Defining Observation Fields for Verification of Spatial Forecasts of Convection

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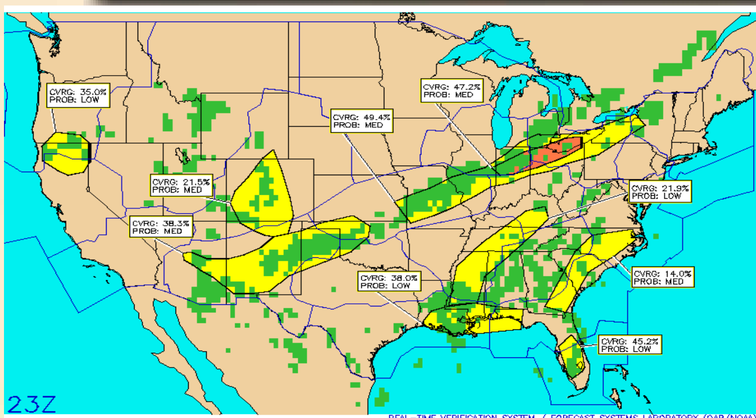
NCAR

AWRP

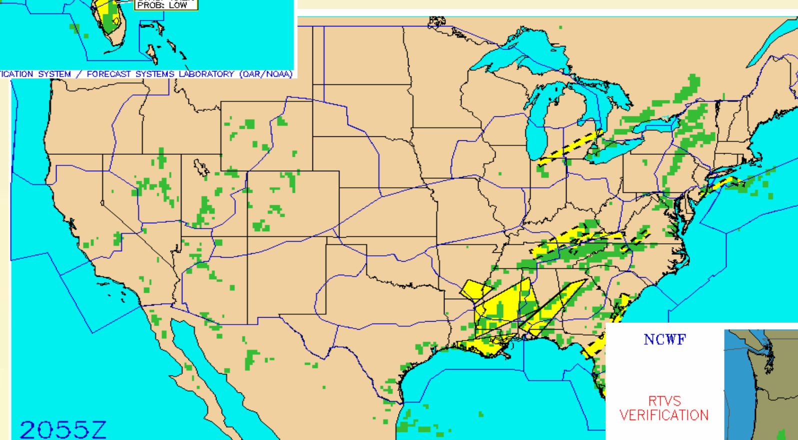
Outline

- The convective forecast verification problem in an aviation context
- Defining observations that incorporate operational considerations and forecast attributes
  - Contrast old vs new verification strategy
- Application new strategy to 2004 evaluation of convective forecasts

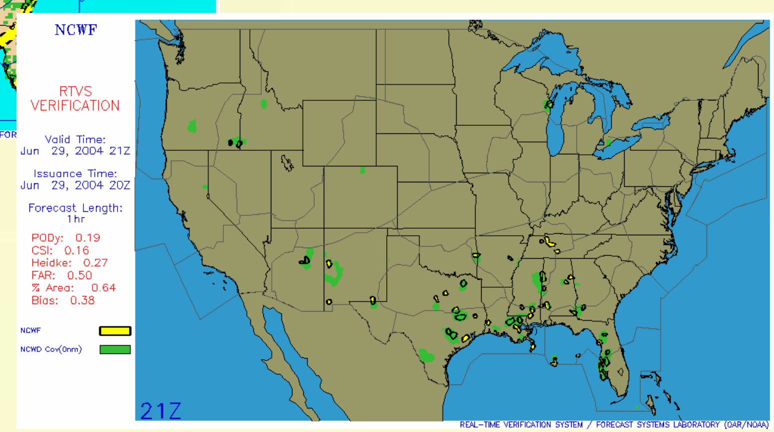
Convective Forecasts



CCFP



C-SIGMET



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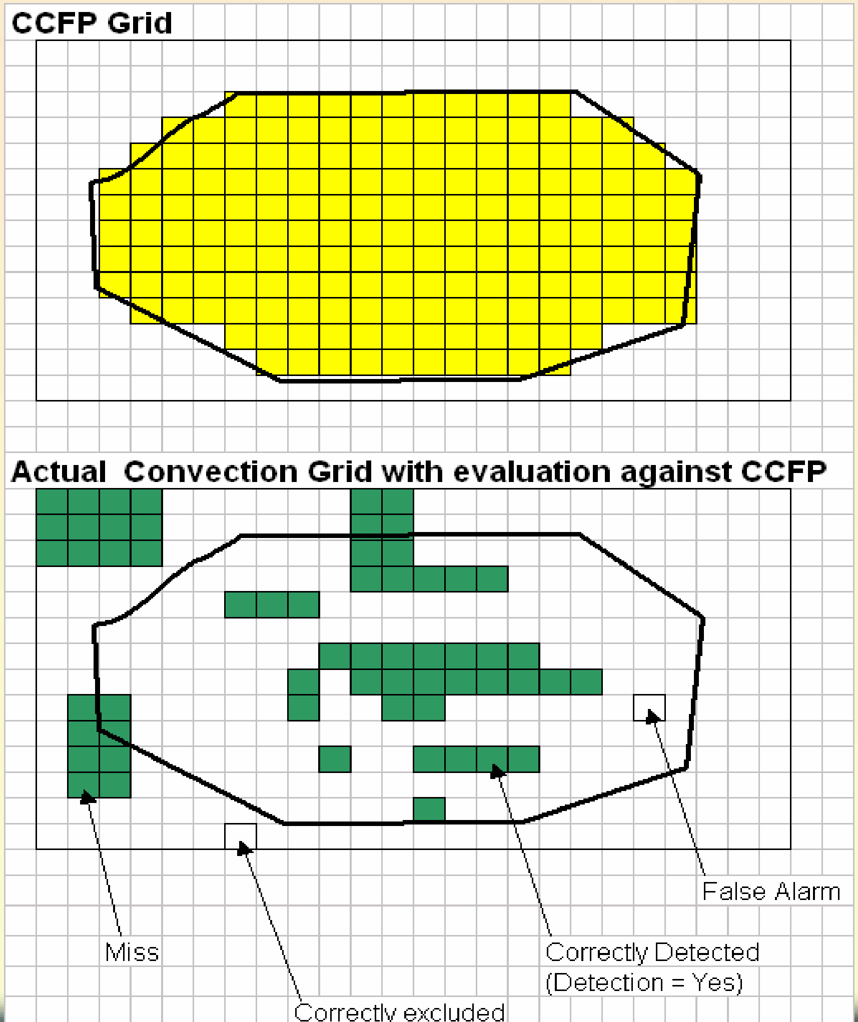
Role in Convective Forecast Verification

- Determine which forecast is “better”
- Evaluate the quality of these forecasts using the same verification technique
- Evaluate the quality of the forecast as it is applied by the end user

