



Lake Street
working with the weather

Can ML/AI help end users increase forecast successes and highlight potential busts?

Workshop on Diagnostics for Global Weather Prediction

Isla Finney

September 11th 2024

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Outline and aims

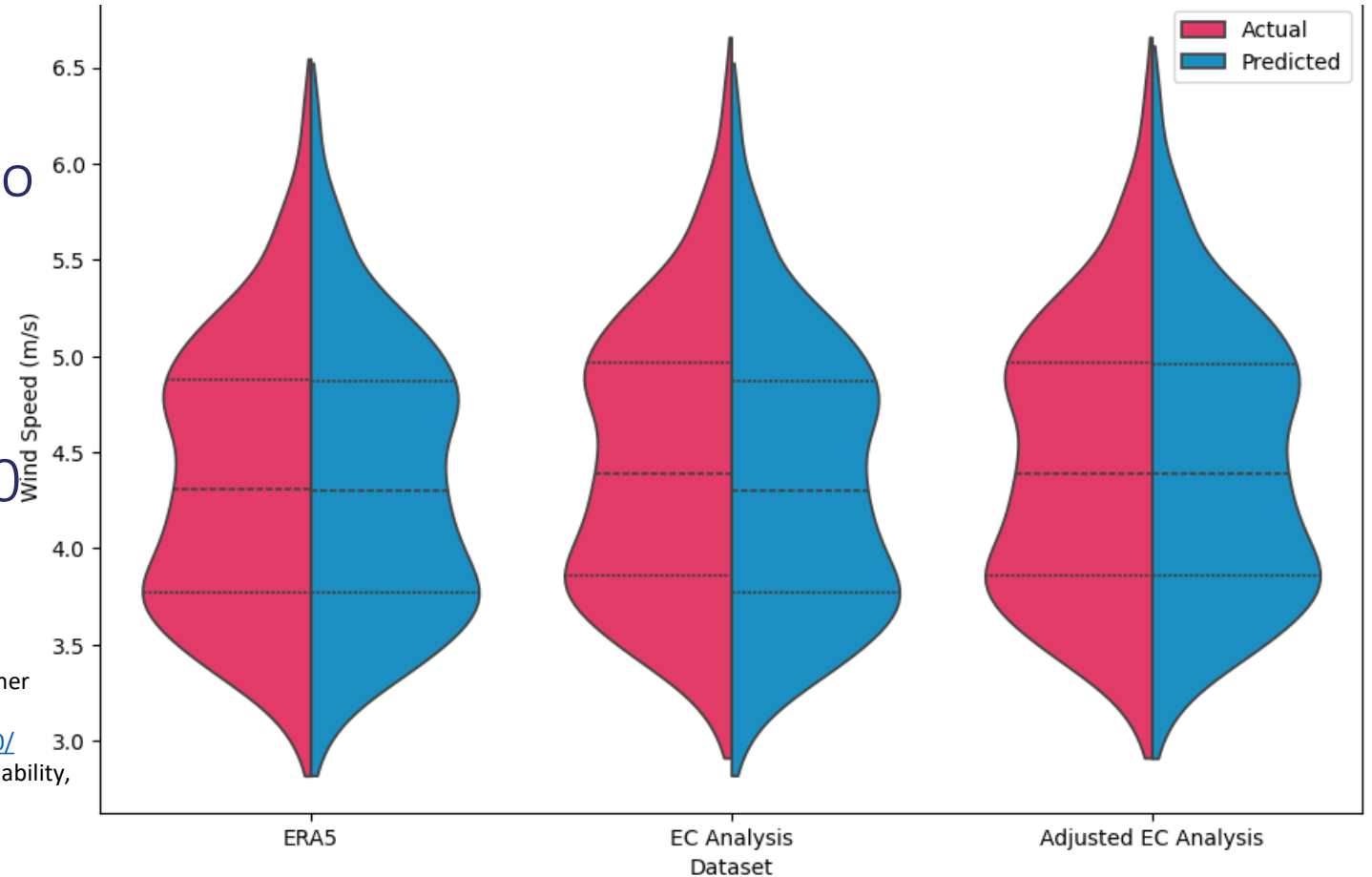
- Operational forecasters have range of ML/AI charts available
 - Thanks to ECMWF
- Majority have restricted use due to licenses. EC AIFS much less so
 - Thanks to ECMWF, especially for AI open data 😊
- ML/AI deterministic so far, at least as far as usable accessible data
- Diagnostics suggest AI forecasts “better”
- Two practical examples of using AI forecasts
 - Forecasting wind generation at two UK wind farms
 - Forecasting shift cooler for Europe over the weekend/Monday
- Thoughts for how AI could help us find “ultimate predictability”



Deriving AIFS 100m wind speed

CNN model trained on ERA5 2010-19 & 22-23, validated on 2021
Out of sample test on 2020

- 100m wind speed NOT an output variable of AIFS
- AI model created using ERA5 data to derive 100m wind speed from AIFS outputs
- Operational forecasts off EC init
- EC init 6z/18z not available for 2020
(let us know if it is!), so use EC analysis

