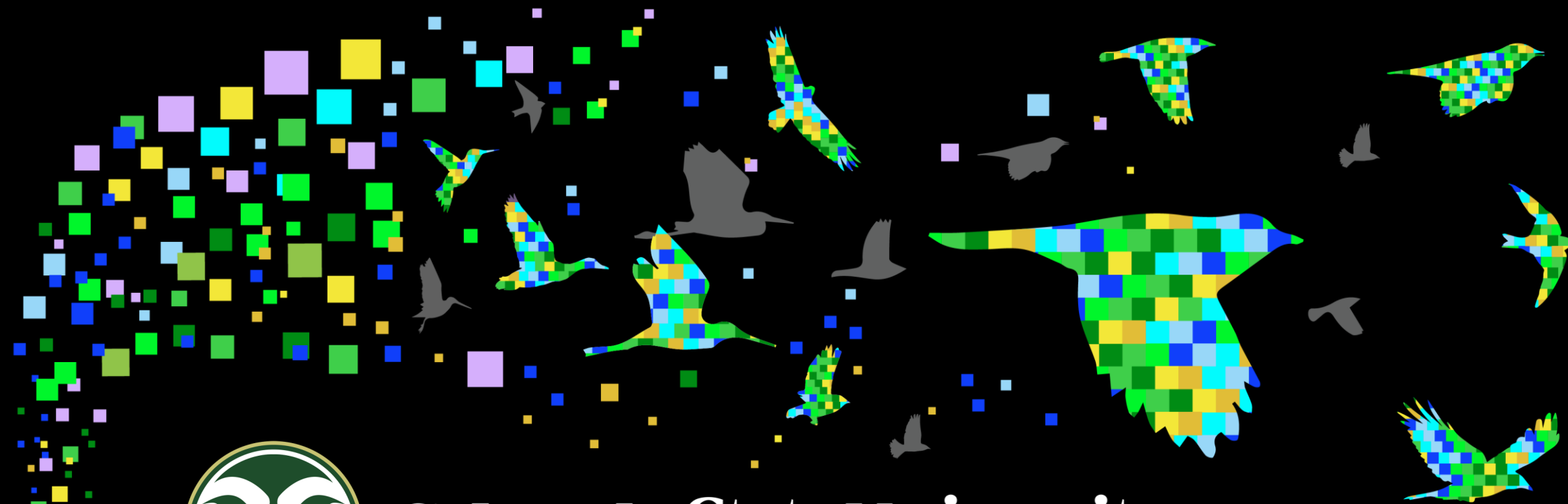
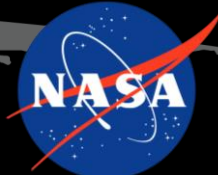


Aeroecology, an emerging ecological frontier



Colorado State University



Kyle Horton
@kyle_horton
aeroecolab.com



Outline

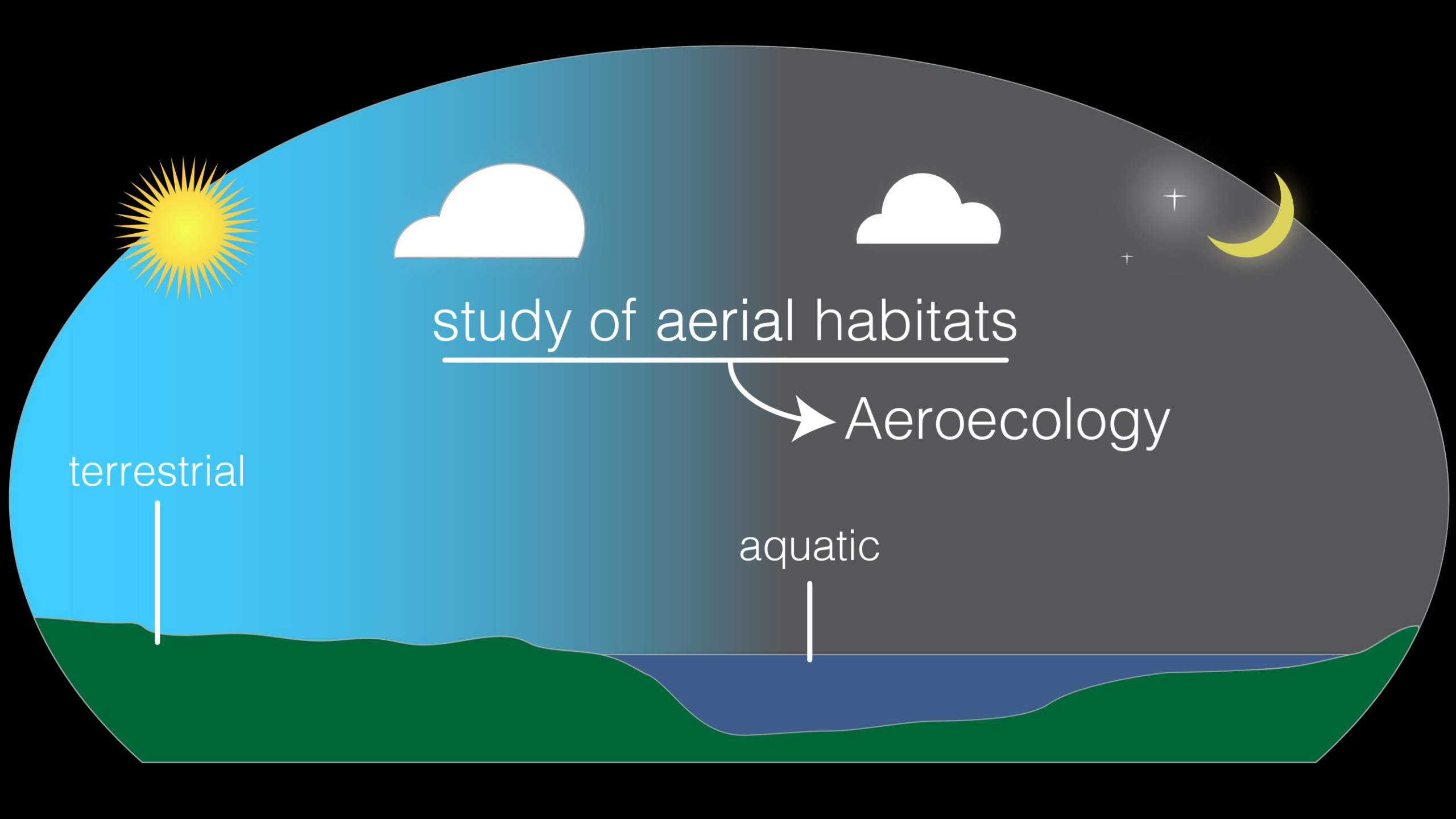
1. What is aeroecology?
2. How can aeroecology inform the design of tools for migrant bird conservation?
3. How can field measures be used for validation of weather surveillance radar?



