Deep Learning guided statistical downscaling of climate projections for use in hydrological impact modelling in Danish peatlands

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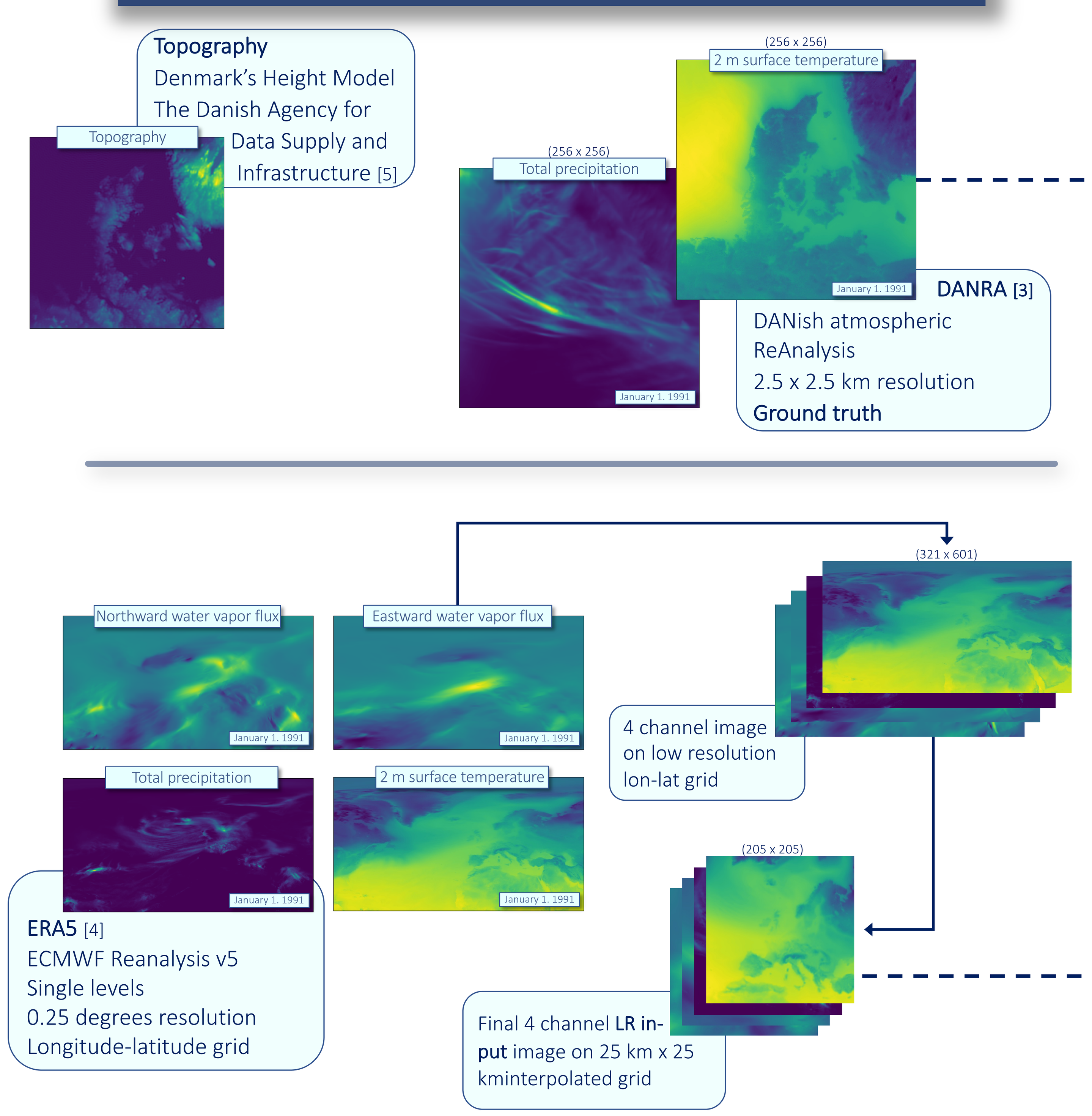
OVERVIEW

Distributed hydrological models like the DK-model [1] need **high-resolution** (HR) **climate variable fields** as input for **hydrological dynamics modelling**. To provide these fields, this study aims to develop **statistical deep learning** methods for downscaling of lower resolution climate projections to bypass computationally expensive and energy intense **full scale HR model simulations**.