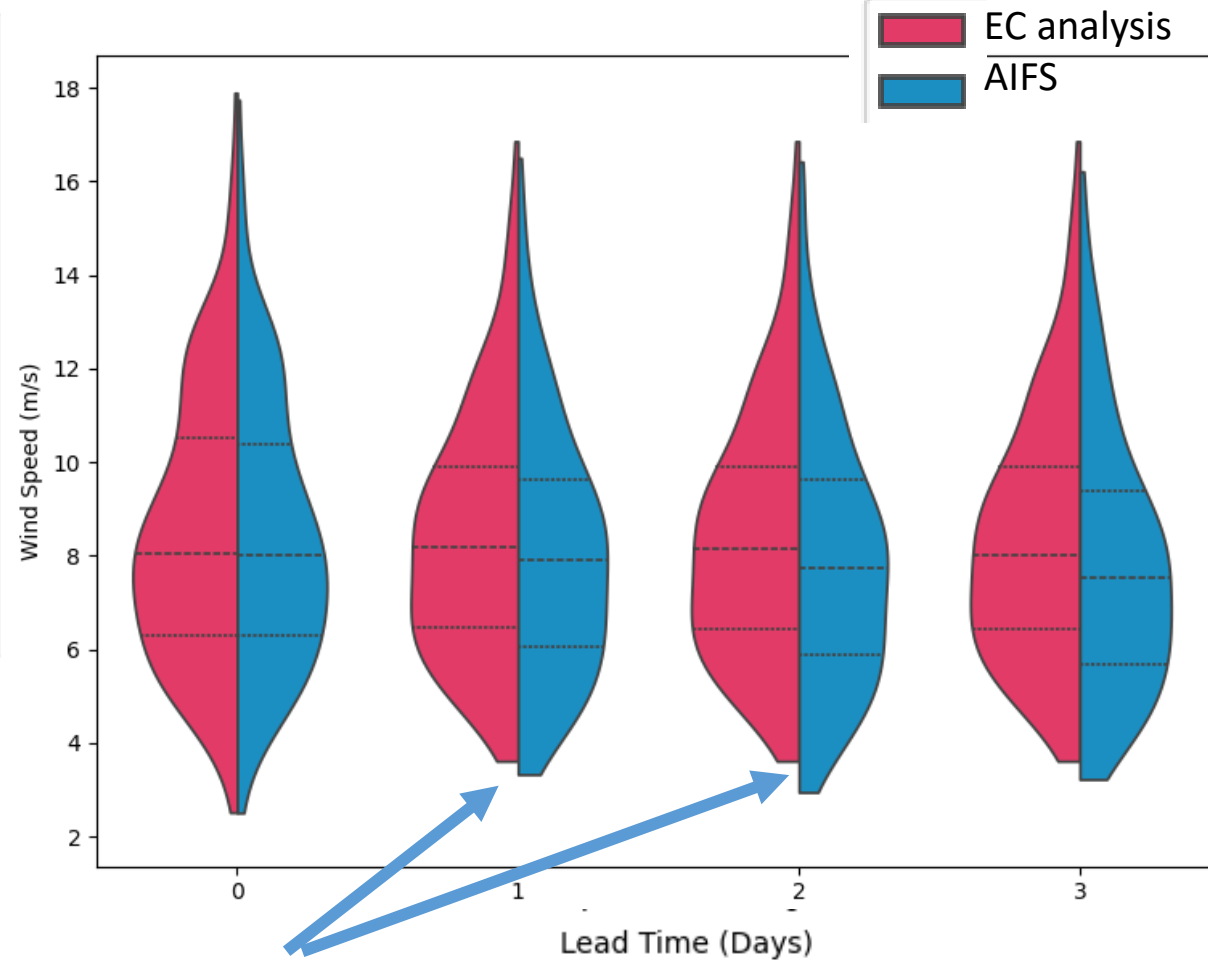
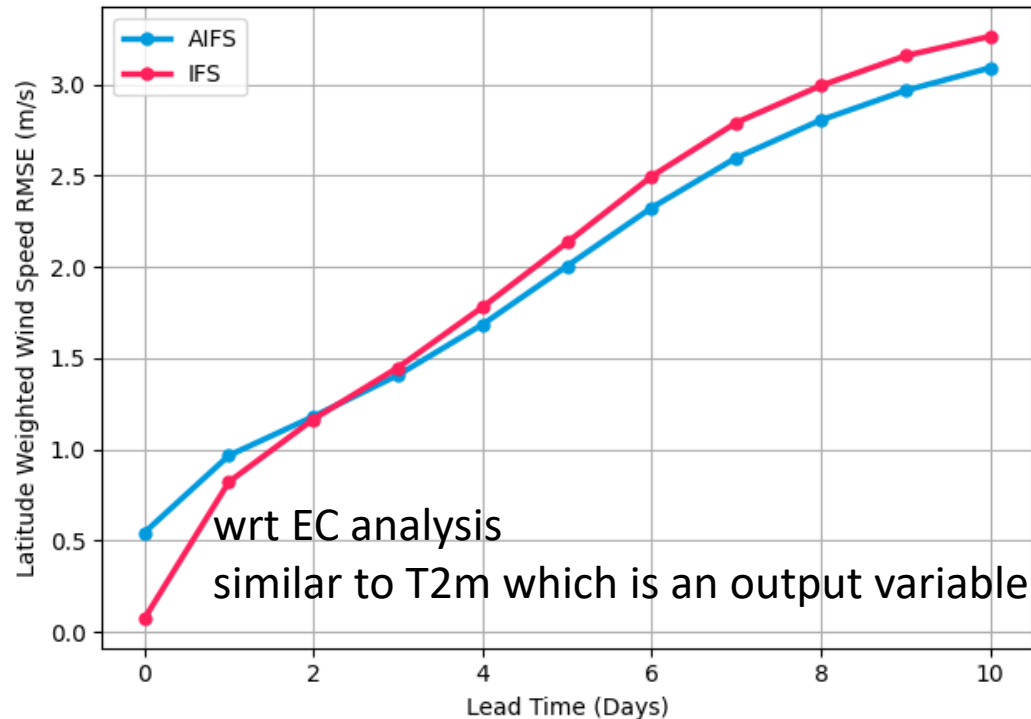


