



NoName GENHACK WEEK 4

OULAD ALI AYOUB

YUXIN LI

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objective
: correct
the bias



Approach

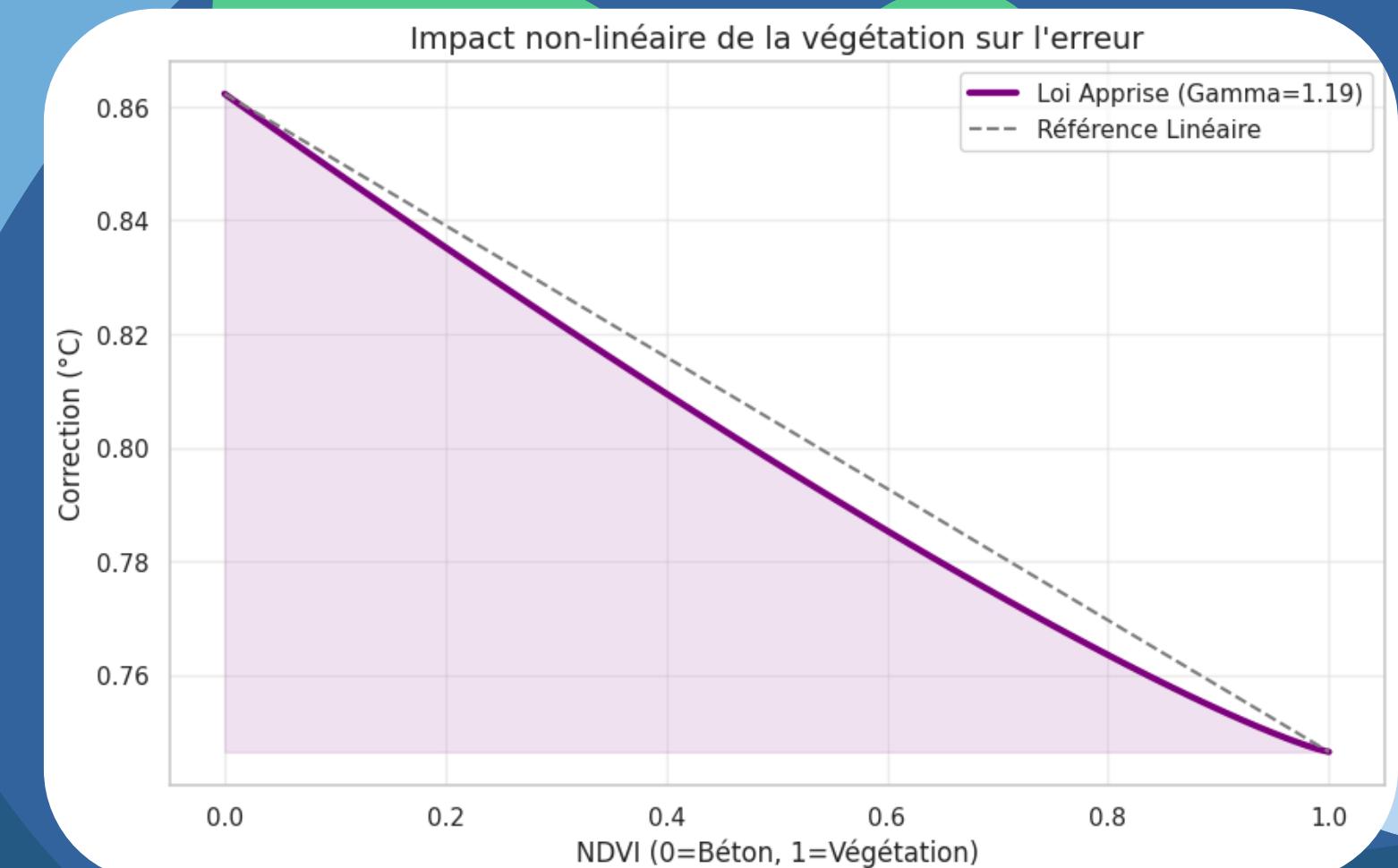
Framing the task as a Residual Learning problem

