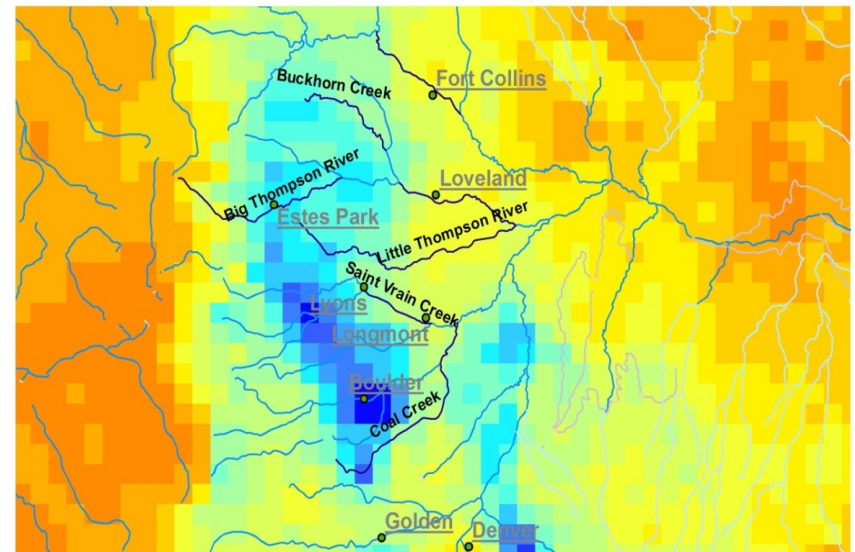
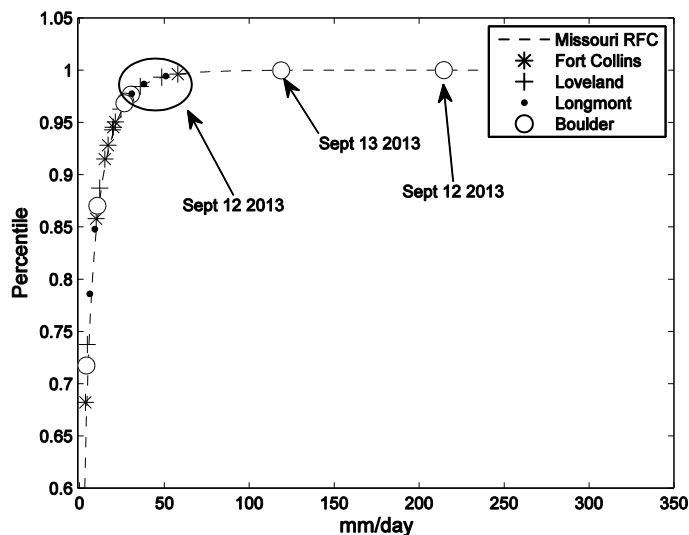
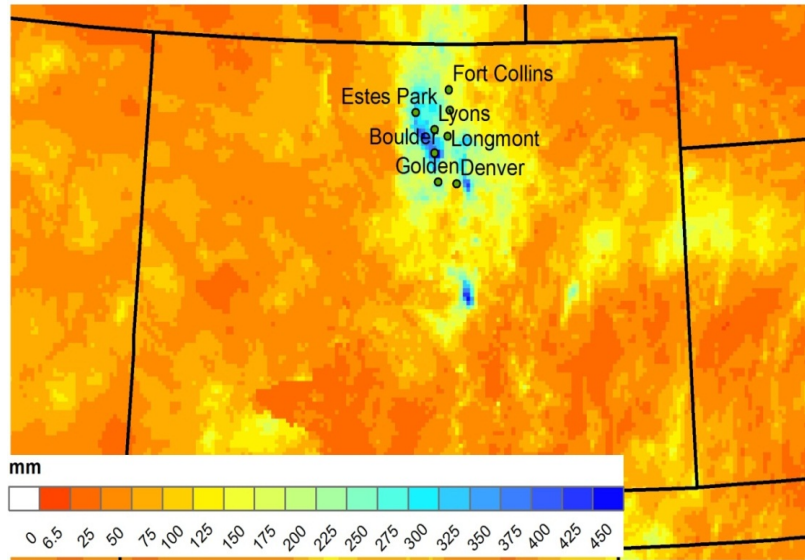
Radar