ERA5 data contains modified Copernicus Climate Change Service information (2024)
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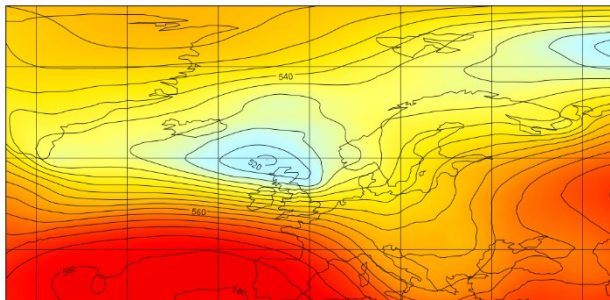


Forecast 100m windspeed vs actual

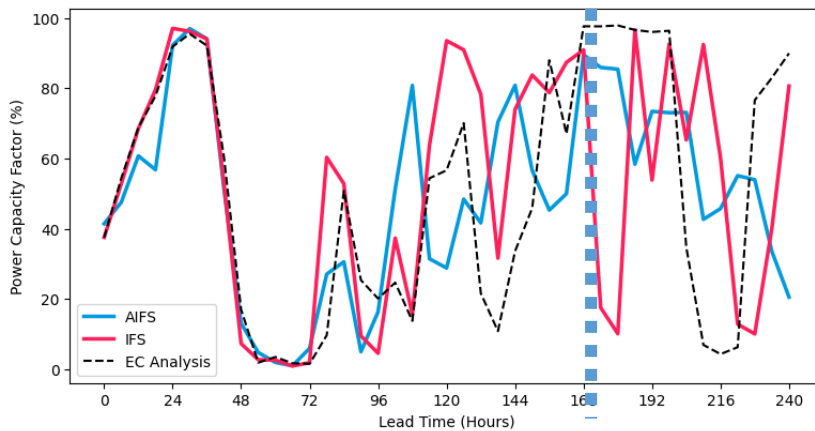
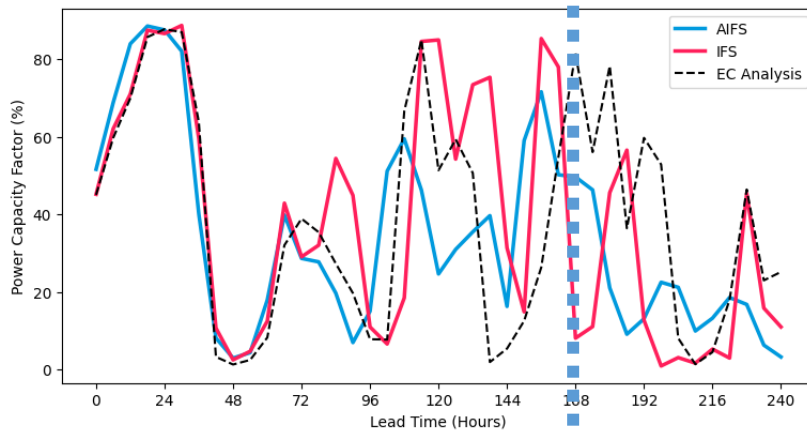
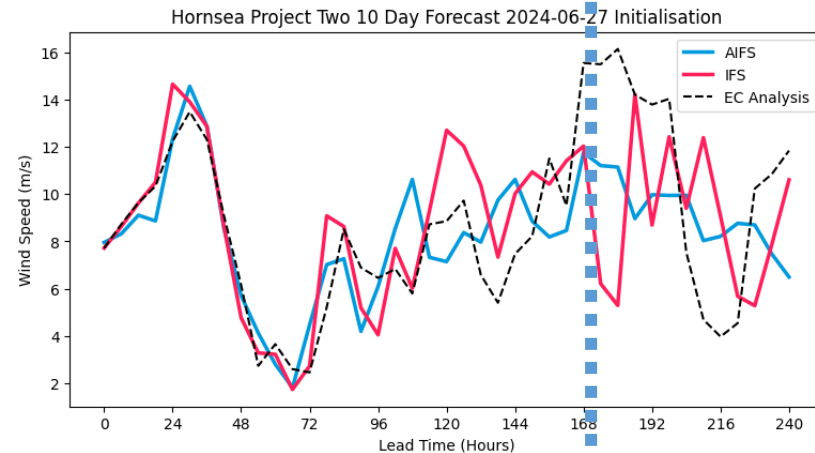
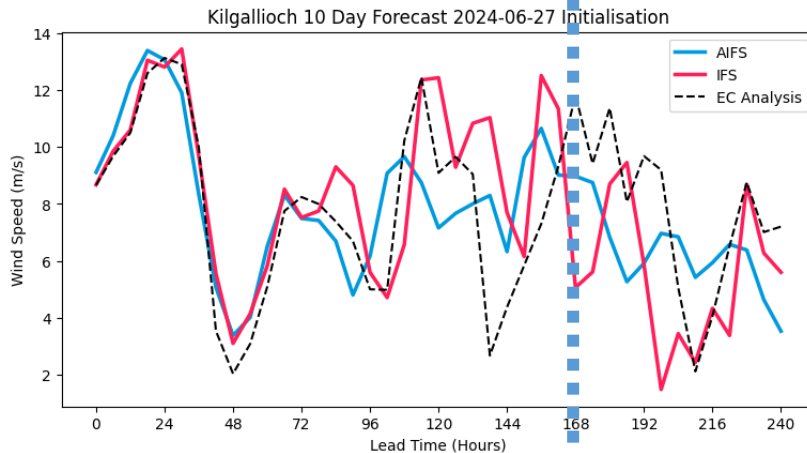
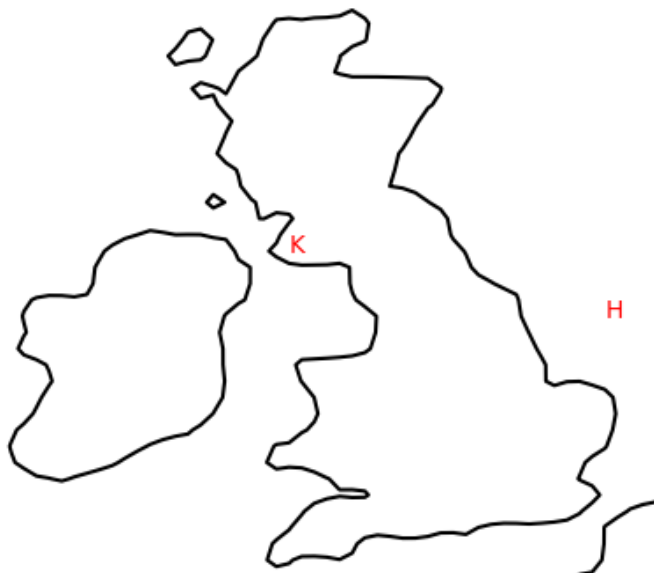
Europe, March – July 2024 initialisations