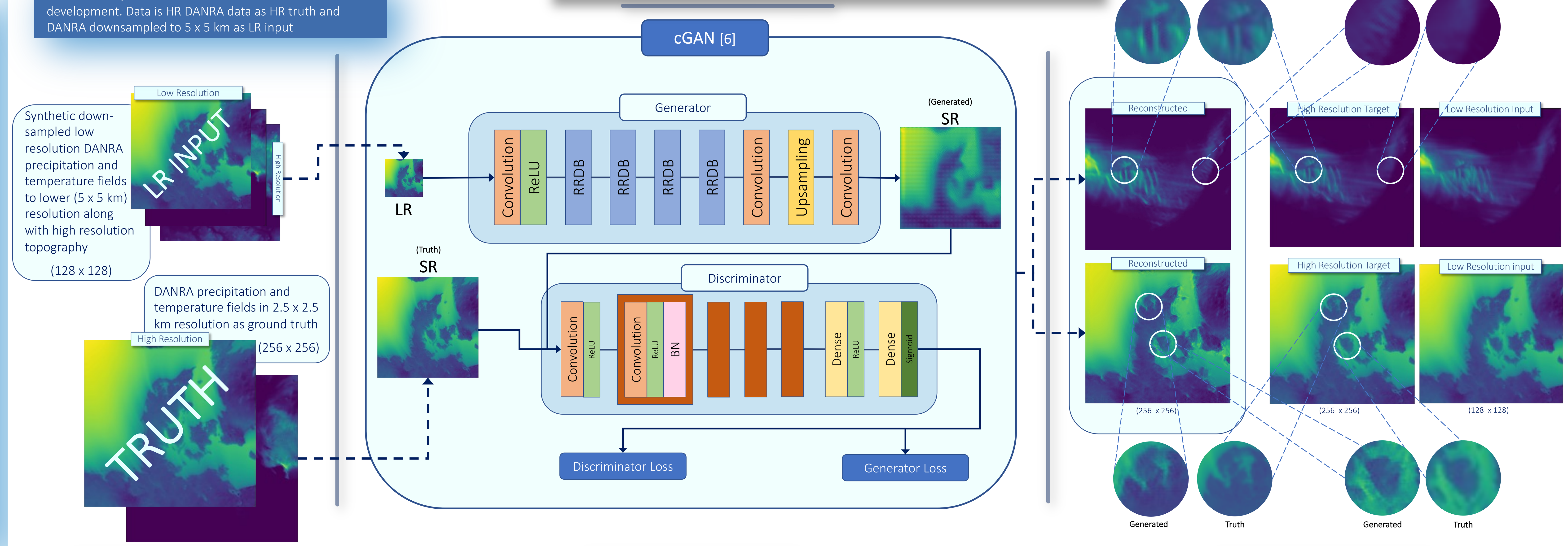
So far, a **conditional Generative Adversarial Network** (cGAN) model [2] has been investigated for downscaling **artificially downsampled** low-resolution (LR) **DANish atmospheric ReAnalysis** (DANRA) [3] data with some success. The ground truth has been the ultra high-resolution, **super-resolution** (SR), DANRA dataset of resolution 2.5 x 2.5 km.

The next steps include developing a model that takes DANRA as ground truth and multiple **ECMWF Reanalysis v5** (ERA5) [4] fields as low resolution input. Further, a number of **new deep learning (DL) methods**, not yet fully employed in the geosciences, will be explored such as Multi-Scale Gradients GANs and Bayesian deep learning.

