ML emulation of a local-scale UK climate model

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High-resolution rainfall simulations are expensive

There's a trade-off between simulation resolution and spatial and temporal domains, ensemble size.
For example, in Met Office's UKCP18 dataset:

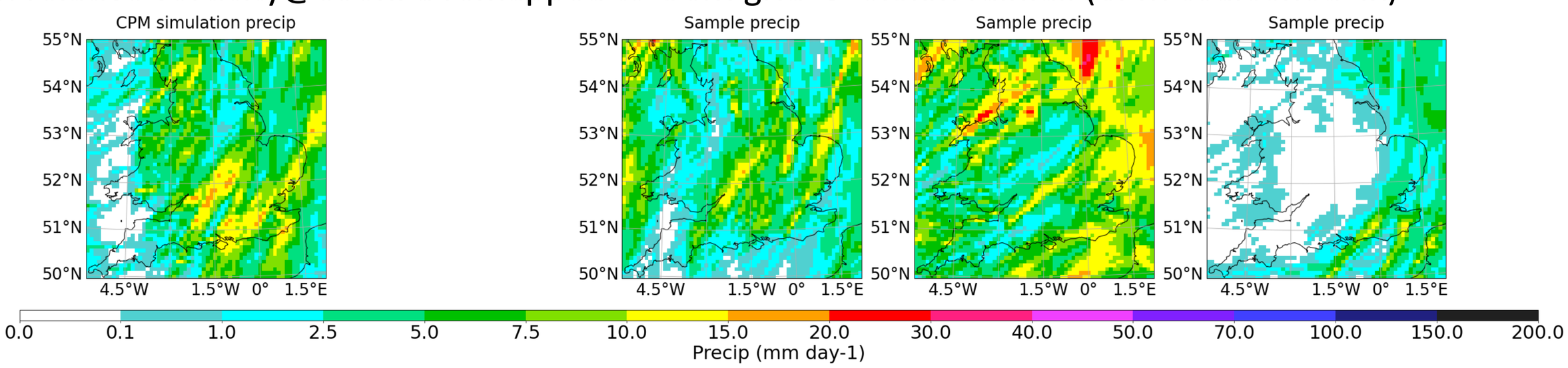
- **GCM**: global coverage, large ensembles, low resolution (60km)
- **CPM**: high resolution (2.2km) but UK & Ireland only, 60 years, 12 ensemble members

Complement CPM projections with diffusion models

Conditional diffusion models in this work) can **stochastically downscaling** low-resolution outputs of a GCM to generate **more, cheaper samples** of high-resolution daily rainfall.

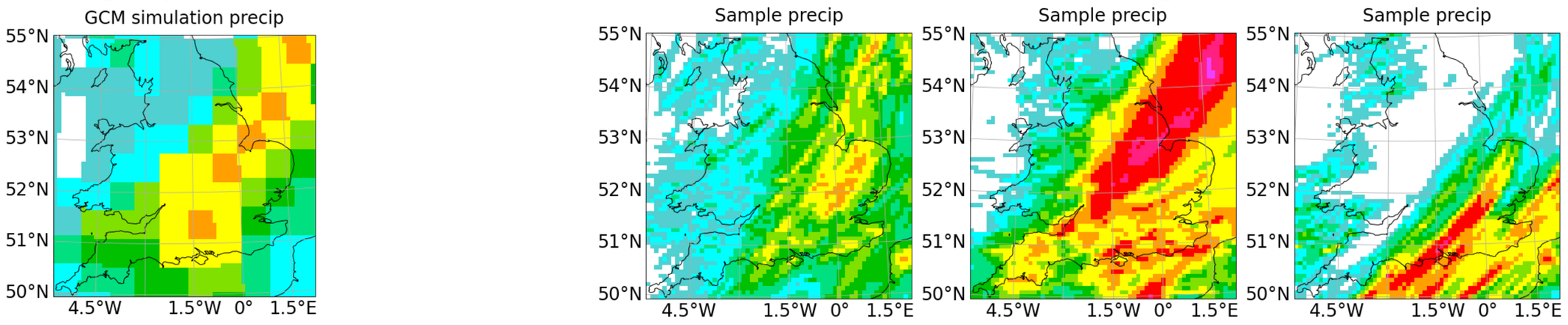
Training

CPM relative vorticity@850hPa remapped to GCM grid → 8.8km rainfall (CPM coarsened 4x)