Quantified radar

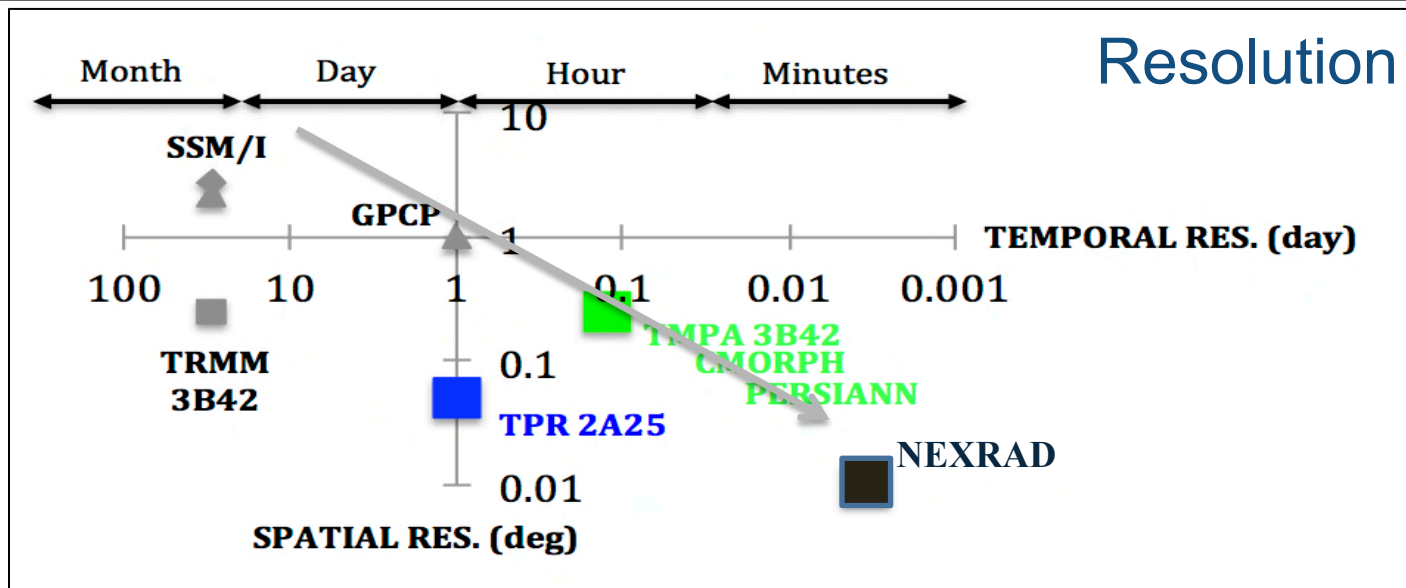
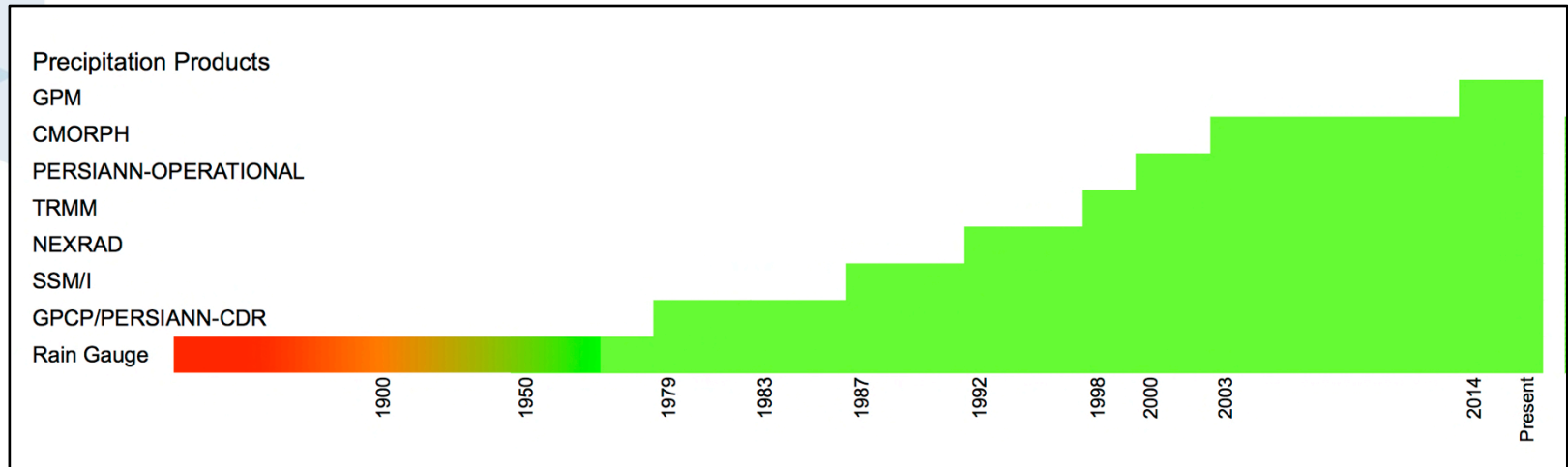
# Application of Radar data