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study of aerial habitats

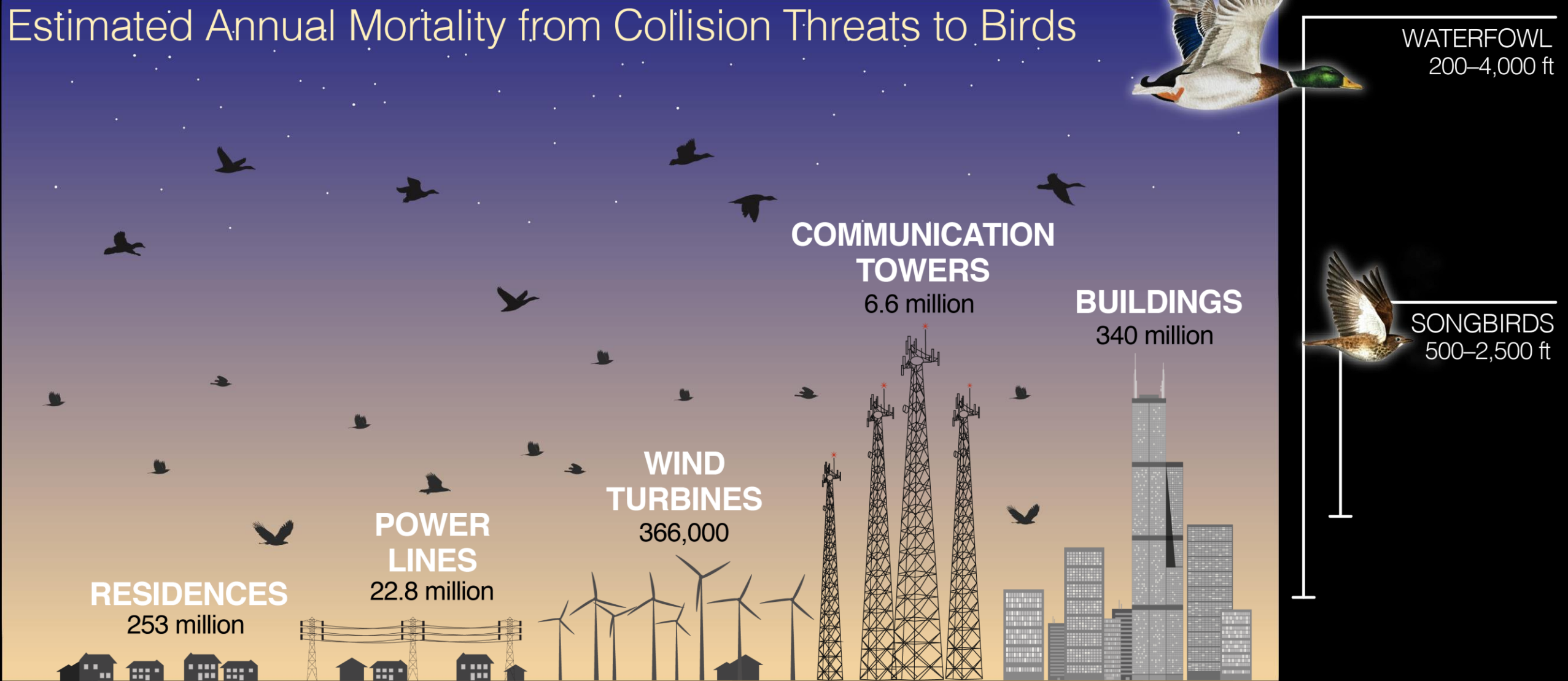
→ Aeroecology

terrestrial

aquatic

DANGEROUS SKIES:

Estimated Annual Mortality from Collision Threats to Birds



Outline

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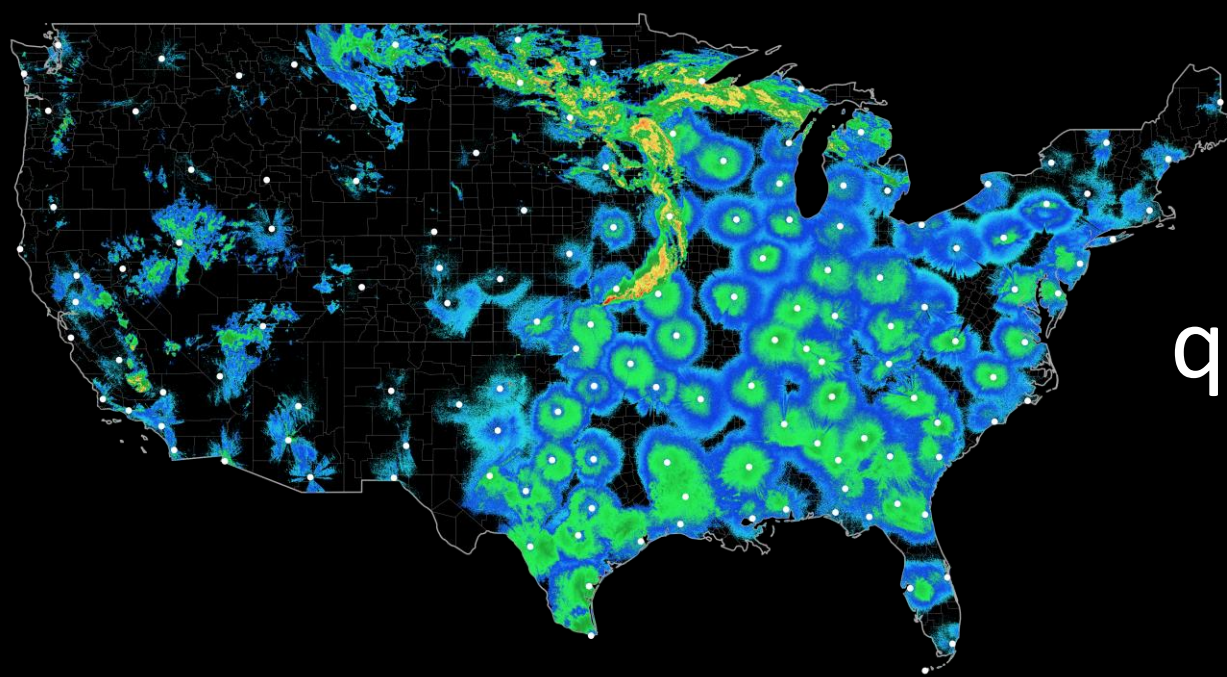




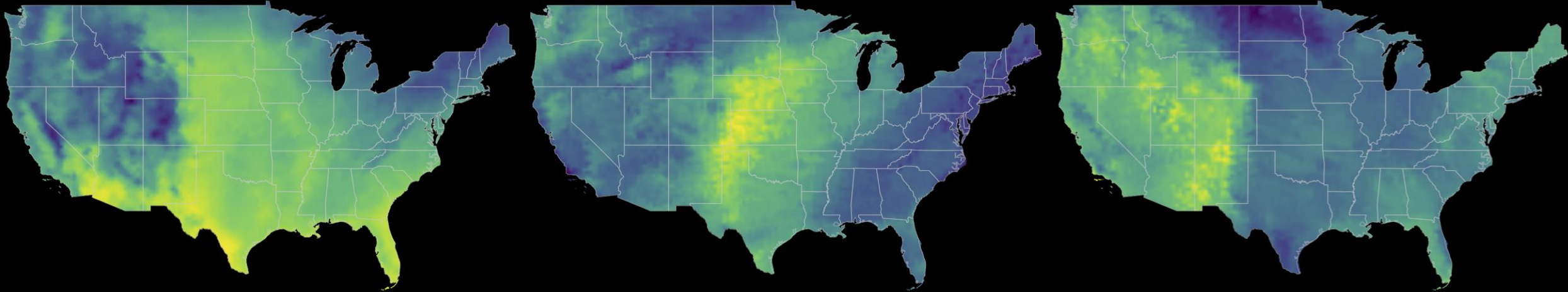
BirdCast

Can we forecast migratory movements?

2021 | **1.8 million** page views
466k users



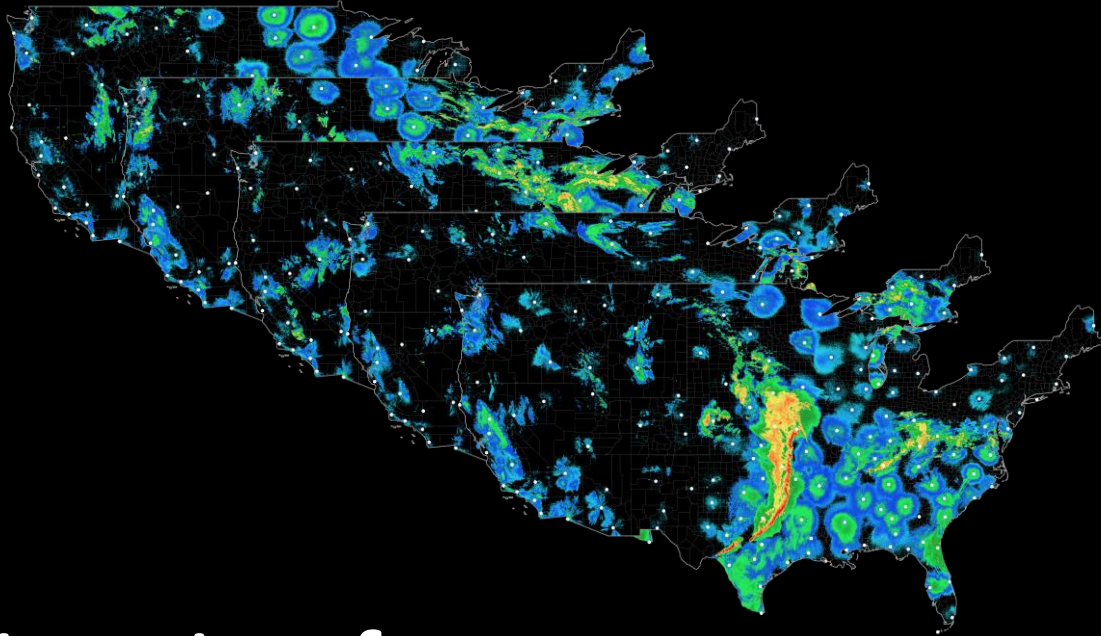
Radar data
quantifying bird
migration



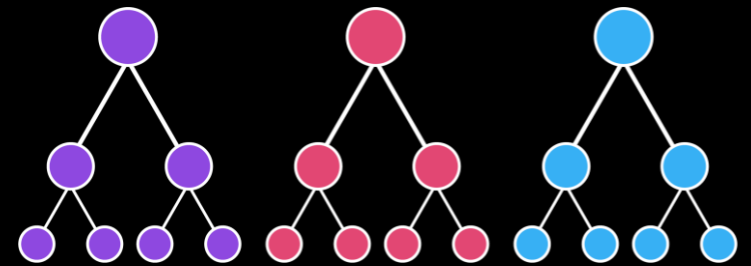
Air temperature + North/South wind + East/West wind

...and altitude, pressure, relative humidity, longitude, latitude, date, cloud, and visibility.