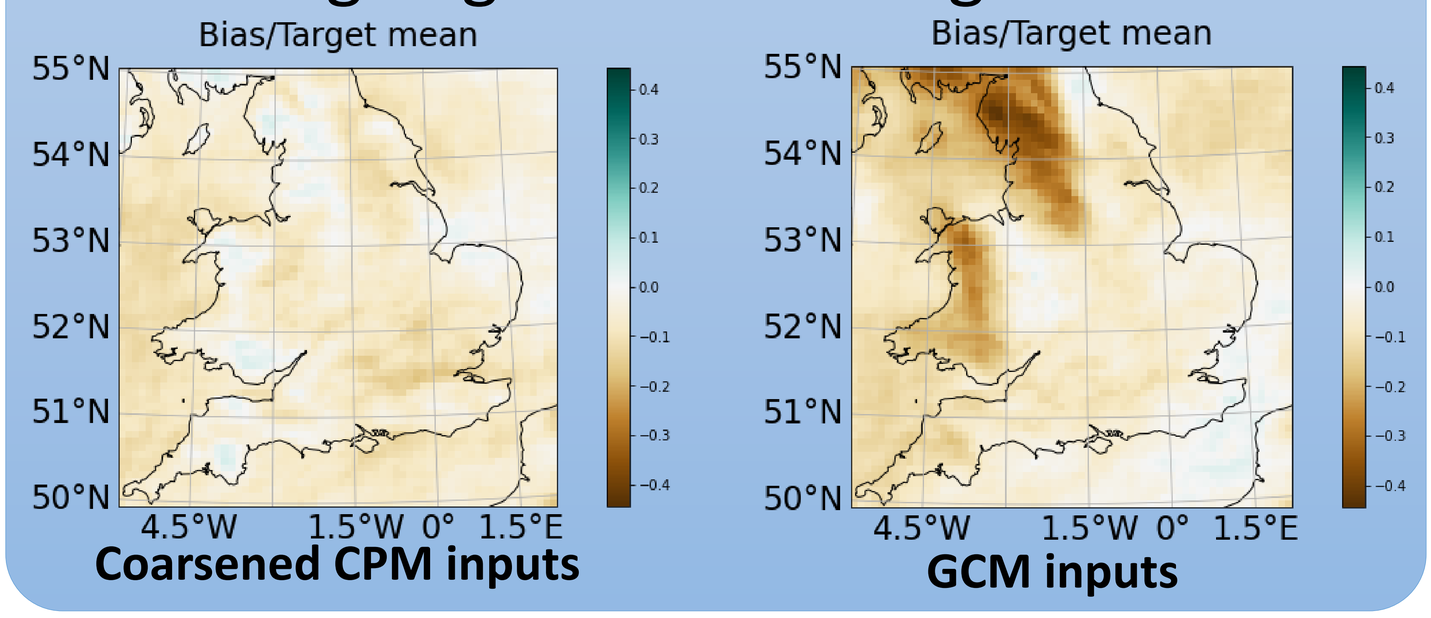


Sampling

Conditioning inputs can also be based on lo-res GCM data when sampling



Ongoing work: Differing biases



ML model

Diffusion model based on NCSN++ and the framework for score-based generative models using SDEs by Song et al (2021).

Next steps

- More conditioning inputs
- Temporal sequences (i.e. video diffusions)
- Extreme rainfall
- Generalise to other models & locations

References

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Further information

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