Forecasting regional PV power in Great Britain with a multi-modal late fusion network

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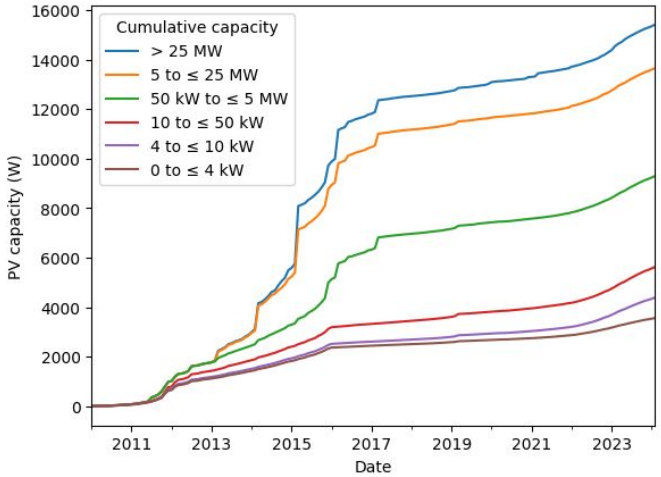
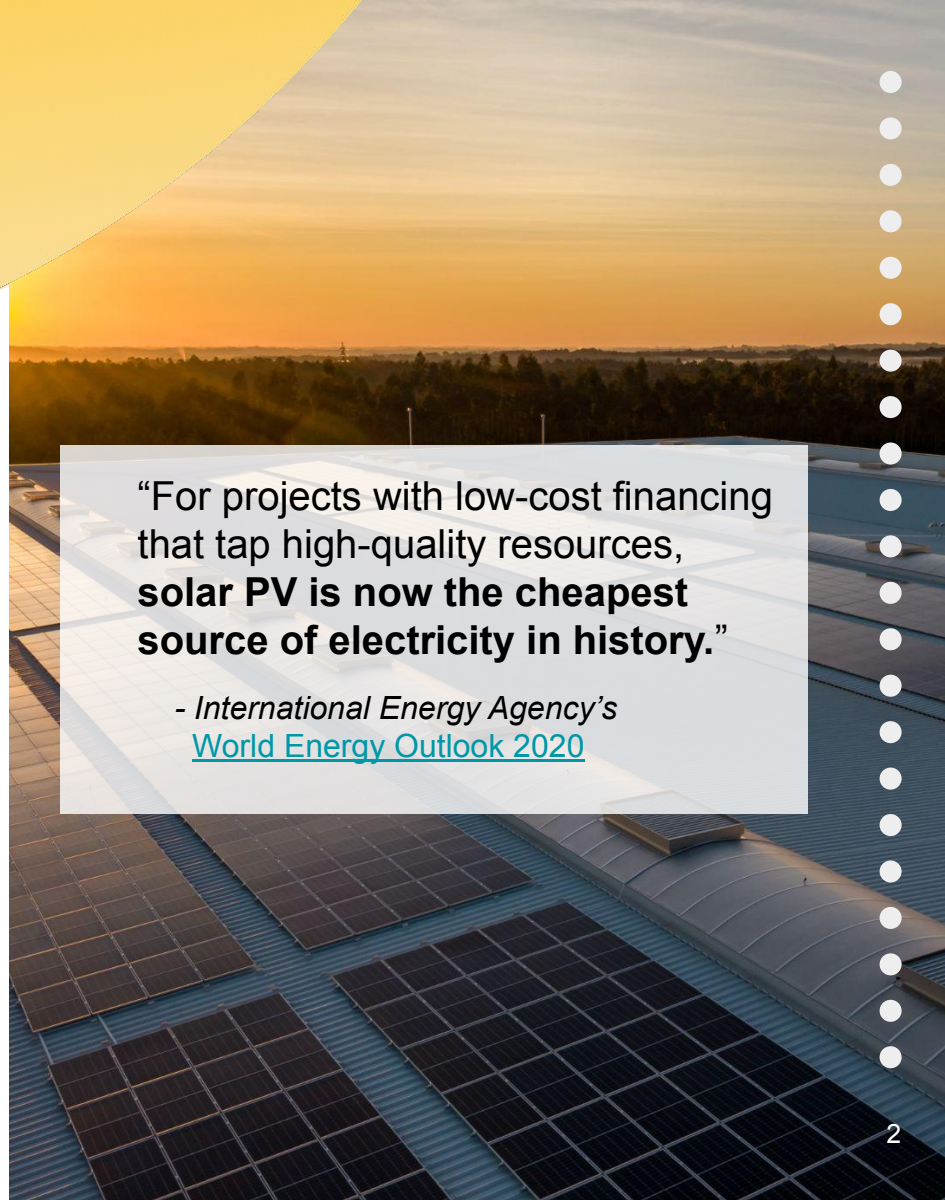
Solomon Cotton, Zakari Watts, and Jack Kelly

