EcoCast: A Spatio-Temporal Model for Continual Biodiversity and Climate Risk Forecasting

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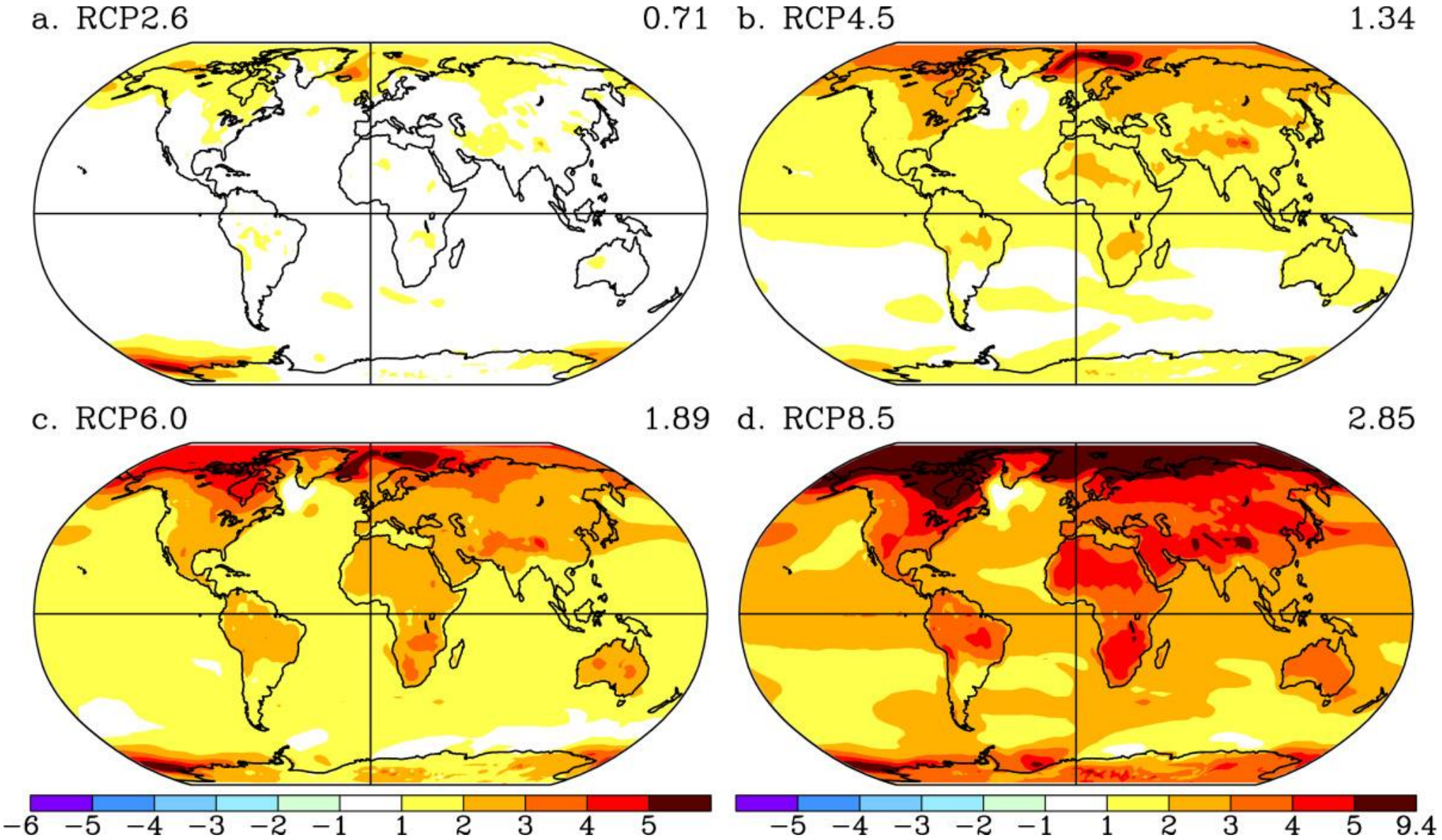
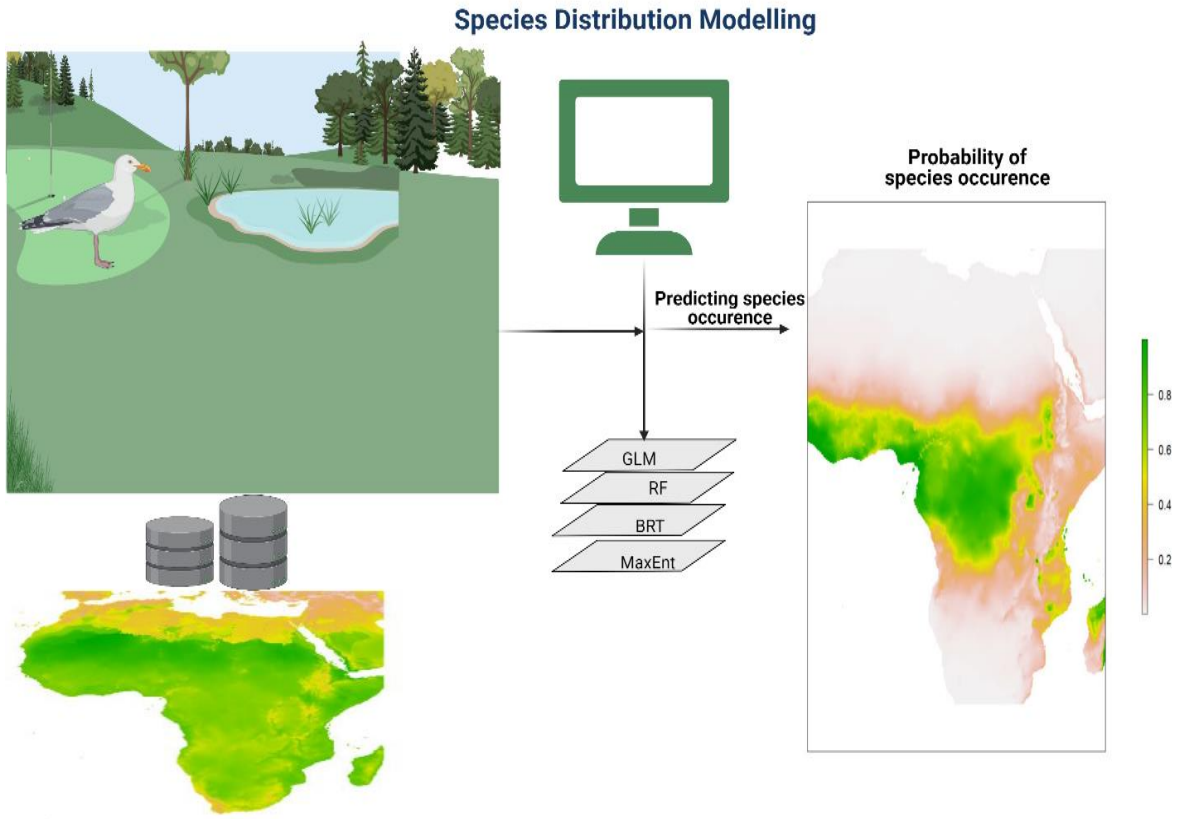
Climate Change and its impact on Species



