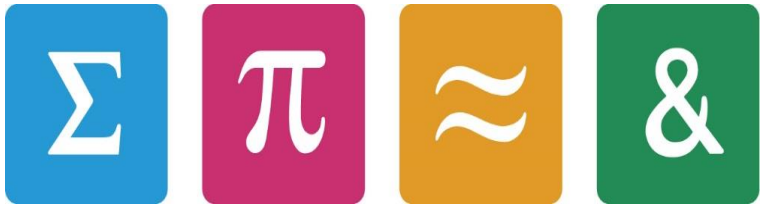
Econometric Forecast and analysis of the determinants of electricity wholesale prices in a geospatial generalization



International Symposium on Forecasting

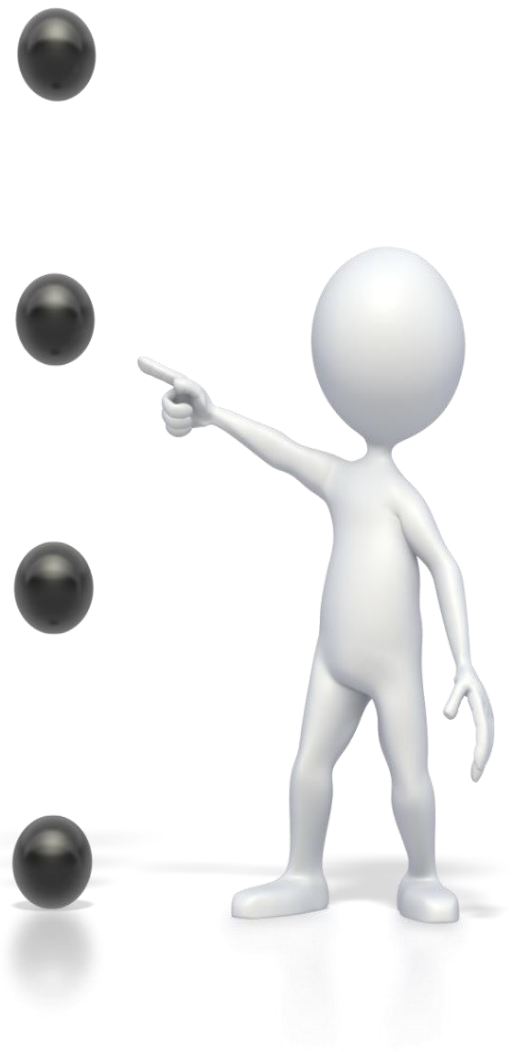
Hes·so // VALAIS WALLIS
School of Management & Tourism

Prof. Miriam Scaglione (PhD)
Prof. Stéphane Genoud (PhD)
Prof. Jean Christophe Loubier (PhD)