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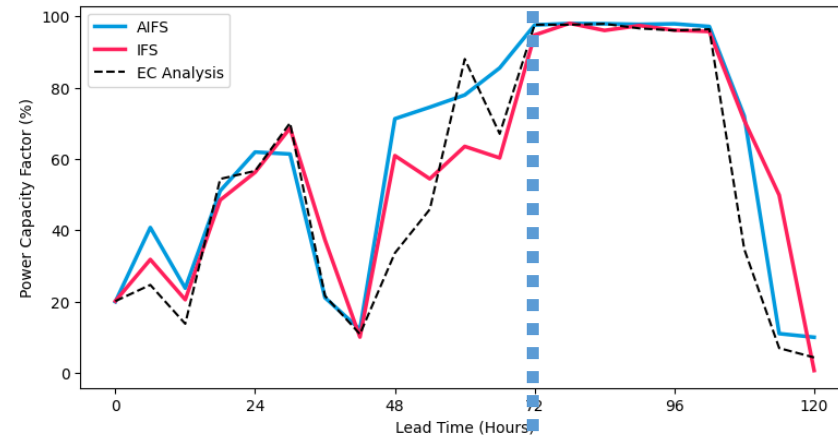
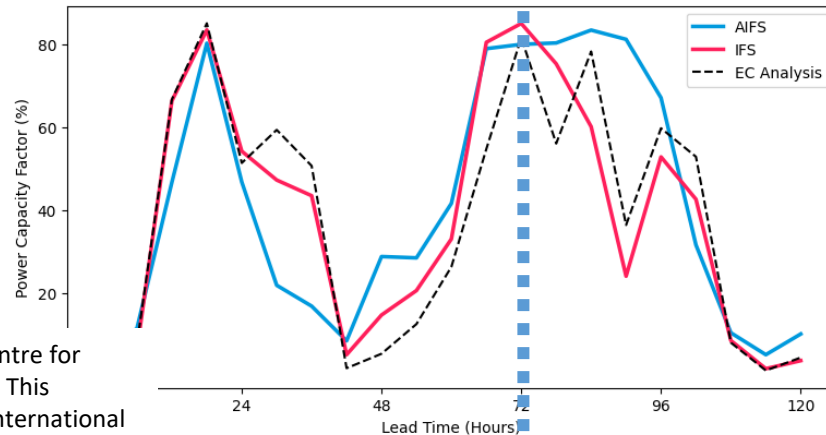
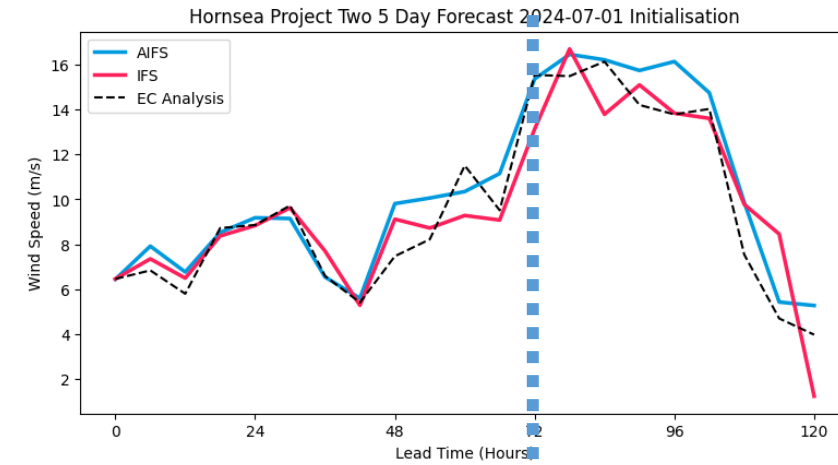
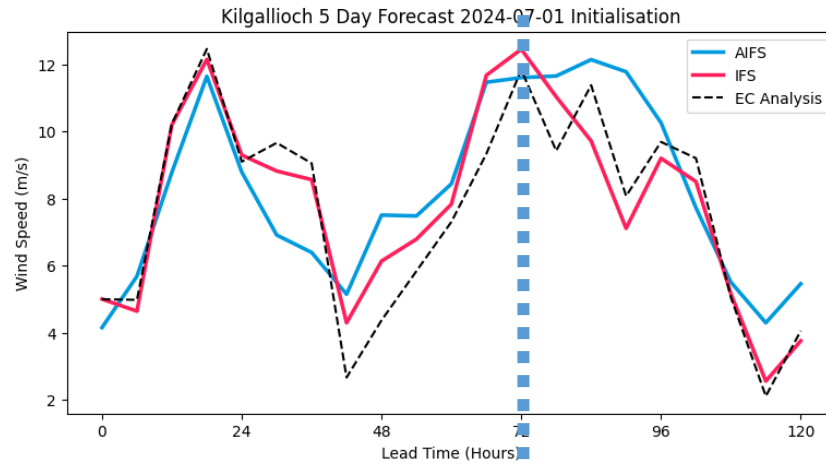
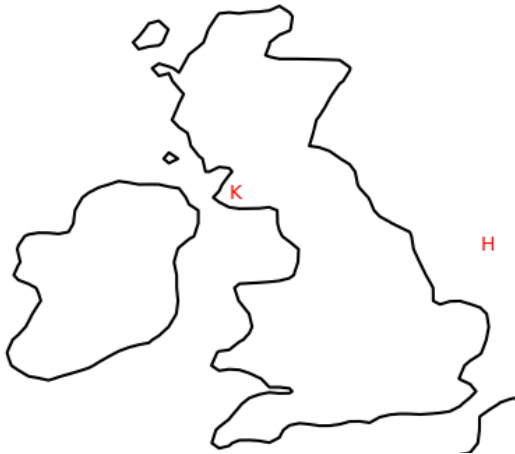
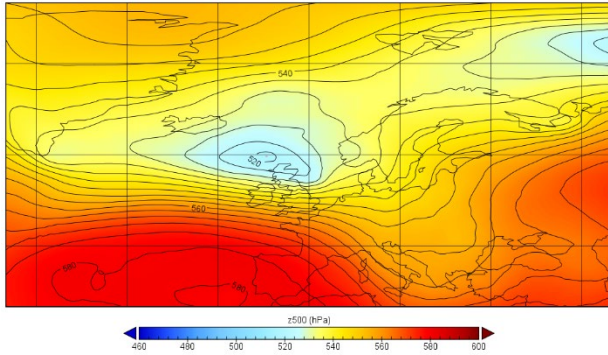
UK wind farm example (1) wind power forecasts



