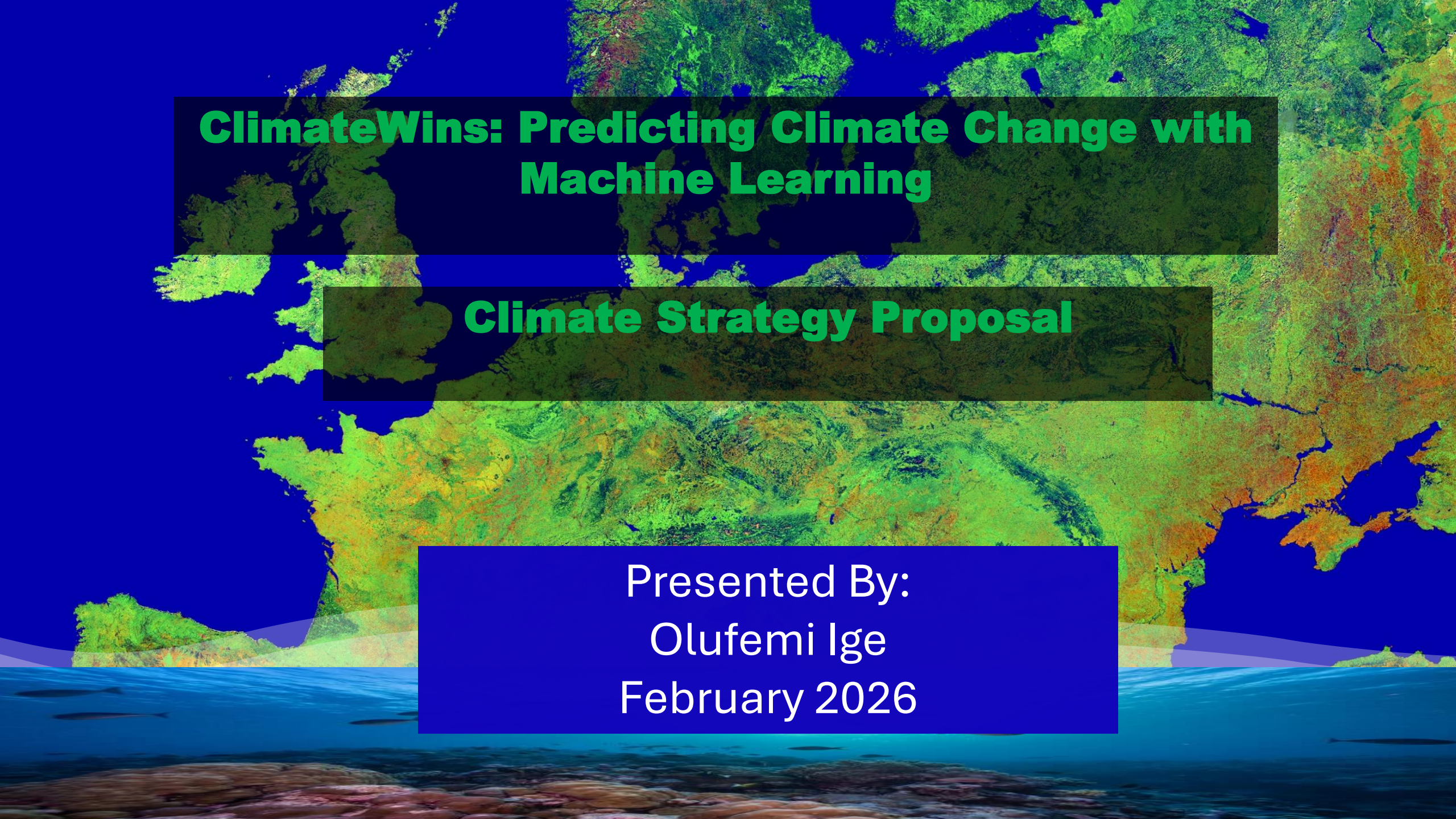


ClimateWins: Predicting Climate Change with Machine Learning

Climate Strategy Proposal

Presented By:
Olufemi Ige
February 2026

Executive Summary

- Europe’s climate regimes remain structurally stable but increasingly variable.