Old Verification Strategy

Grid-based approach

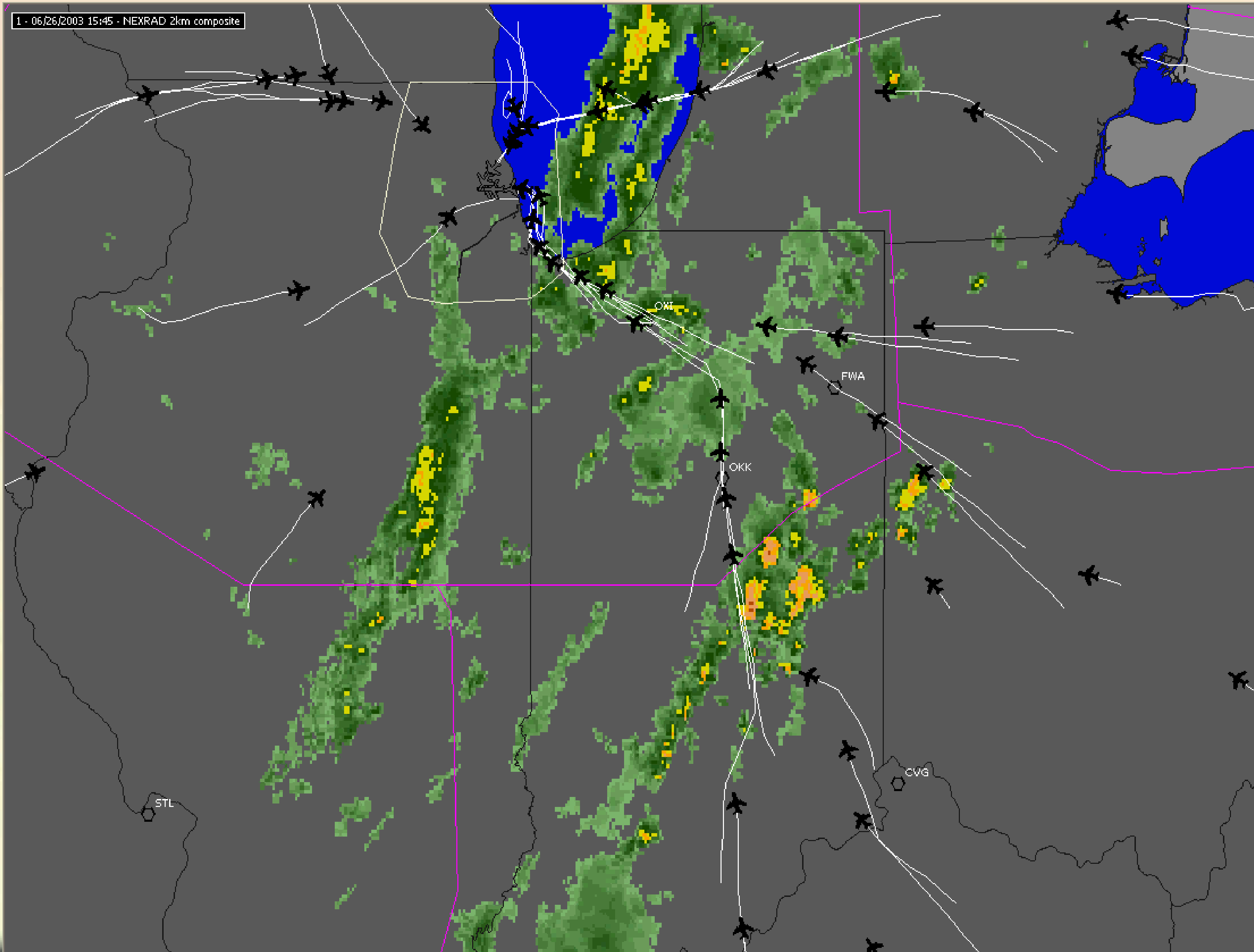
- Binary comparison
- Compare forecasts with observations
  - *Assume a forecast 'scale'*
  - *Overlay forecasts and observations*
  - *Test inclusion in forecast*
- Methods consider the entire domain or sub-domain
- Compute coverage



Defining the Observations

Issue: what convective activity affects the flow of air traffic

- Begin by defining the observations to meet user requirements
  - Understand what convectively impacts the flow of air traffic
- Defining observations to so they incorporate the forecast criteria.


1 - 06/26/2003 15:45 - NEXRAD 2km composite
OKK
FWA
CVG
STL

Re-defining the Observations

Basic assumption:

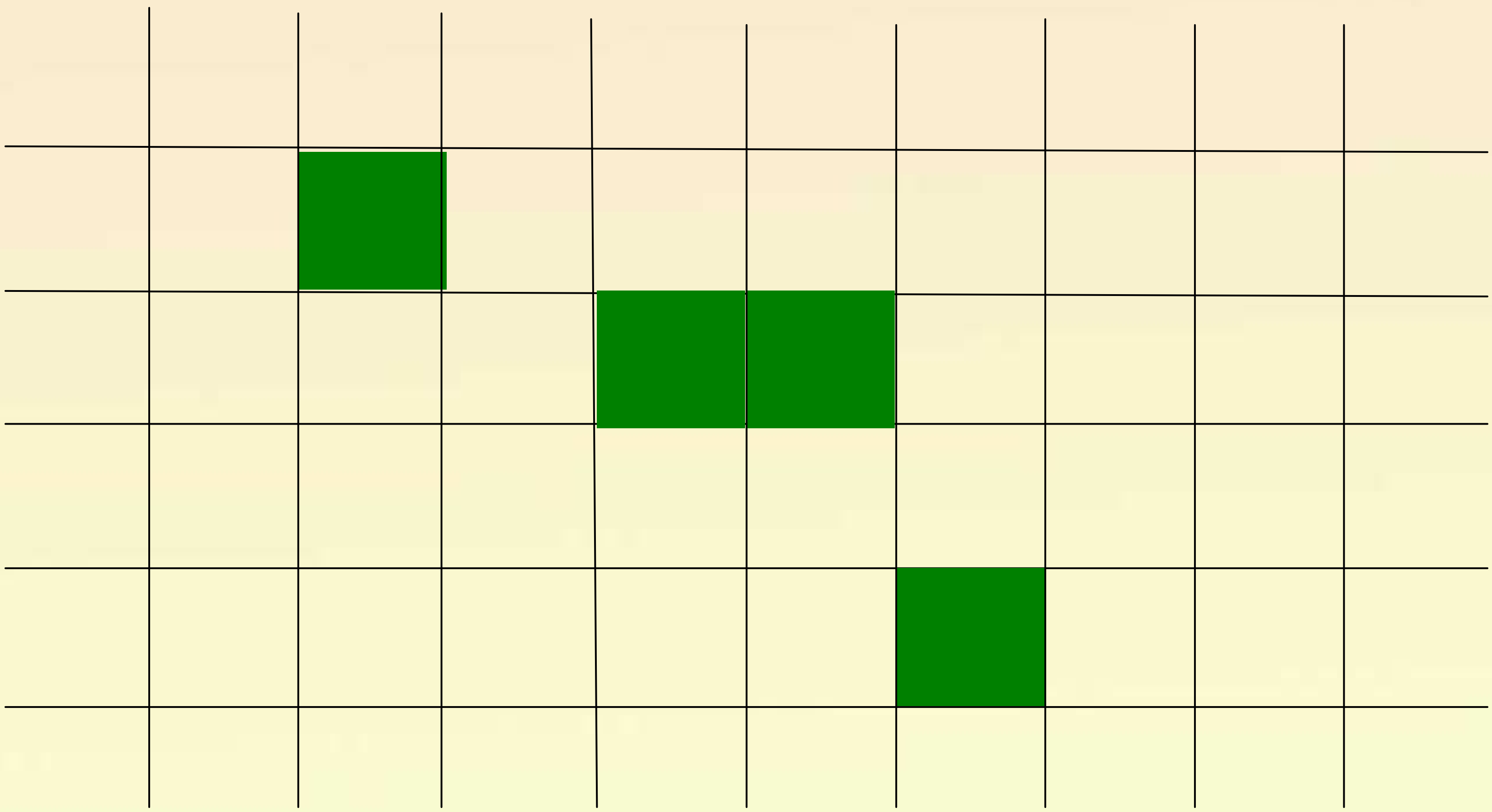
the area of significant convection impacts the flow of air traffic over some distance and extending away from the significant convective area

