D-RES PROJECT

Provision of distributed grid resilience using EVs during extreme weather events

THE UNIVERSITY of EDINBURGH

UNIVERSITY OF BATH

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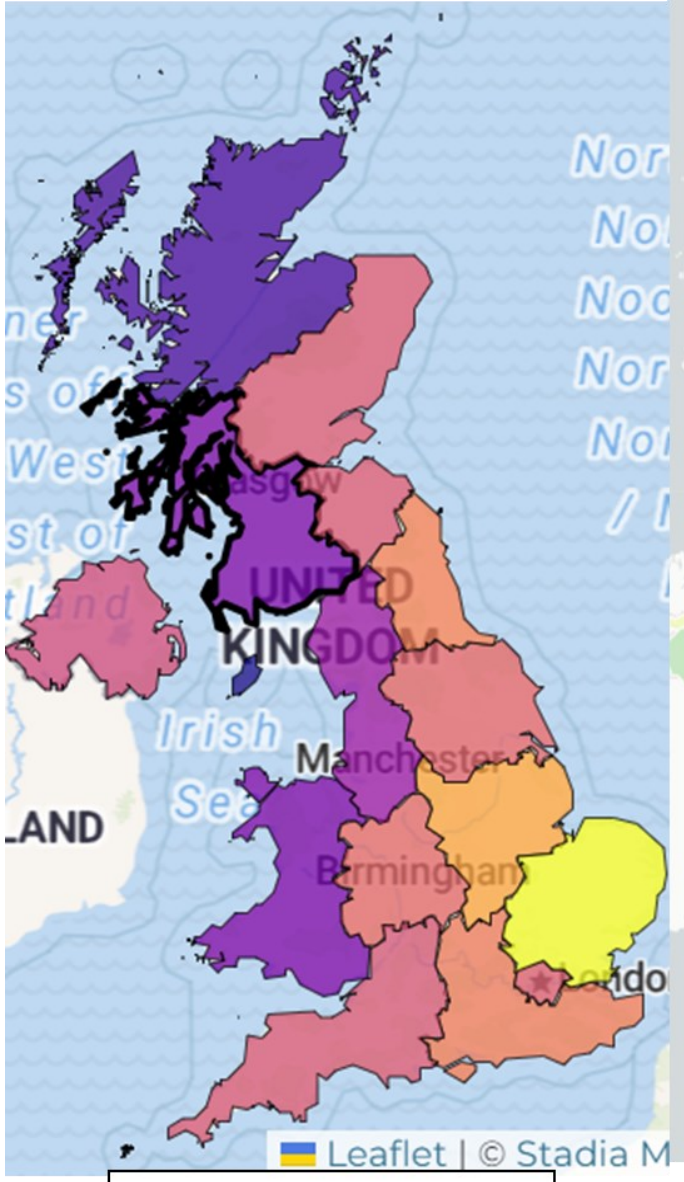
Project website:

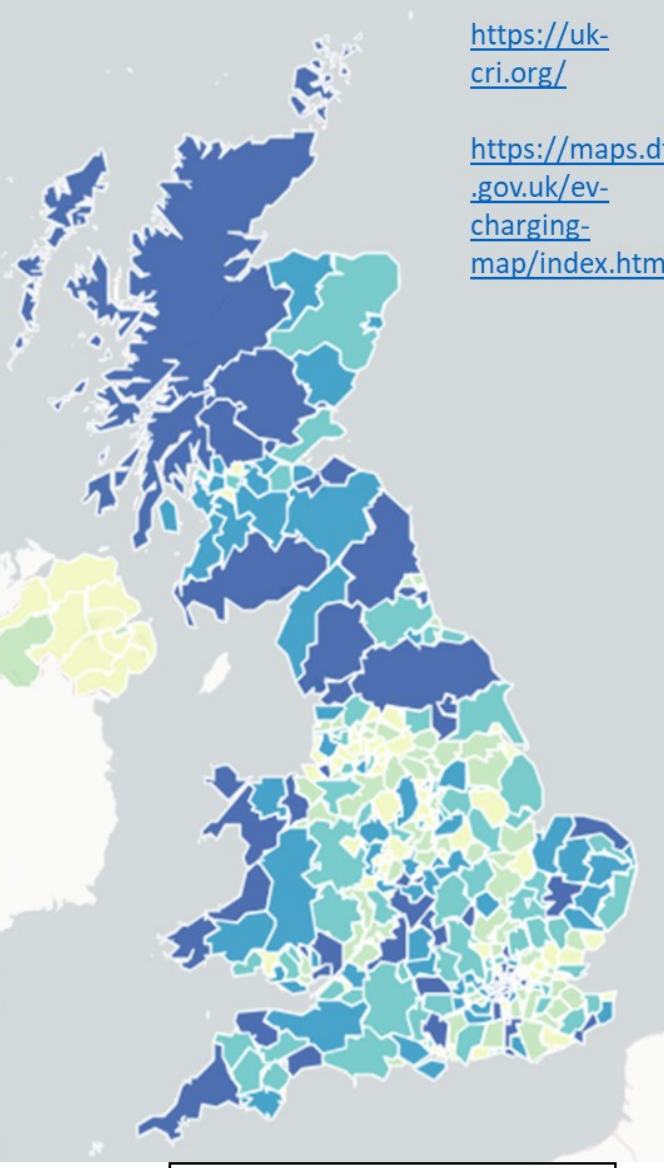
DAFNI
Data & Analytics Facility for National Infrastructure