- ML can detect anomalies and forecast exposure risk but cannot score habitability alone.

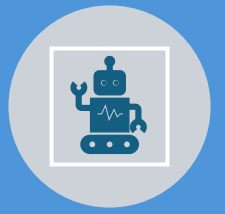
- Additional data (infrastructure, population, resilience) is required for full risk assessment.

- ML provides early-warning signals but requires socioeconomic data for actionable planning.

CLIMATEWINS OBJECTIVES

TRENDS	FIND NEW PATTERNS IN WEATHER CHANGES OVER THE LAST 60 YEARS
ANOMALIES	IDENTIFY WEATHER PATTERNS OUTSIDE THE REGIONAL NORM IN EUROPE
GROWTH	DETERMINE WHETHER UNUSUAL WEATHER PATTERNS ARE INCREASING
FORECAST	GENERATE POSSIBILITIES FOR FUTURE WEATHER CONDITIONS OVER THE NEXT 25–50 YEARS
SAFETY	DETERMINE THE SAFEST PLACES FOR PEOPLE TO LIVE IN EUROPE WITHIN THE NEXT 25–50 YEARS

ML APPROACH



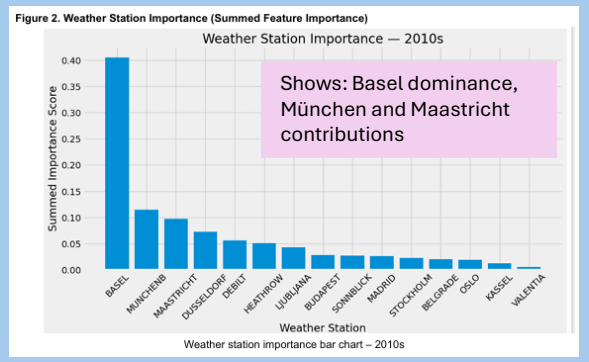
COMBINE UNSUPERVISED LEARNING, DEEP LEARNING, AND OPTIMIZATION TECHNIQUES

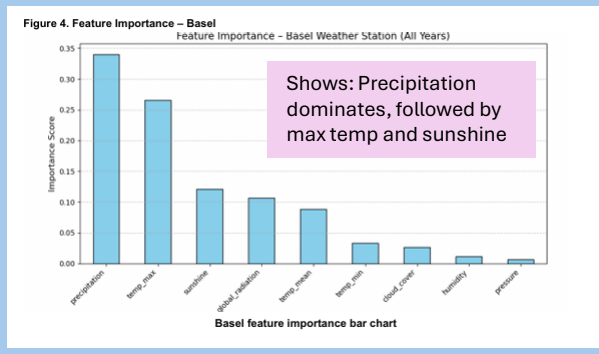
LEVERAGE 60+ YEARS OF EUROPEAN WEATHER DATA (18 STATIONS, 1960-2022)

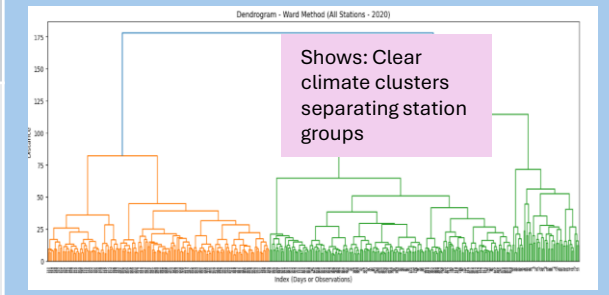
APPLY ADVANCED ML ALGORITHMS TO DETECT PATTERNS, PREDICT TRENDS, AND ASSESS REGIONAL RISK