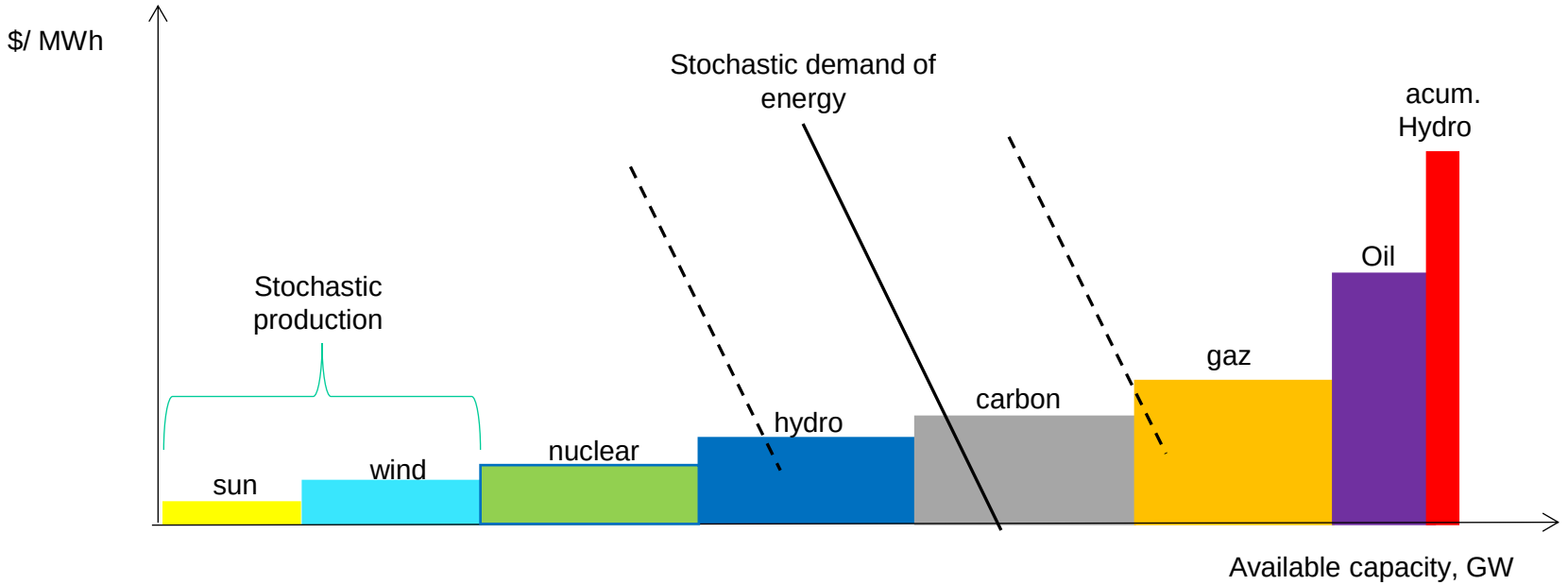
Marut Doctor
Francesco Maria Cimmino

Agenda

- Overview of the German electricity market
- Effect of the volatility on the price
- The raw Data and first statistic
- Outlier detection and seasonal pattern
- Different model to forecast spot price
- Territorial approach
  - Introduction of spatio-model
  - Introduction to weather forecasts
  - Bottom-Up Model as methodology
- Suggestion and comments?



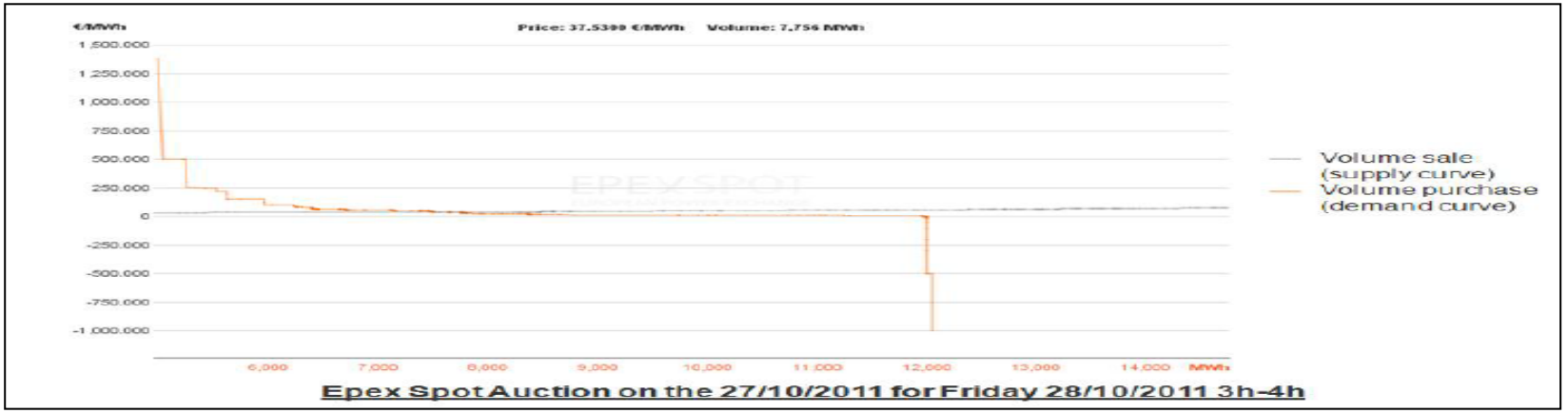
Overview of the German electricity market (rule and price determination)



- German we have the “Energiewende” (energy turnover) => exit of nuclear power in 2002
- In Germany 25 percent in the first half of 2012 is from renewable energy

Renewable type in %				
Wind	Solar	Biomass	Hydropower	bio waste
36.6	21.5	22.5	14.7	3.6