Context

- Existing EV infrastructure
- Apparent need for energy coordination
- D-RES aims to increase awareness about *distributed resilience* in decision making
  - The UK Government and Ofgem are looking to identify priority actions for enabling deployment of V2X.



Climate risk
(Median days/year with "record-breaking weather")



https://uk-cri.org/

https://maps.d
.gov.uk/ev-charging-map/index.htm

EV charging infrastructure
(No of charger per 100,000 people)

Selected Storm Events Affecting Orkney

Jan-2019

> News > Scottish News > Weather

Scotland set for 75mph winds as first storm of 2019 batters the country bringing travel chaos

Met Office have issued a yellow weather warning - with travel disruption to be expected across the country.

NEWS By Record Reporter

12:36, 06 Jan 2019

Jan-2022 (Malik)

Storms: Energy operator SSEN to invest £12.5m after power cuts

11 March 2022

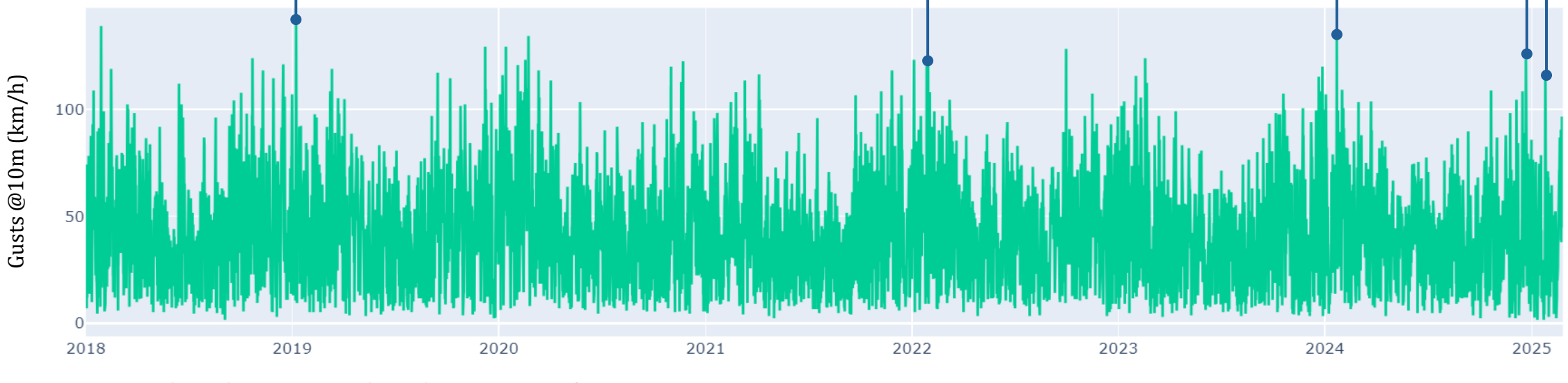
Storm Malik

Jan-2025 (Éowyn)