Re-defining the Observations

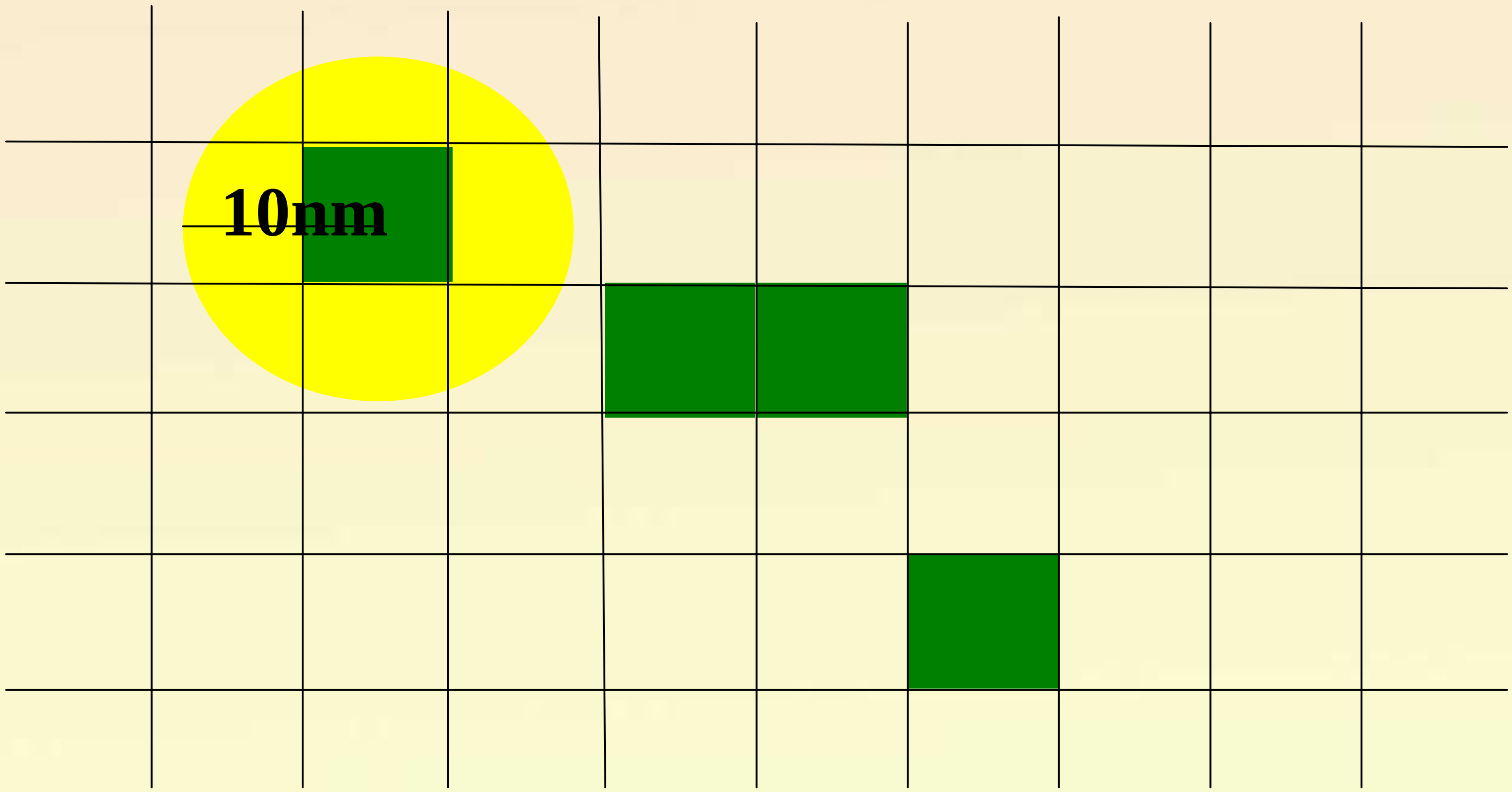
Define a Convective Constrained Area

- Builds on the Airmen’s Information Manual (AIM) definition where a safe distance from convection is suggested
- Incorporate the user requirements for moving air traffic and forecast attributes