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UK wind farm example (2)

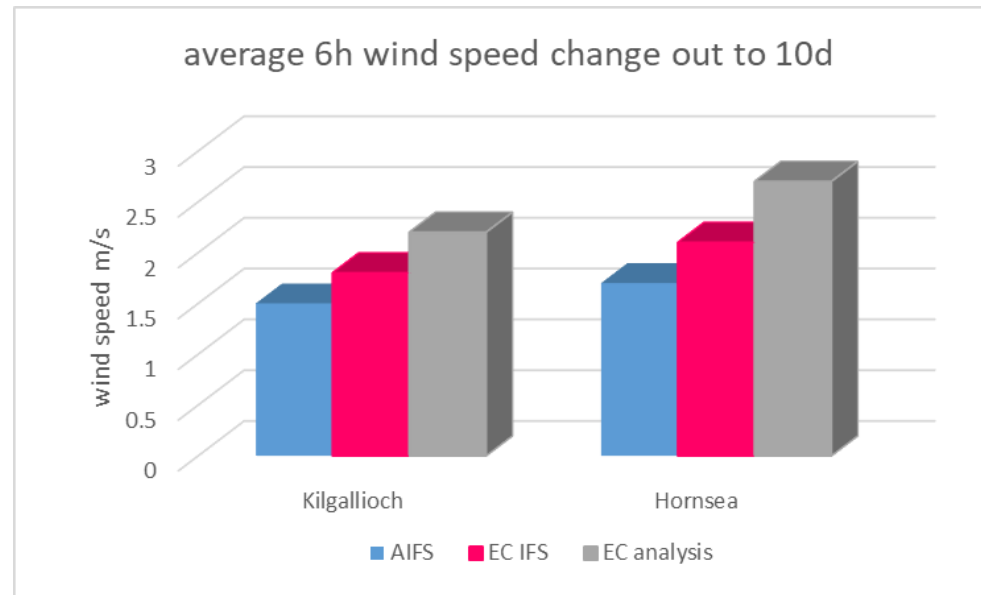


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UK wind farm example: conclusions

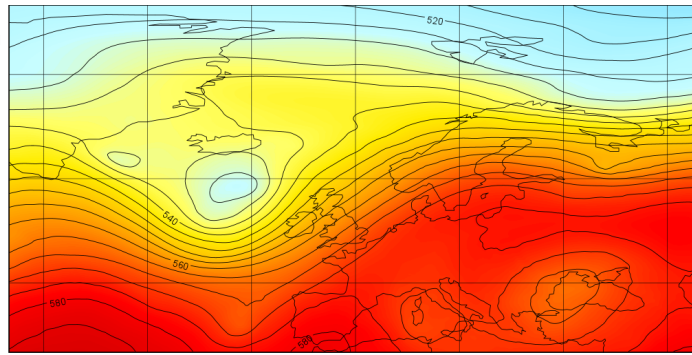
- Can derive “end user” outputs not included in AI models
- AIFS does give progression of fronts, and associated changes in winds
- But pattern evolution is too smooth, more so than the EC IFS



