

Storm Resilience

Fault Forecasting and Rapid Response to Lightning

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Storm Resilience - Introduction

About

Funded by Ofgem's Network Innovation Allowance (NIA).

Lead:



- **Duration:** 2019-2021
- **Total cost:** ~£600,000

[Progress reports and more information](#)

Partners & suppliers:



GE Digital

Objectives

The project will demonstrate the following methods in two separate trials to improve network performance:

- **Lightning into PowerOn** – aims to combine network data with real-time lightning data, and identify when a fault is caused by lightning.
- **Resource Estimation Tool** – aims to combine network data, historic fault data, and advanced weather forecasts to predict the number of faults each operational zone will experience and therefore the resources required.

Work Packages

WP1 - Lightning into PowerOn

- Additional functionality developed in PowerOn by GE.

WP2 - Resource Estimation Tool

- Tool developed by DTN using machine learning techniques

Project Benefits

Reduced customer interruptions

Reduced customer minutes lost

Improved customer service and customer satisfaction

Faster and more cost-effective response to transient faults

More accurate emergency planning tools

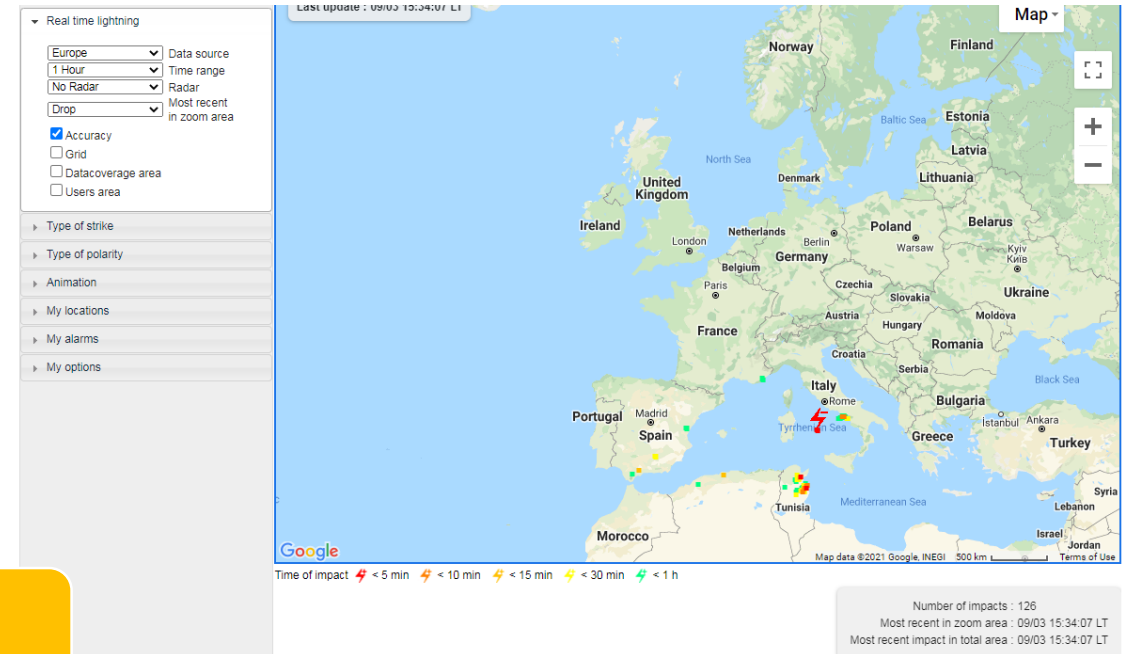
Reduction in customer disruption

Lightning into PowerOn

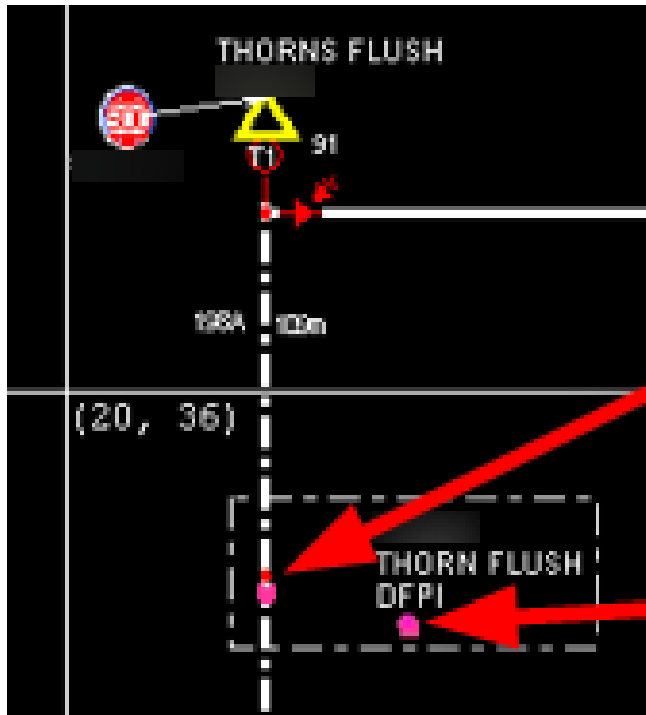
APRS traces the tripped circuit
locating overhead components and
GPS coordinates

Request the weather data, through
an API, from a real time weather
service provided by DTN

Link lightning strikes to the circuit
by distance and time (up to 1km² in
the last 60 seconds)



