

Using weather stations to control switch heating

Speaker

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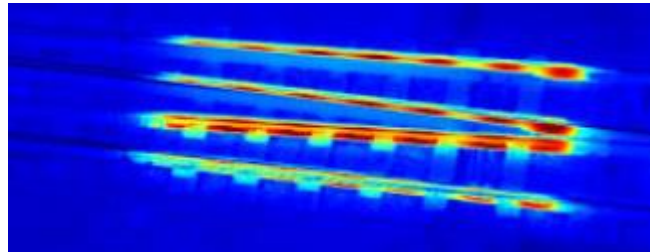
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Some facts about switch heating in Belgium

- Installed power switch heating: 50 MW
- 5% of a big nuclear power plant
- Decision to turn on the heating (manually) based on weather forecast twice per day



Opportunities

- Reduce CO₂ emission -> Ecological
- Turning on heating in time -> Punctuality
 - Local weather conditions are covered better
 - Reduction of amount of signaling blocks
- Turning on/off heating when it's necessary -> Cost reduction



How?

- Optimization of switch heating
 - Weather stations
 - Weather forecasts based on our measurements based on our needs
 - Automatic system
 - Limited interventions by **signalling blocks**

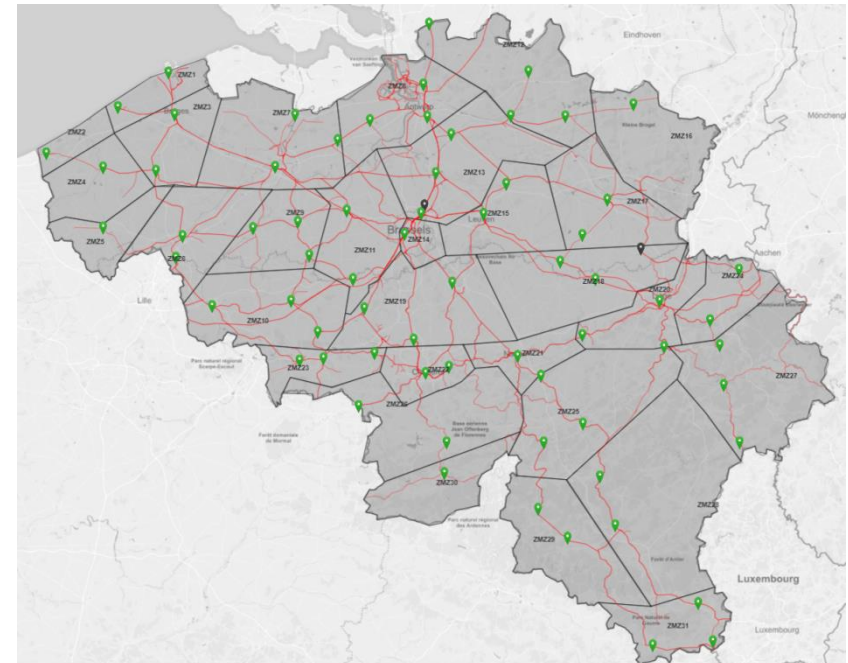
Weather stations

- Sensors: Rail temperature, air temperature, relative humidity, precipitation
- Centralised database: data every 3 minutes
 - Automatic monitoring
 - Reuse data for other projects (!)