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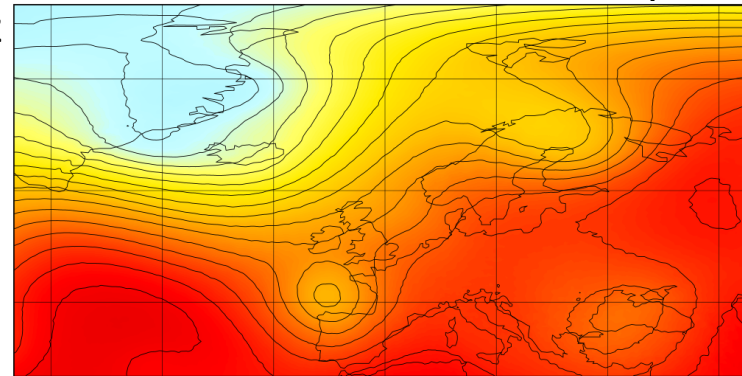
Aug 28th



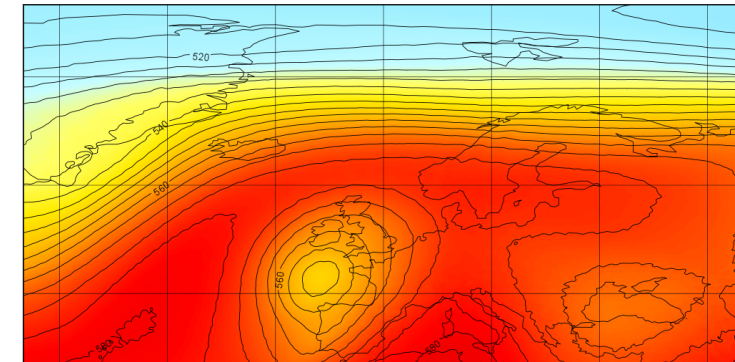
DE temperature forecasts

init Aug 28th

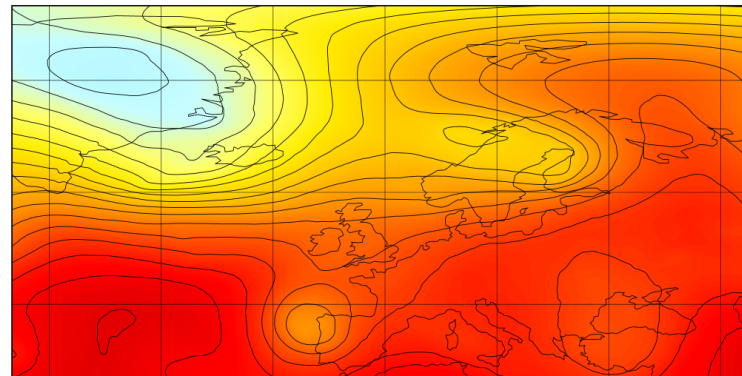
Sep 3rd



Sep 6th



AIFS 00z



IFS 00z



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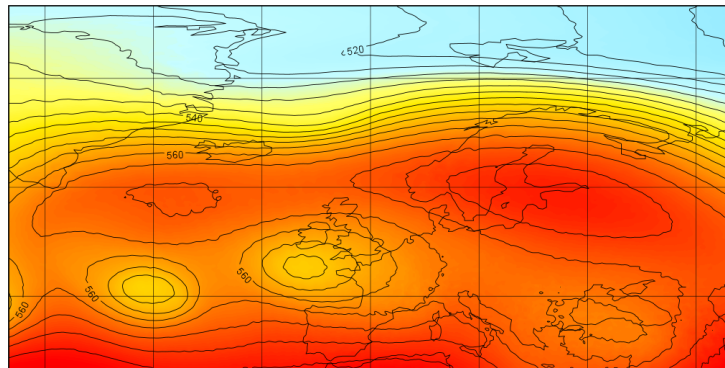
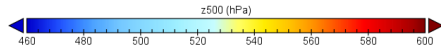
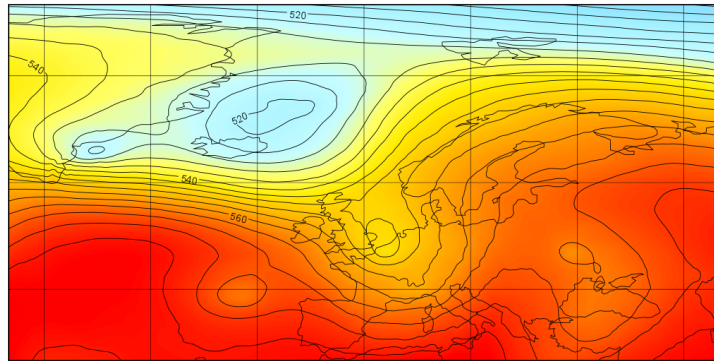