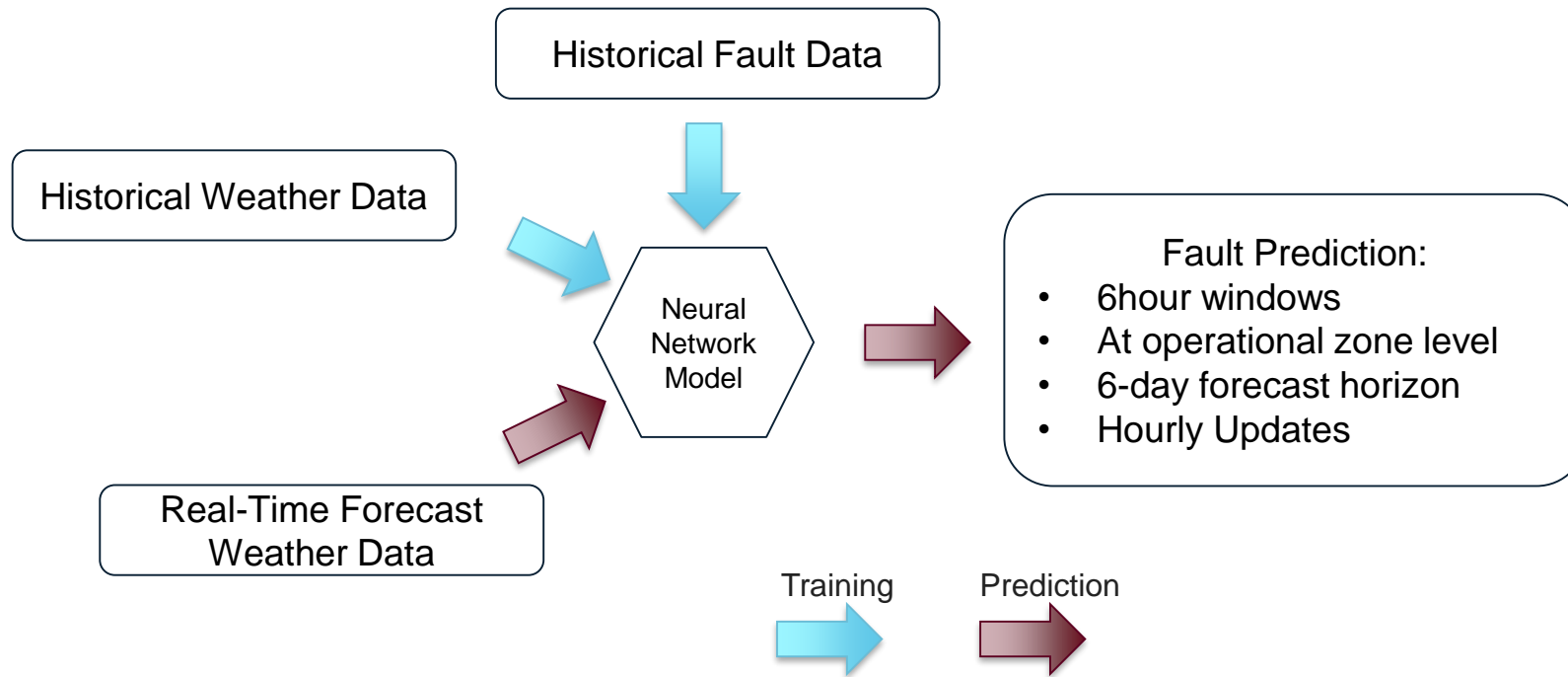
Lightning into PowerOn



Who	What
SYSTEM	CRANLEIGH 33/11KV LEATHERN BOTTLE RECLOSER tee 1710JR SITE teed cct (09) - 11kV Oil
STARTUP	Automation enabled at 000302_09_APP starting APR5
LIGHTNING_RECLOSER	Found 62 OH component(s) with valid coordinates
LIGHTNING_RECLOSER	Recloser function is switched OFF, mode = [0]
LIGHTNING_RECLOSER	Applying delay before requesting data from the Weather service: 15 seconds
LIGHTNING_RECLOSER	Total number of lightning strikes found: [1]
LIGHTNING_RECLOSER	Requesting data from weather service ...

- The weather service provides the number of lightning strikes found and their GPS locations
- APRS can then take the decision to reclose the tripped circuit.
- By reclosing circuits earlier we can make CI and CML savings.
- Advanced Distribution Management System (PowerOn) logs all data for post analysis

Resource Estimation Tool – Back End

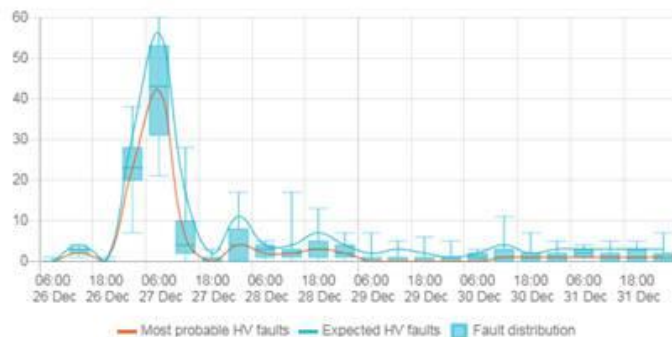


Deterministic Model is executed 51 times (using ensemble weather forecasts sourced from ECMWF model), generating a distribution of fault probabilities. This quantifies forecast 'confidence' (which varies depending on the meteorological characteristics of the storm event).