## Colorado Front Range Floods

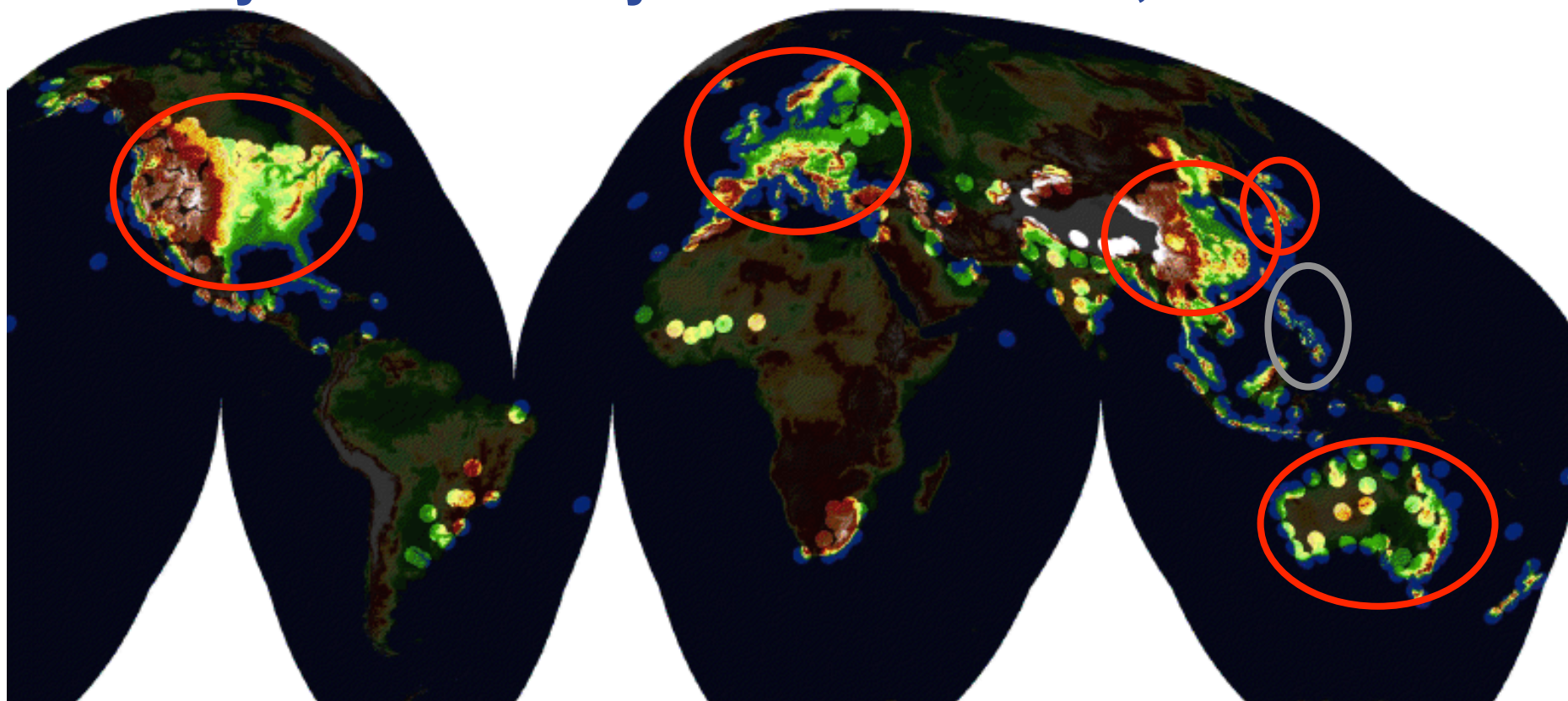
- Analysis Based on **NCEP Stage IV** bias adjusted radar data
- Event Dates  
September 9 – 16, 2013