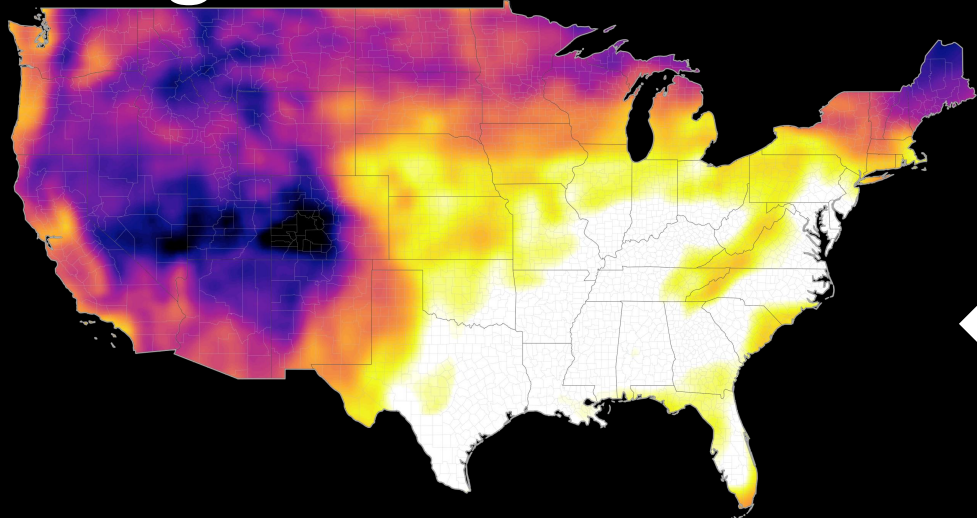
Radar training data



Learn associations



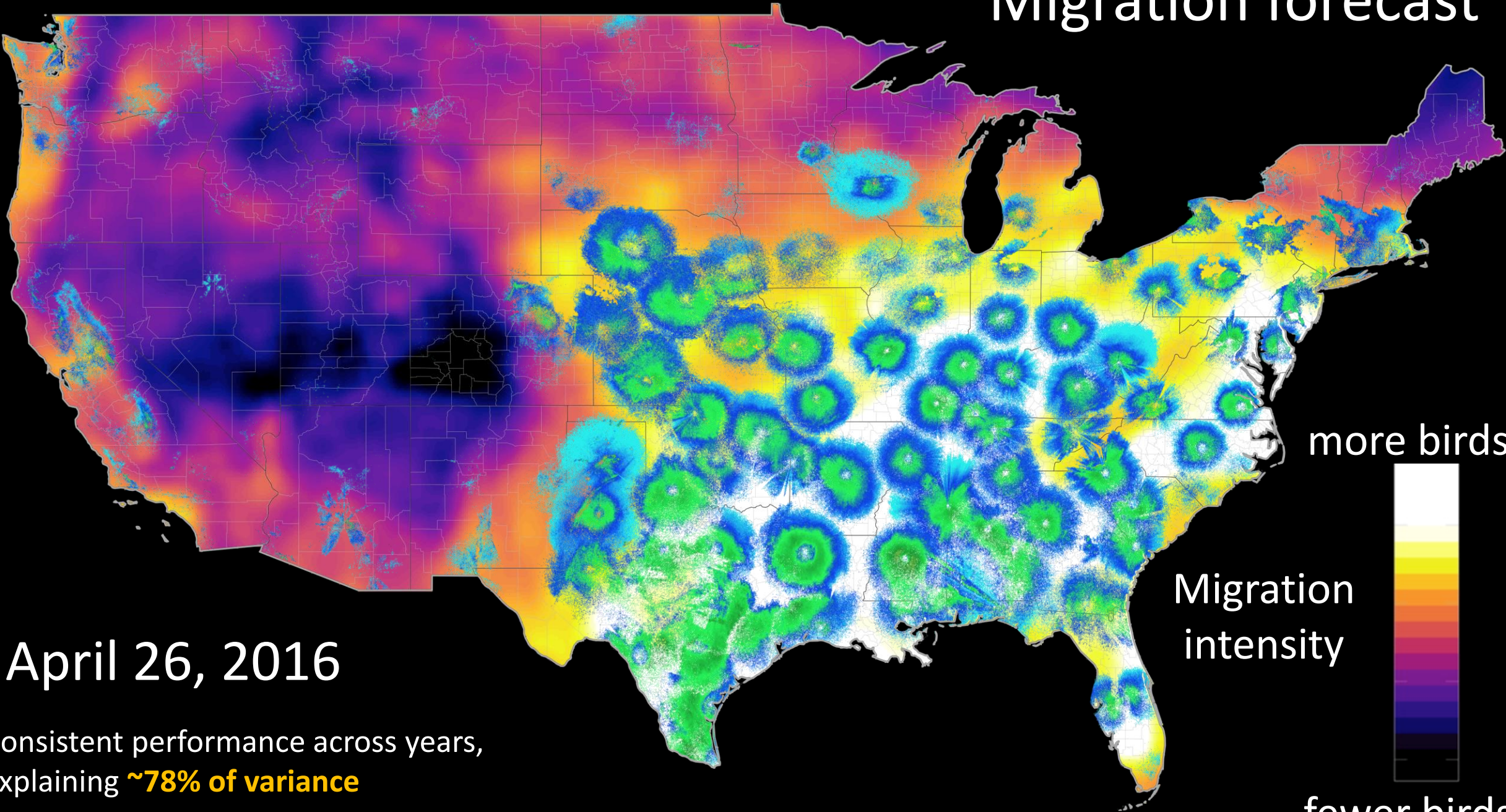
Migration forecast



New data

Global Forecast System
(GFS)