Effect of the volatility on the price

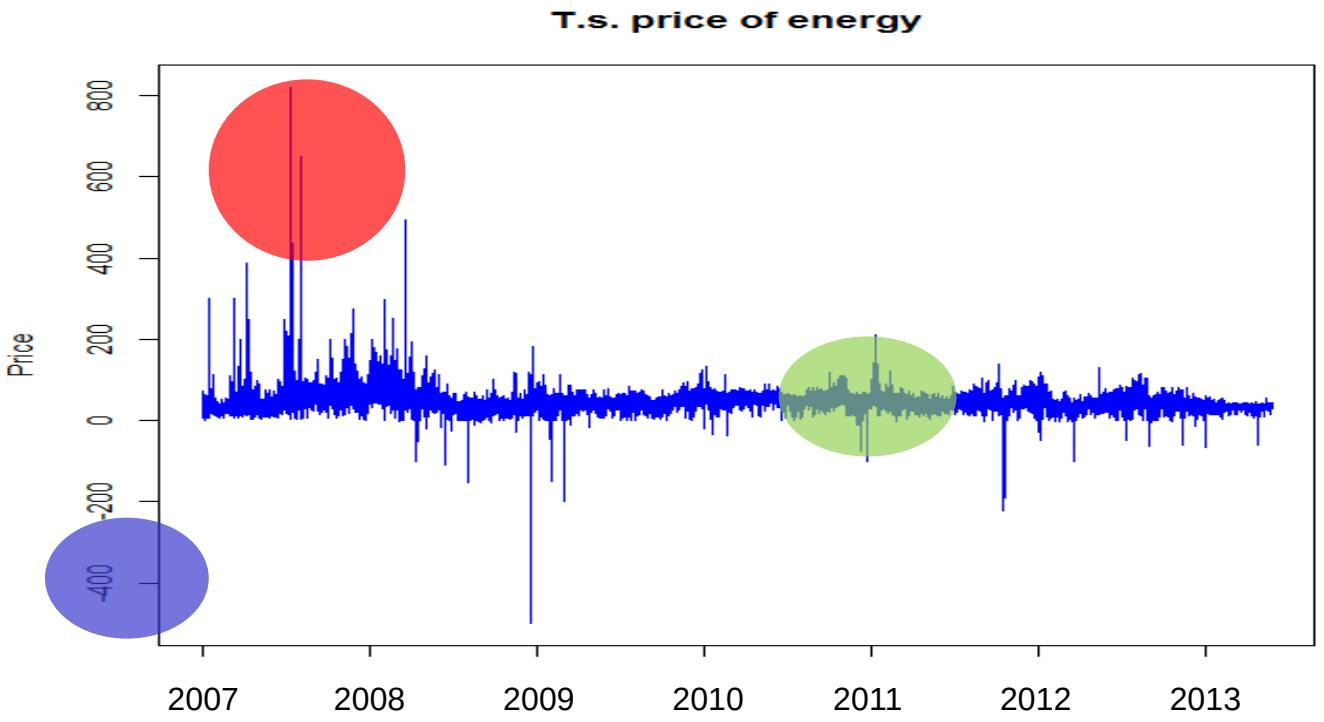


Source https://www.epexspot.com/en/

Source https://www.epexspot.com/en/

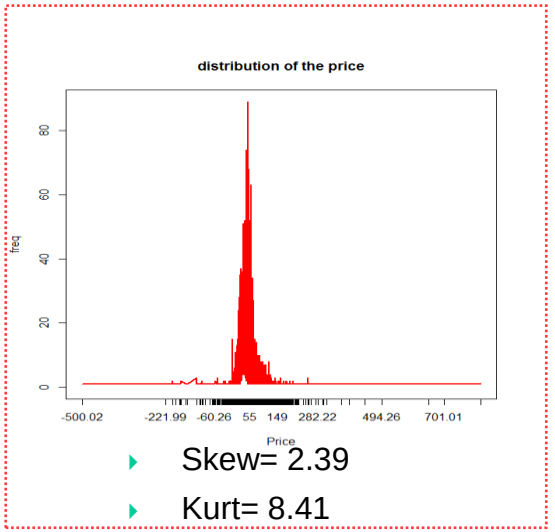
- Electricity is a « special » commodities
- In Germany is quoted in eeX (European electricity exchange)