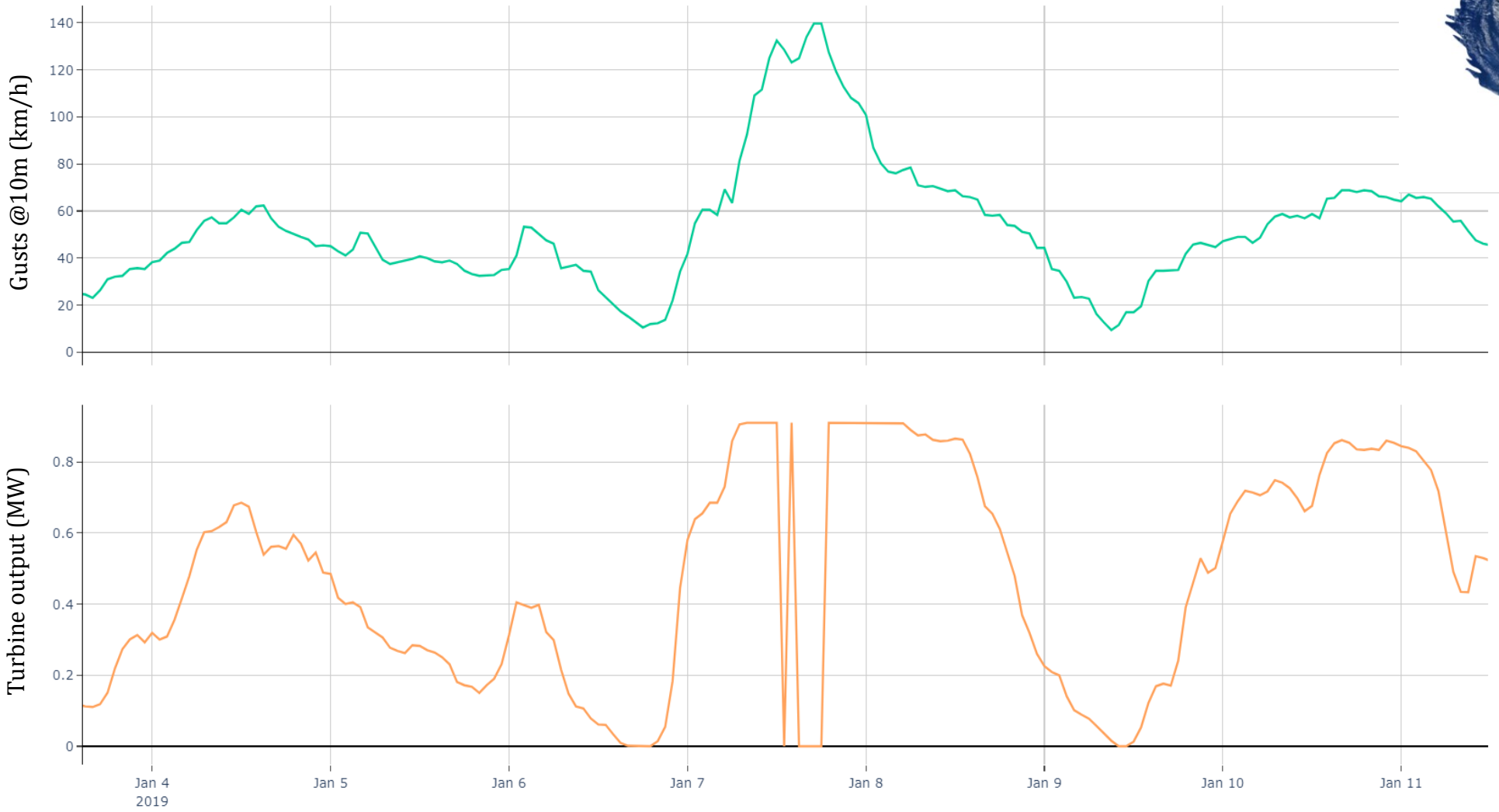
Dec-2024

"On Saturday, gusts of between 75 – 85 mph are expected across the west coast, the north of Scotland, and Orkney and Shetland, reaching their peak in the late afternoon and early evening."

Jan-2024 (Isha)



What do short “events” look like?