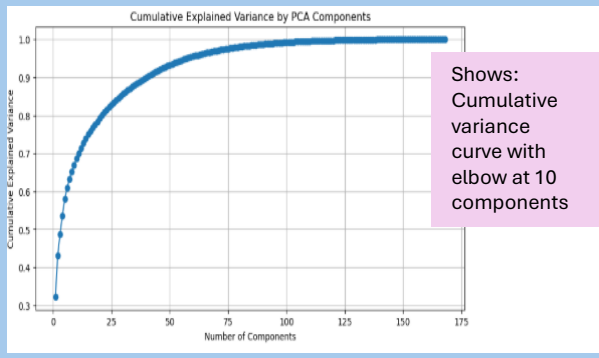
MACHINE LEARNING METHODS SUMMARY

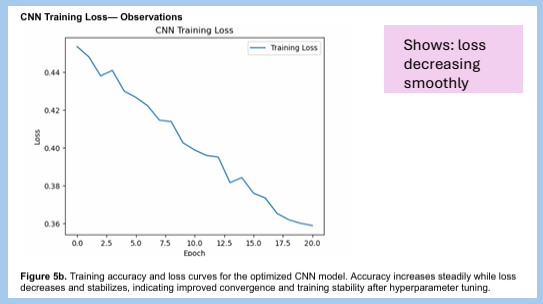
ML MODEL	PURPOSE
Unsupervised Learning: • PCA (Principal Component Analysis) • K-Means & Hierarchical Clustering	• Dimensionality reduction to simplify data • Identify natural groupings in weather patterns
Deep Learning Models: • CNN (Convolutional Neural Networks) • RNN/LSTM (Recurrent Neural Networks)	• Learn complex multivariate patterns & interactions • Capture temporal weather sequences
Optimization: • Bayesian Optimization • Random Forests	• Find optimal hyperparameters efficiently • Ensemble learning for robust predictions
Generative Models: • GANs (Generative Adversarial Networks)	• Generate & test synthetic extreme weather scenarios

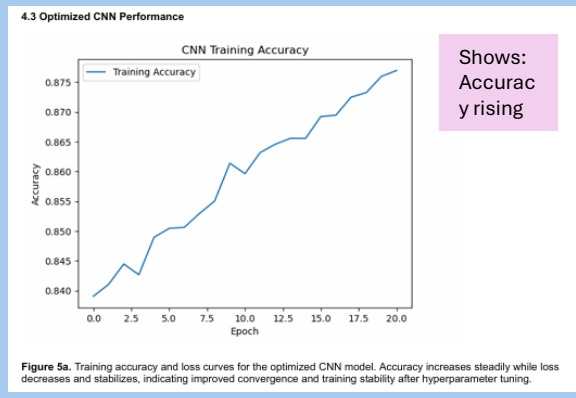


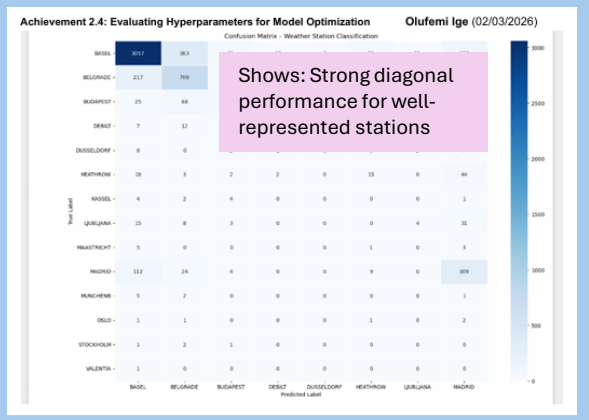












Thought Experiment #1:

Detecting Historical Climate Anomalies

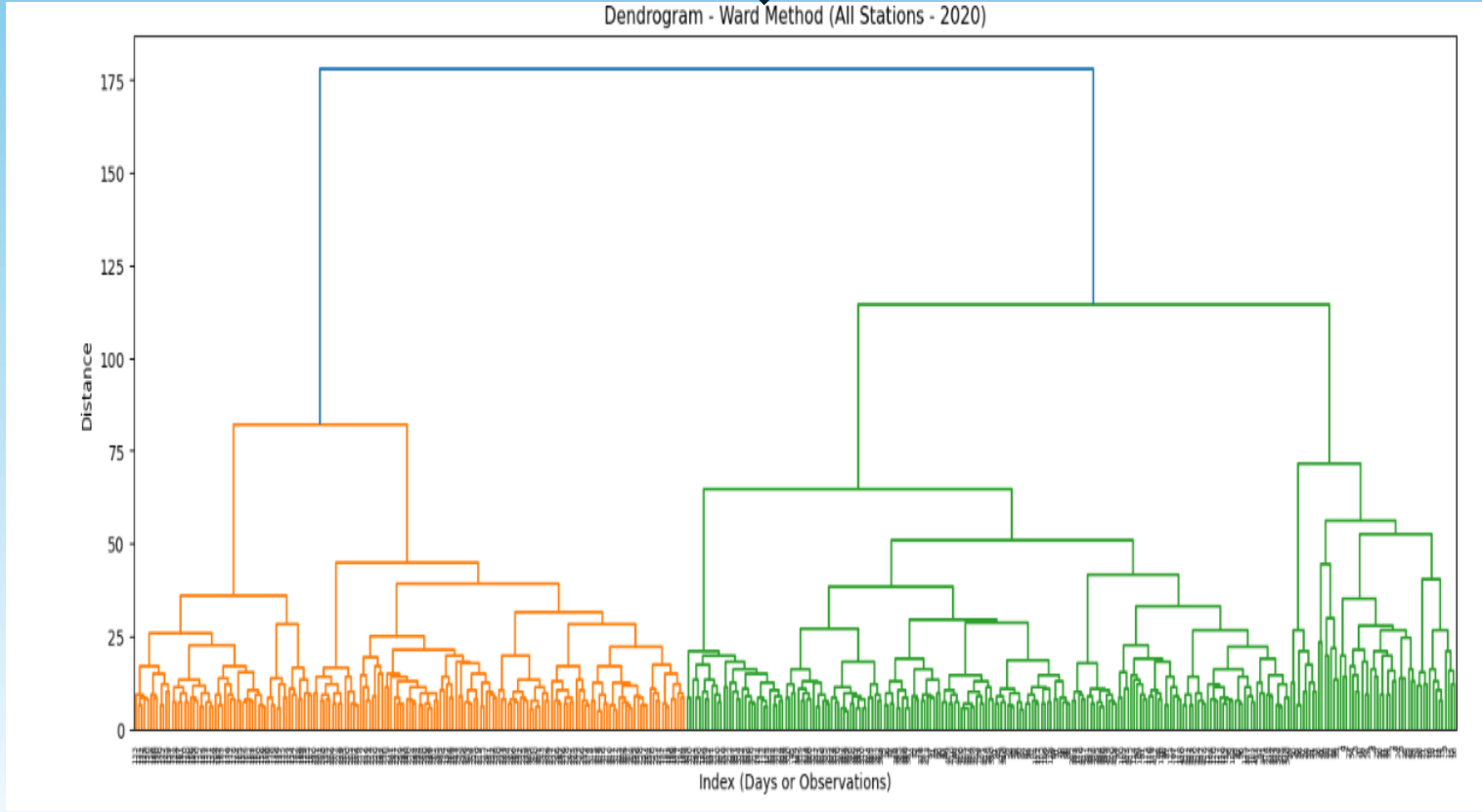
Analysis Question:

Is it possible to detect weather patterns that deviate from the historical climatic norms of a region?

Answer:

- Yes — deviations from historical climate norms can be detected.
- Hierarchical clustering reveals stable climate groups.
- High-distance merges indicate anomalies.
- Deviations from long-term norms are detectable.
- Supports early warning for unusual weather behavior

This Ward dendrogram shows tight climate clusters and highlights potential anomalies as observations that merge only at much higher distances.



Thought Experiment #2:

Are Europe's Climate Regimes Structurally Shifting?