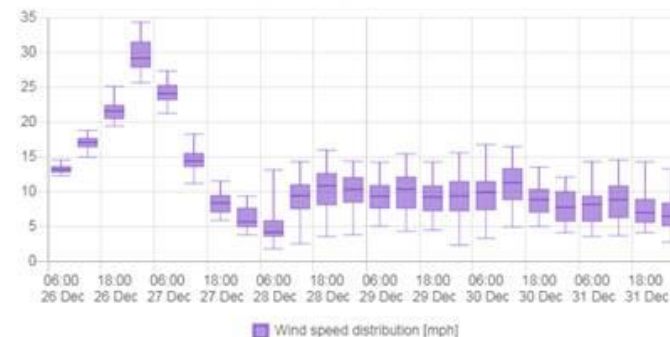
Resource Estimation Tool – Front End



HV faults probability

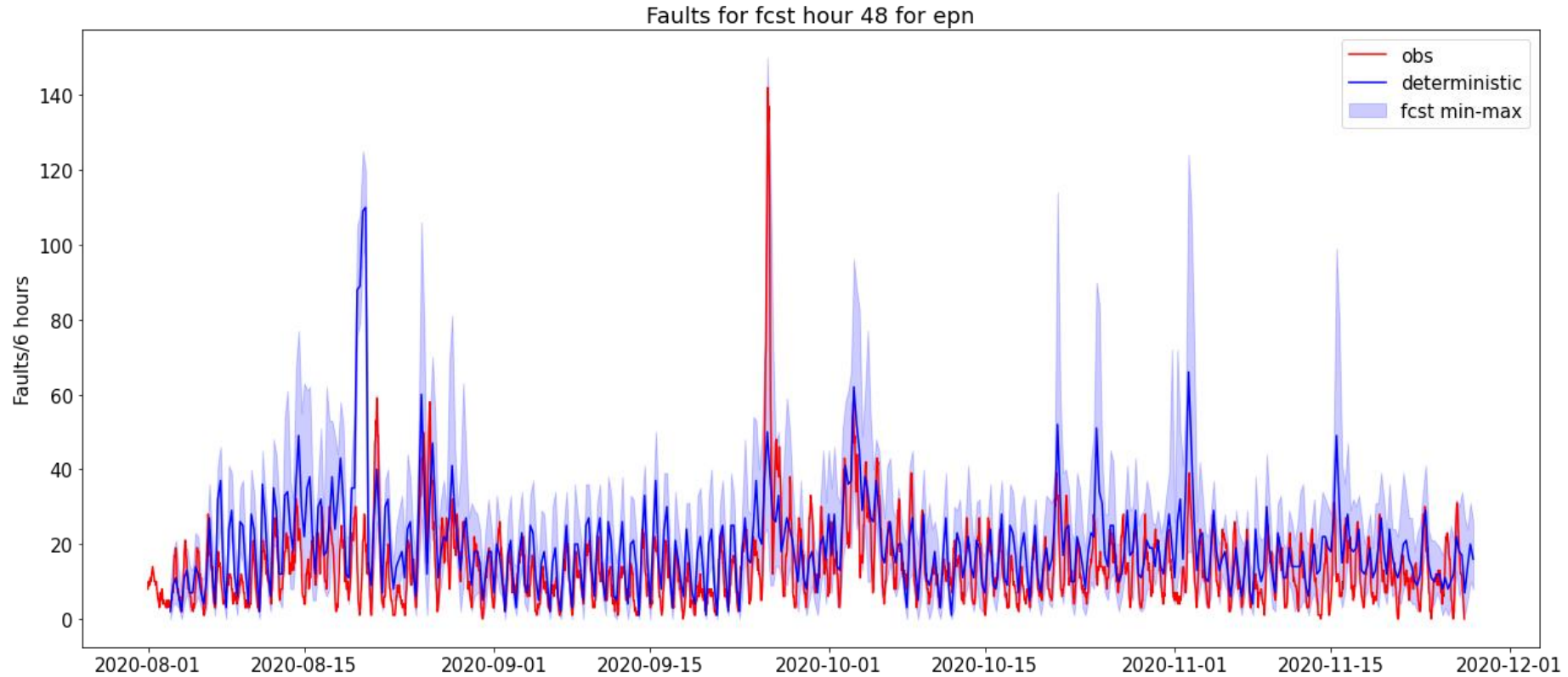


Mean wind speed probability (not gust!)



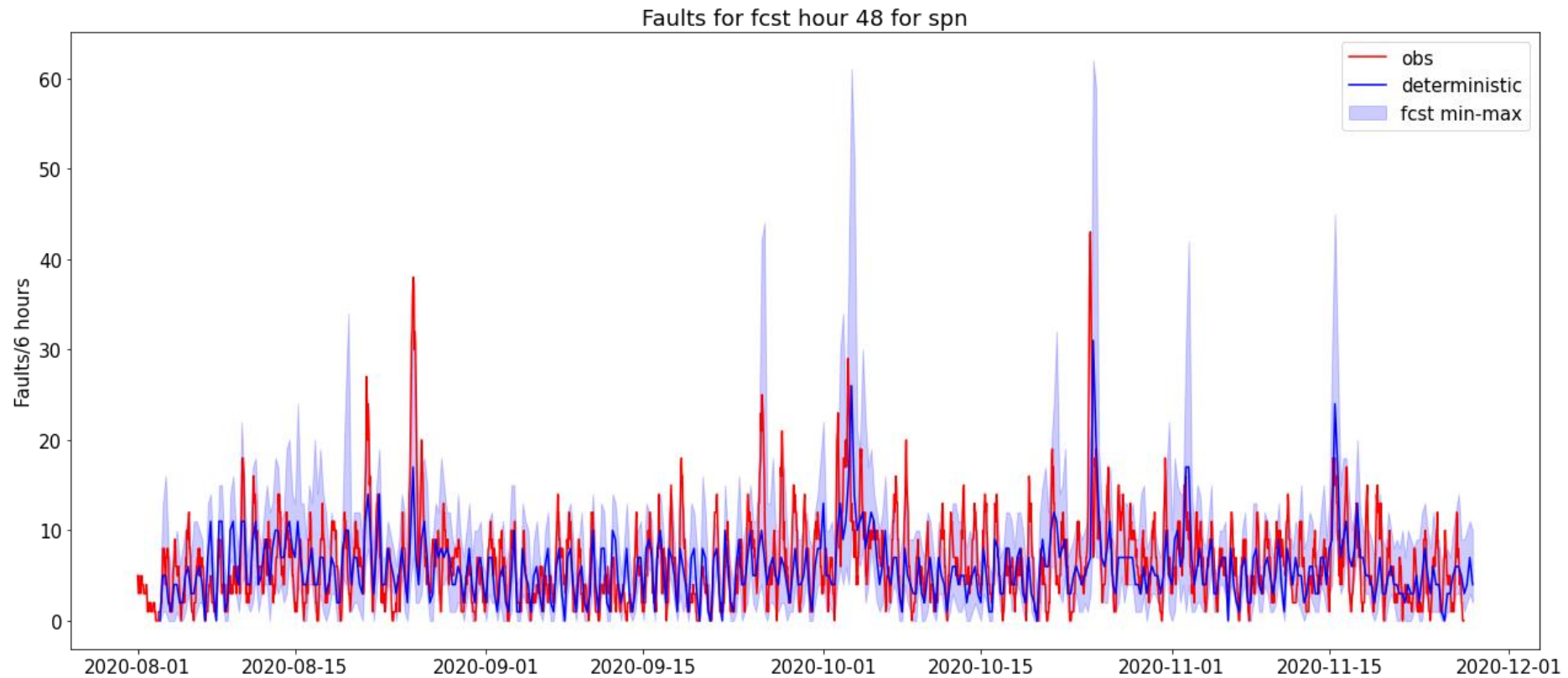
- The tool provides a 6 day ahead deterministic and probabilistic forecast.
- Faults forecast are split into four 6 hour windows for each day.
- Save plans that can be shared with the wider business and referred back to.
- Tool calculates ‘Teams needed’ based on fault forecast, restoration profile, and clearance rate (editable by planner)