Mapping Network faults on D-RES

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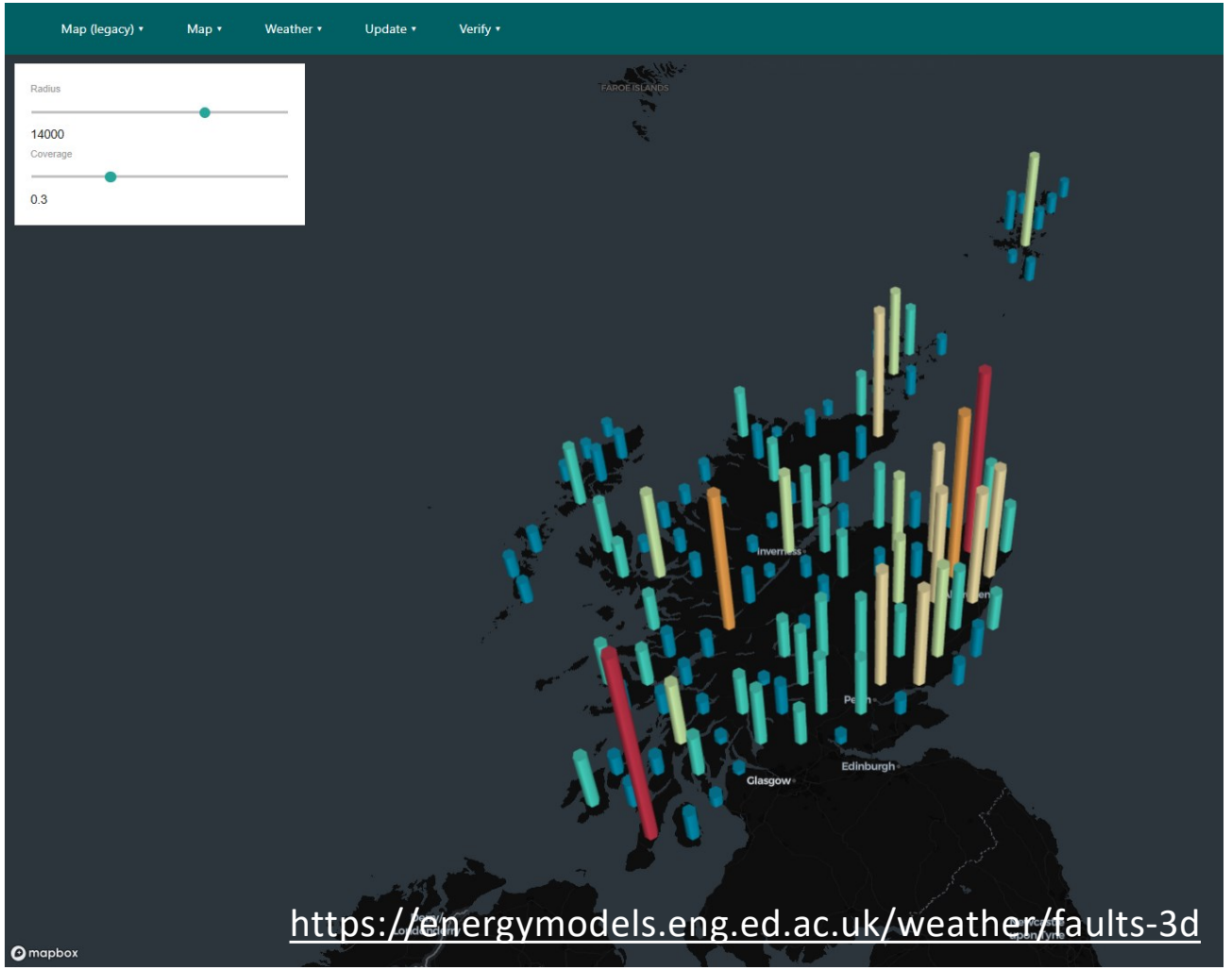
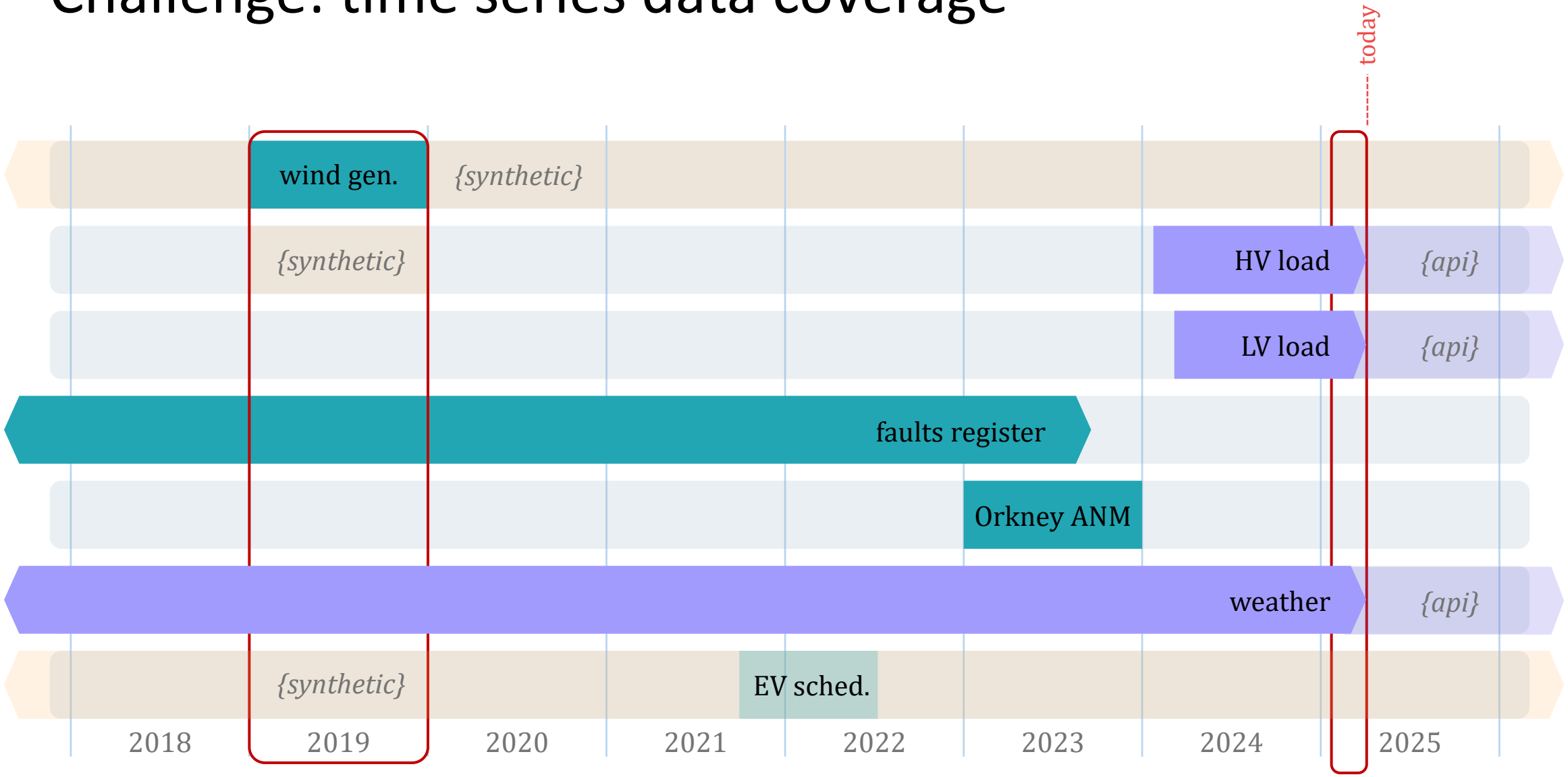
Using data from SSEN (NaFIRS database)…