# Precipitation Availability and Resolution



## World wide weather radar coverage > 800 systems listed by Heistermann et al., 2013



**Power Areas related to NHMSs of US, China, Japan, Philippines, Australia and Europe**

<http://www.hydrol-earth-syst-sci.net/17/863/2013/hess-17-863-2013.pdf>

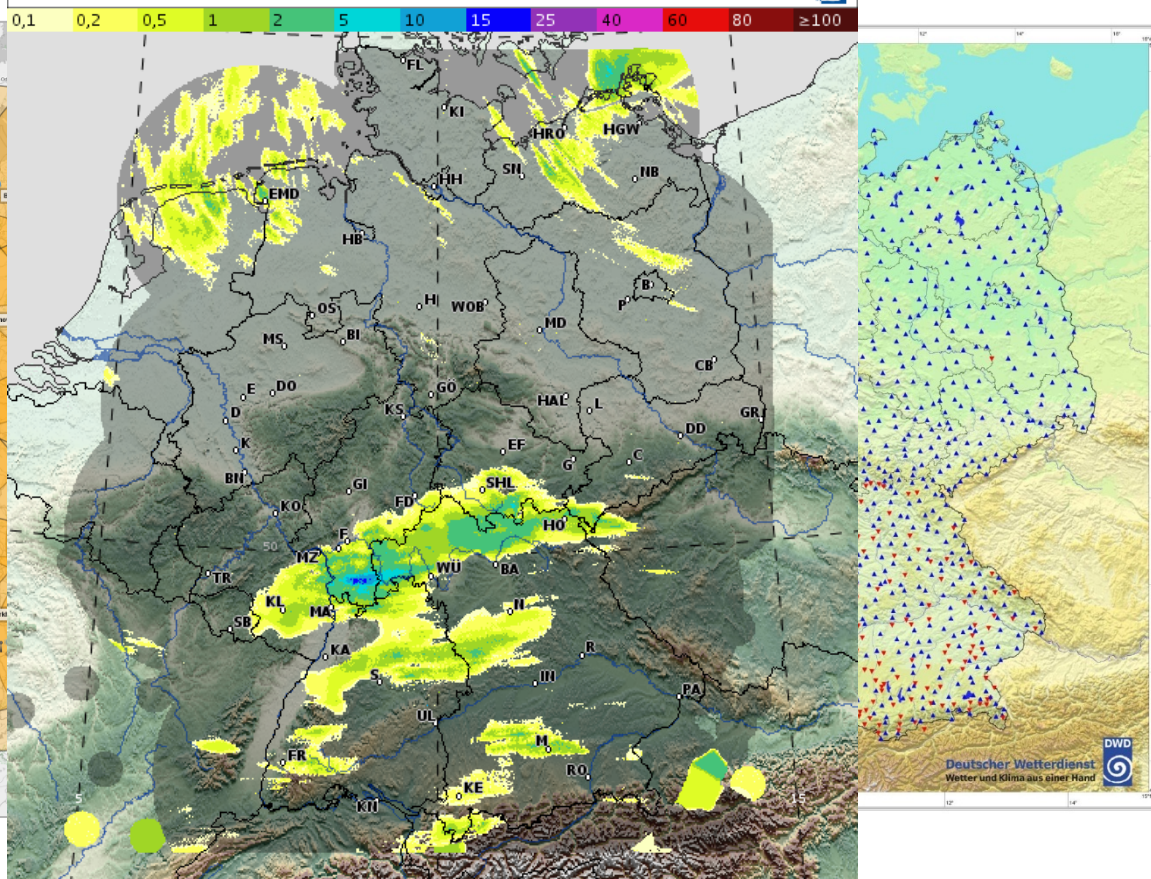
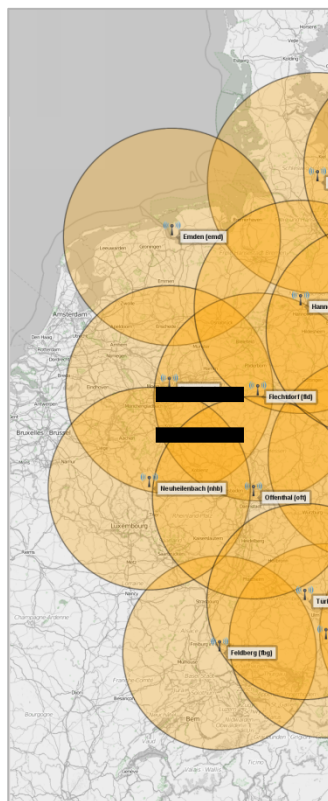
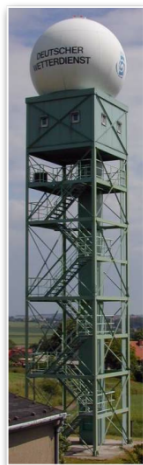
Heistermann et al. (2013), HESS

# 2 Radar based QPE with calibration against gauges

## Two Types of Precipitation Measurement

17 C band radar stations operated by DWD  
RADOLAN-Produkt RW (mm/h)  
Termin: 2012-11-05 22:50 UTC  
© 2012 Deutscher Wetterdienst, Geographiedaten: © BKG (www.bkg.bund.de)