Migration forecast



April 26, 2016

Consistent performance across years,
explaining **~78% of variance**

Continental Estimates

Tonight

Sep 21, 2022

481 million
forecast birds

Tomorrow

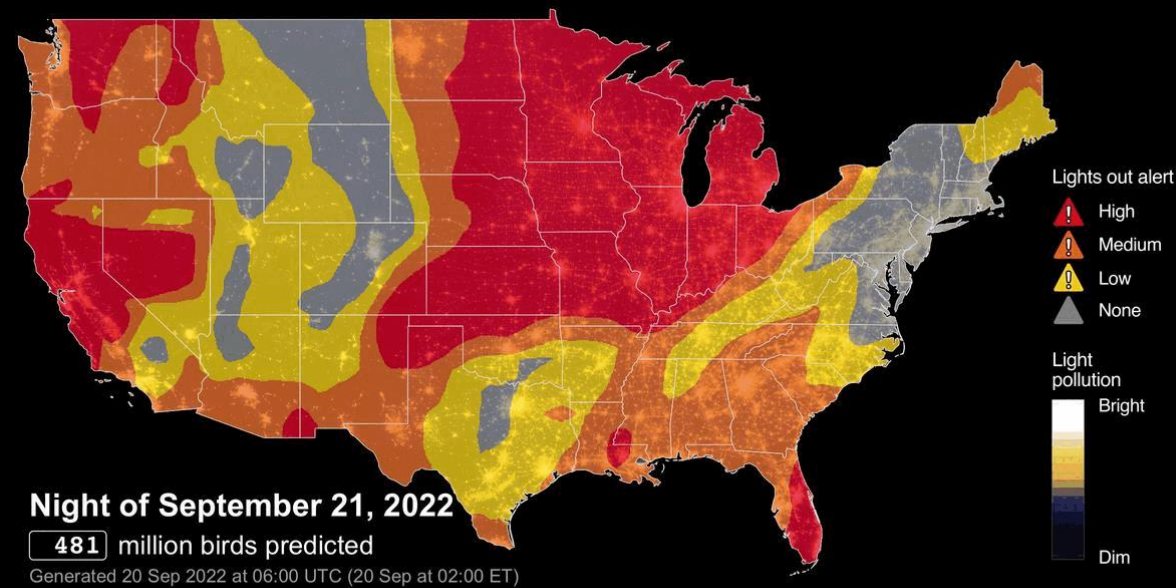
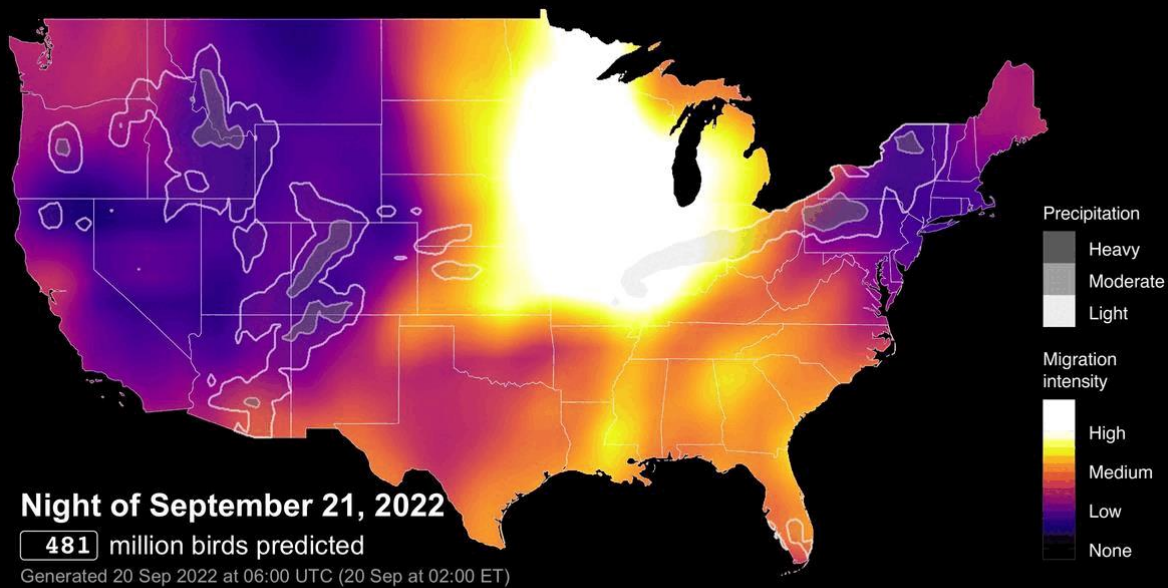
Sep 22, 2022

471 million
forecast birds

Night after tomorrow

Sep 23, 2022

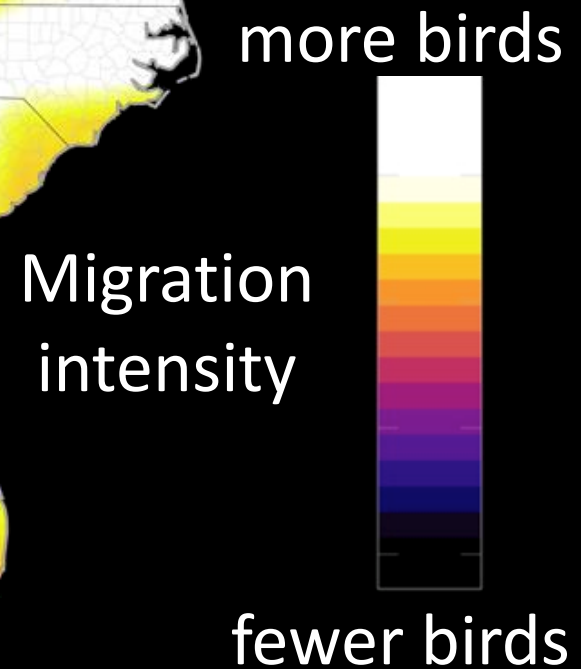
325 million
forecast birds



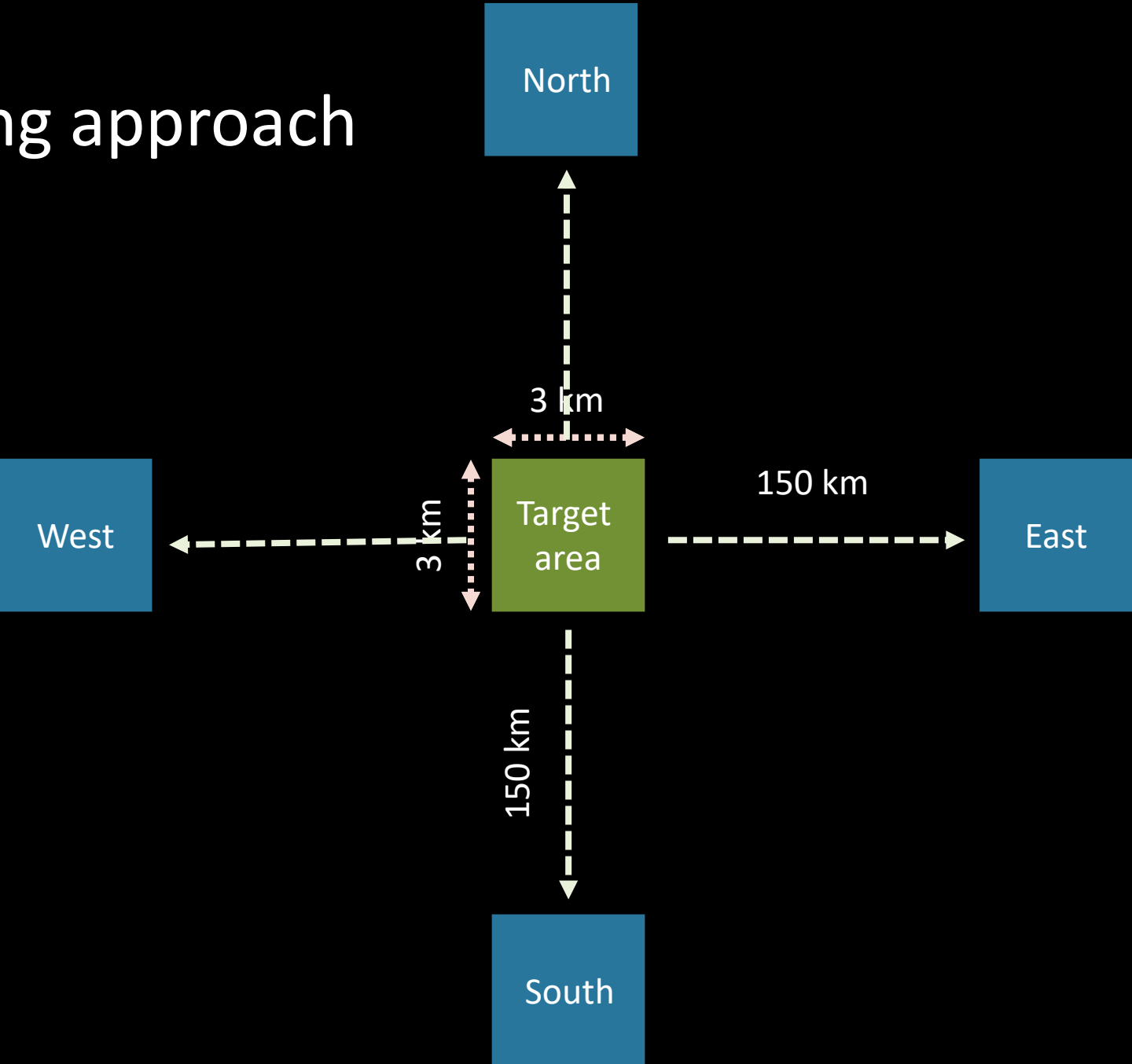
Migration forecast

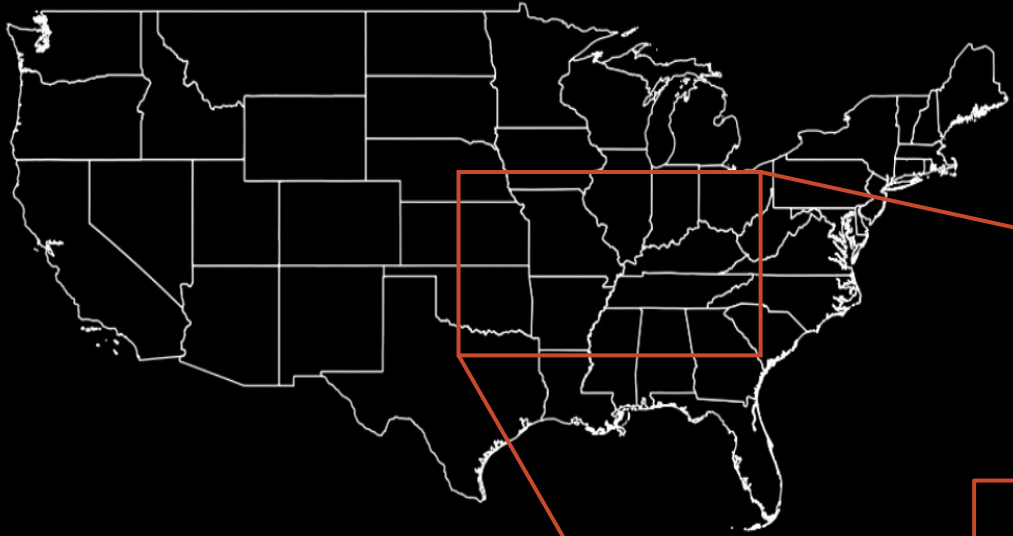
- Lack spatial predictors
 - Landcover
 - NDVI
 - Light pollution
- Overly smooth spatial predictions
 - Model trained on 143 points...but millions are possible