- airbourne deposits (excluding windborne material)
- condensation
- corrosion due to atmosphere/environment
- flooding
- freezing fog and frost
- ice
- lightning
- rain
- snow, sleet and blizzard
- solar heat
- wind and gale (excluding windborne material)
- windborne materials



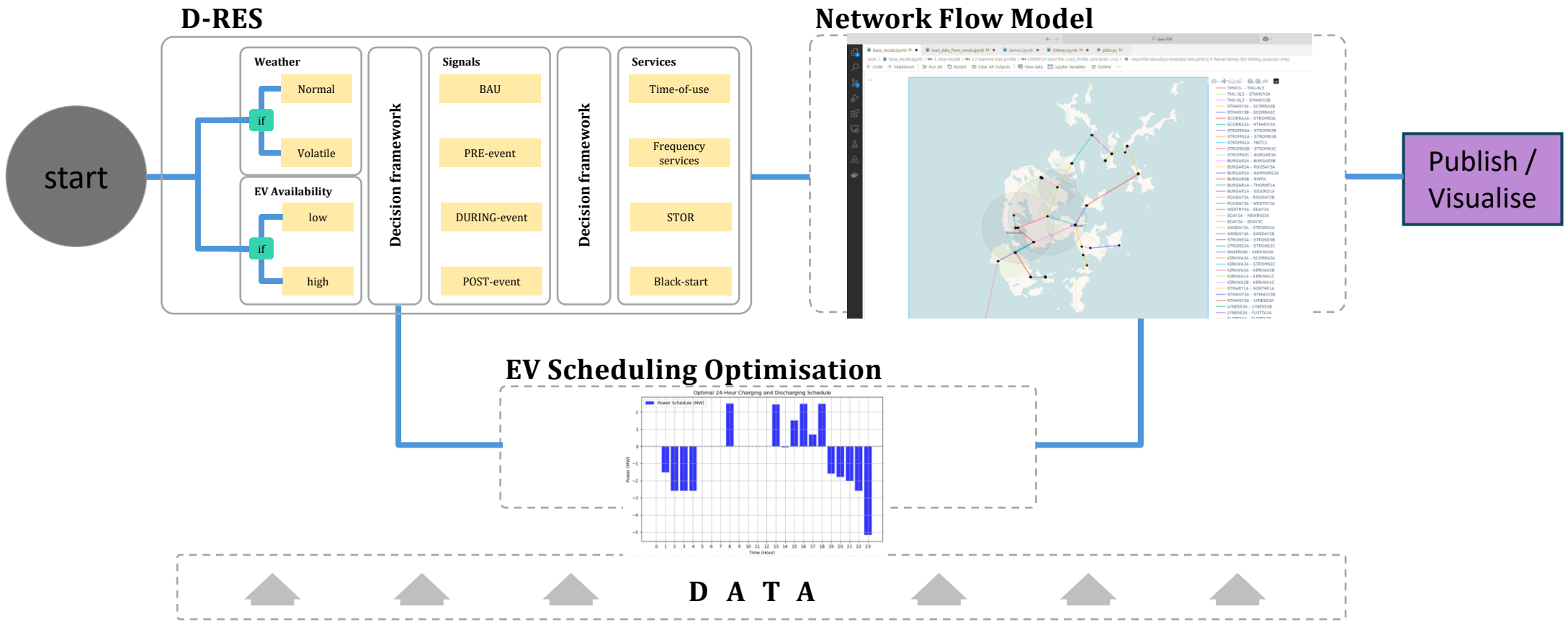
Data: https://data.ssen.co.uk/ssen-distribution/nafirs