The raw data and first statistic



The hourly data go from 02/01/2007 to 02/09/2014
From the raw data we can see

- Presence of negative price
- Presence of outlier
- High variance



- Skew= 2.39
- Kurt= 8.41

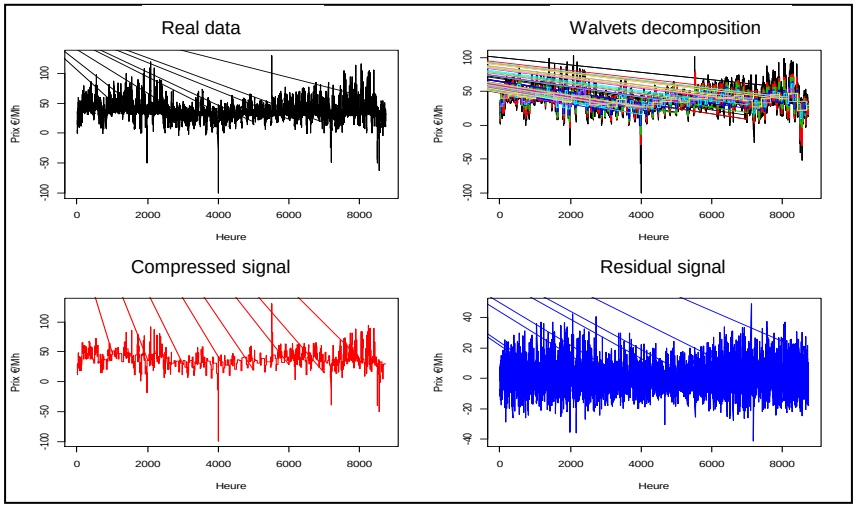
Min.	1st Qu.	Median	Mean	3rd Qu	Max.	Variance
-500.00	31.88	42.05	44.74	54.86	821.90	22.71

Outlier detection and seasonal pattern

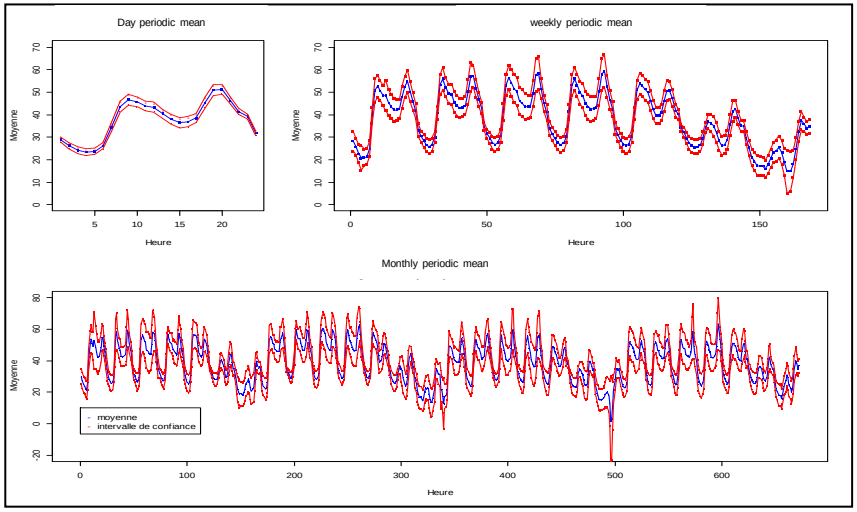
Haute Ecole de Gestion & Tourisme
Hochschule für Wirtschaft & Tourismus

Detection of extreme values

(wavelets)



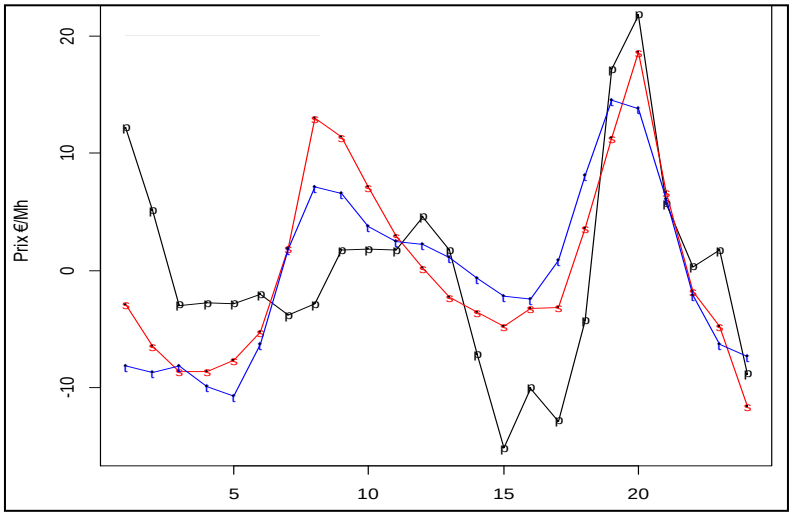
Seasonal pattern



Different model to forecast spot price for 2013 (residuals)