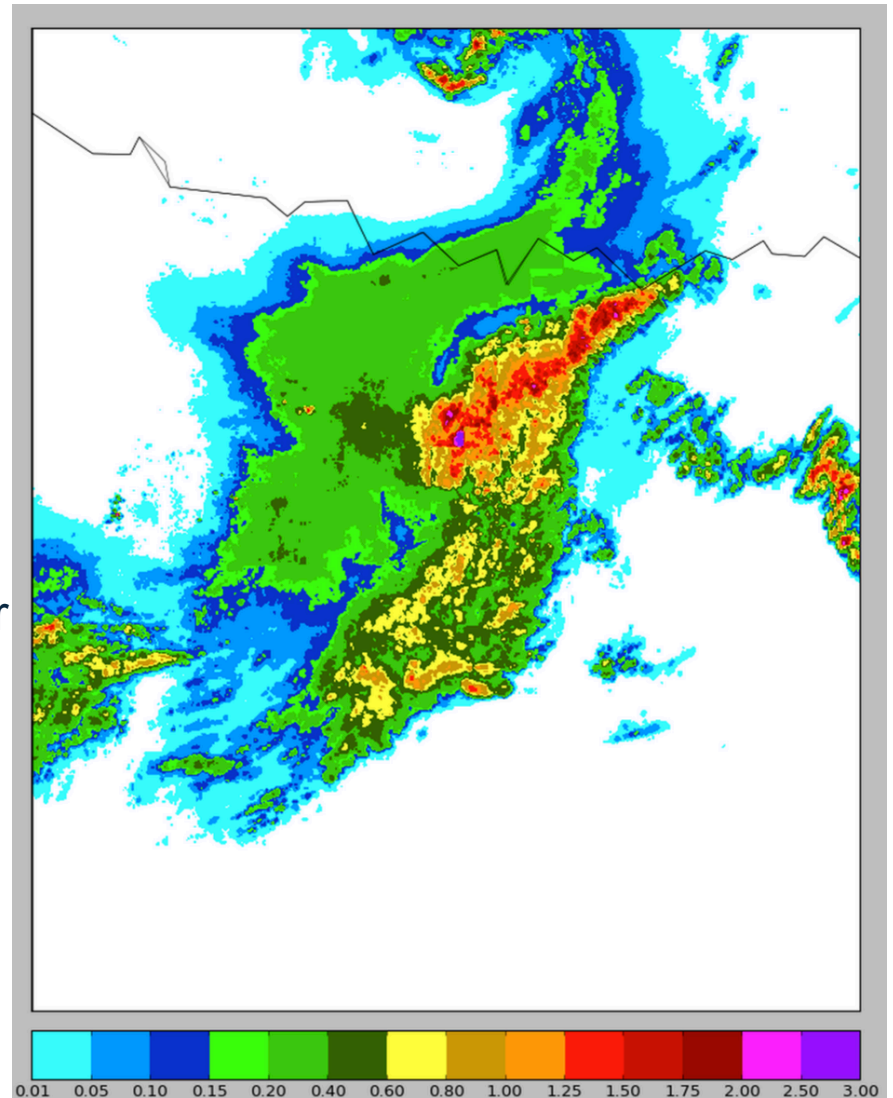
Gauges operated by state authorities



# Multi-sensor Precipitation

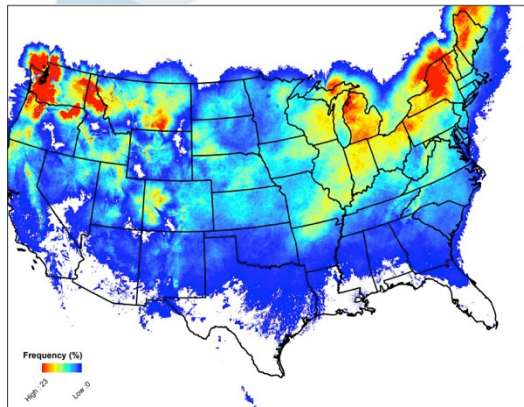
## High-Resolution NEXRAD Reanalysis (NMQ/Q2)

- Provides rainfall amounts at 1-km resolution every five minutes
- Can easily scale to other time periods
  - Hourly, daily, seasonal totals
  - Peak rainfall over a given period
- Also provides hail identification and other information on precipitation type
- Will be available from around 2001 to 2012.