Open Climate Fix

GB photovoltaic solar capacity is increasing

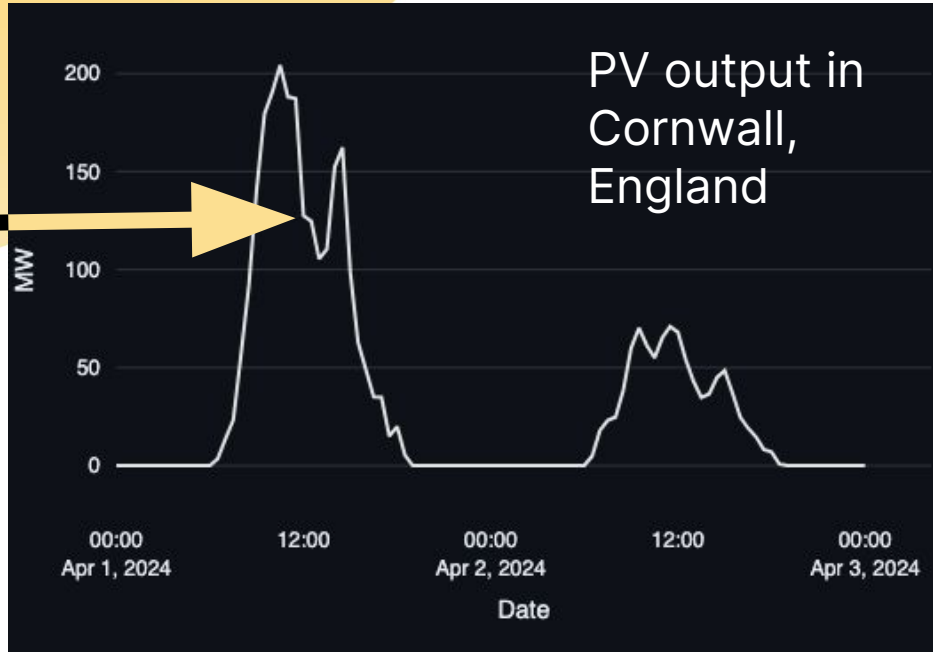




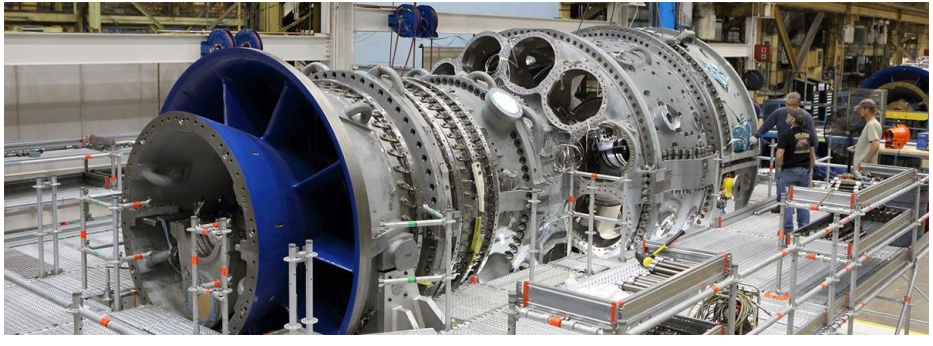
"For projects with low-cost financing that tap high-quality resources, **solar PV is now the cheapest source of electricity in history.**"

- International Energy Agency's
World Energy Outlook 2020

- Local weather has big impact on solar
- Hard to predict

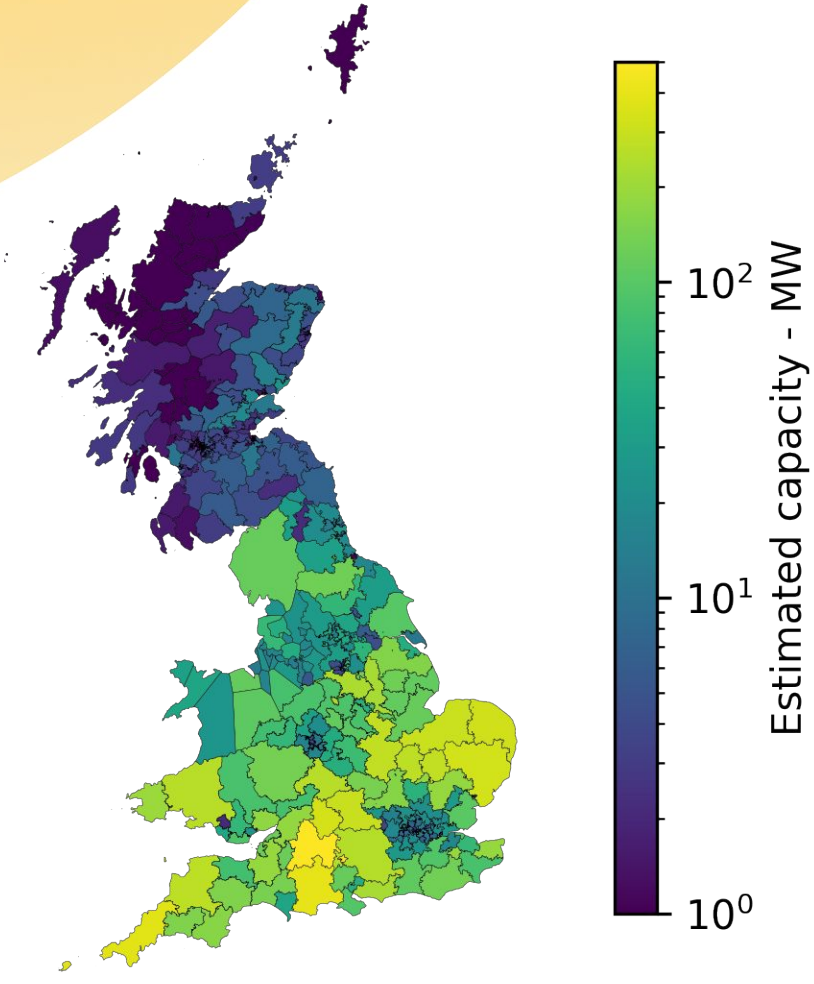


- Accurate forecasts important for grid operators
- Fossil fuels wasted due to poor forecasts

