Using weather stations to control switch switch heating

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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 CO$_2$ 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

Minimal temperatures at Paliseul from 2018-01-01 until 2018-05-01

Comparison manual vs automatic control

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