... bust for both IFS and AIFS

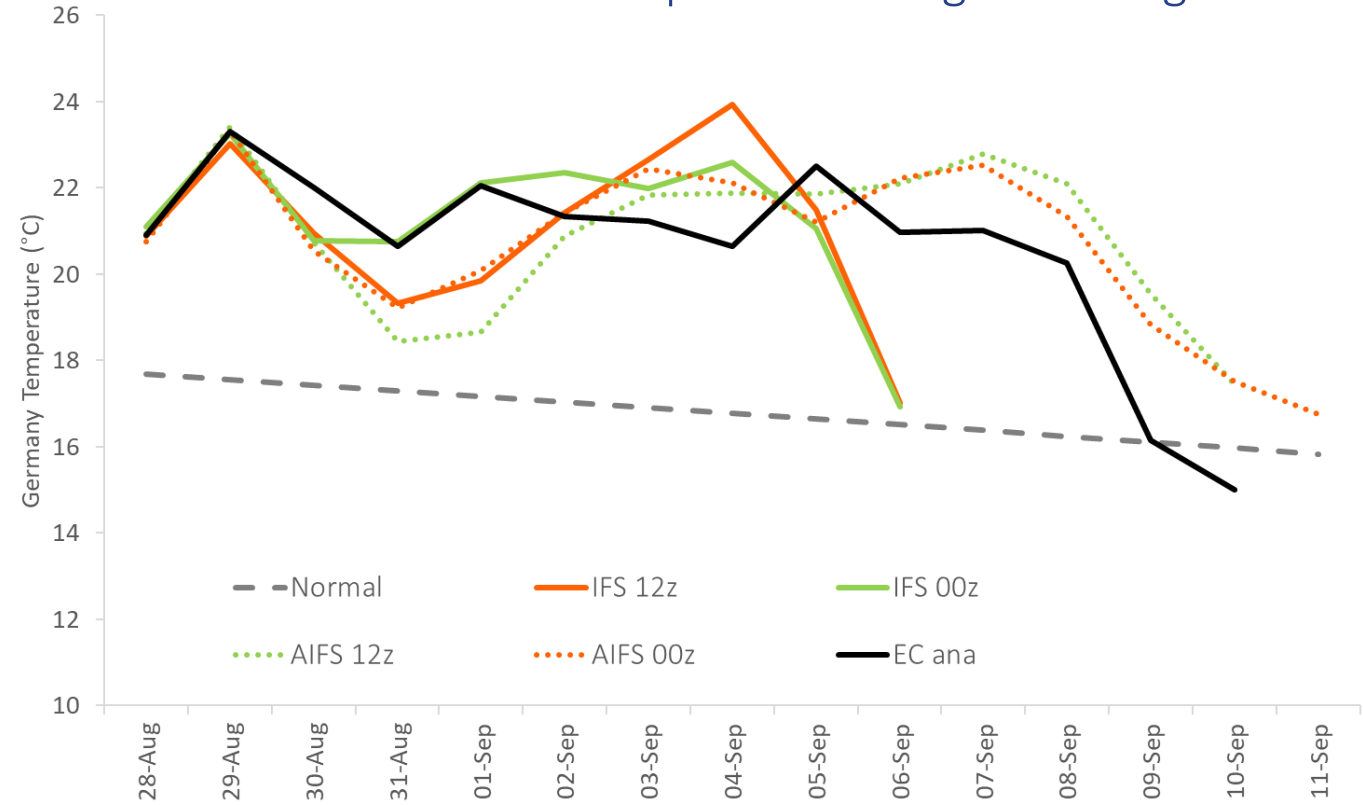
Neither captures the regime change

analysis

Sep 9th



AIFS



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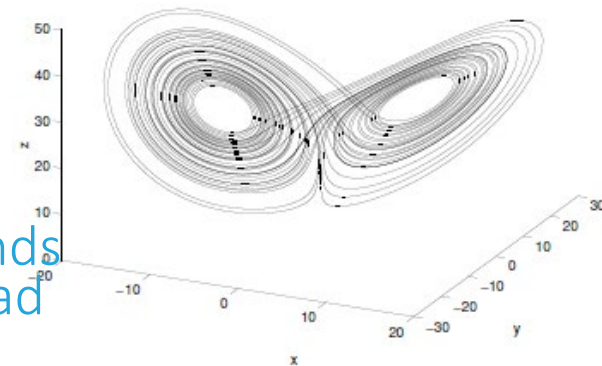
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AIFS contribution to op forecasting

- Currently
 - AIFS sometimes flags predictability barrier / uncertainty, but not always
NWP ensembles more helpful
 - Examples exist with all combinations of AIFS 00z/12s and NWP 00z/12z
agreeing/disagreeing
 - Like any new model/cycle, method of creation suggests situations to discount
e.g. stratospheric driven changes during winter
- Evolution / opportunity in v2?
 - AI initialisation from observations, rather than using EC initialisation
 - Relax initialisation constraints to get an ensemble with ics on multiple strands
of strange attractor, not just one. Then could start having meaningful spread
 - Flow dependent ensembles



Source: Gilmour 1999



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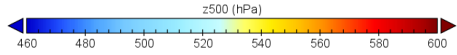
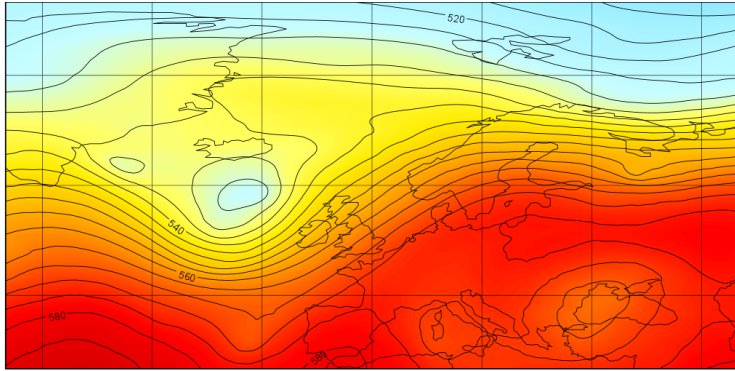
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Aug 28th