Challenge: time series data coverage



The D-RES Workflow

- weather-informed adaptive strategies for energy management,
  - amidst increasing EV penetration
  - and risks posed by weather events



D-RES Codebase

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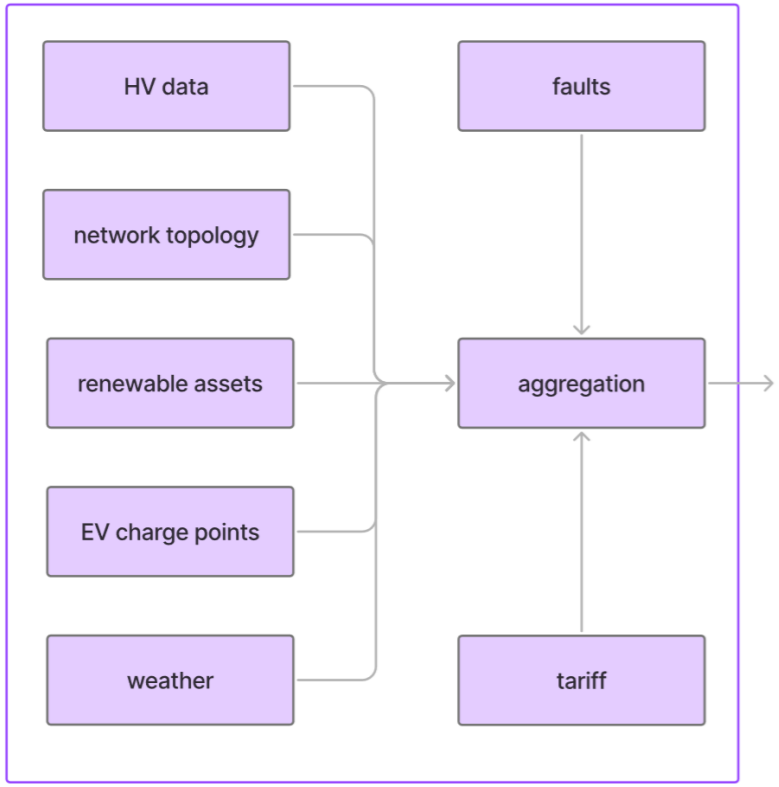