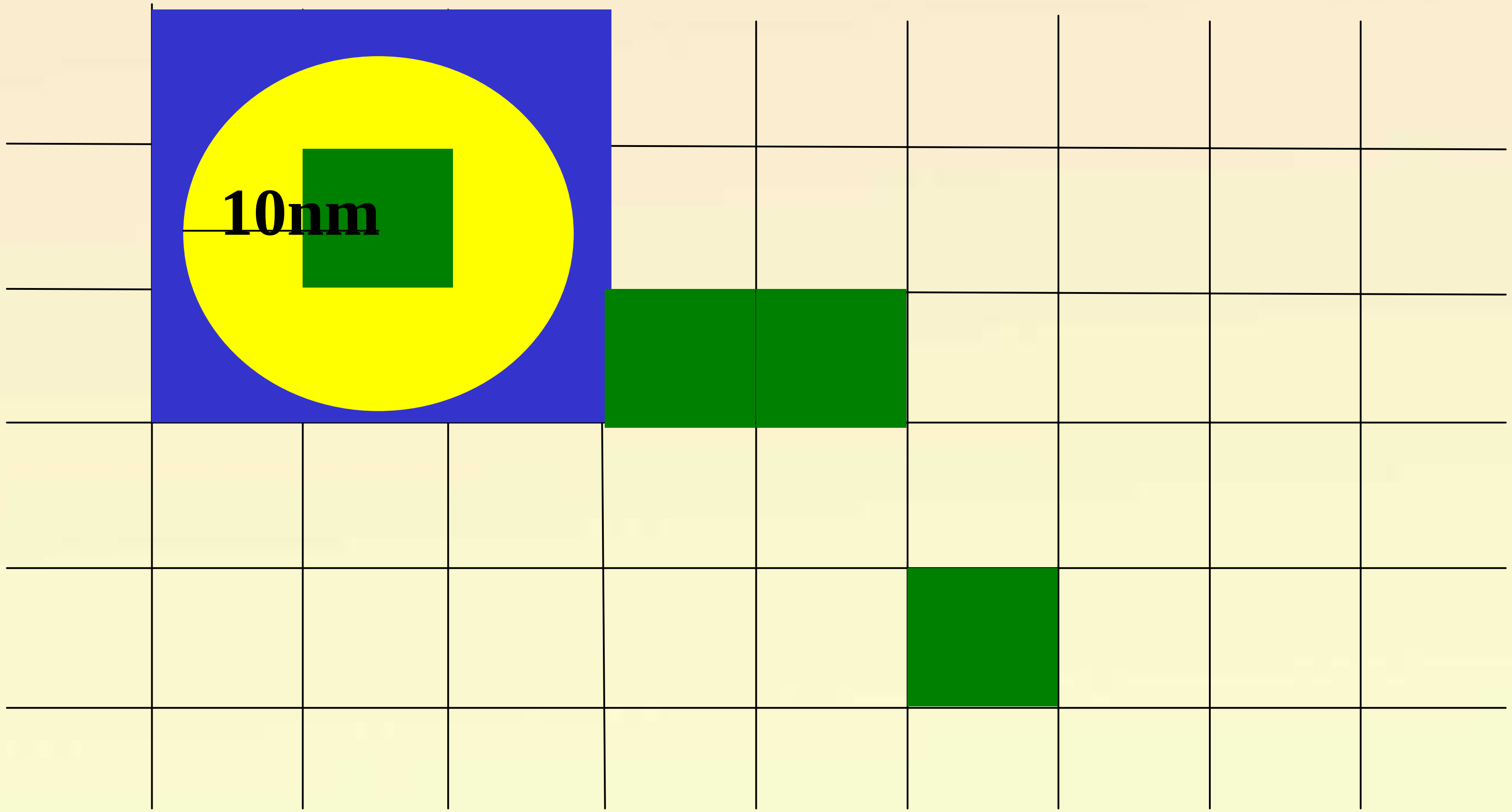
Construction of CCA



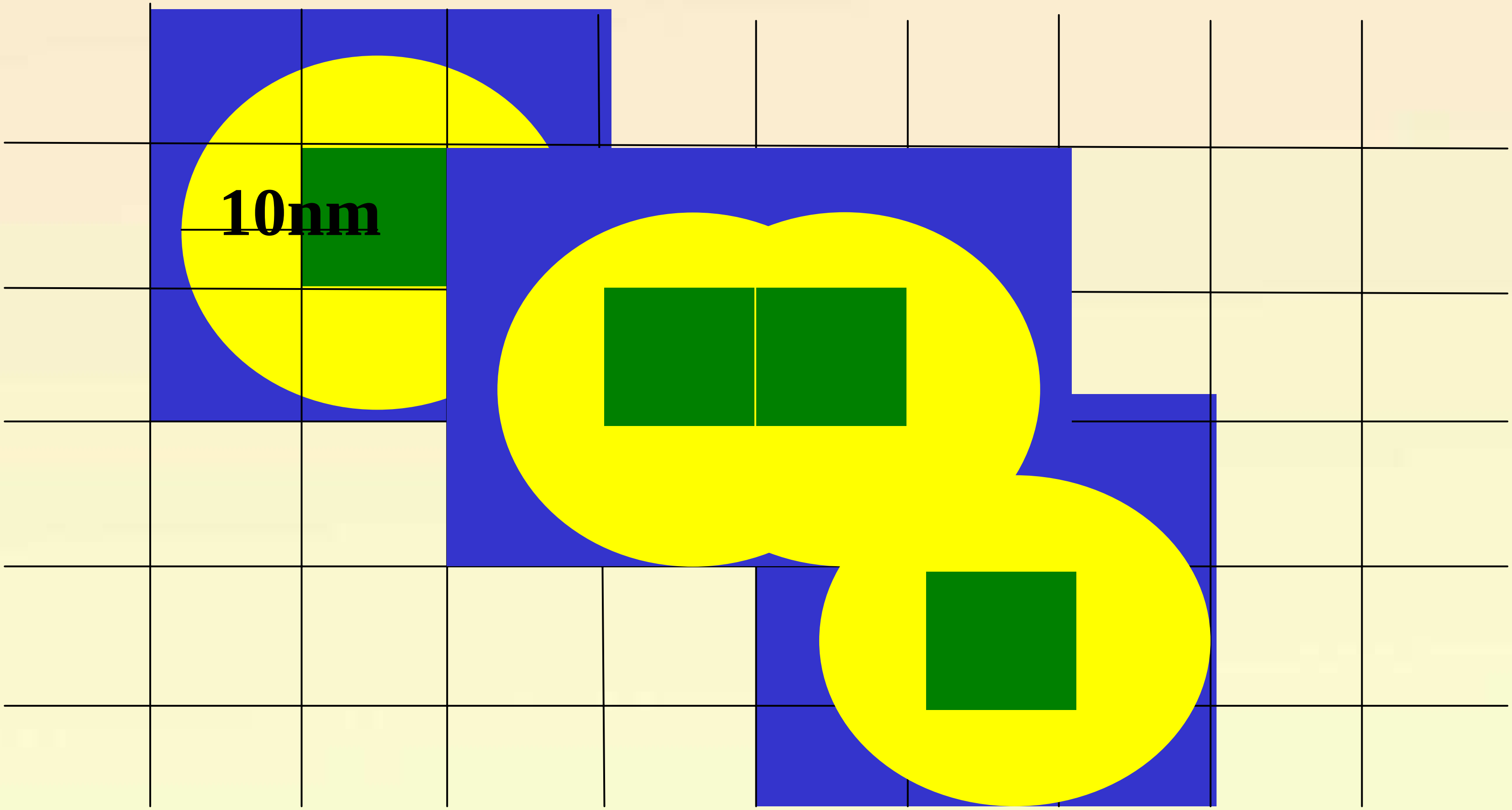
Re-defining the Observations CCA



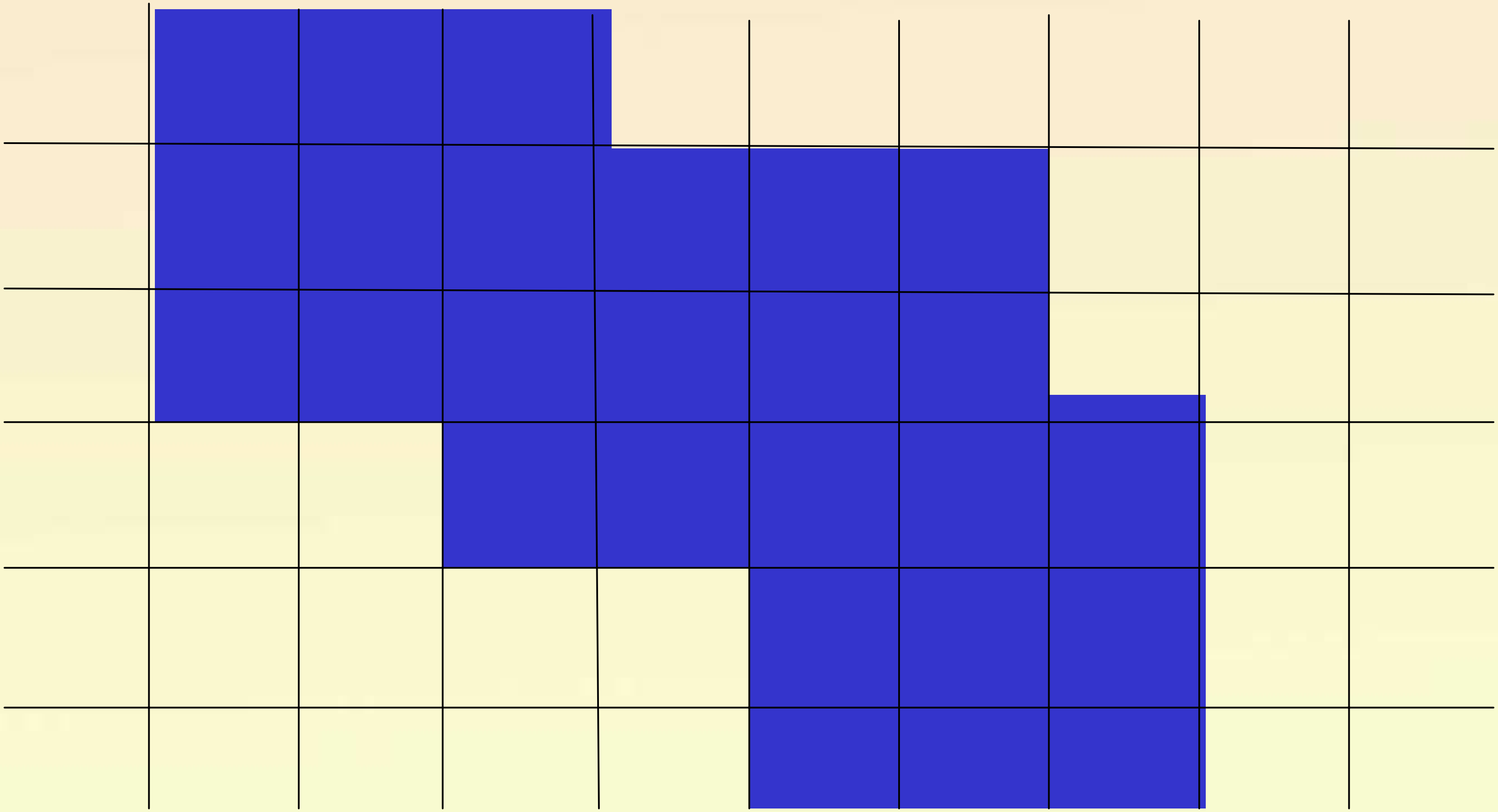
Re-defining the Observations CCA



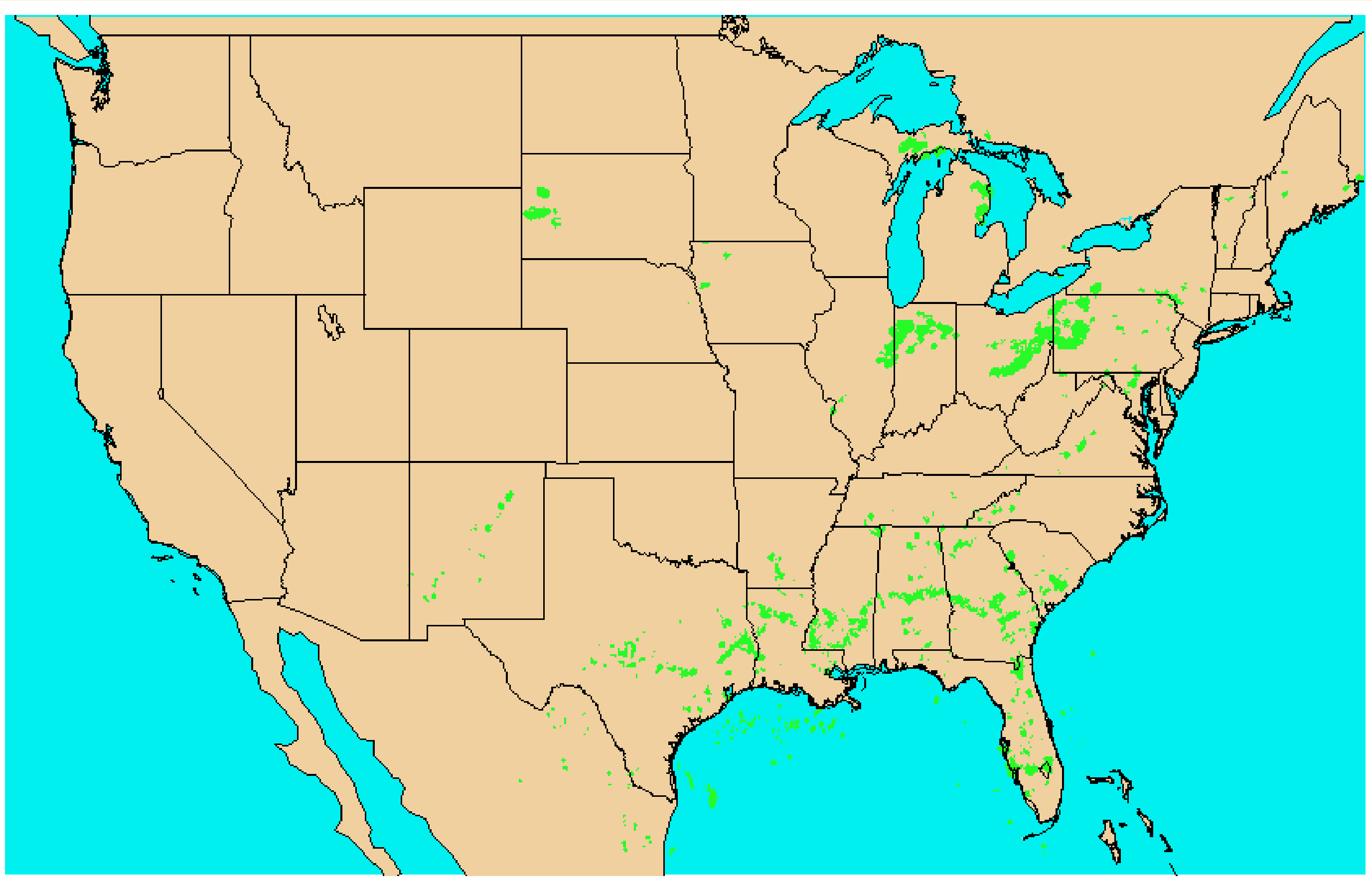