Climate zones

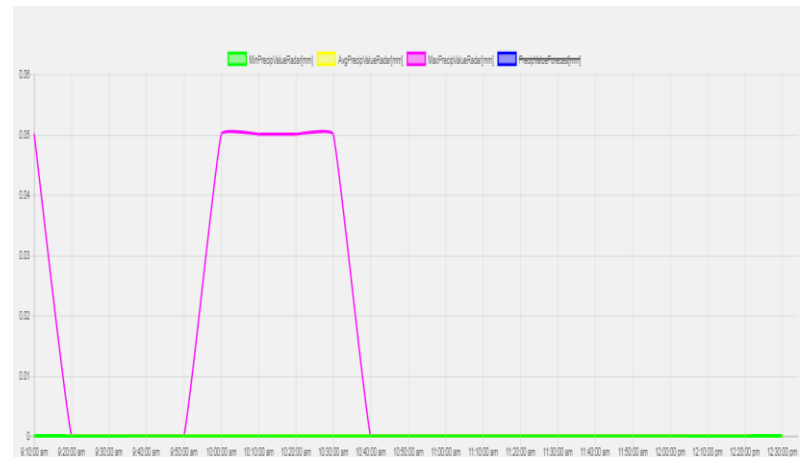
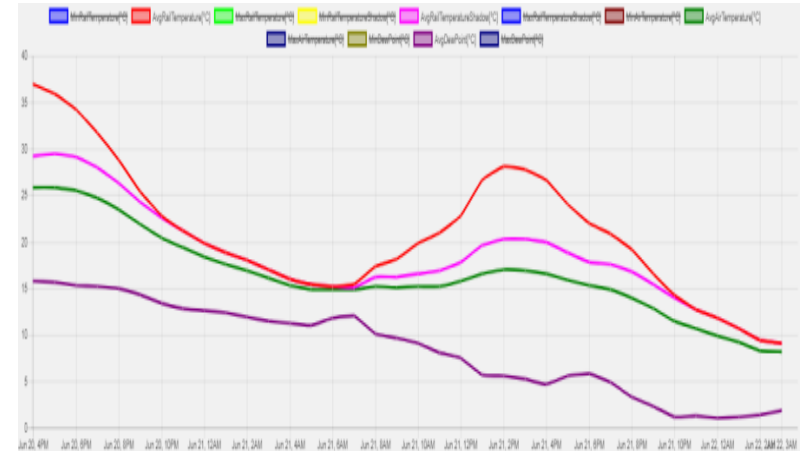
- Separate climates/important regions/altitudes
- 31 climate zones
 - One per switch bundle would be overkill
- 2-4 weather stations per climate zone
 - Near most important switch points



Weather forecasts

- “Forecast”: Every hour, resolution 1 hour, next 36 hours: Rail temperature, air temperature, wind speed, dew point, cloudiness, precipitation, weather type
- “Radar”: Every 10 minutes, resolution of 10 minutes, next 3 hours

Precipitation, precipitation type



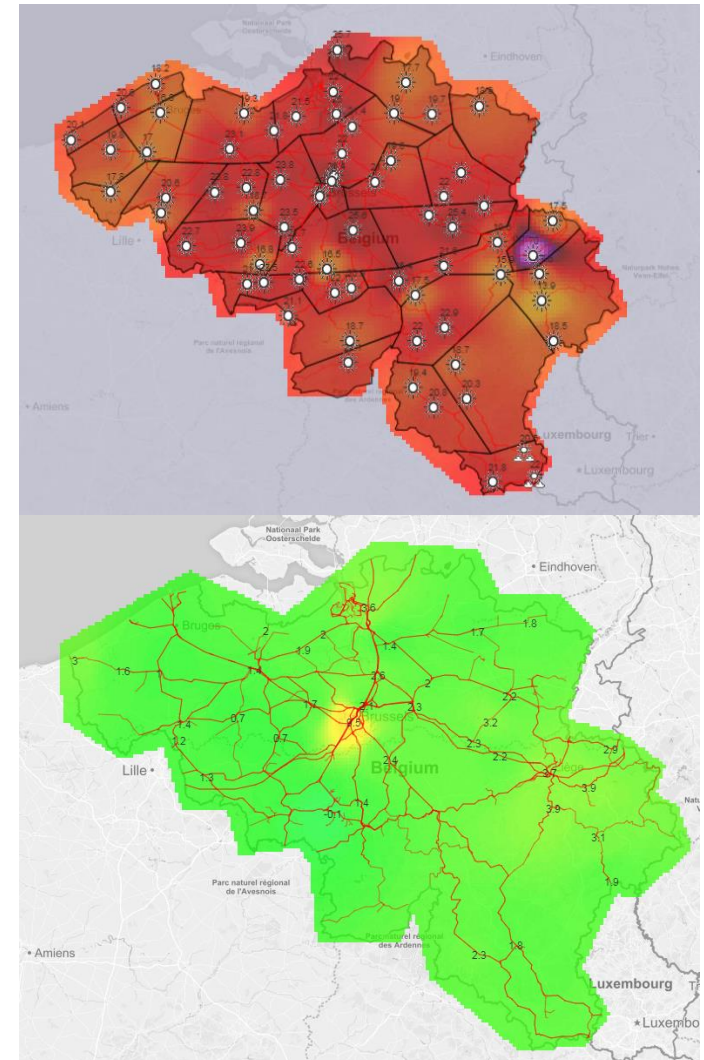
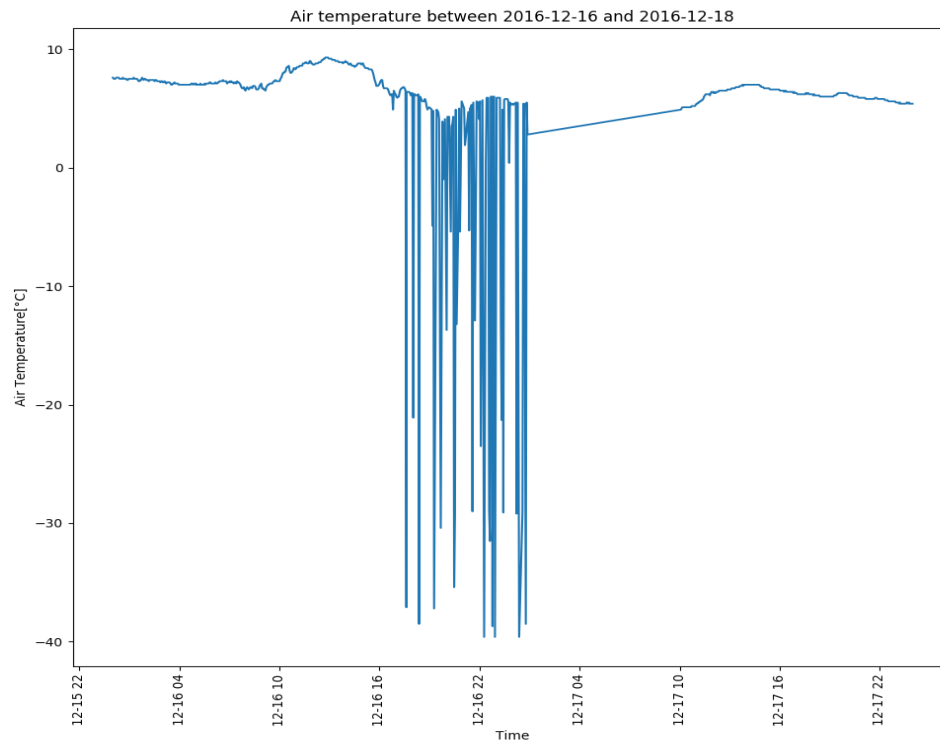
Decision algorithm