April 26, 2016

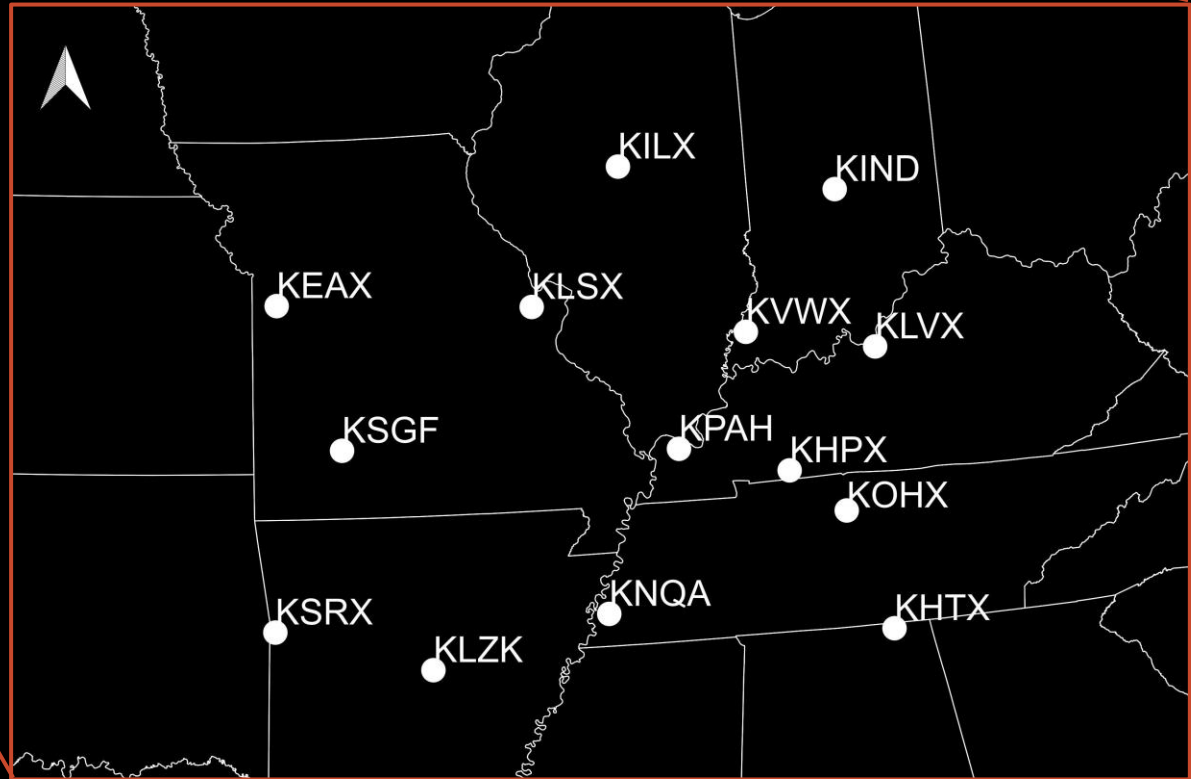


New modeling approach

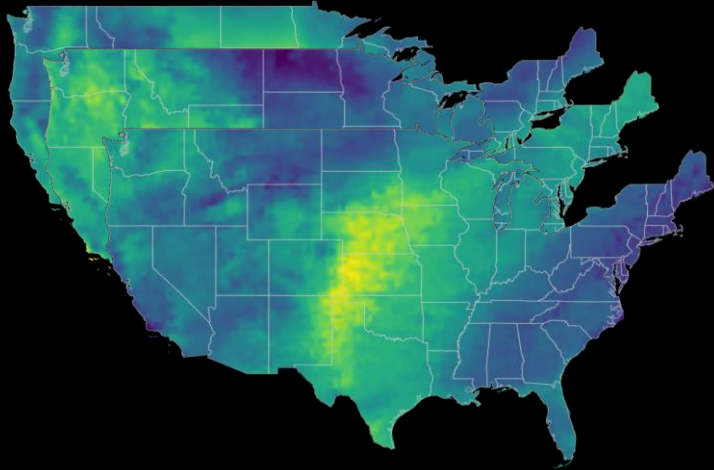




- 1,287 points sampled
- March 1 to November 15
- 2012-2021

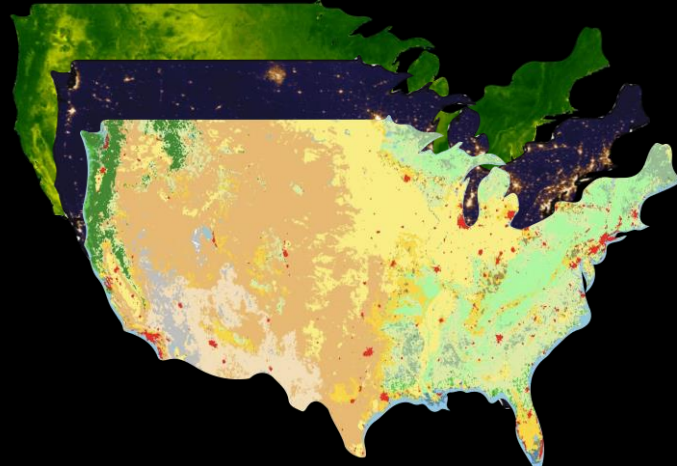


Scenarios



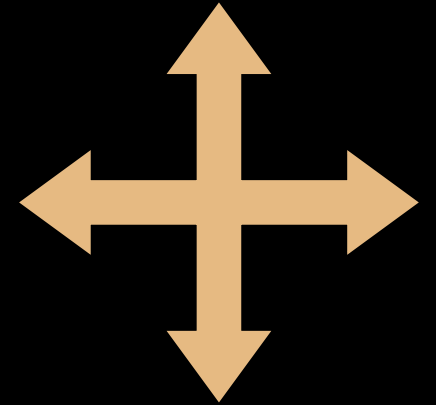