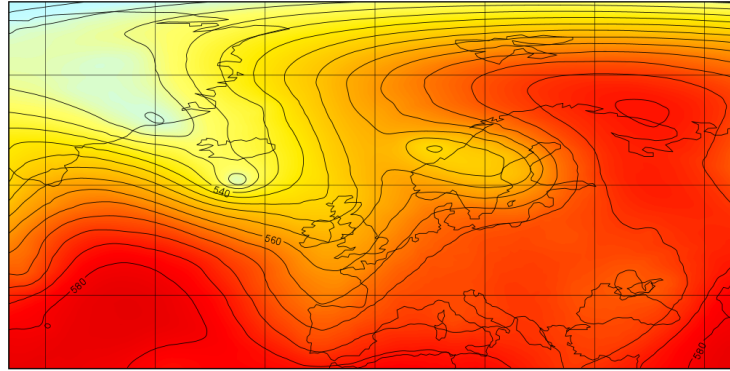


IFS & AIFS

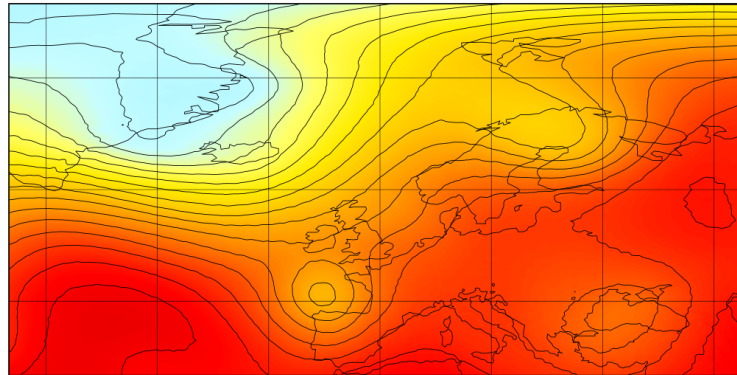
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Sep 3rd

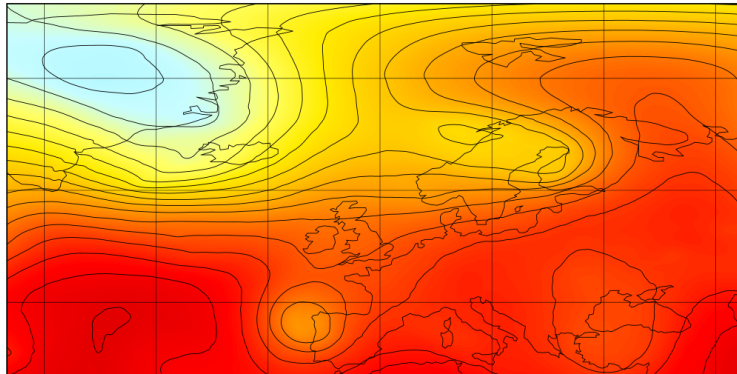
analysis



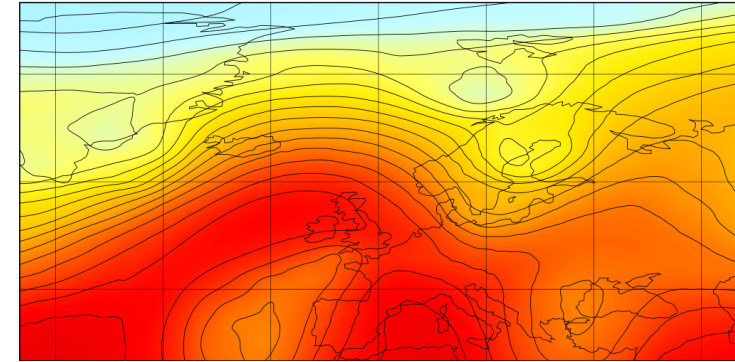
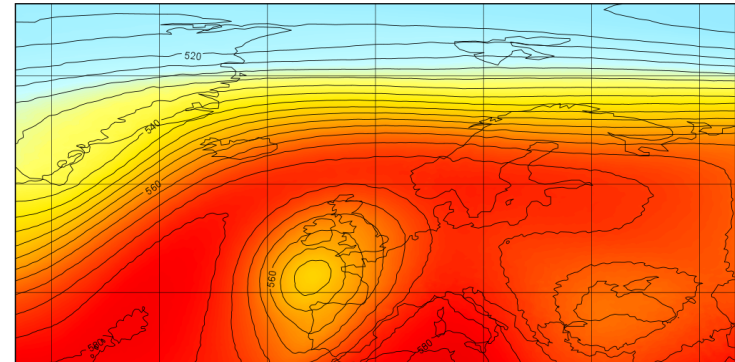
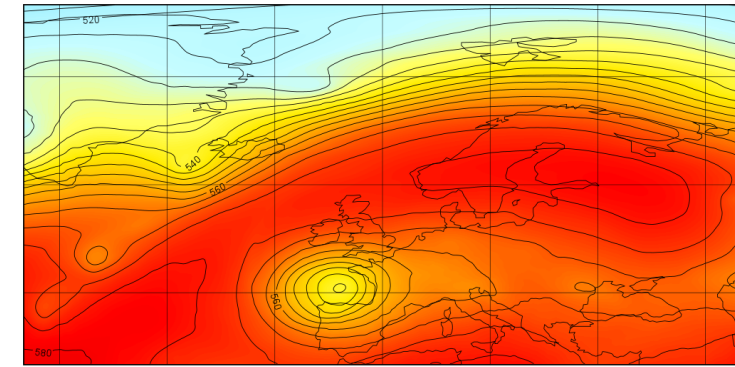
AIFS



IFS



Sep 6th



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