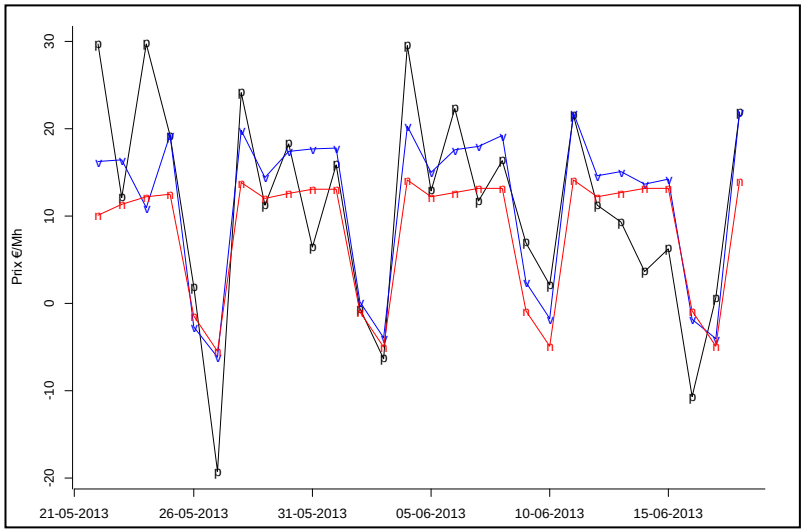
Hes·so VALAIS WALLIS
Haute Ecole de Gestion & Tourisme
Hochschule für Wirtschaft & Tourismus

24 hours forecast in the spot EEX



p: Real price
s: Sarma forecast
t: Tbats forecast

28 days forecast for 8 am in the spot EEX (split for each hour)

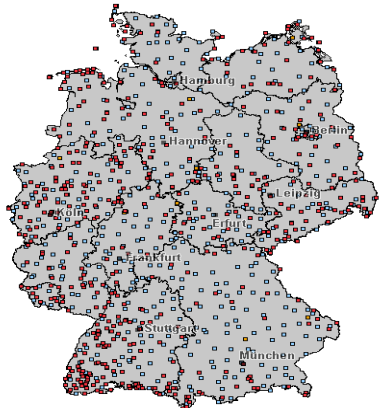


p: Real price
v: Var forecast
v: Nested-sarma forecast

Till now we have found some methods, to forecast the residuals part of wavelets (smooth part). Now we to like to be able to forecast outliers which depend on environmental factors (such as weather).

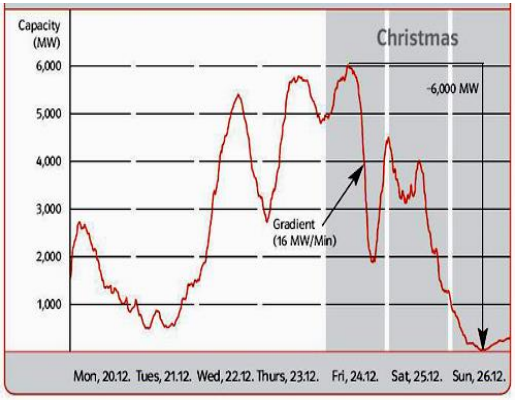
Territorial approach

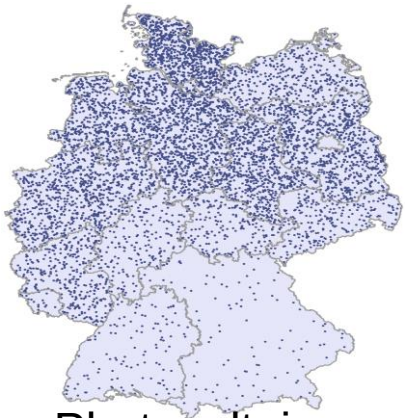
- Geolocalisaton of weather station ✓
- Geolocalisation of photovoltaic installation ✓
- Determine the best model to use this information to forecast the endogenous shock in the price