Atmospheric predictors

+



Terrestrial predictors

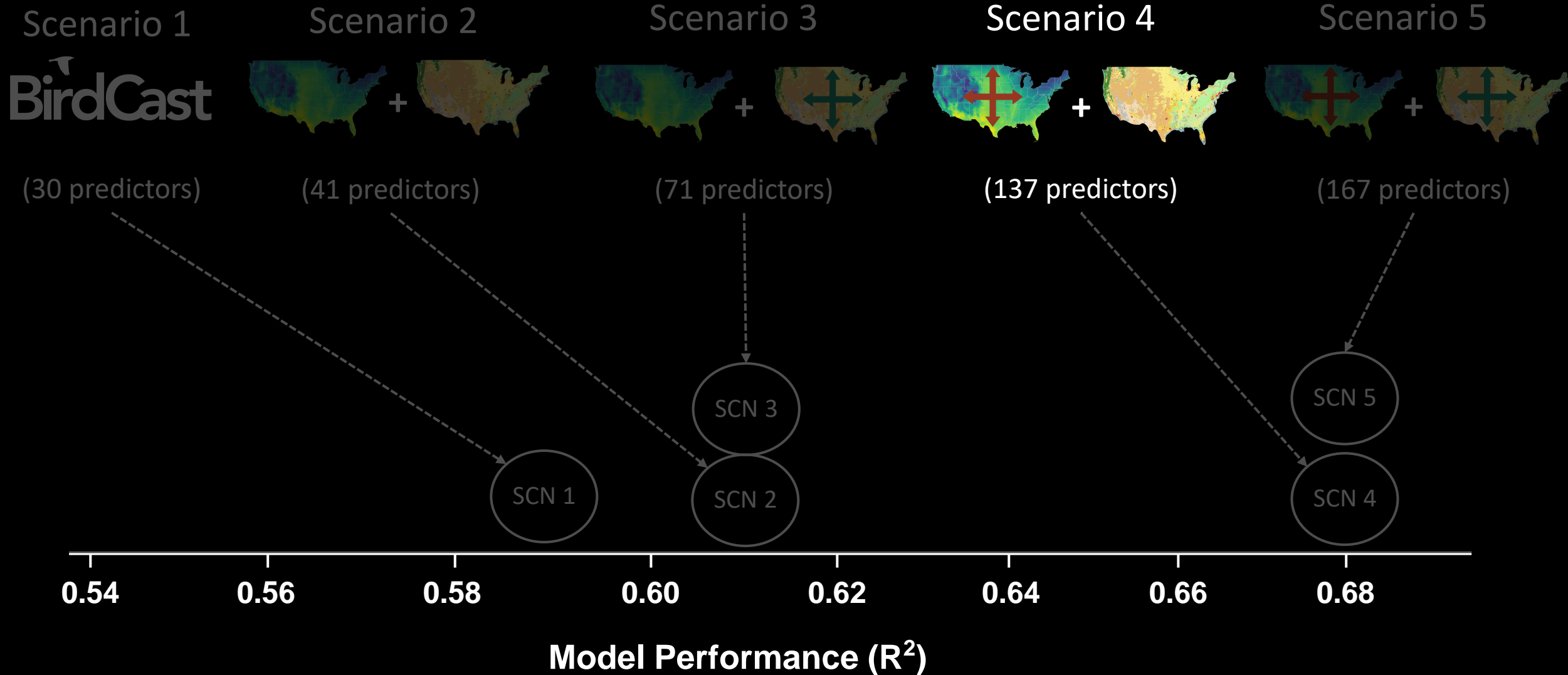
+



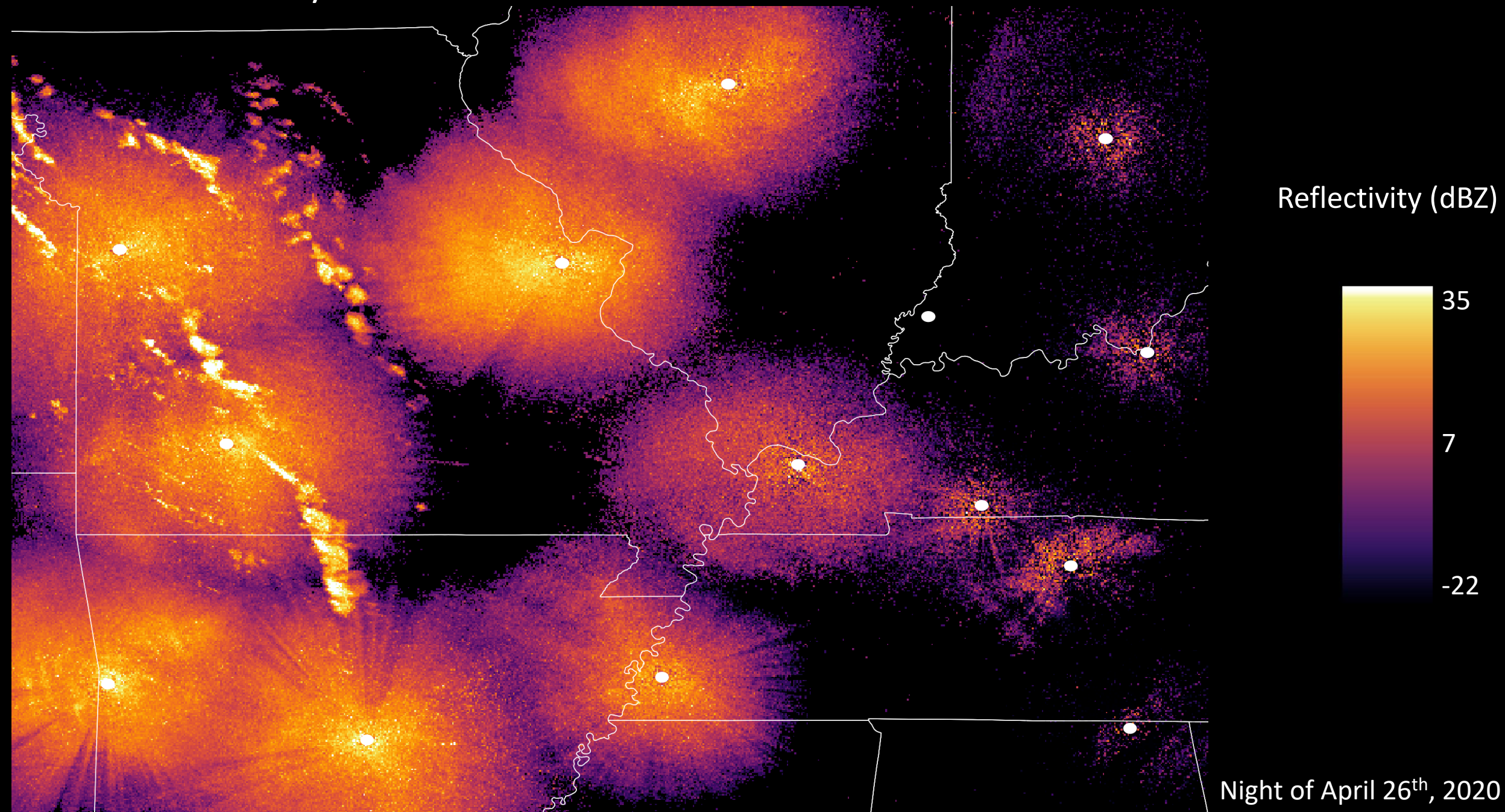
Spatially distant predictors

Results

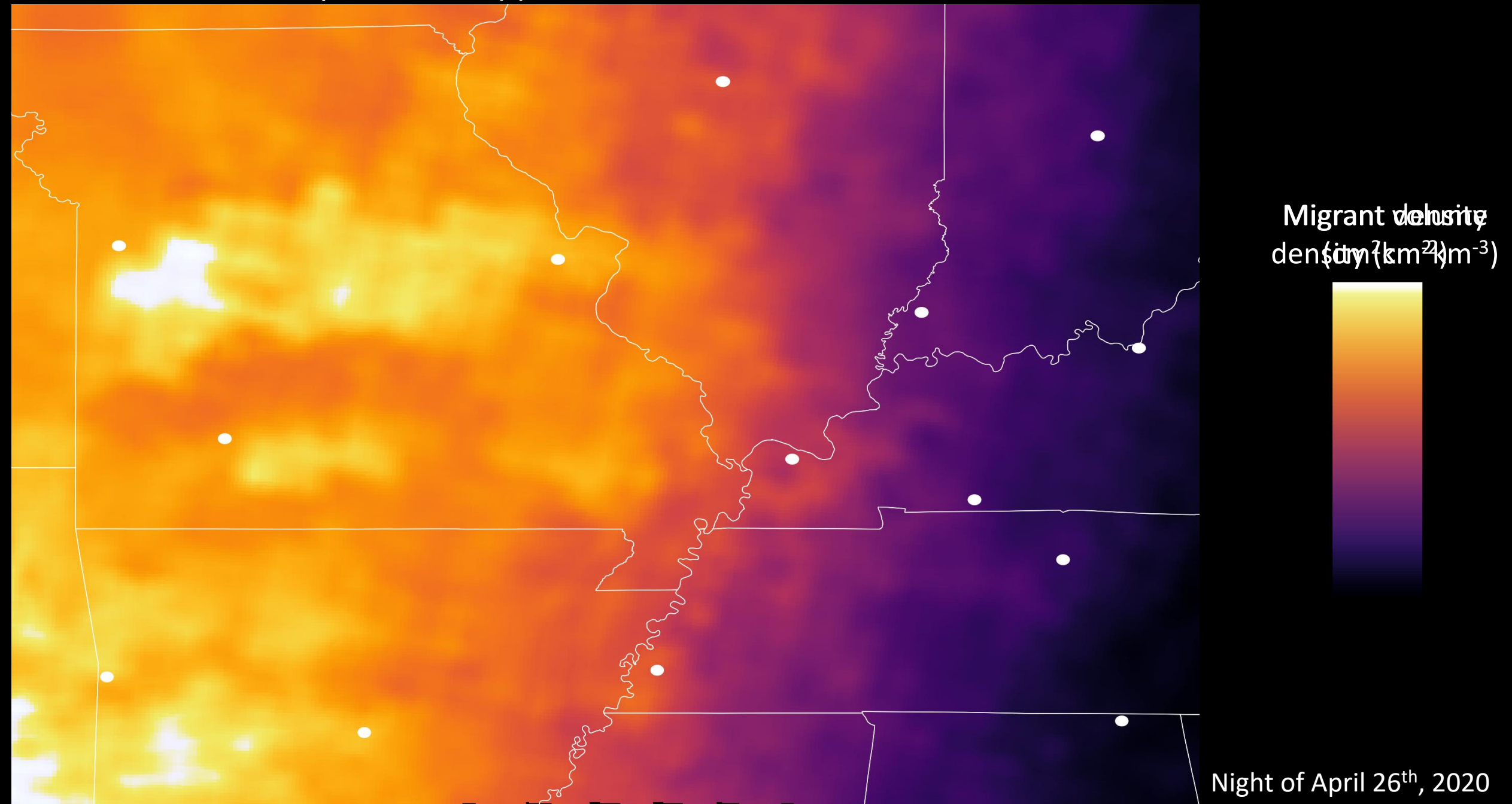
$$R^2 = 1 - \frac{\text{Residual sum of squares}}{\text{Total sum of squares}}$$