Re-defining the Observations
CCA



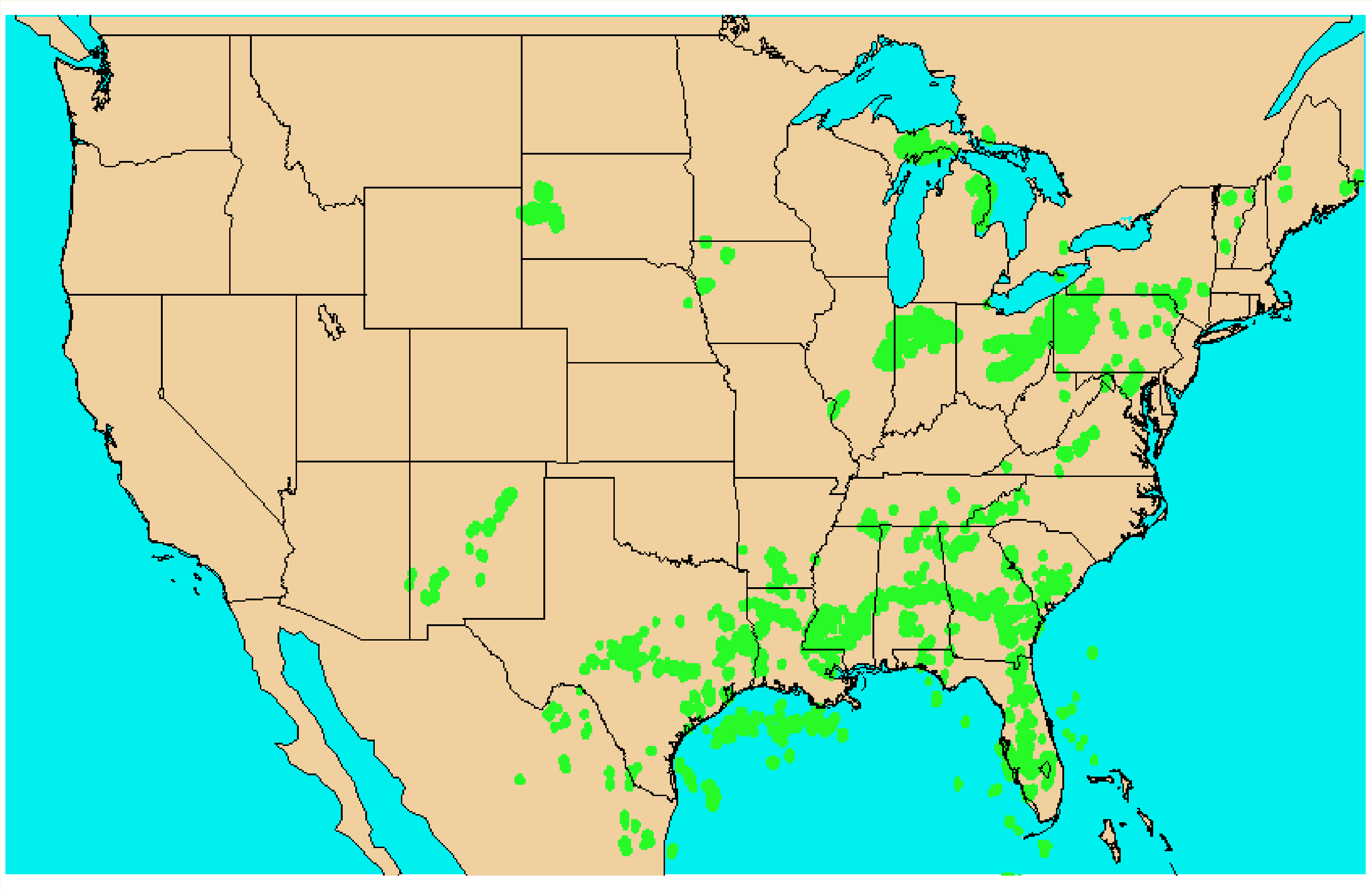
Convective Constrained Area



Raw Observations



Convective Constrained Area

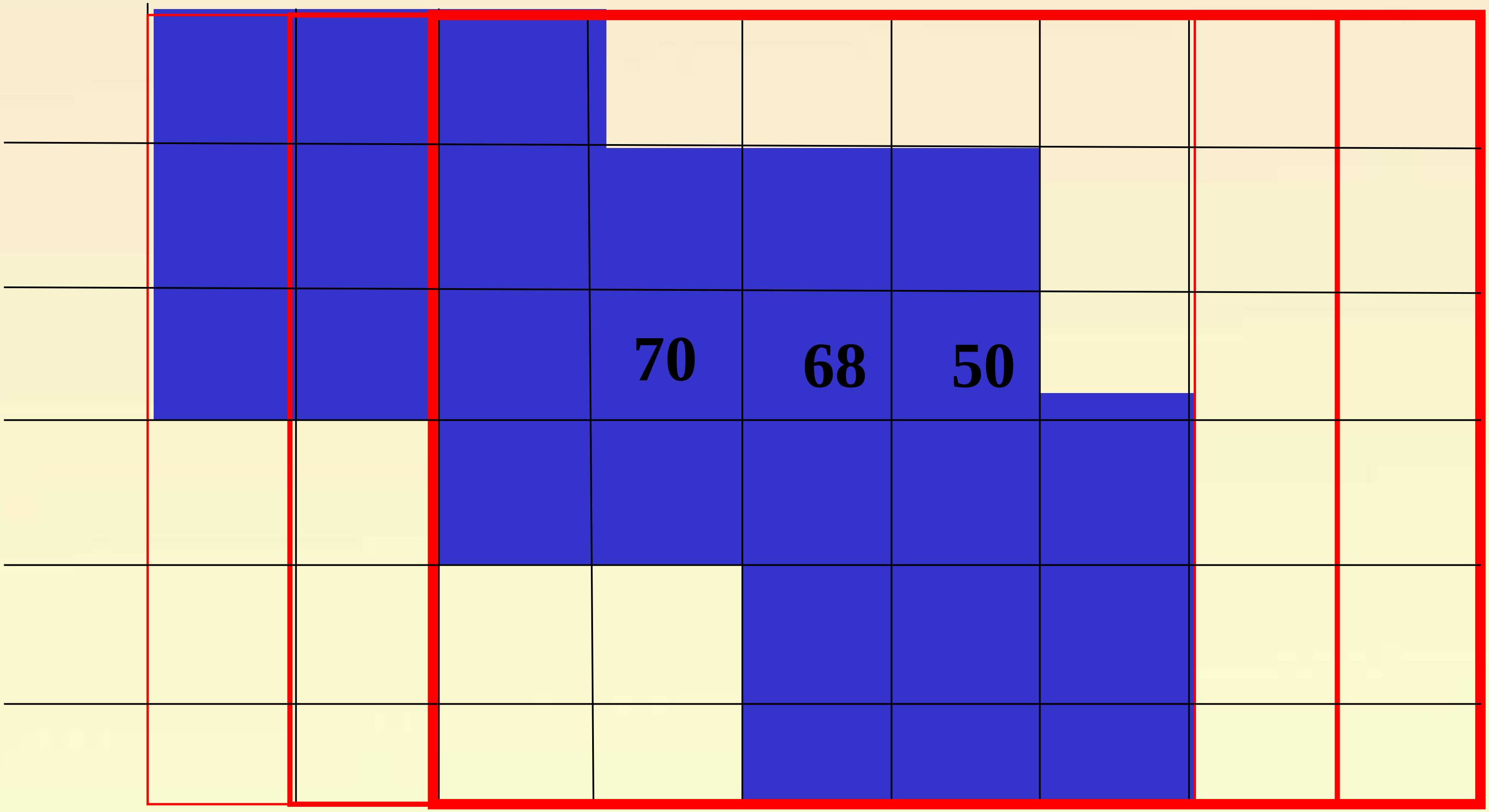


Incorporate Forecast Attributes into the CCA