- Interpretable Linear Methods (OLS)
- Physics-Informed Neural Network (PINN)
- Non-linear Ensemble Learning (Random Forest - RF)
- SOTA Deep Learning: Graph Neural Network (GNN)



The Nonlinear Role of NDVI

$$\Delta T = \beta_0 + \beta_1 \text{NDVI} + \beta_2 \text{Altitude} + \beta_3 \text{SummerFlag} + \beta_4 \text{NDVI}^2 + \varepsilon.$$



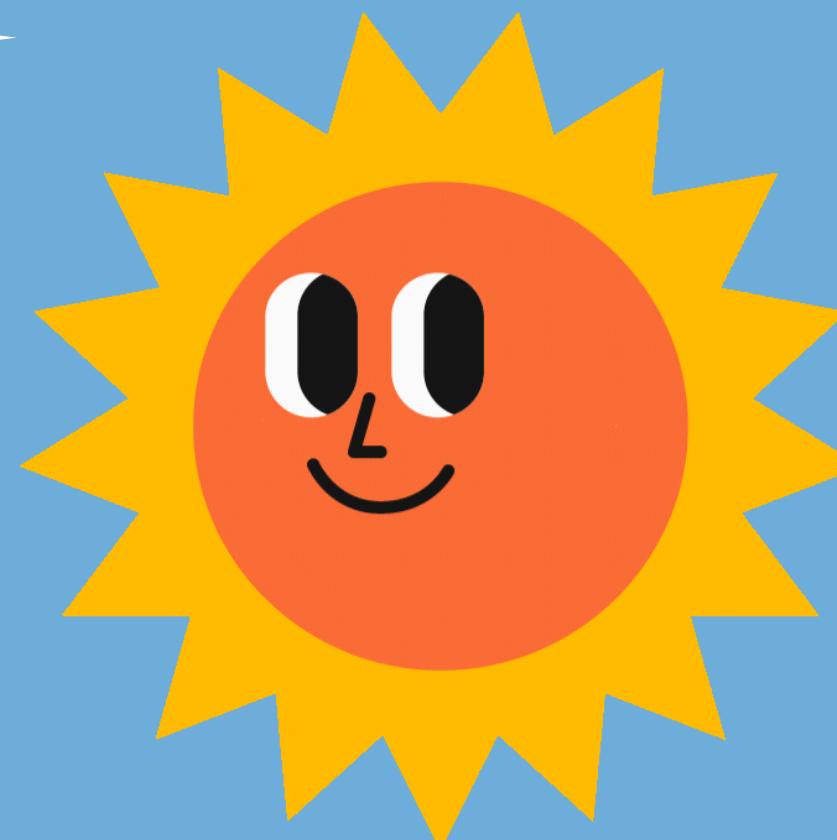
Predictive Correction Models



LINEAR REGRESSION WITH A CUSTOM
LOSS FUNCTION

$$\hat{\epsilon} = \beta_0 + \beta_1 \cdot \text{Altitude} + \beta_2 \cdot \text{NDVI}.$$