Species Distribution Models



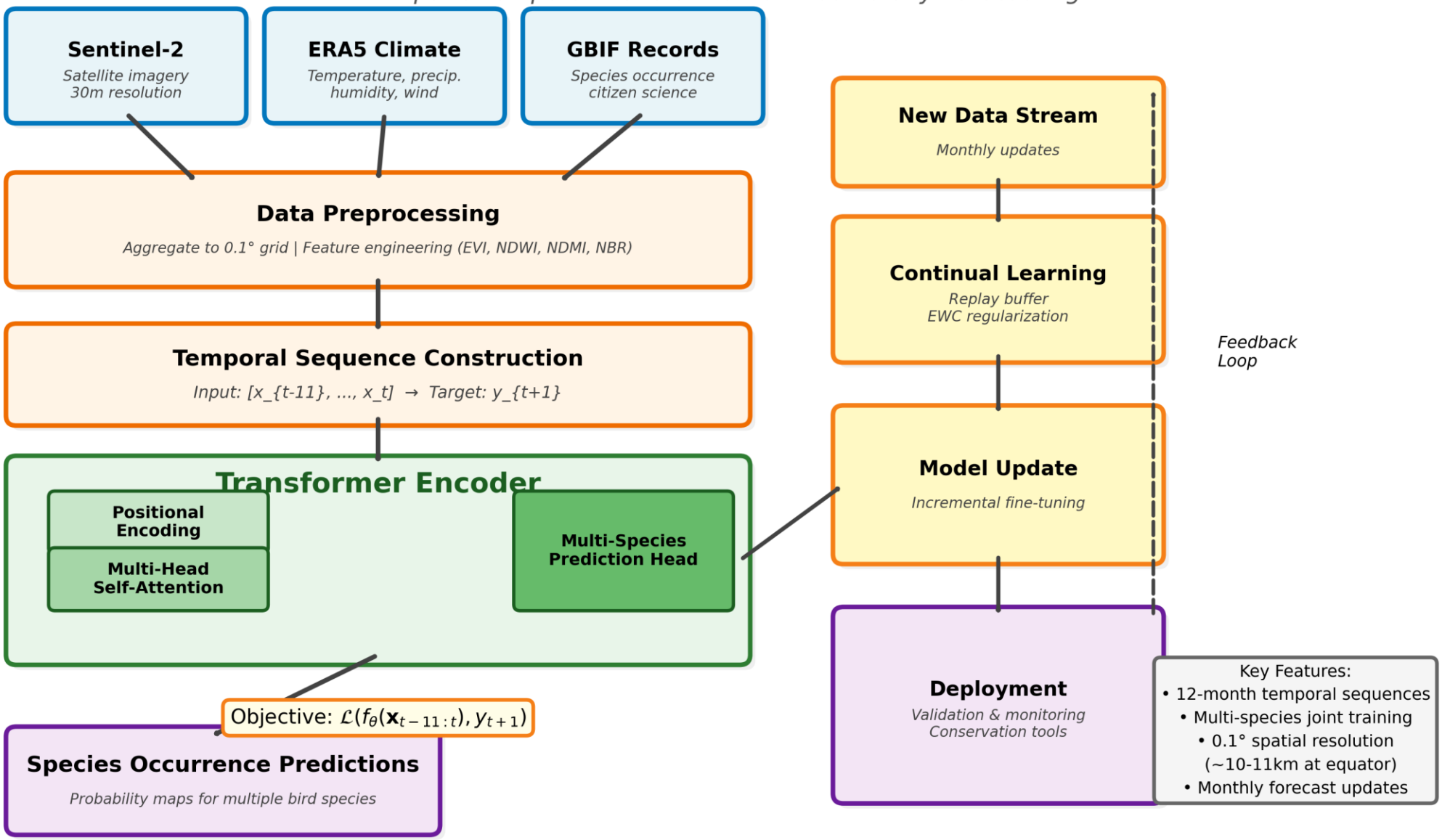
(*modified from* www.biorender.com)