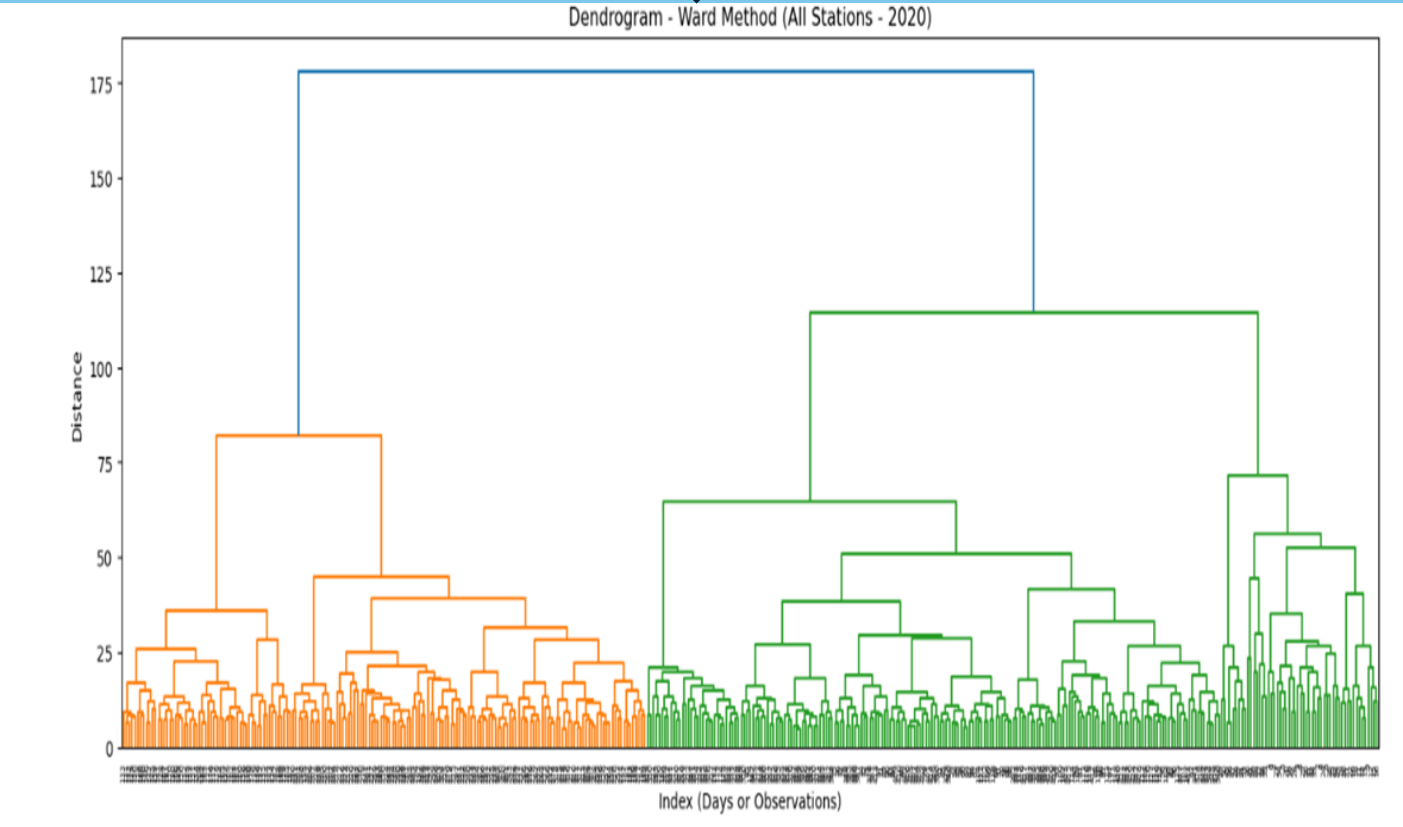
Analysis Question:

Have Europe's climate regimes structurally shifted over the past 60 years?

Answer:

- Yes, stable regional climate regimes remain statistically identifiable. Localized deviations exist, but there is no evidence of continent-wide structural breakdown.
- Climate variability is increasing unevenly, not systemically.

This diagram shows and identifies climate exposure thresholds that differentiate stable from volatile regions, forming a foundational layer for long-term habitability assessment.