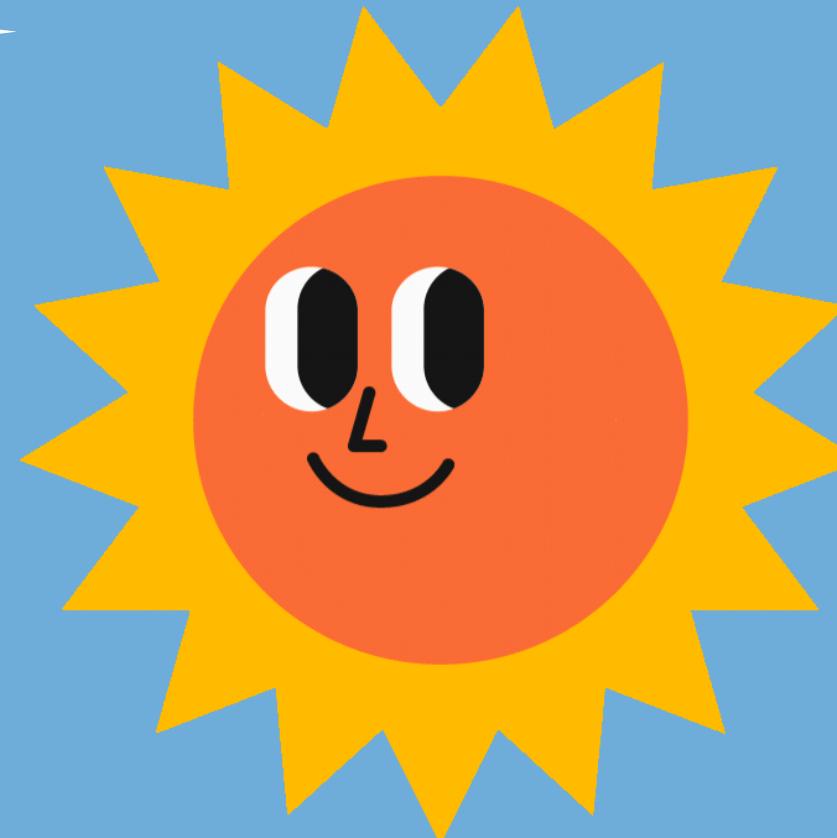
Predictive Correction Models



PHYSICS-INFORMED NEURAL NETWORK

$$\mathcal{L} = \text{MSE} + \lambda \frac{1}{N} \sum_{i=1}^N \left(|\hat{\epsilon}_i - \epsilon_i| \cdot \frac{e^{-\sqrt{H_i}}}{\text{NDVI}_i + \delta} \cdot I_{\text{summer},i} \right)$$