weather station

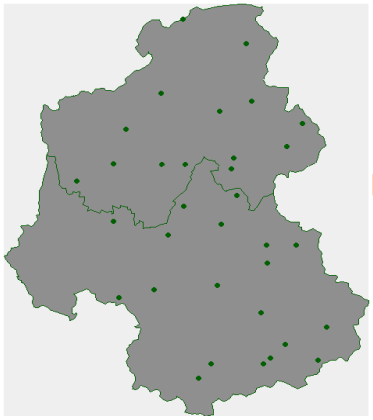
interpolation weather data

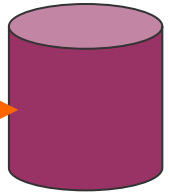




Photovoltaic installation

Introduction of spatio-model





Meteo database

Two family of spatio models

1. Deterministic (global and isotropic)
2. Probabilitistic (local and anysotropic)

The question is to identifie what is the best approach (familly) to integrate the meteo effect in the project

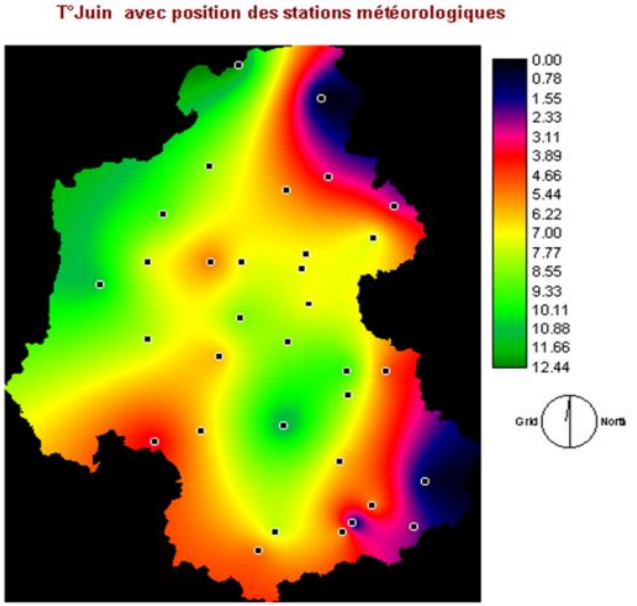
Interpolation objective

The goal of spatial interpolation is to estimate a function where Xi= (x;y) in every point Xp = (xp;yp) of field

$$R(Xp) = \sum_{i=1}^{m} Wi.R(Xi)$$

In relation with

- proximity of real points (meteo stations)
- Influence in the calculus of Xp (named in the equation)



