

INTEGRATIVE MIGRATORY BIRD MANAGEMENT ON MILITARY BASES: THE ROLE OF RADAR ORNITHOLOGY

Sidney A. Gauthreaux, Jr. and Carroll G. Belser
Department of Biological Sciences
Clemson University
Clemson, SC 29634-0314



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INTRODUCTION

- There is considerable concern over the declines in populations of migratory birds that breed in North America and winter south of the United States border.
- A considerable amount of protected habitat for migratory birds can be found on military installations.

INTRODUCTION

- The management of migratory birds on military installations must occur not only during the **breeding** and **wintering seasons** but also during **migration periods** in spring and fall.
- The emphasis of this paper is on the spring and fall migration periods when birds stop on military bases en route to their breeding and wintering grounds.

INTRODUCTION

- In this paper we discuss how our work with three radar systems can compliment migratory bird management on the ground and also contribute to mission readiness by enhancing flight safety and the avoidance of bird strikes at military installations.

INTRODUCTION

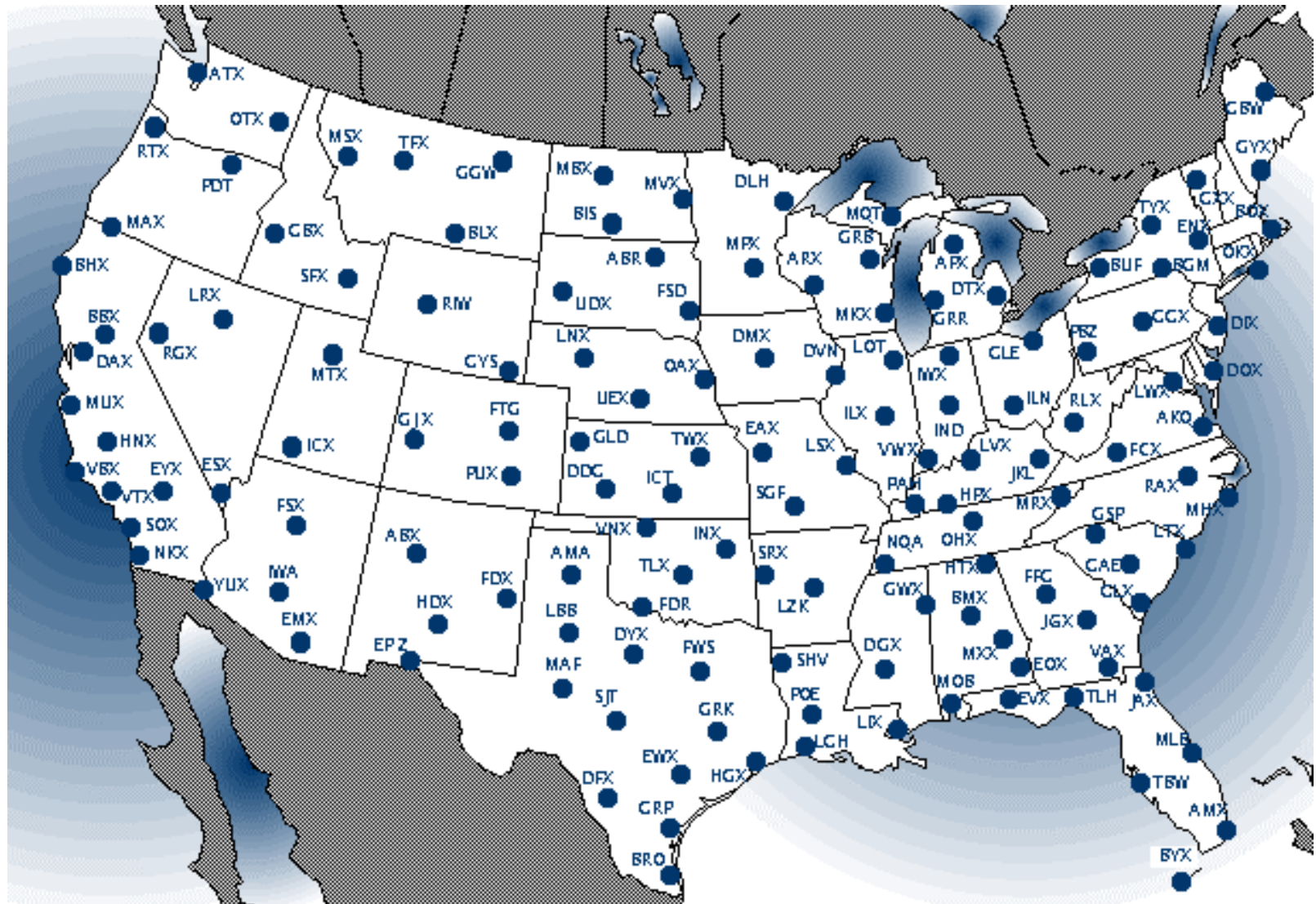
We use three different radar systems to monitor bird migration:

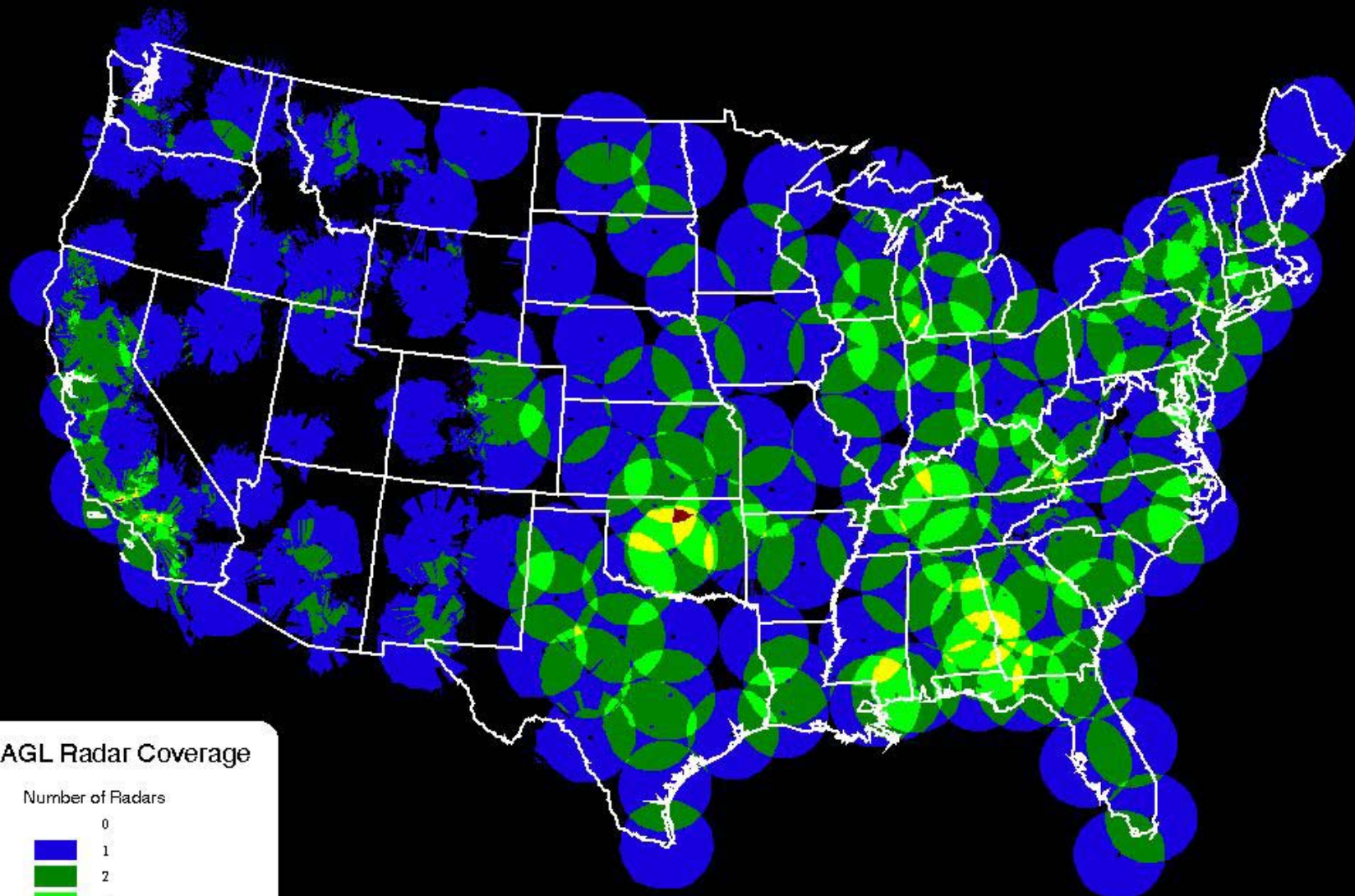
- WSR-88D (weather surveillance radar-1988, Doppler)
- A mobile high-resolution bird-detecting radar BIRD RAD
- Fixed-beam vertically pointing radar and thermal imager

APPROACH

- Begin with an examination of migratory movements at a continent-wide scale,
- progress to a smaller scale of reference-- the 240km range coverage of individual weather radars,
- move to an even smaller scale—the 6 km range coverage of BIRD RAD, and
- end at the smallest scale with an examination of the flight behavior of individual birds.