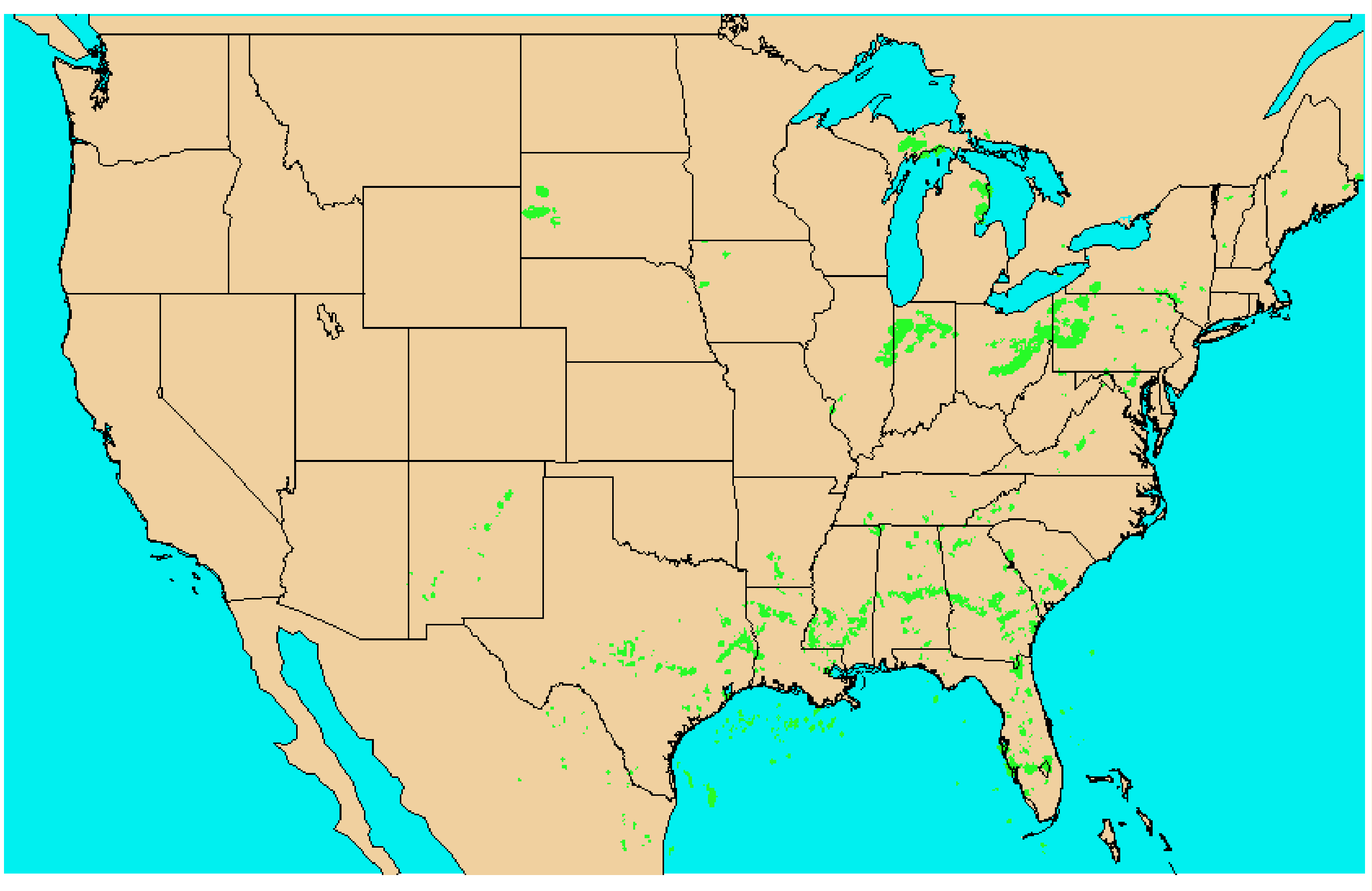
Forecast Characteristics and Scale

- Develop search box that represents minimum forecast size of 3,000 sq mile (92x92 Km)
- Compute a coverage and apply to each box on the verification field