Key Contributions- *EcoCast*

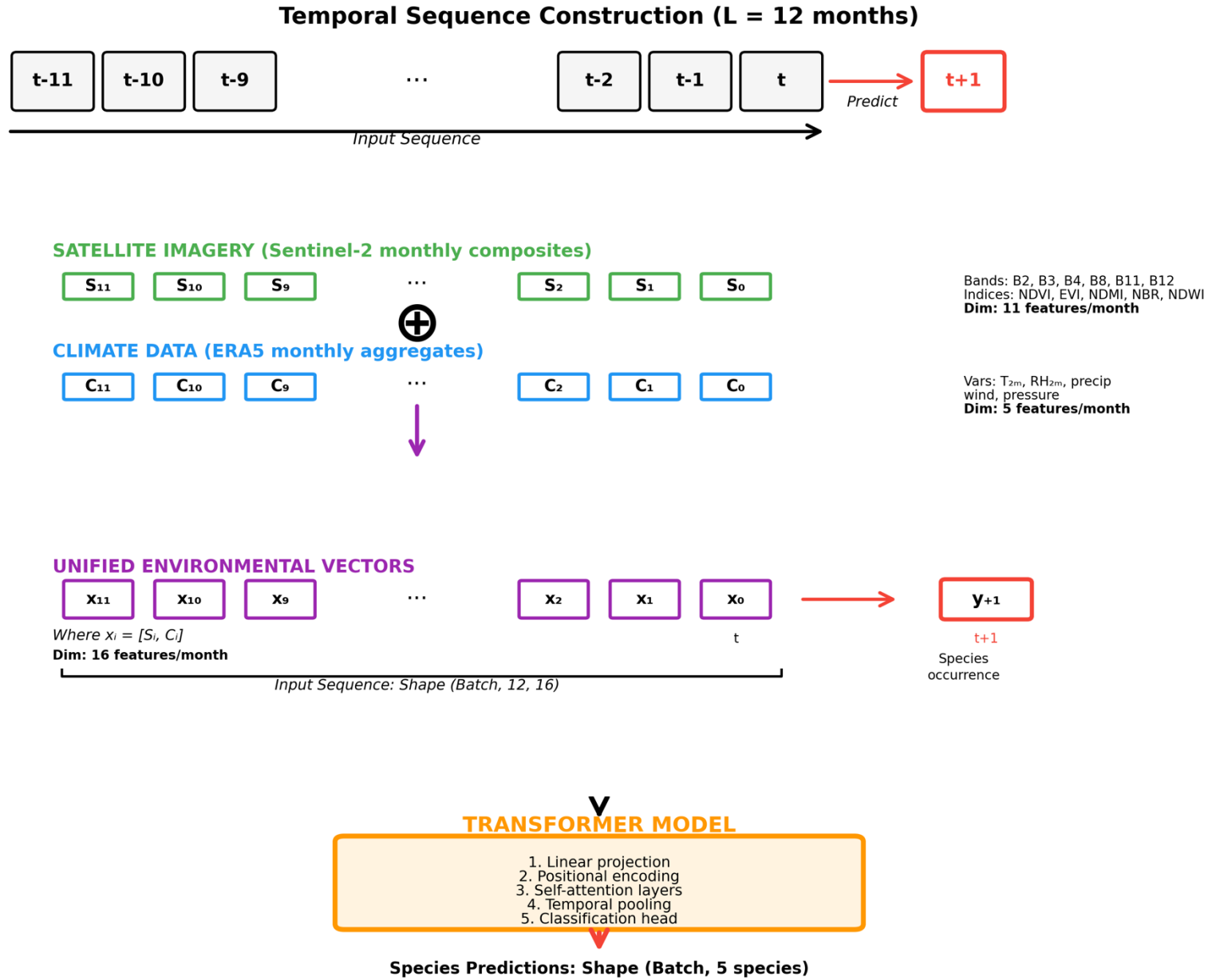
- **Operational Forecasting**: Predicts next month based on observed environmental sequences
- **Multi-Modal Integration**: Satellite imagery (Sentinel-2) +Climate data (ERA5) + Citizen science (GBIF)
- **Transformer Architecture**: Captures long-range temporal dependencies and seasonal patterns
- **Continual Learning**: Designed to adapt to new data without catastrophic forgetting