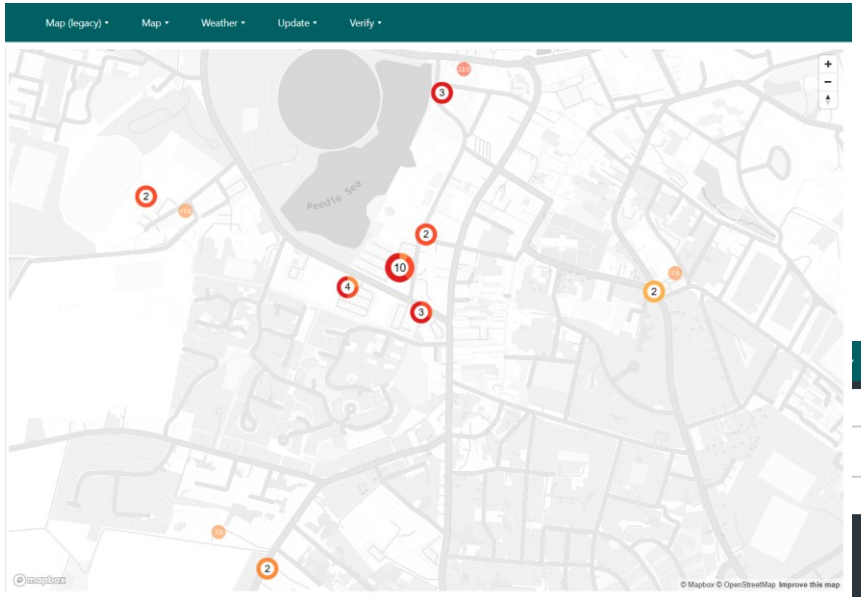

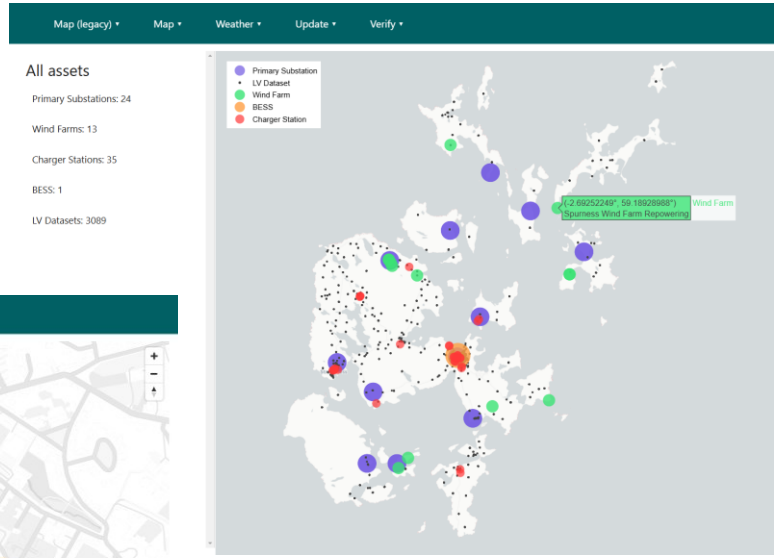

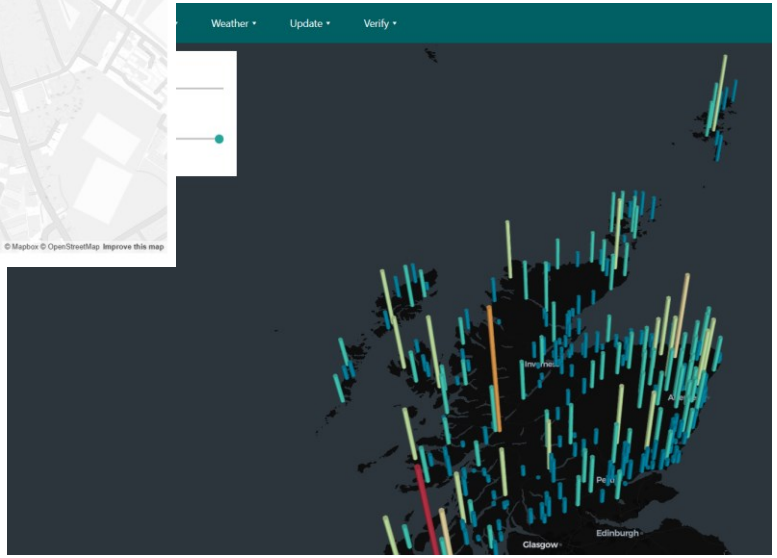

Model setting

“Normal” Weather

Scenario 1: Basic EV Usage

Scenario 2: Smart Charging

Scenario 3: Smart Charging + V2G

Extreme Weather

Scenario 4: Basic EV Usage

Scenario 5: Smart Charging

Scenario 6: Smart Charging + V2G

Include

Optimisation Model

Multi-objective Grey Wolf Opt

Run on

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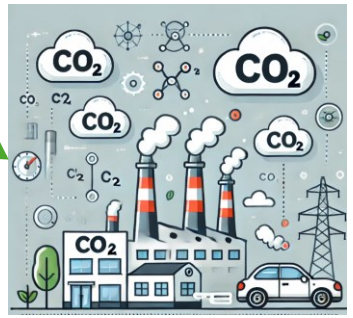


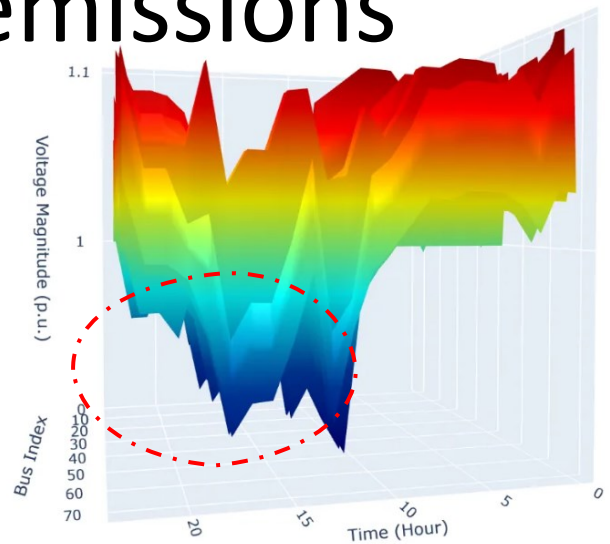
Results: network performance, bills, emissions