Predictive Correction Models

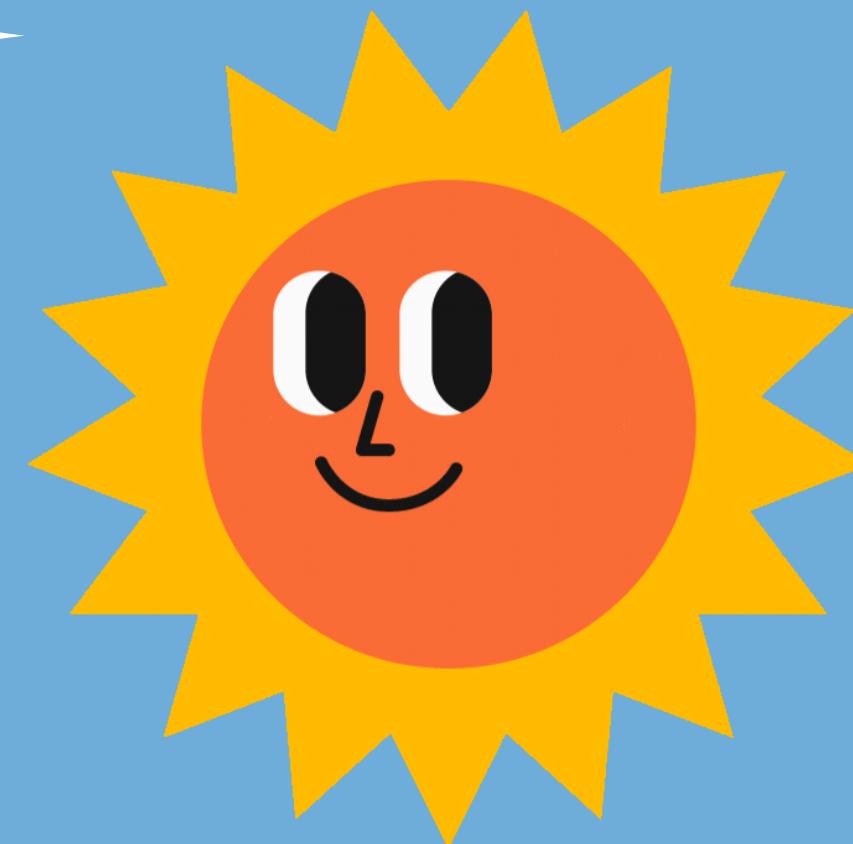


RANDOM FOREST REGRESSOR WITH
FEATURE ENGINEERING

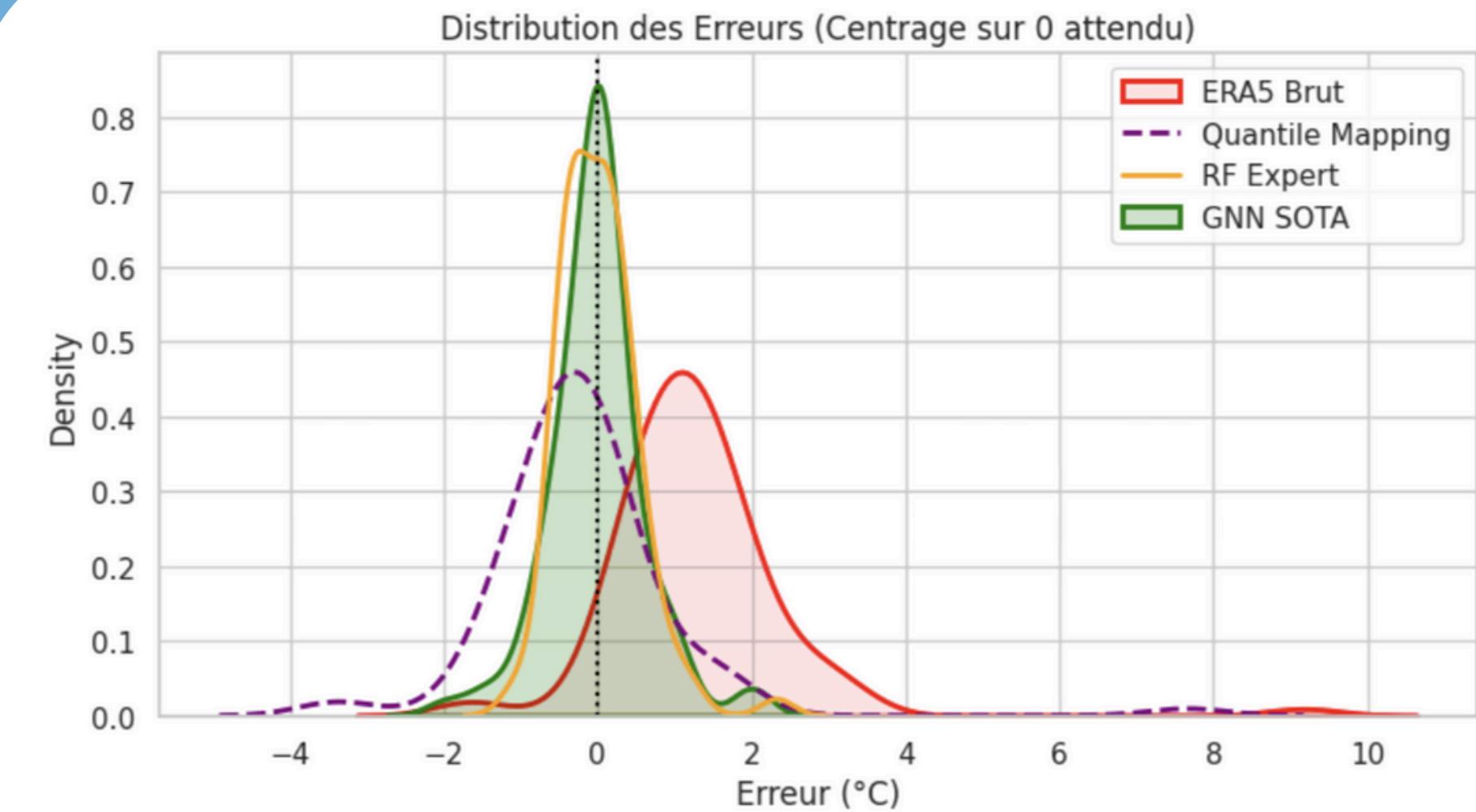
$$T_{\text{final}} = T_{\text{ERA5}} + \text{RF}(\text{Features}).$$

$$\text{Feat}_{\text{phys}} = \frac{\exp(-\sqrt{H})}{\text{NDVI}} \times \text{Season_Flag}.$$