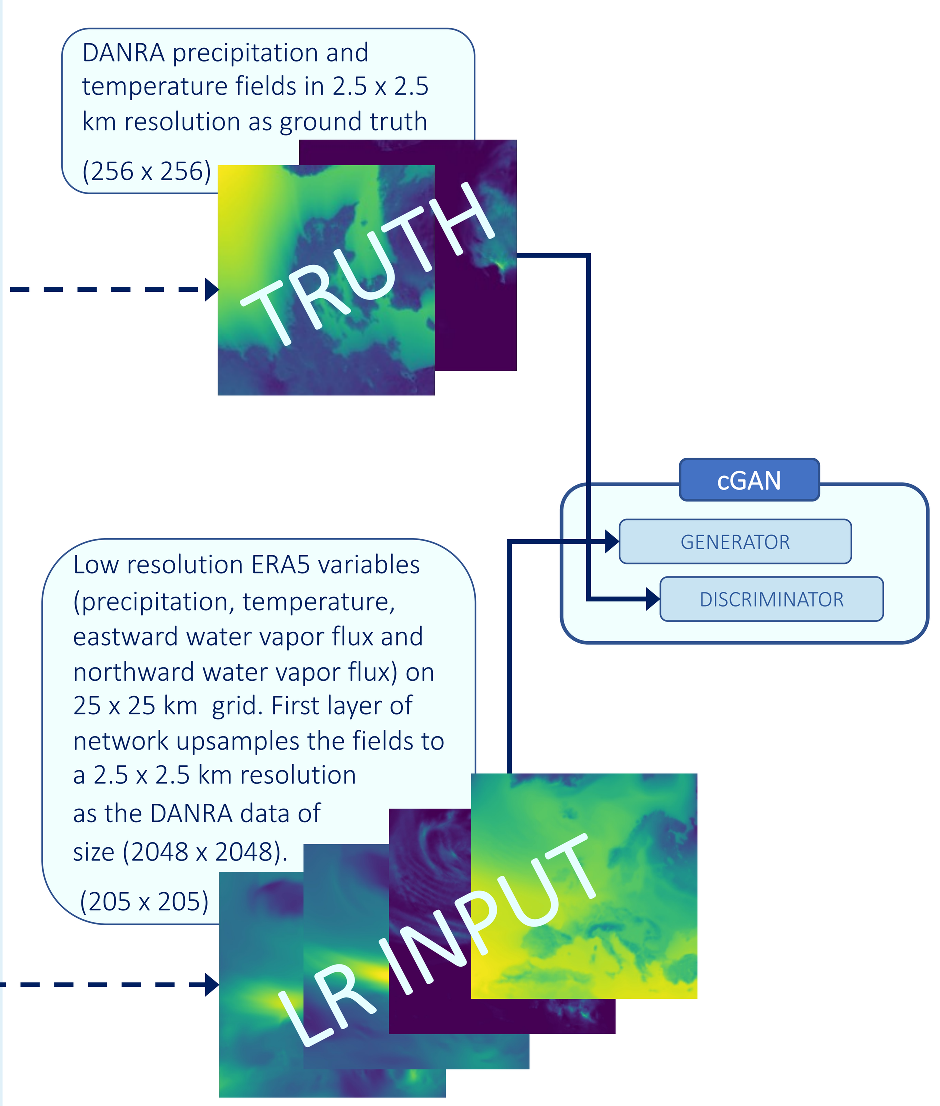
DATA



SO FAR...

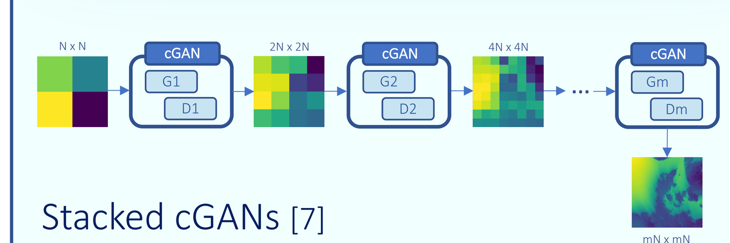


WHAT'S NEXT?



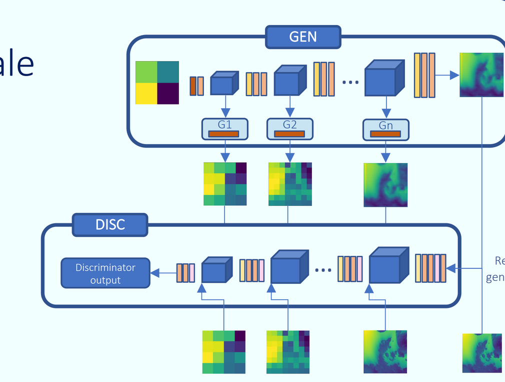
DATA

For Super-Resolution Downscaling of Climate Variable Fields



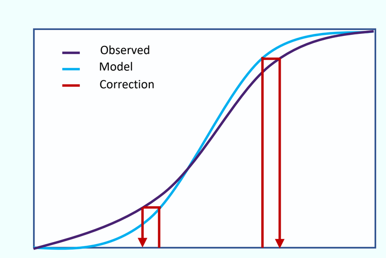
Stacked cGANs [7]

Multi-Scale Gradient GANs [8]

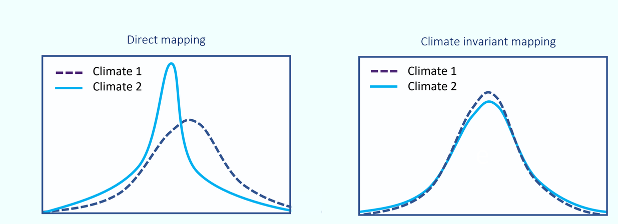


For Quality Assurance of Climate Projections

Bias Correction

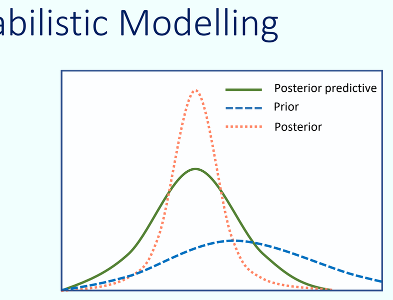


Climate Invariant Machine Learning

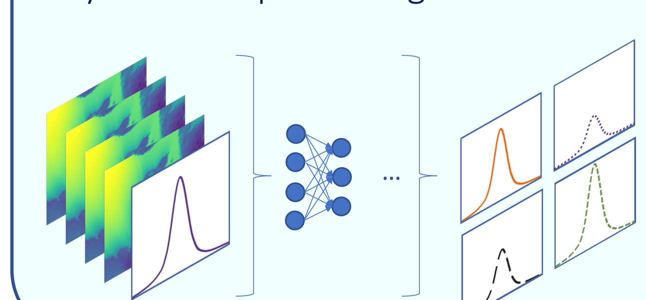


For Realistic Climate Variable Field Generation for Hydrological Modelling

Probabilistic Modelling



Bayesian Deep Learning



METHODS

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References

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