2590.12 kg CO_2

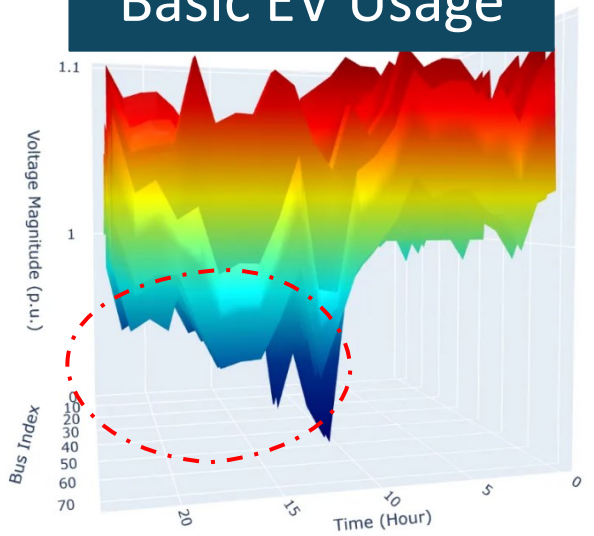
23554.58 kg CO_2

Different Operation in Extreme Scenarios	Charging Cost	Discharging Revenue	Net Bills
Basic EV Usage	£2,290	/	£2,290
Smart Charging + V2G	£2,850	£2590	£260

If 235 EVs would be willing to participate in Smart Charging and V2G.



Basic EV Usage



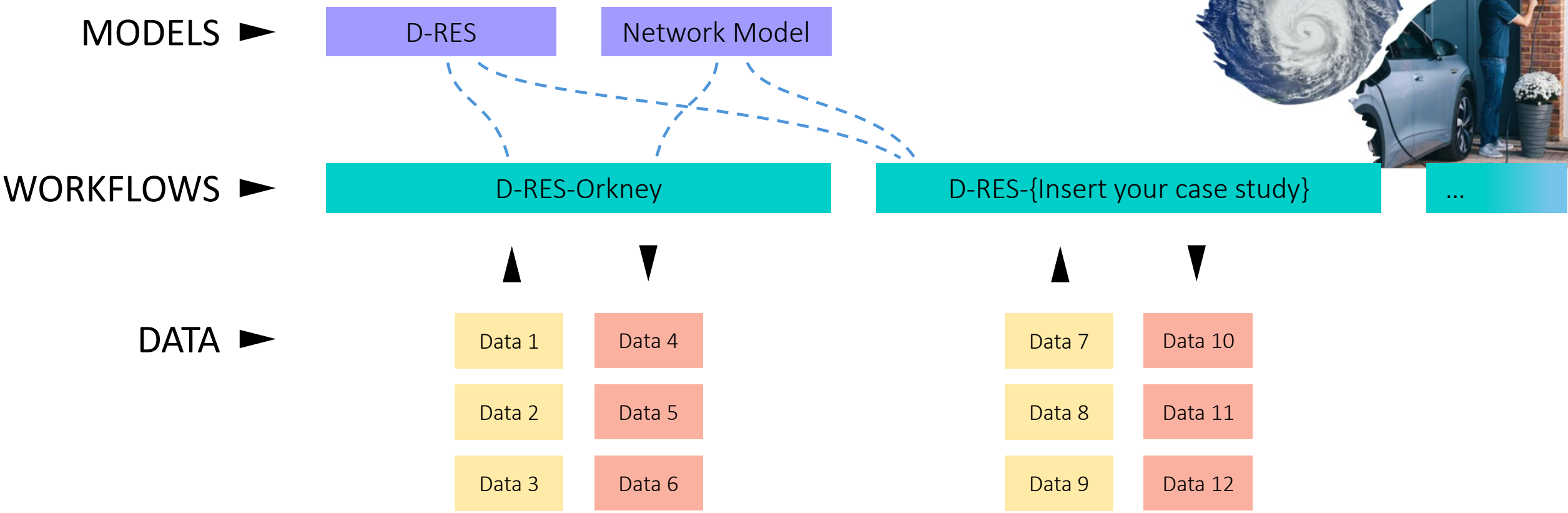
Smart Charging + V2G

Design and Deployment for Re-use

MODELS ►

WORKFLOWS ►

DATA ►



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