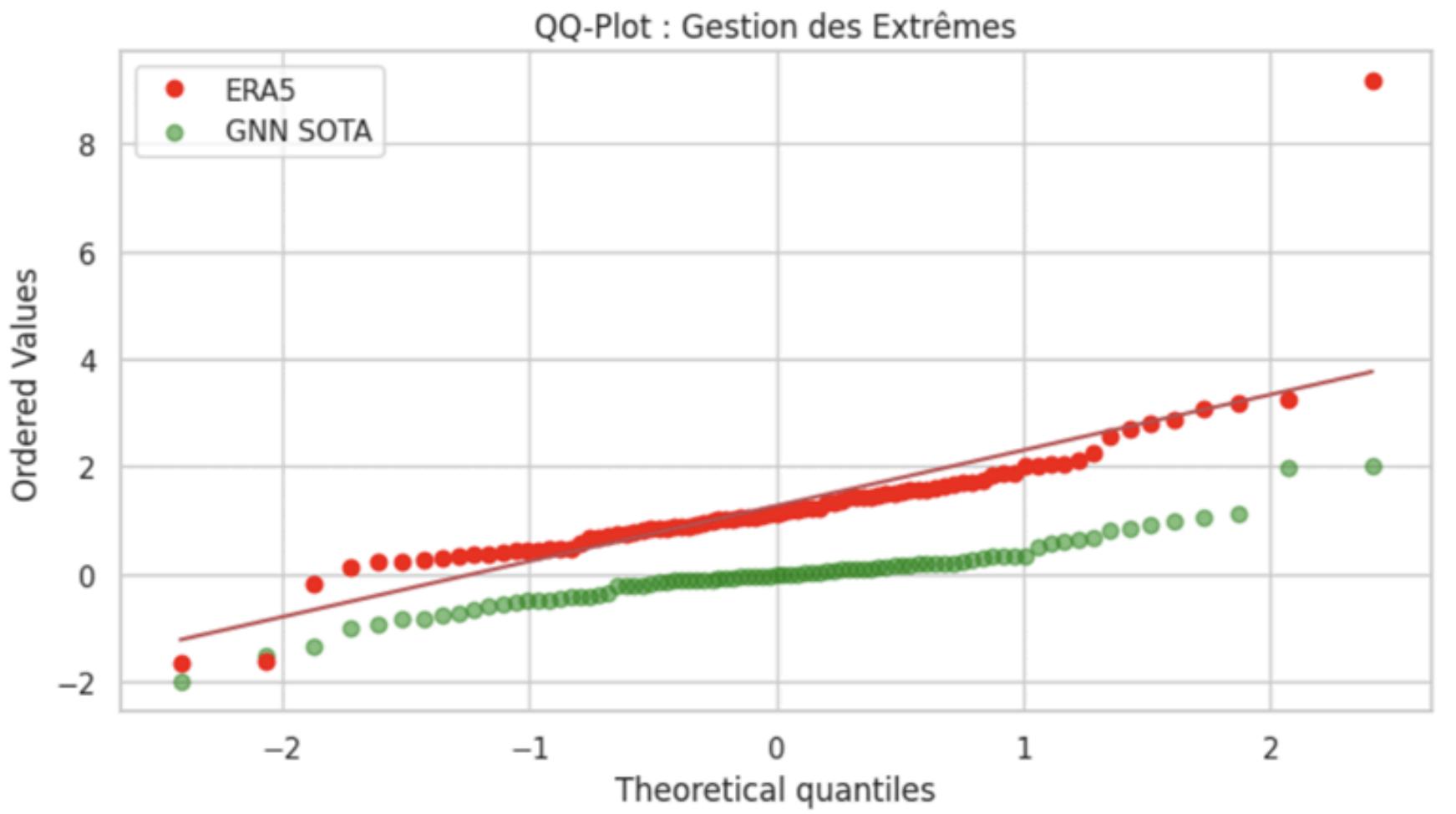
Predictive Correction Models



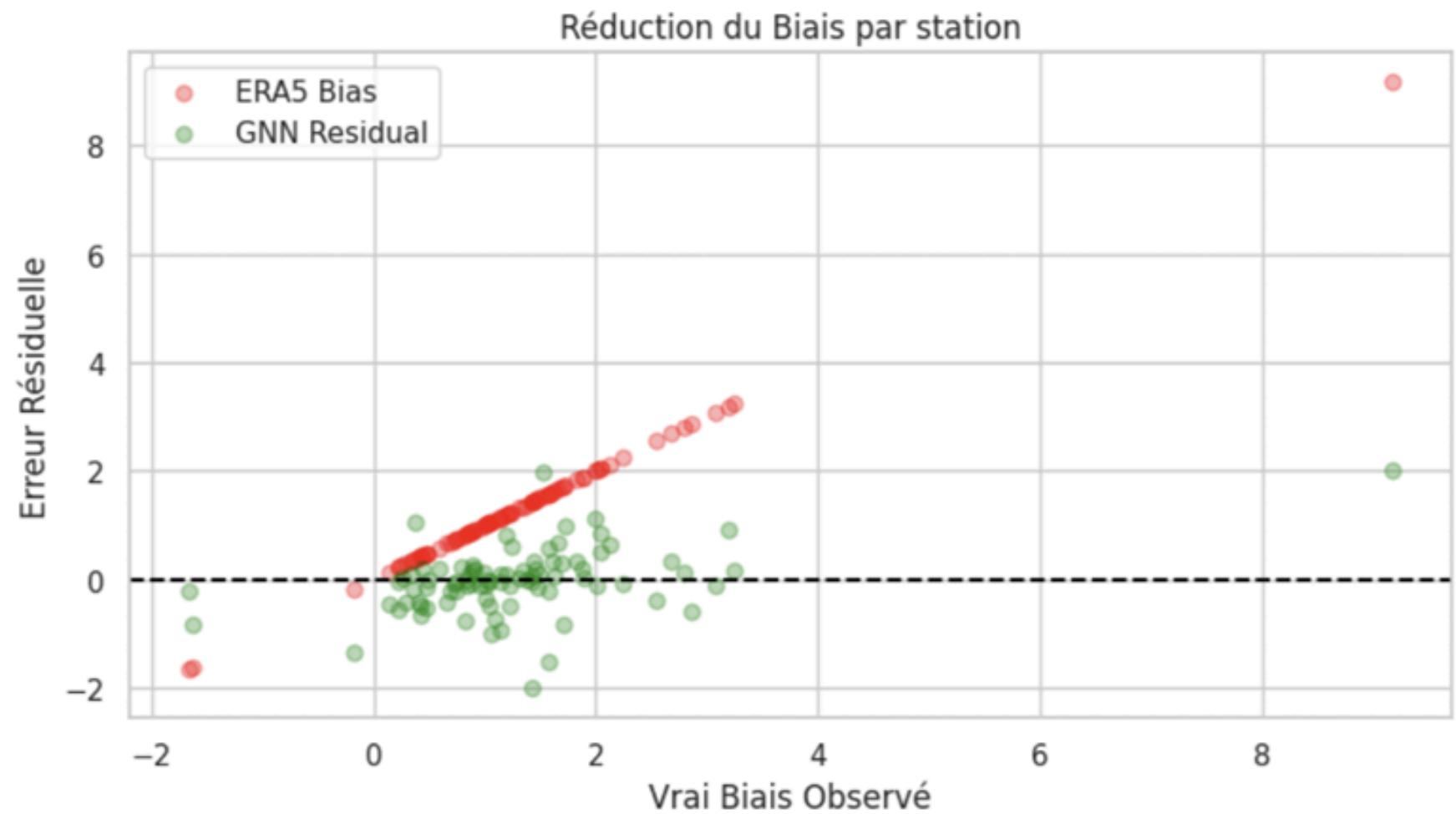
GRAPH NEURAL NETWORK : GNN



(b) Error distributions centered on zero



(c) QQ-Plot: extreme-value behavior



(d) Station-level bias reduction

Thank you