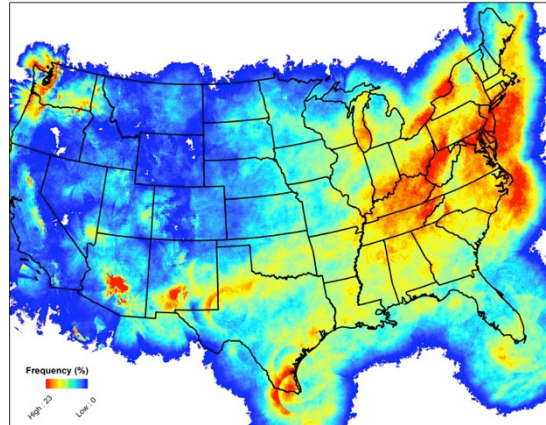


# Frequency of type of Precipitation

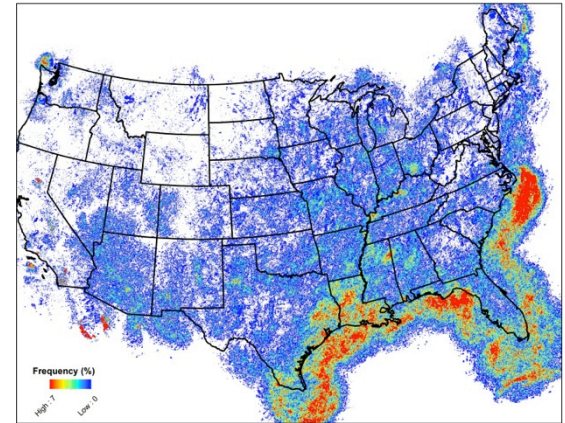
Cool Stratiform



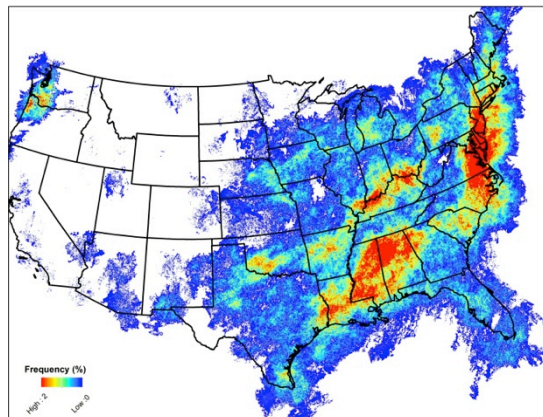
Warm Stratiform