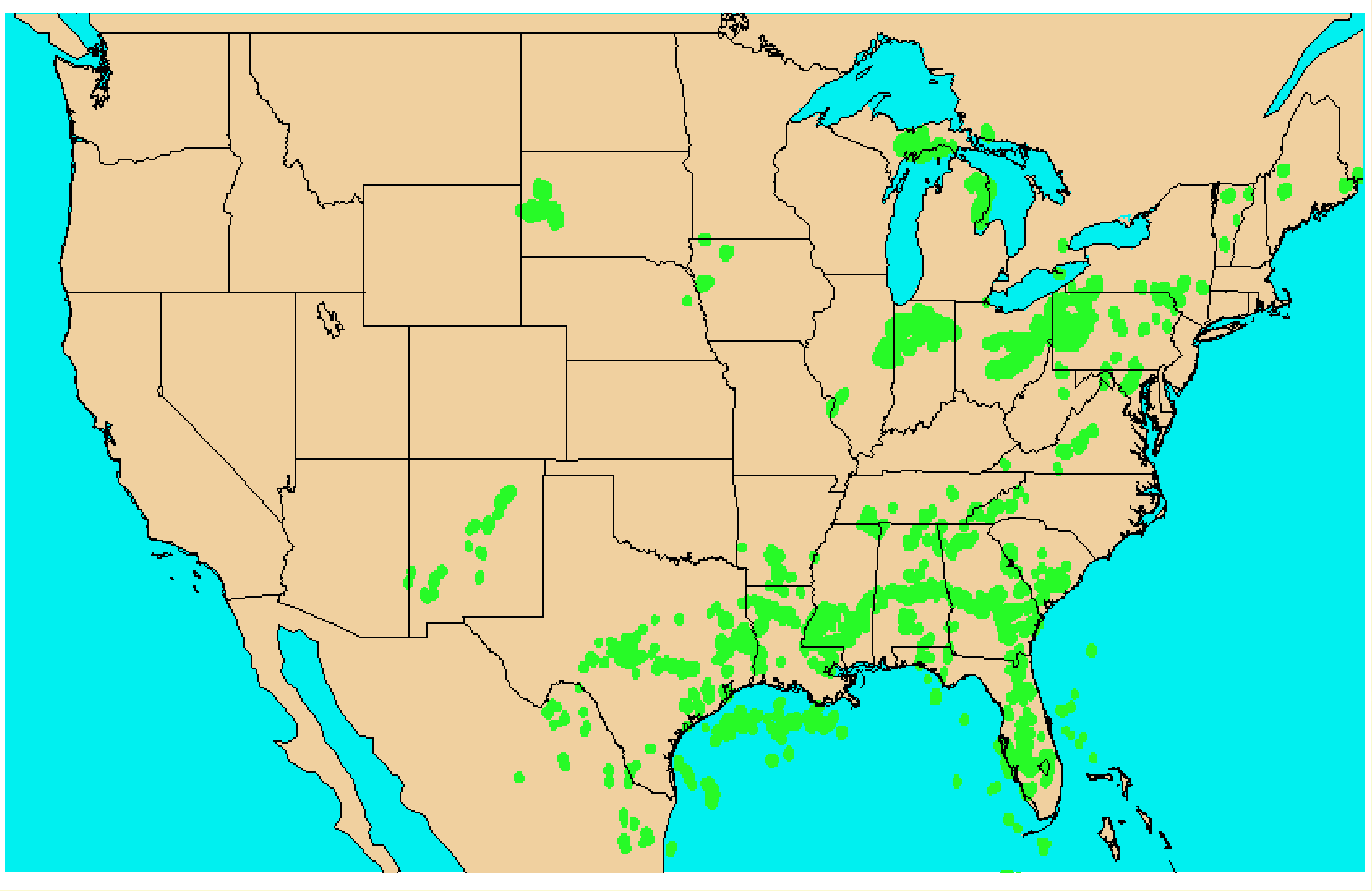
Coverage Verification Field



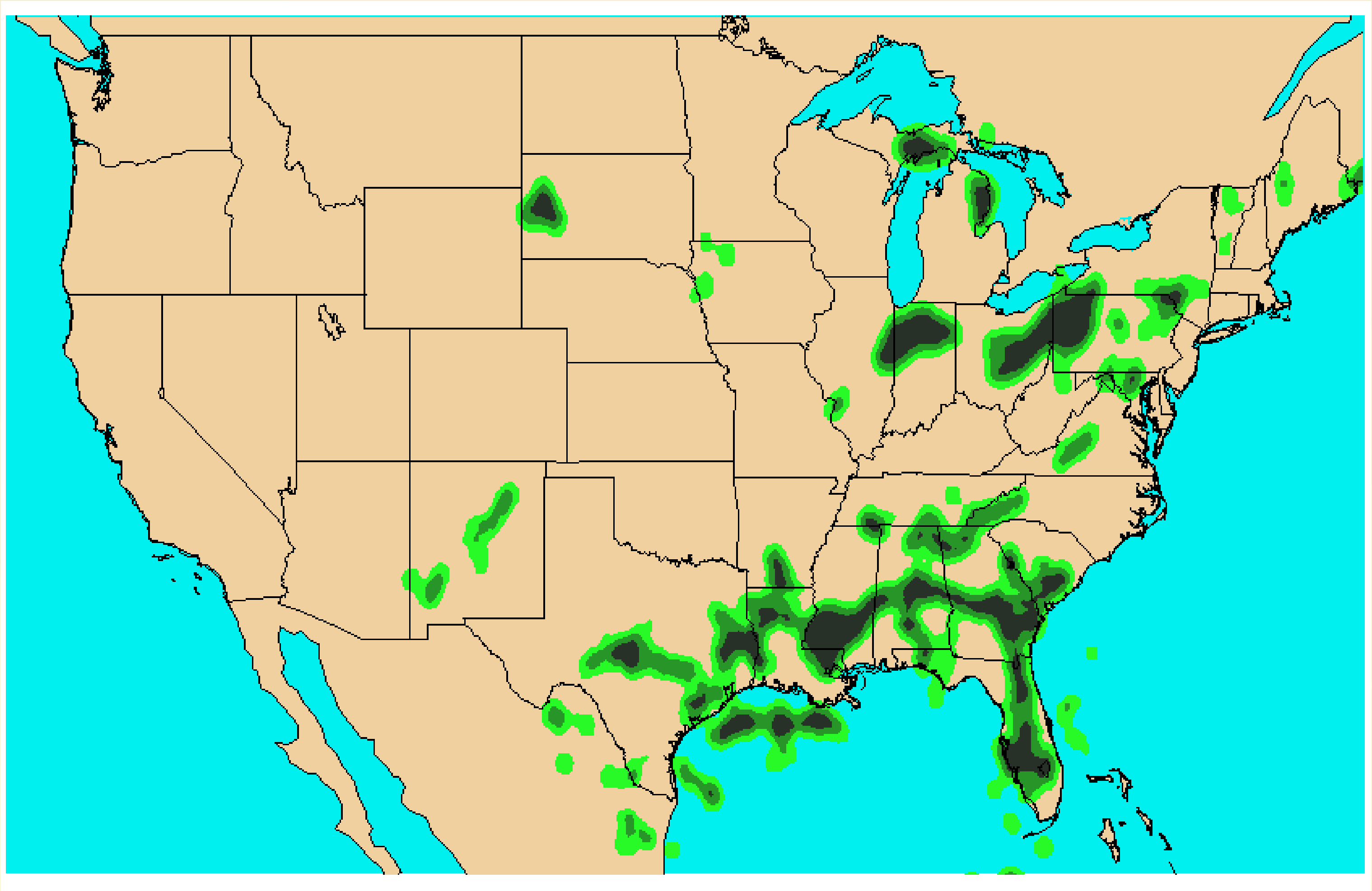
Raw Observations



Convective Constrained Area



Verification Field



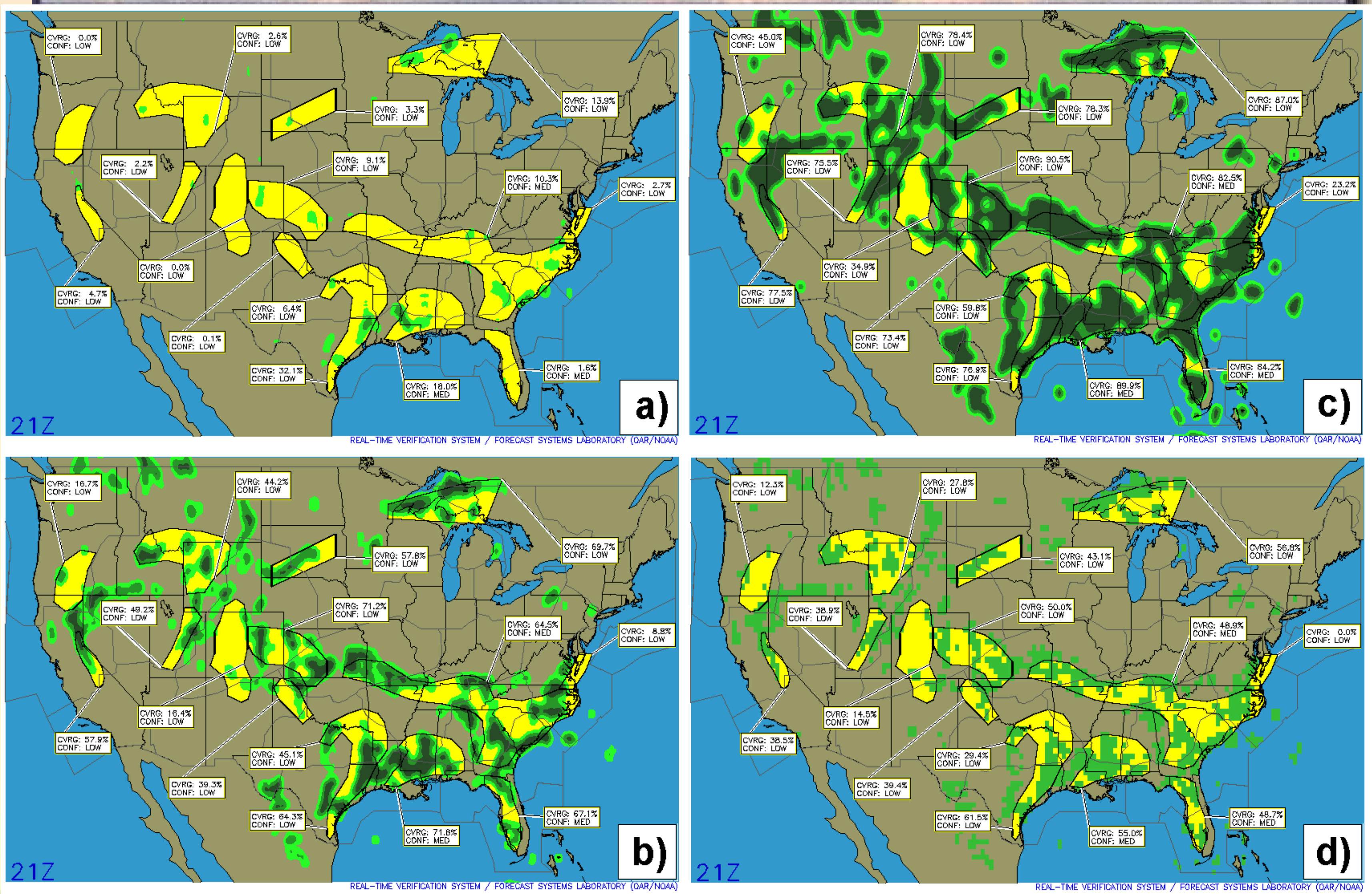
2004 Statistical Comparison

Statistic	Grid technique	CCA+Coverage
PODy	**0.31**	**0.32**
PODn	**0.98**	**0.98**
CSI	**0.18**	**0.21**
TSS	**0.29**	**0.30**
Heidke	**0.29**	**0.33**
Gilbert	**0.17**	**0.20**
Bias	**1.03**	**0.82**
% Area	**2.8**	**2.8**
Area Efficiency	**10.8**	**11.2**

Re-defining Observations

- Key issue – size of the radius used to re-define the observations

CCFP 2-h; 30 June 2004



Skill Scores

CCFP (2-h forecast) 30 June 2004, VT 2100 UTC				
Statistic	***0 nm***	***10 nm***	***20 nm***	***40-km box method***
PODy	*0.74*	*0.49*	*0.42*	*0.49*
CSI	*0.08*	*0.35*	*0.37*	*0.29*
Heidke	*0.12*	*0.40*	*0.40*	*0.34*
% Area	*18.09*	*18.09*	*18.09*	*18.10*
Bias	*8.63*	*0.90*	*0.56*	*1.21*

Summary

- Important to define observations to reflect forecast attributes and forecast use
- Difficult to definitively define how to use the observations so that they do reflect the use of the product

Future Work

- Determine how to justify a representative radius for the CCA (i.e., aircraft data)
  - Dependent upon region, time of day etc.
- Use the CCA as:
  - the basis for the object-oriented technique
  - nowcast to establish where the convection meets the forecast criteria