EcoCast Architecture

Spatio-Temporal Transformer for Biodiversity Forecasting



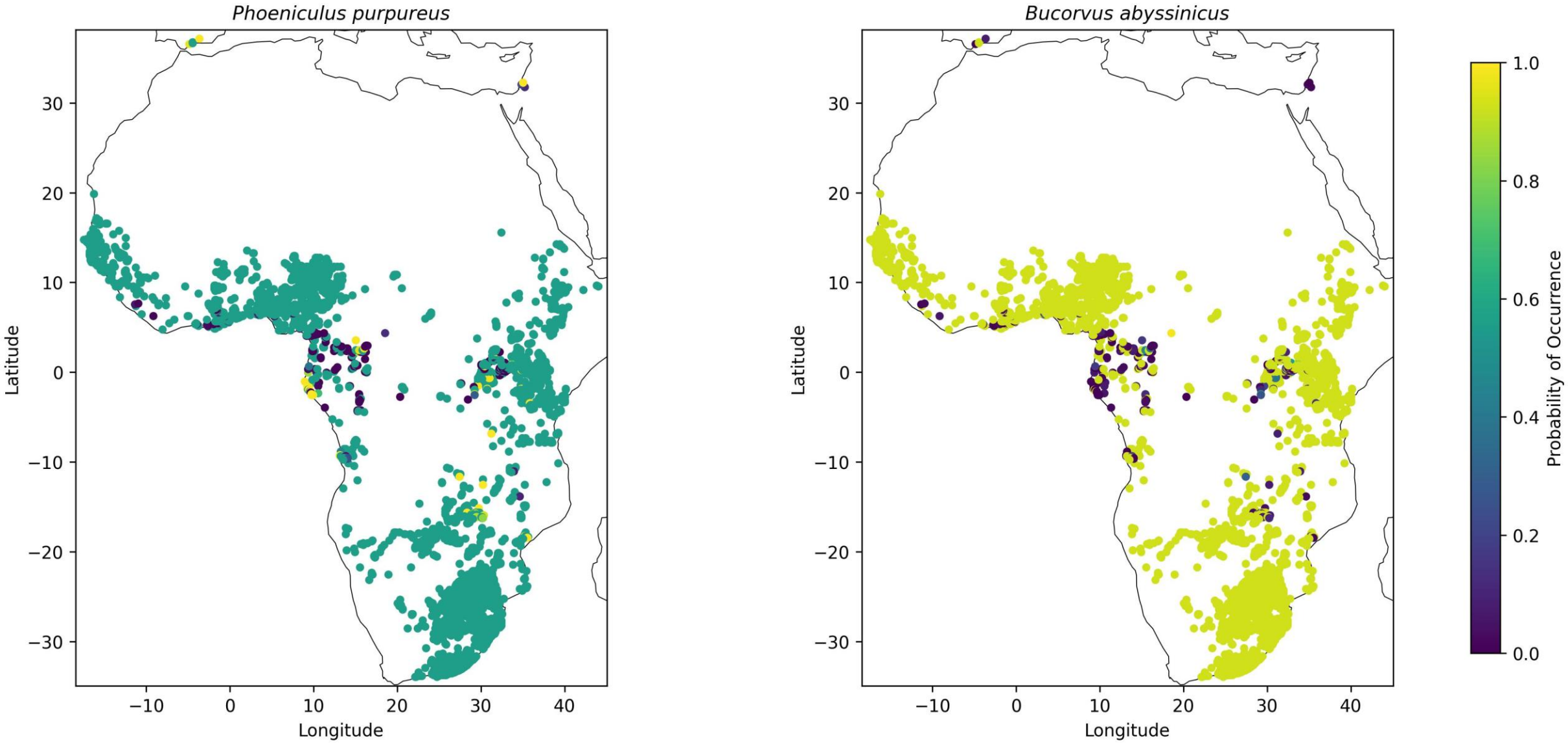
EcoCast Temporal Alignment: Unified Processing of Satellite and Climate Data



Results

Model	F1 (macro)	PR-AUC (macro)
Baseline (Random Forest)	0.31	0.29
EcoCast forecast	**0.65**	**0.72**
Improvement	**+34 pp**	**+43 pp**

Results



Operational Forecast for January 2024

Conclusions & Future Work

- We introduce the first transformer model for operational African biodiversity forecasting
- No future climate projections required
- Continual learning design for non-stationary environments

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- Real-time forecasts of biodiversity hotspots at risk
- Scenario analysis for land-use planning

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Future Directions:

- Expand coverage: More species, regions, and taxa beyond birds
- Enhanced continual learning: Real-time model updates
- API development: Enable local data integration
- Policy engagement: Demonstrate intervention success stories

Acknowledgement

We extend our sincere appreciation to the thousands of individuals who have contributed to the collection of GBIF data and to the global open community contributing to ESA for Sentinel-2 data, as well as to ECMWF for ERA5 climate reanalysis.

GitHub Repo

Paper

THANK YOU FOR LISTENING

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