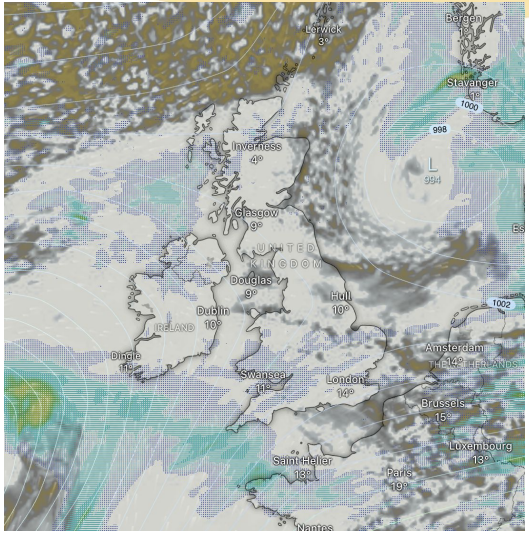


Gas turbine kept running as backup

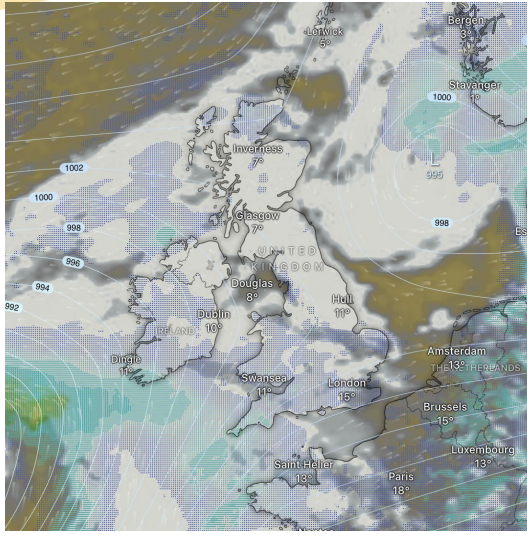
- Train model to predict PV output of 317 regions
- Predict total for region
- 30 mins - 8 hours horizon



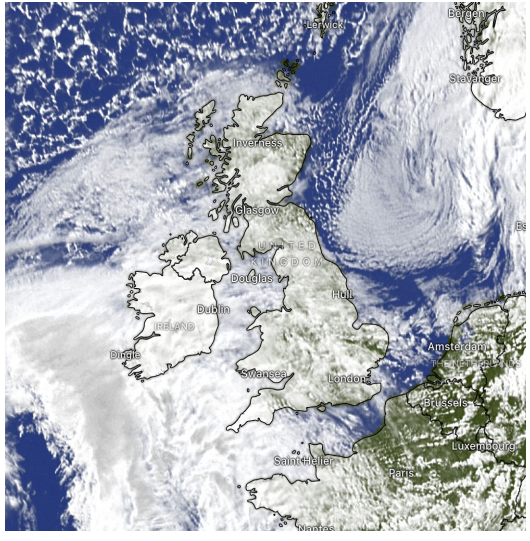
UK Met Office - UKV



ECMWF - IFS



EUMETSAT RSS



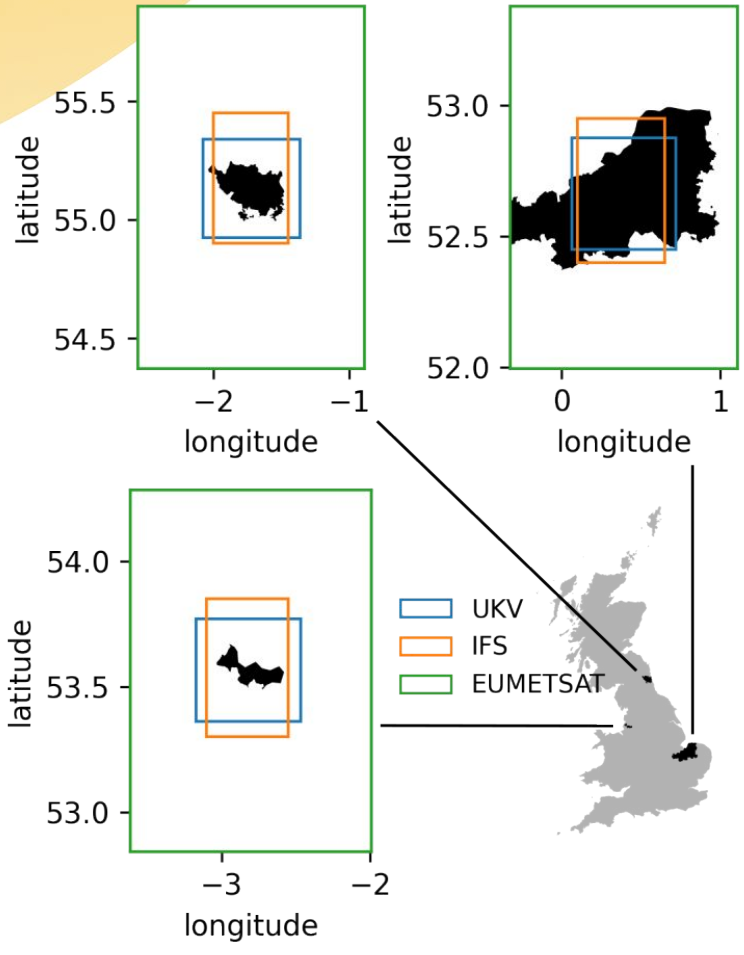
------- Numerical weather predictions -------

