DeepRain – Improving local scale rainfall prediction through deep learning

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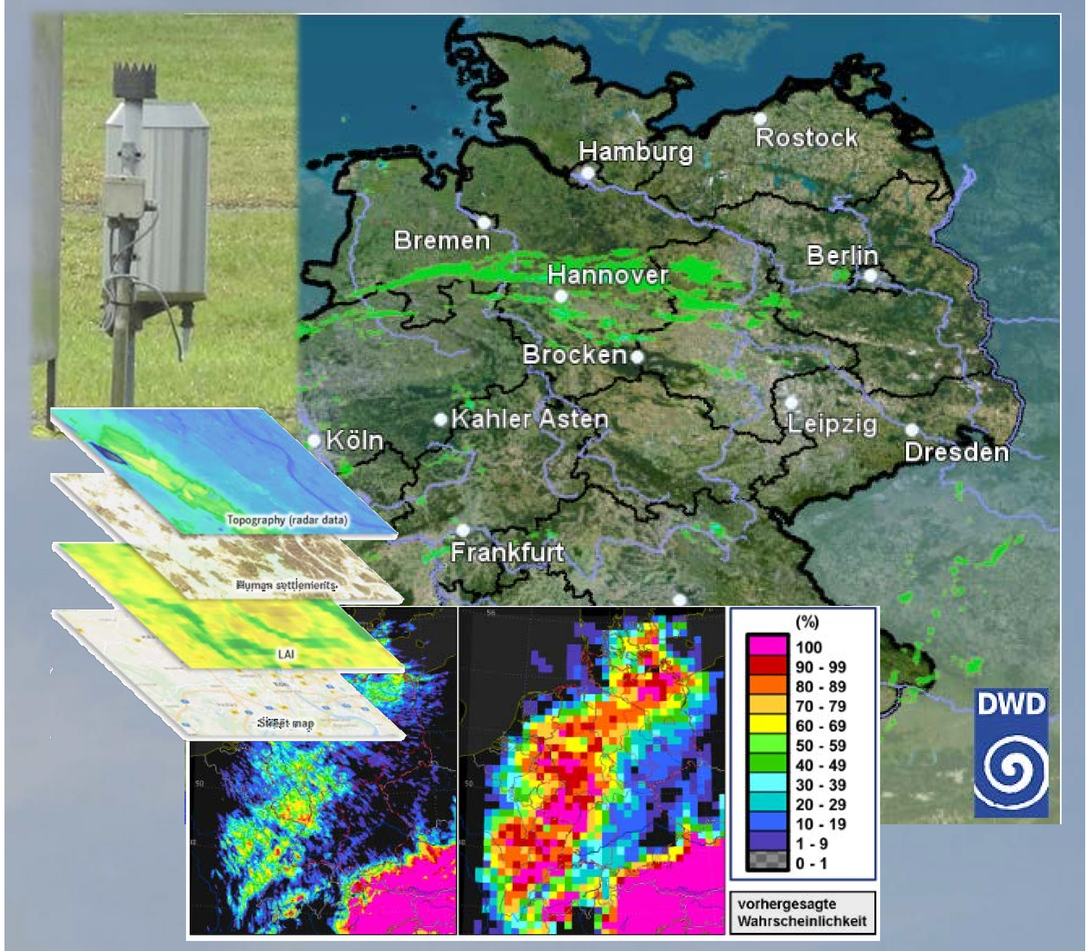
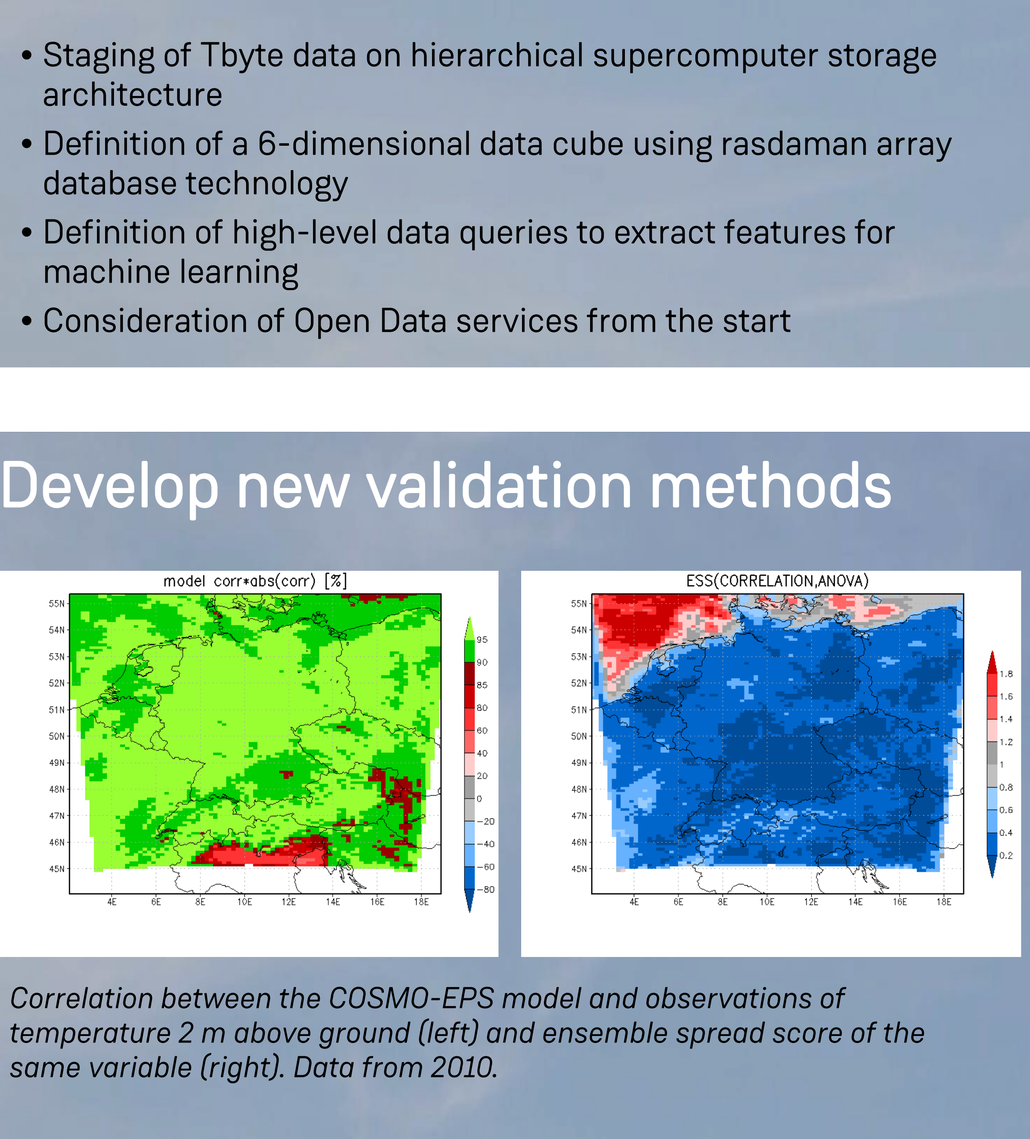
Fusion of diverse datasets: model, radar, geography, observation