Thought Experiment #3:

Future Habitability: What ML Can and Cannot Predict Within 25–50 Years

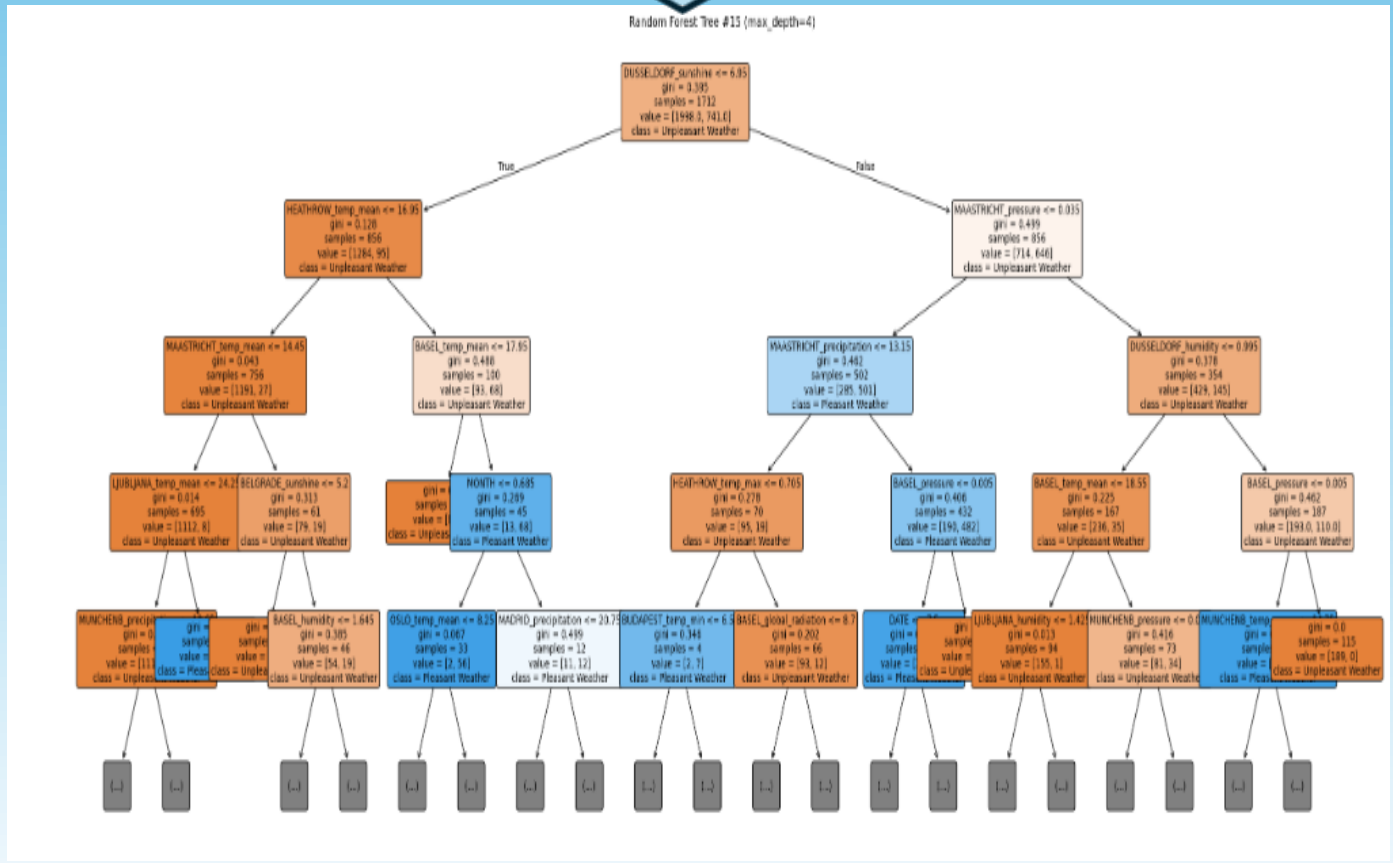
Analytical Question:
Can ML help identify safer places to live in the future?

Answer: Yes — partially and indirectly.

ML Can: detect regimes, track instability, model exposure

ML Cannot: determine habitability without infrastructure, population, and resilience data

This diagram shows whether unusual weather patterns are emerging by highlighting stable clusters versus areas of localized variability.