NEXRAD Reflectivity



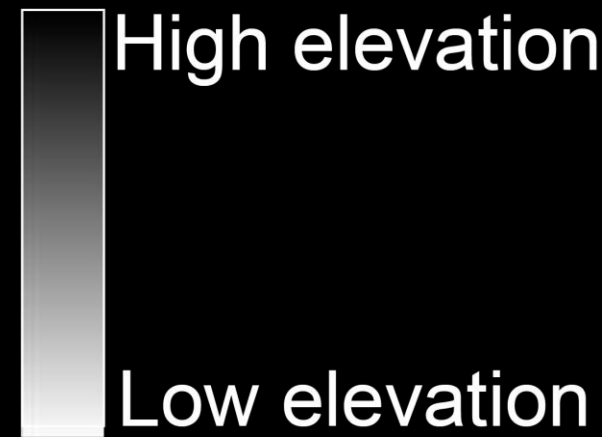
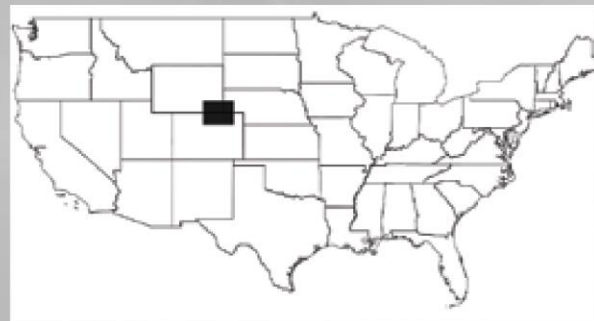
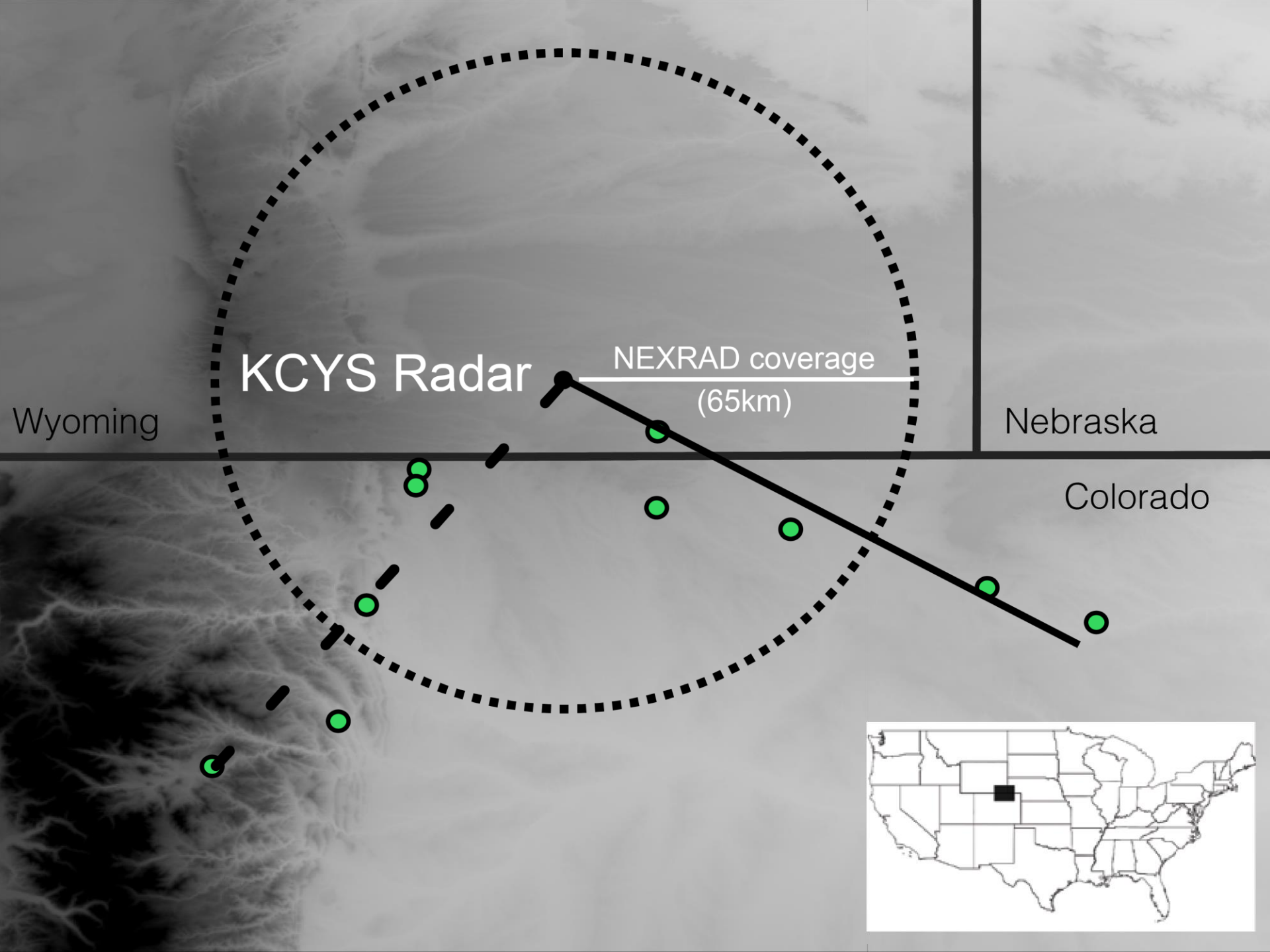
BirdCast Prediction (v2.0, ~5km)



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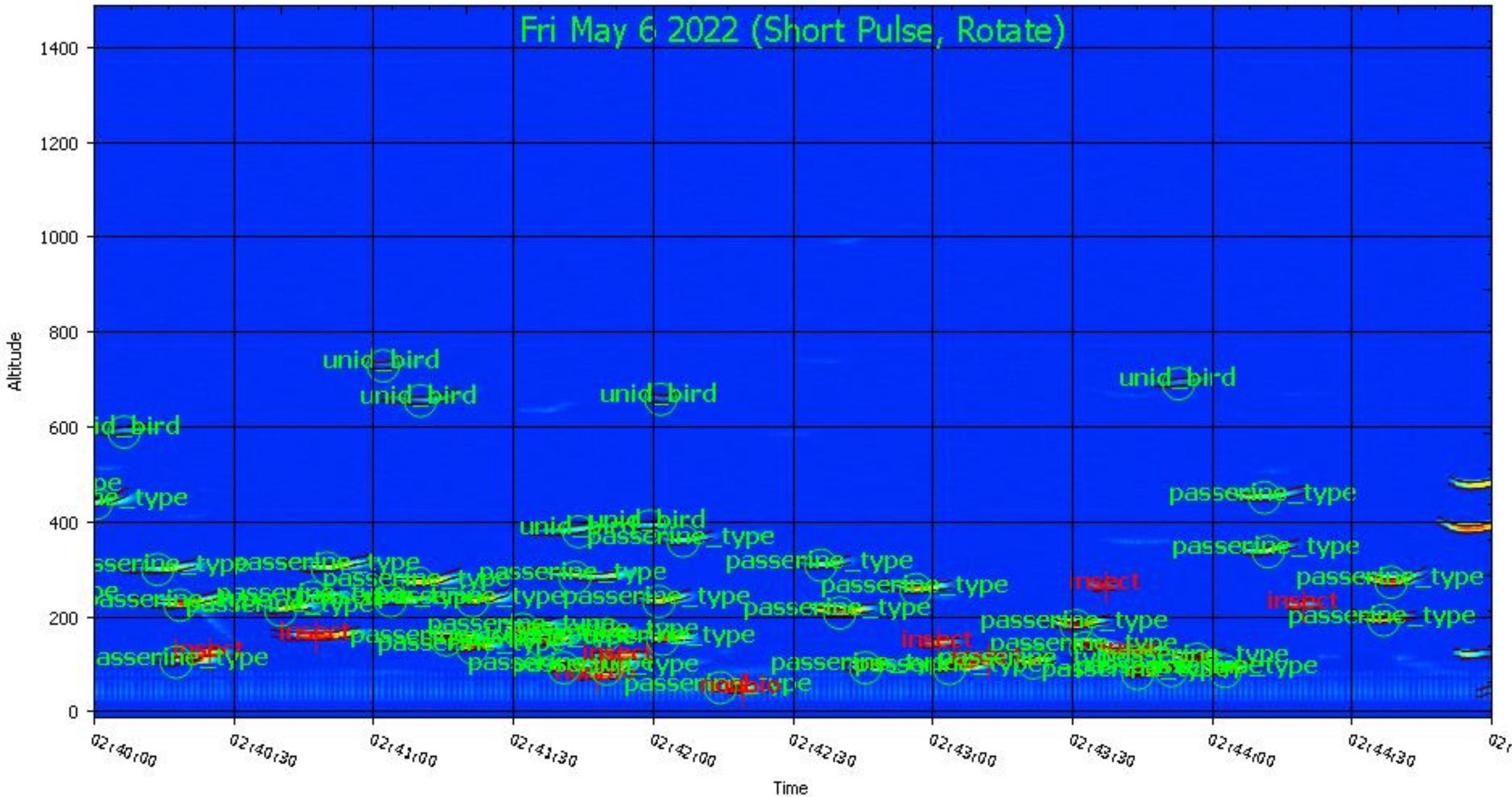