- Based on current weather(weather stations)
 - Cold weather with precipitation, freezing mist, frost, snow, dusty snow
- Preheating 1h/2h (based on weather forecast/radar)
 - Cold weather with precipitation, freezing mist, frost, snow, dusty snow
- Post heating
- Decision made **per climate zone**

Decision algorithm

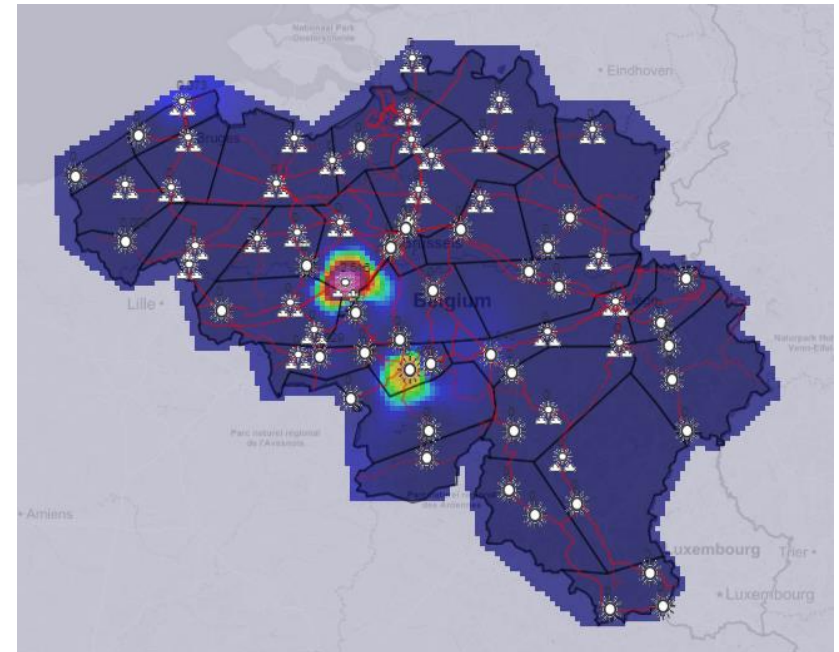
- Precautions:
 - Assume the worst
 - Backup climate zones when data is missing
 - Every climate zone has at least 2 weather stations

What if the sensors are broken/wrong?