Tool Performance EPN



Observed versus forecast faults in EPN between August and November

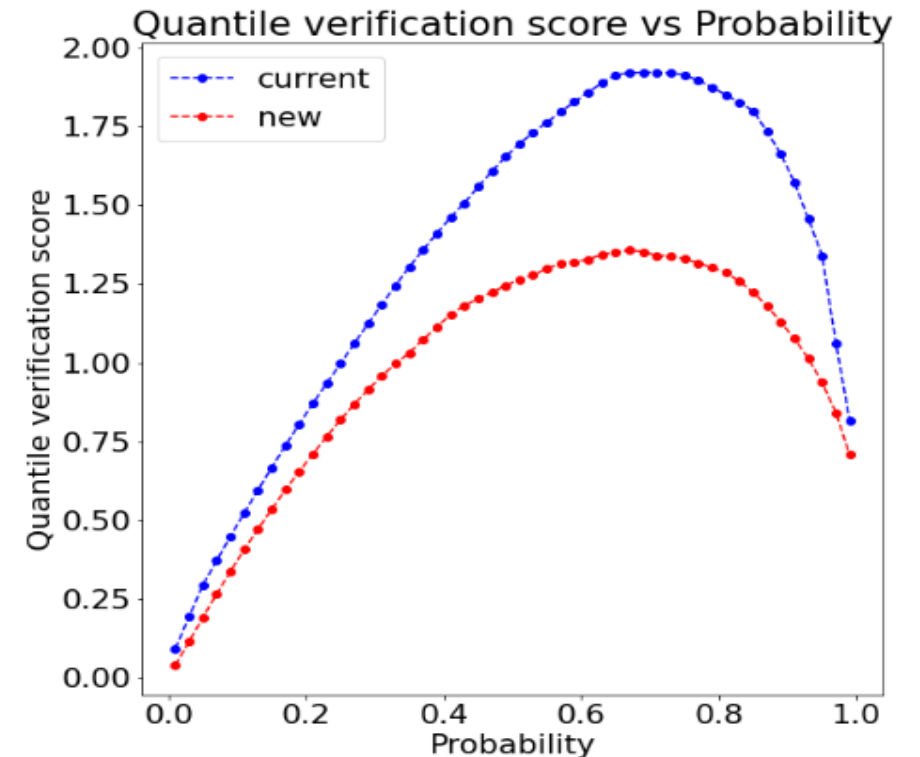
Tool Performance SPN



Observed versus forecast faults in EPN between August and November

Next steps

- Quantifying the success rate of Lightning into PowerOn
- Active Mode – APRS automatically reclosing circuit breakers
- New model configuration has been researched and back-tested, largely eliminating fault forecast bias in SPN and enhancing performance in both SPN and EPN
- Analysis to be performed on fault forecast performance of rainfall and temperature-related LV cable faults
- Future development of resource estimation tool could explore inclusion of additional datasets e.g. vegetation, LiDAR, and asset health.



Thank You For Attending!



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