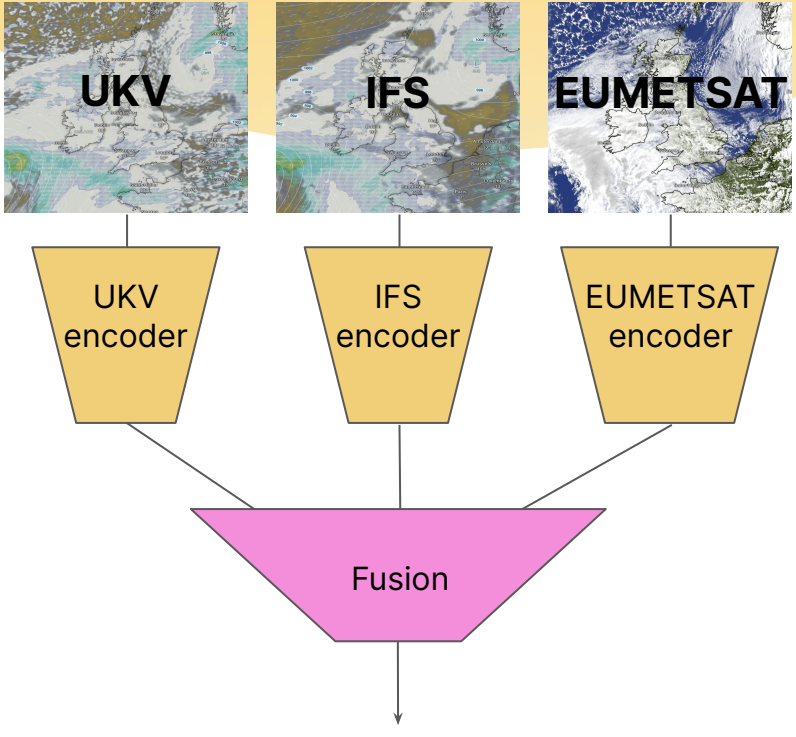
3 hour delay

Satellite images

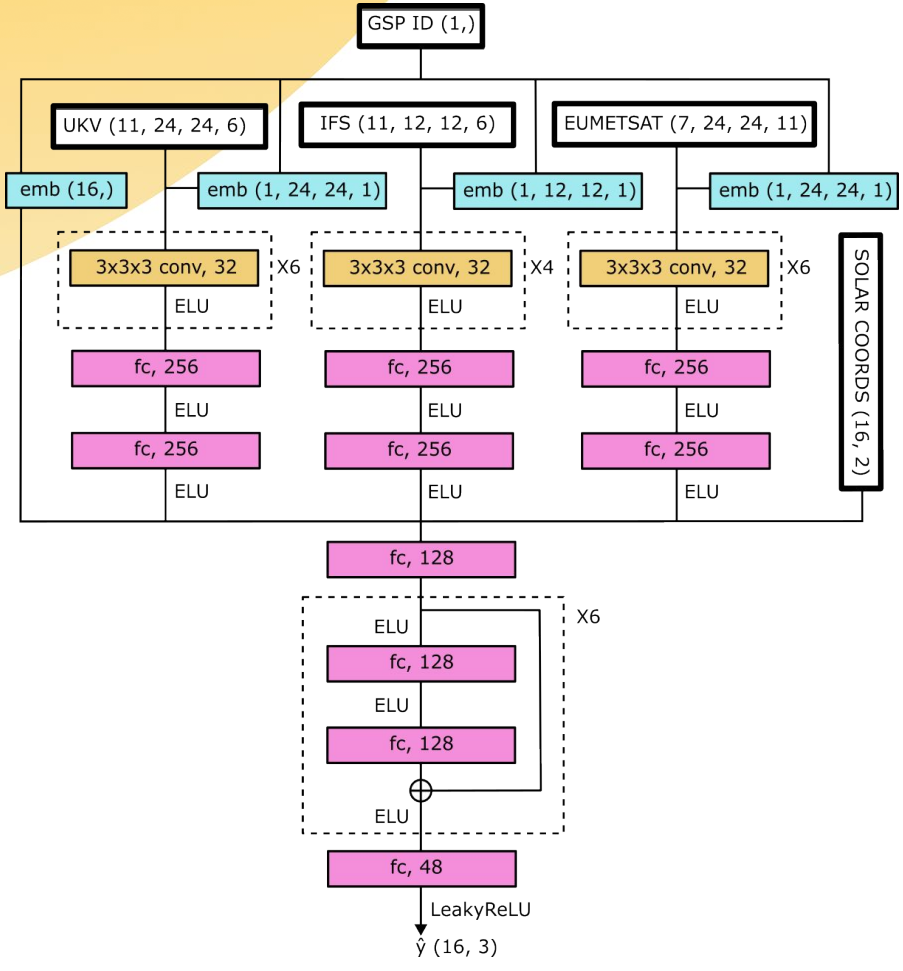
1 hour delay

- Spatial slice centred on GSPs
- GSPs are very different sizes
- Window size is compromise