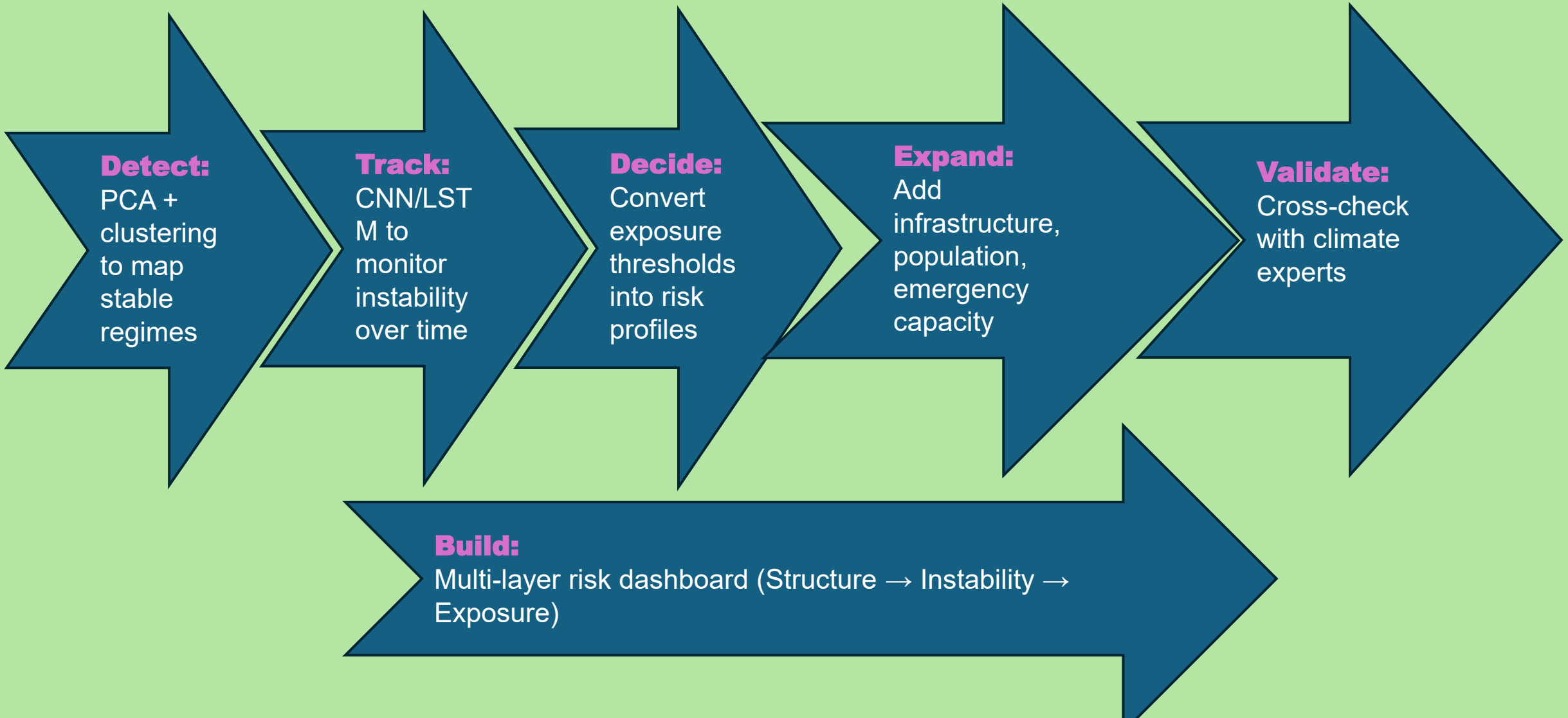
Data Gaps That Limit Habitability Scoring:

- **Critical Gaps:**
  - Infrastructure resilience.
  - Population vulnerability.
  - Emergency response capacity.
  - Land use and urban density.
  - Exposure pathways.

- **Key Insights:**
  - Weather alone cannot define long-term habitability — risk and resilience matter equally

Key Insights & Recommendations

Integrating ML structure, instability tracking, and exposure modeling creates a scalable climate-risk framework.



Conclusion

- ML reveals meaningful climate structure and emerging variability.
- Europe’s climate is shifting unevenly, not collapsing.
- A multi-layer risk framework can guide long-term planning.

Future work will integrate socioeconomic resilience data to produce a full habitability index.

Thank You For Your Attention

Please email me your questions and comments

Email address: feminoble8@gmail.com

Github