What if the sensors are broken/wrong?

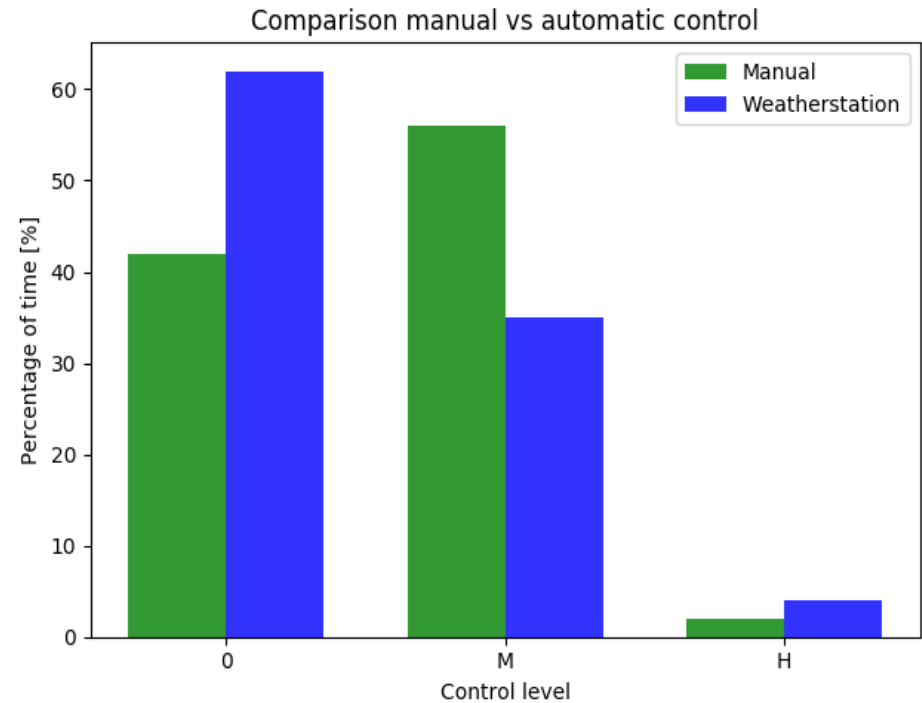
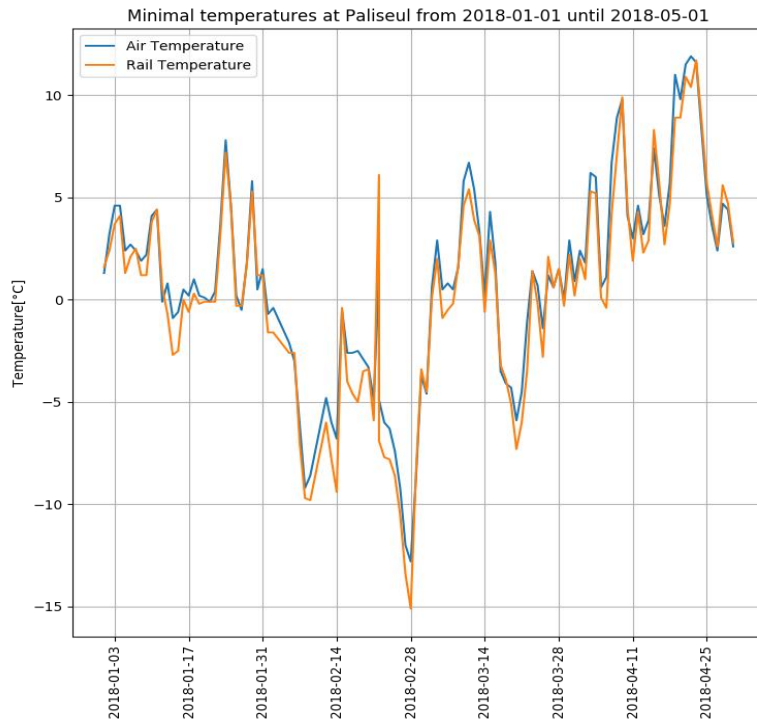
- Use Machine Learning and statistics to detect them!
- Nearest neighbours/Random Forests with statistical tests



POC decision algorithm: Paliseul



POC decision algorithm at Paliseul: Some Results



0 : no heating
M : heating with thermostat
H : heating full power



- Further outroll and system testing (2/31 signaling blocks in winter 2018/2019)
- New smart switch heating
 - Additional data gathering
 - More control possibilities



QUESTIONS