Simplified network diagram

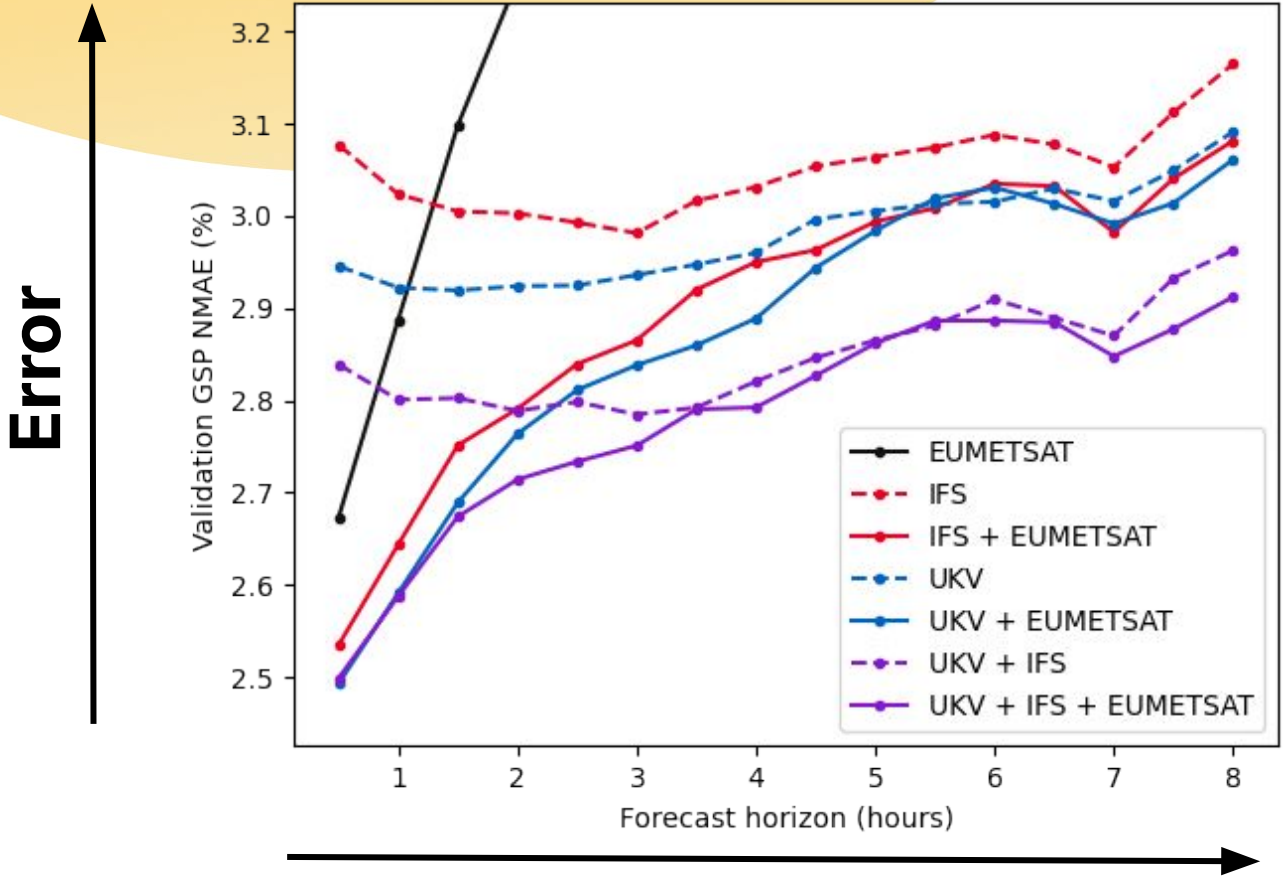


Full network diagram

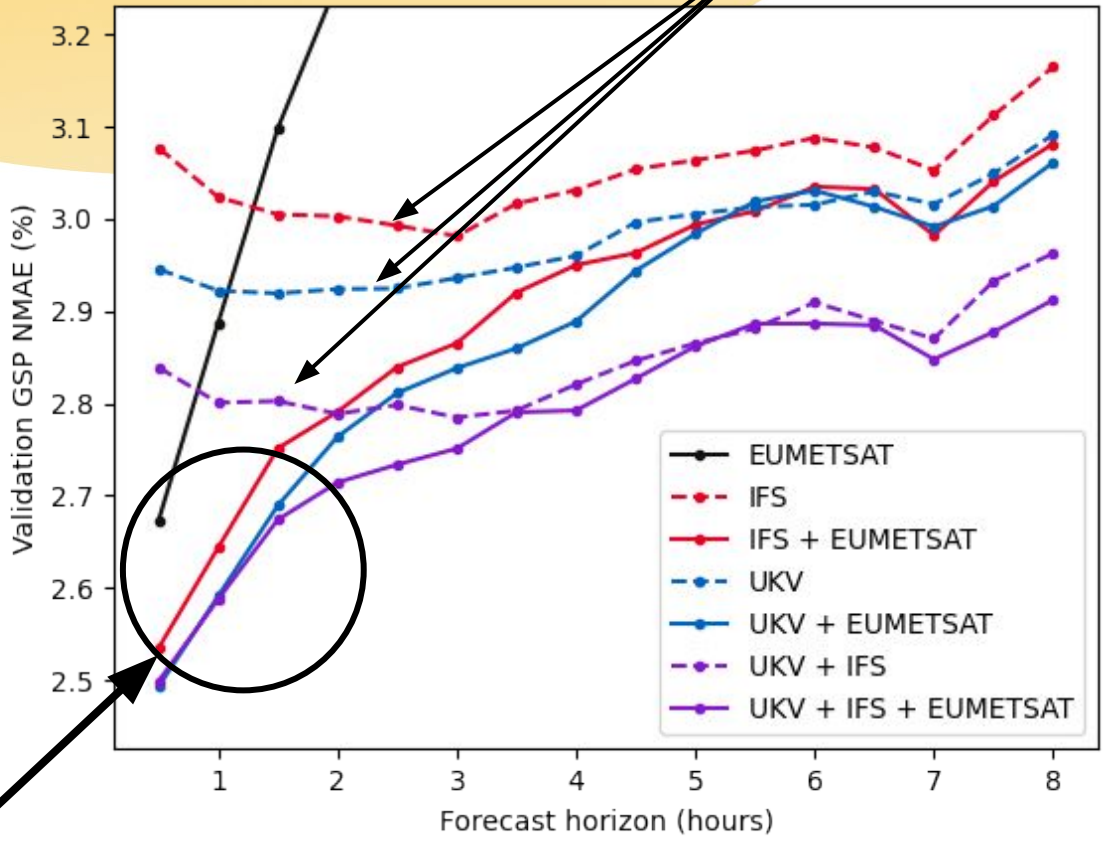
Experiment details

Which data sources influence the accuracy at different horizons?

- Train on 1.6 million samples 2020-02-02 until 2022-05-07
- Evaluate on 32,000 samples 2022-05-08 until 2023-05-08


Error
Validation GSP NMAE (%)
3.2
3.1
3.0
2.9
2.8
2.7
2.6
2.5
1
2
3
4
5
6
7
8
Forecast horizon (hours)
EUMETSAT
IFS
IFS + EUMETSAT
UKV
UKV + EUMETSAT
UKV + IFS
UKV + IFS + EUMETSAT
Time into future