Introduction to weather forecasts

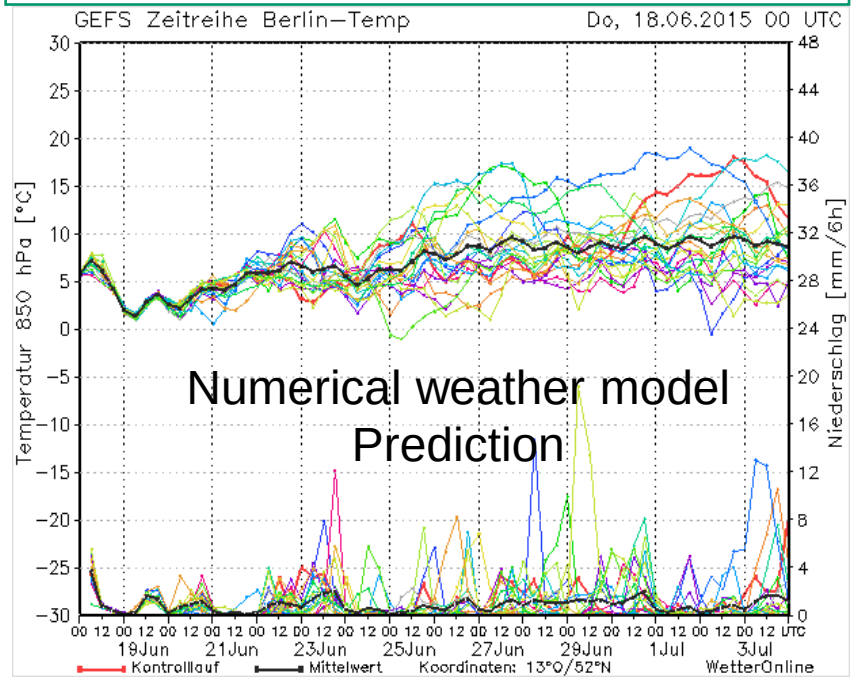
Two datasets for weather data

1. Measured weather data (actual values)
2. Numerical weather models (predicted values)

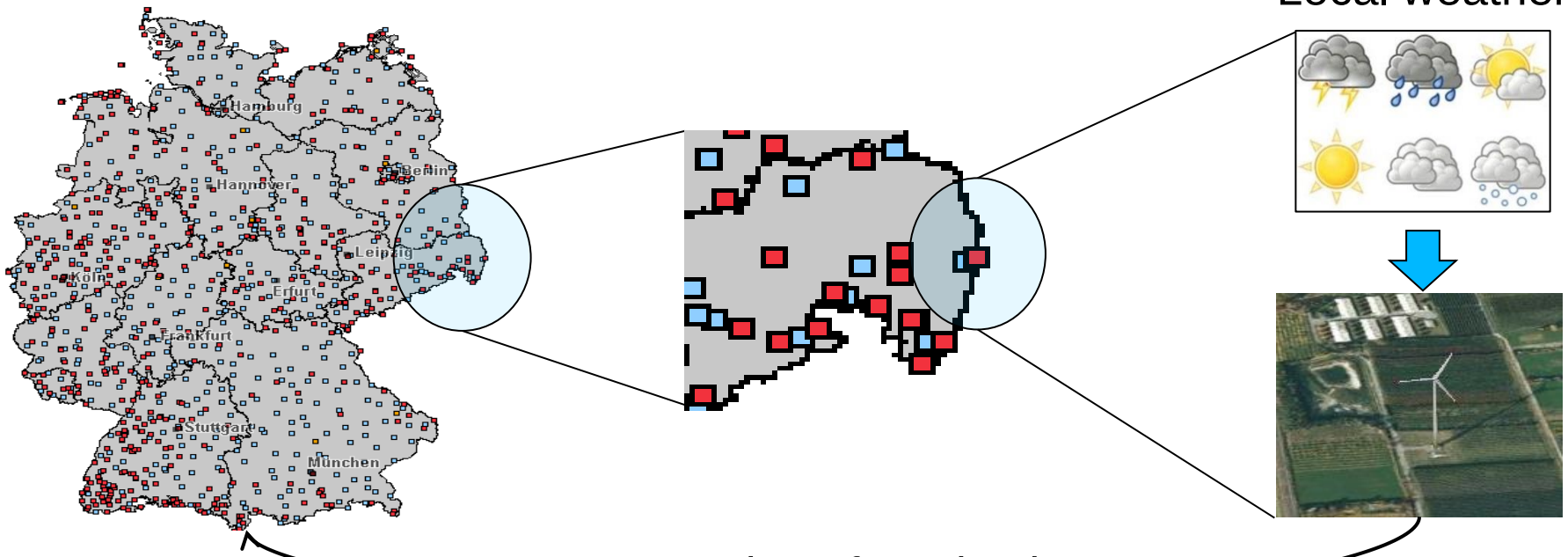
Quality of prediction: Comparison between predicted and actual values

Cross validation

Verification done by meteorologists is performed here by automatic comparison of predicted and measured values



Bottom-Up Model for methodology



Suggestion and comments?

Idea of model to integrate spatial and temporal aspect?

Experience?

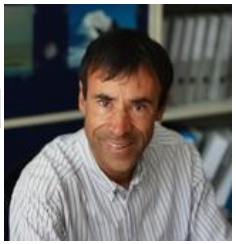
Happy to hear your comments and suggestions!

Miriam Scaglione
miriam.scaglione@hevs.ch

Jean Christophe Loubier
Jchristophe.loubier@hevs.ch

Francesco Maria Cimmino
Francesco.cimmino@hevs.ch

Stéphane Genoud
Stephane.Genoud@hevs.ch



Marut Doctor
Marut.Doctor@hevs.ch