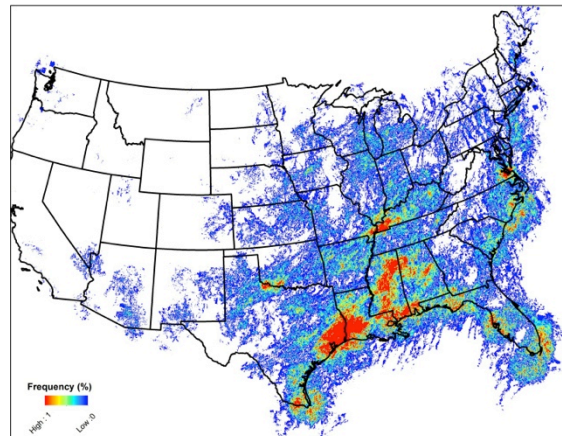
Convective



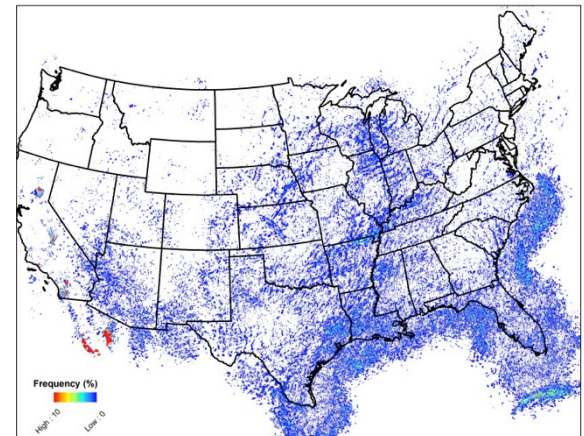
Tropical Stratiform

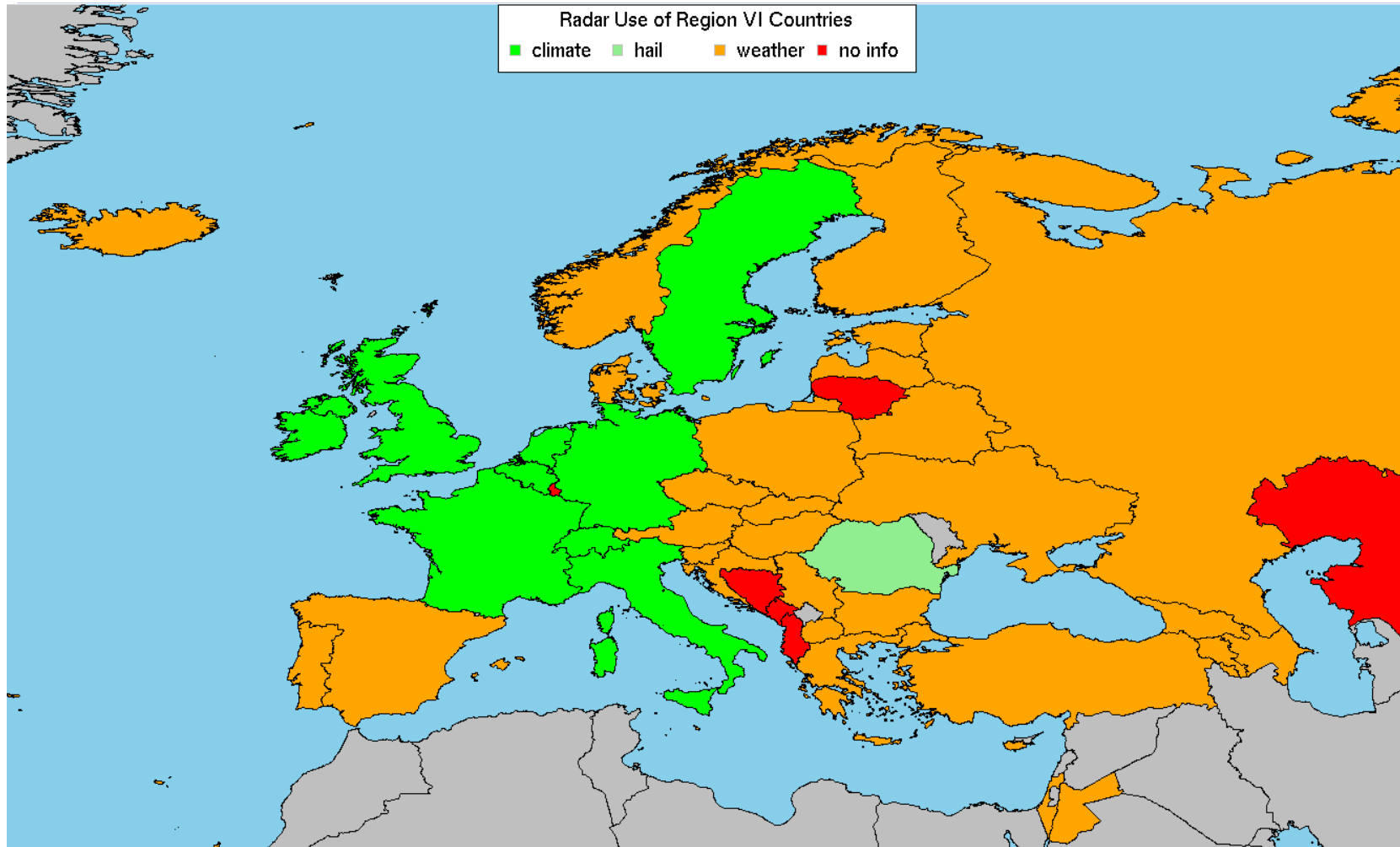


Tropical Convective



Hail





Length:

B: 10

CH: 11+

D: 15+

F: 10

IRL: 8

NL: 10

S: 6

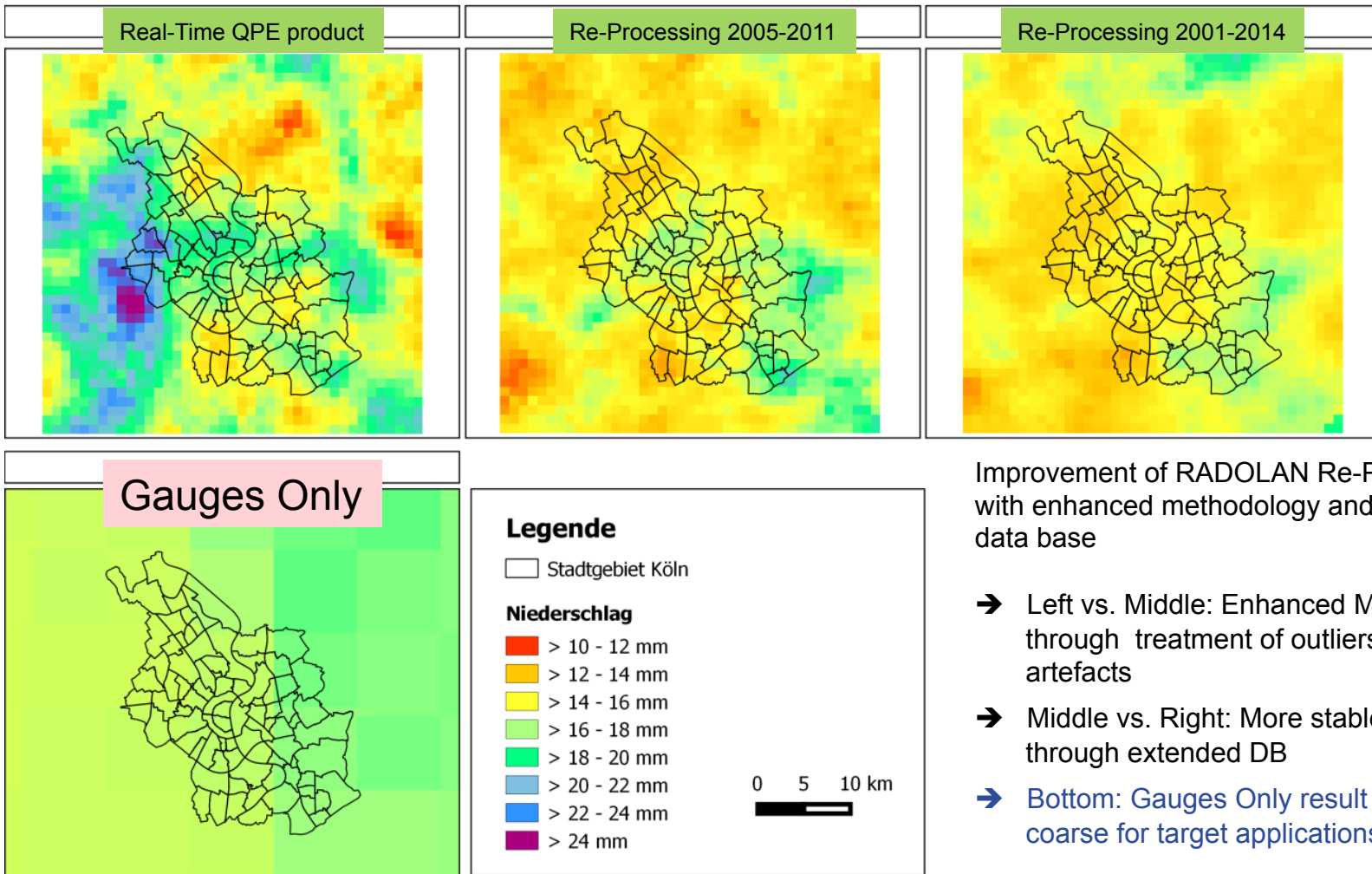
UK: 8

Use of Weather Radar Data in WMO Region VI Countries (Fig. 2 in Keupp et al., 2016).

**Climate:** multi-annual time series produced / **hail:** a hail climatology compiles / **weather:** only information on radar use for weather purposes / **no information yet received**

# 3 First Results and Future Perspectives

## Extreme precipitation across Cologne for duration 1h and return period 1yr



Improvement of RADOLAN Re-Processing with enhanced methodology and extended data base

- Left vs. Middle: Enhanced Methodology through treatment of outliers and radar artefacts
- Middle vs. Right: More stable statistics through extended DB
- Bottom: Gauges Only result (ways too coarse for target applications)

### **WCRP Grand challenge: Weather and Climate extremes**

- Precipitation extremes might (in some cases) not be detected by a rain gauge network (especially small-scale events)
- Combination of Radar (high spatial and temporal resolution and area coverage) and rain gauge data (as in RADOLAN) can be of help there

### **WMO CCL Task Team on the Use of Remote Sensing Data for Climate Monitoring, (TT URSDCM)**

- Will consider the paper “Use of Weather Radar Data for Climate Data Records in WMO Region VI”



- Many Problems of real-time radar based QPE, persist in climate mode
- Short time series yet not exceeding 15yrs
- No ocean coverage
- Sensor modifications over time (Homogeneity)
- Small errors amplify when integrated across longer aggregation periods
- In-situ validation data not available everywhere
- Complexity and time variability of atmospheric conditions
- Calibration and retrieval algorithms need to be harmonized
- Climate Requirements assembled in CBS/OPAG-IOS/WxR\_EXCHANGE/2.4

- Original reflectivity data needs to be exchanged
- Data is national sometimes even not owned by WMO NMHSs but by companies in the field of flight security (e.g. in Austria)
- Adequate treatment and documentation of missing data
- QPE Methods need to be harmonized (Bias correction, radar-gauge adj.)
- Nothing in place similar to Satellite Data, e.g. EUMETSAT
- No international standards, data storage, and documentation yet in place

**A data storage and documentation standard should be identified and applied ASAP to keep historic radar data assessable for future utilization. Otherwise we will continue to waste climate relevant and expensively raised radar data!**

# Summary and plan

- Several countries have created reprocessed radar data sets;
- The GC Extreme is interested in it and could certainly try analysis with the existing products to provide feedback;
- Plan an initial workshop that considers the needs of the GC Extremes (and others), availability of data and tools, discusses standards, and existing approaches and initializes a process that may lead to a baseline similar to what is achieved for satellite data;
- Andreas Becker (DWD) and Brian Nelson (NOAA) have agreed to follow this topic and will try to organise a first workshop 2017 that would need financial support.
- We are aware that this will be a long term activity but it is probably a not too bad time to start.