No satellite

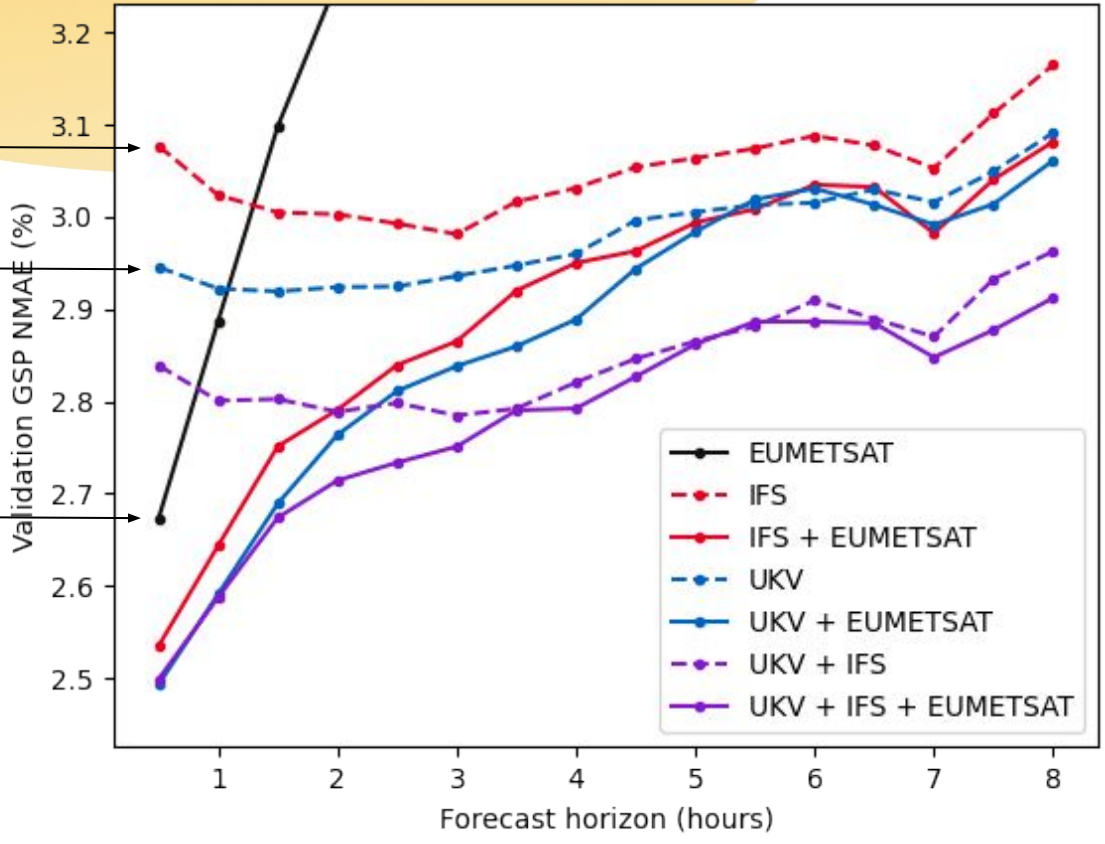


Used satellite

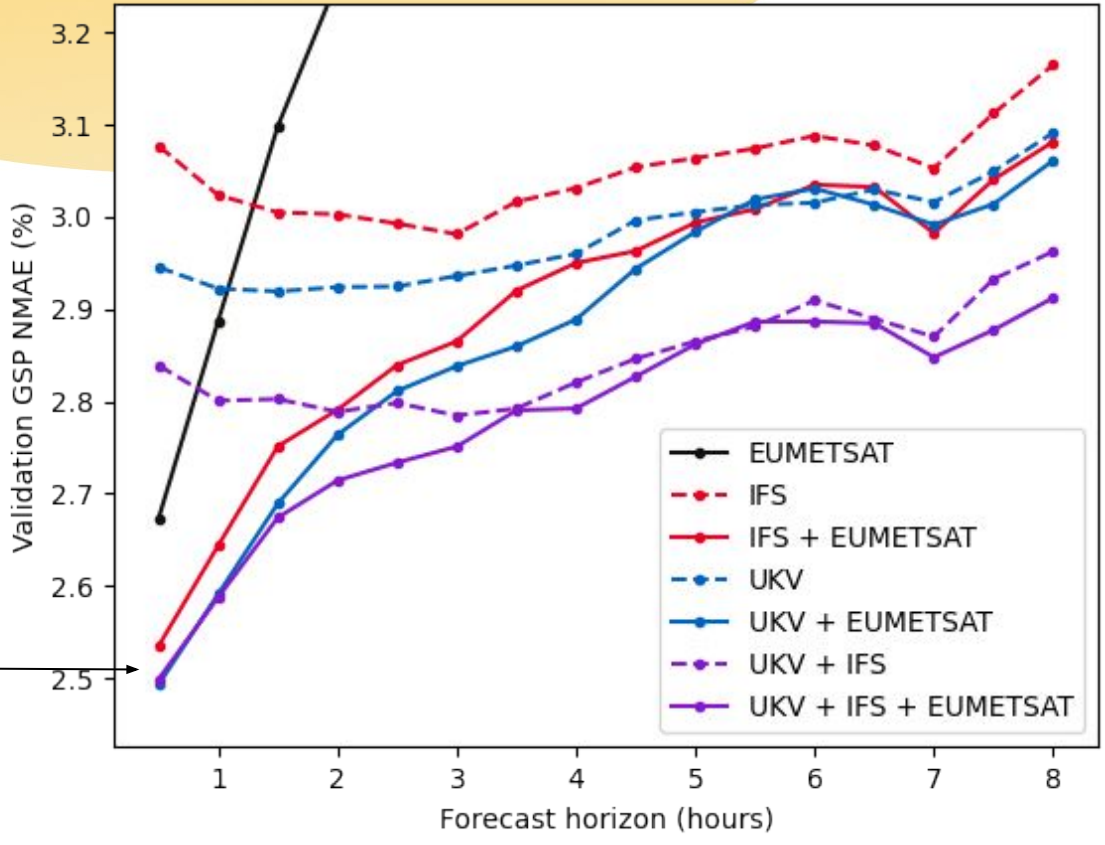
IFS only

UKV only

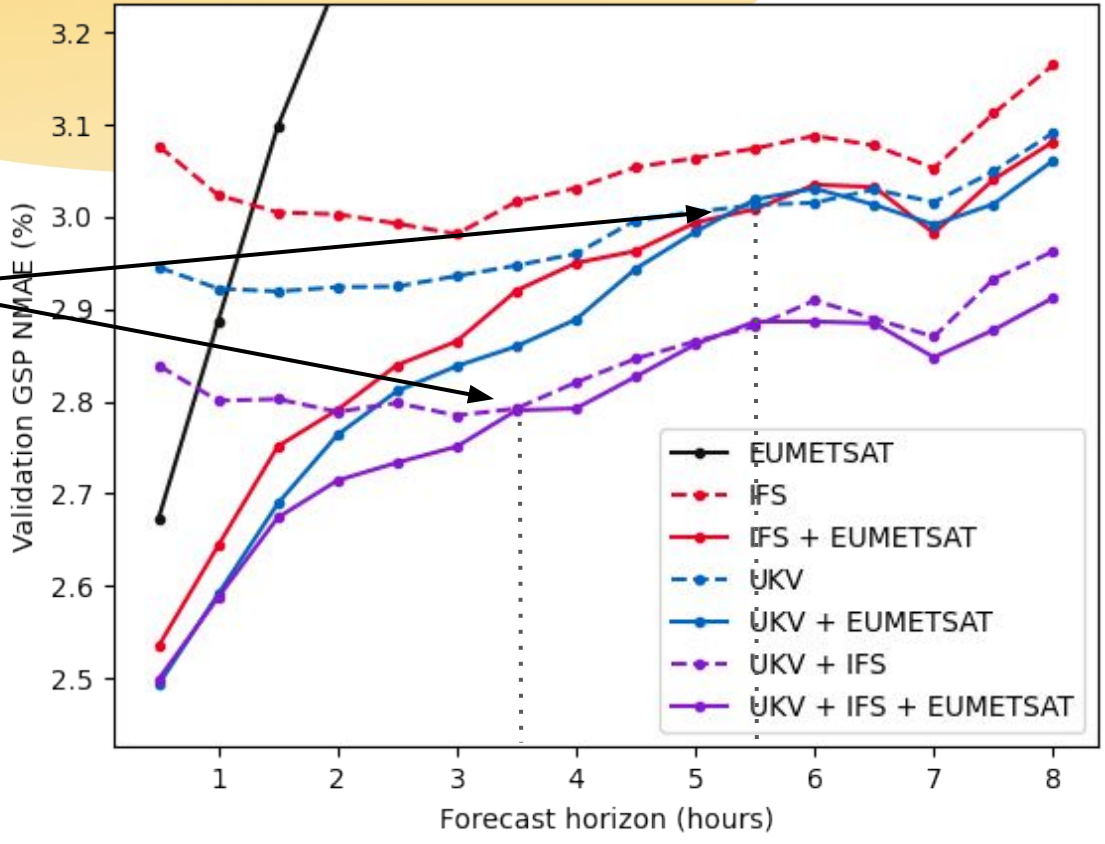