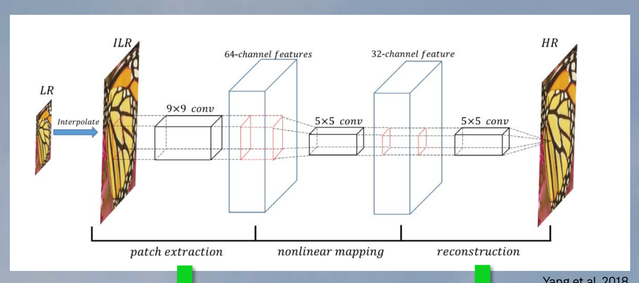
- 600 Tbyte of weather model data (~2 mio files)
- 10 years of radar and rainfall observation data
- 90 m topography dataset from Tandem-X

Develop high-performance workflows

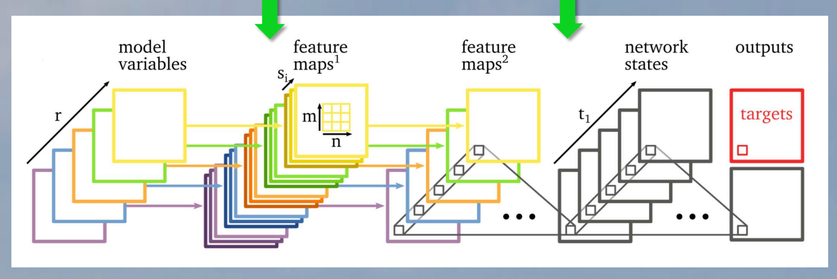


- Staging of Tbyte data on hierarchical supercomputer storage architecture
- Definition of a 6-dimensional data cube using rasdaman array database technology
- Definition of high-level data queries to extract features for machine learning
- Consideration of Open Data services from the start

Apply modern deep learning methods



Yang et al, 2018



- Super-Resolution in Deep Learning:
  Bad interpolation, then learn the correction.
- High dimensional RGB inputs and spatially invariant mapping

For meteorological data:

- Much higher feature depth **r**
- Input: Model | Target: Radar
- Spatial invariance only if geographical features in the input
- High-dim. data but fewer data-points for models with large #parameters

Develop new validation methods

Correlation between the COSMO-EPS model and observations of temperature 2 m above ground (left) and ensemble spread score of the same variable (right). Data from 2010.

$$\rho_{12\cdot3} = \frac{\rho_{12} - \rho_{13}\rho_{23}}{\sqrt{1-\rho_{13}^2}\sqrt{1-\rho_{23}^2}}$$

- Probabilistic and multivariate analysis
- Quantify added value of (ML) Downscaling based on partial correlations
- Evaluation vs alternative, classical mostly linear approaches including COSMO model changes, daily and seasonal cycles, extremes
- Systematic analytics/evaluation of hierarchy in predictor variables based on Akaike/Bayes information criterion

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http://deeprain-project.de

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