swiss-birdradar.com

CSU Aeroecology Lab

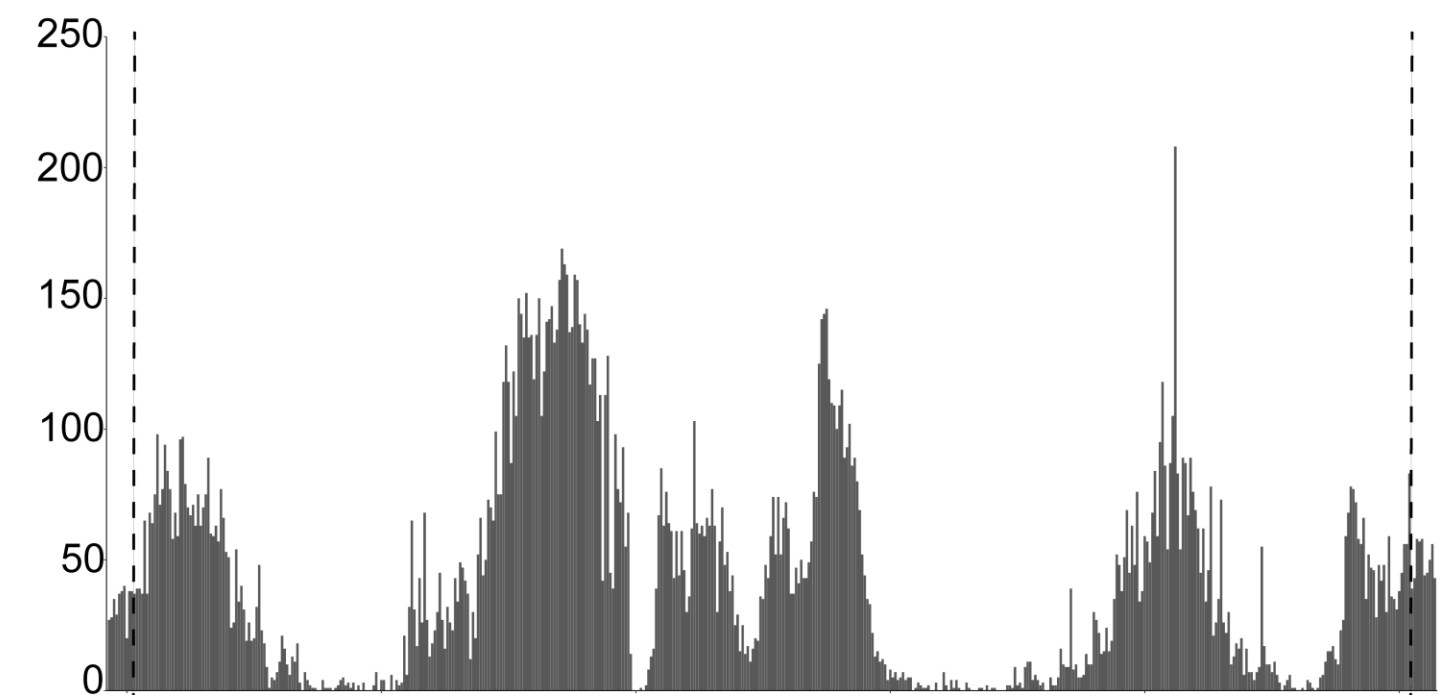


Fri May 6 2022 (Short Pulse, Rotate)

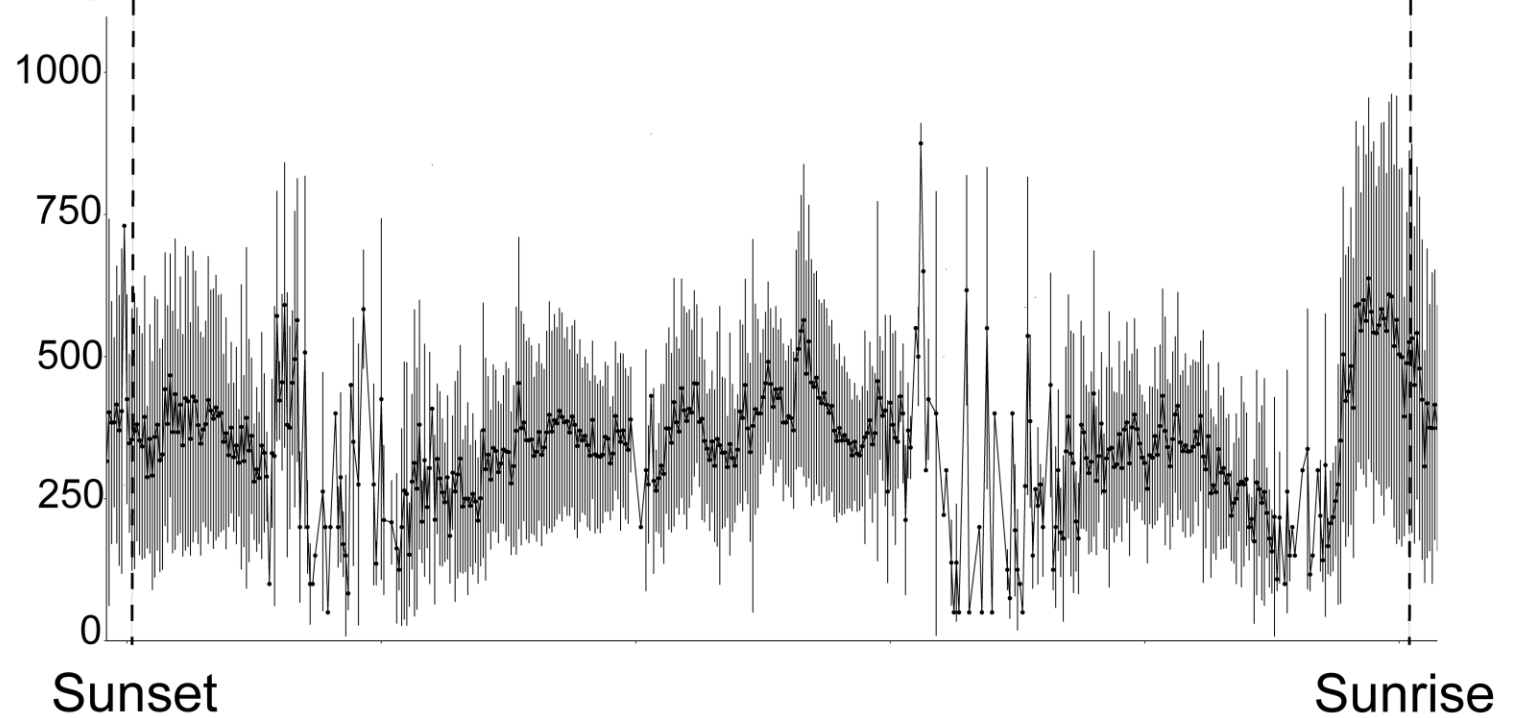


Night of May 6th, 2022

Number of
detections



Mean (\pm SD)
elevation of
detection(m)





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