Satellite only

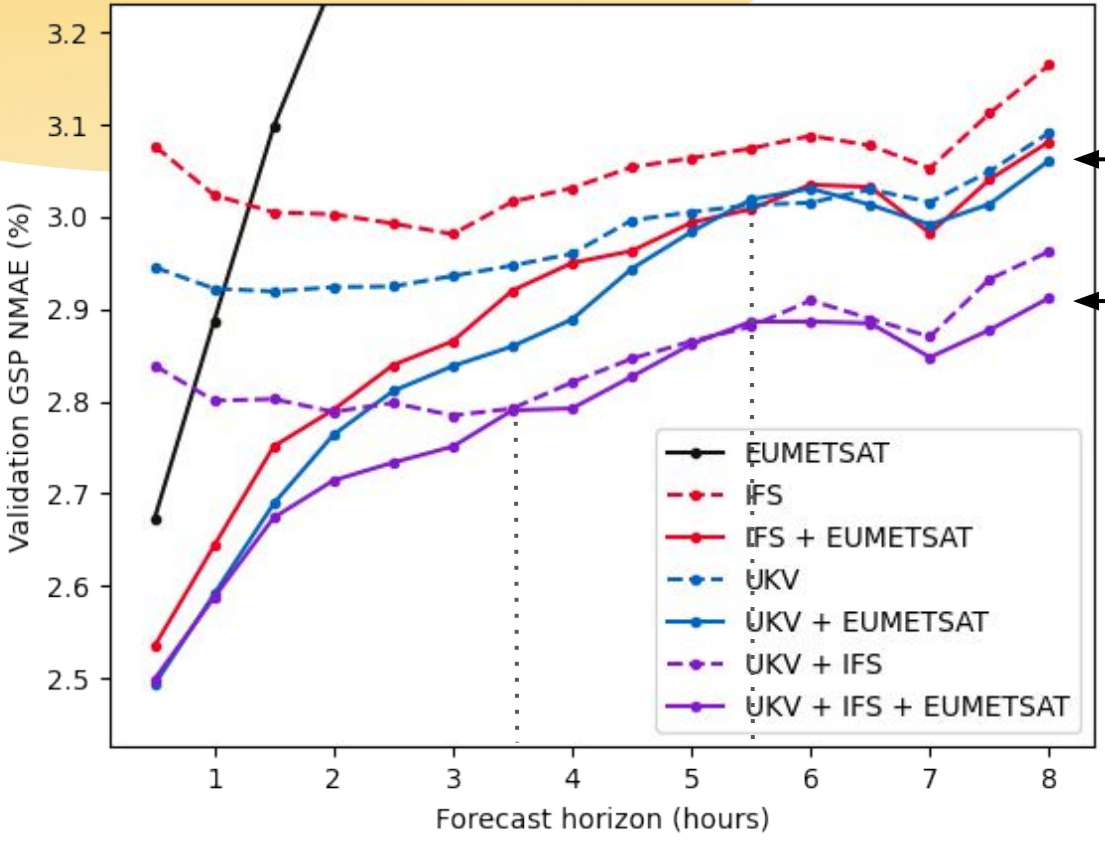


Using both is best



Satellite useful for first 3 - 5 hours





1 weather model

2 weather models

Thanks

All code: https://github.com/openclimatefix/PVNet
Contact: james@openclimatefix.org

QUARTZ SOLAR ← Live forecasts

https://www.quartz.solar