WSR-88D NATIONAL NETWORK

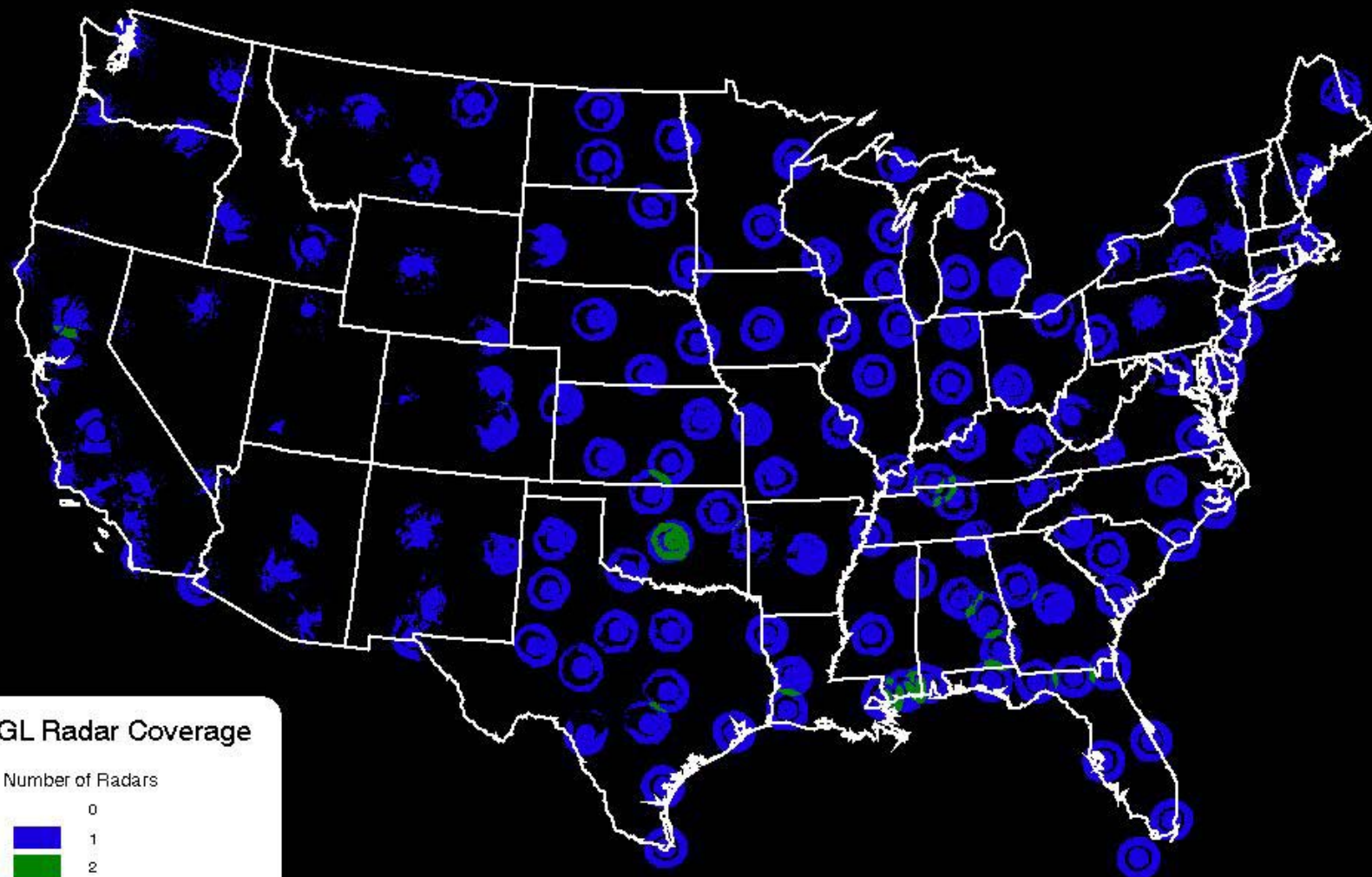




3 km AGL Radar Coverage

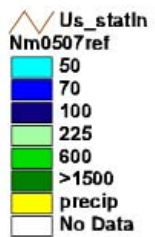
Number of Radars





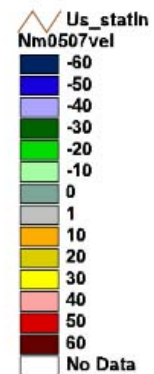
Base Reflectivity

0 1000 Kilometers



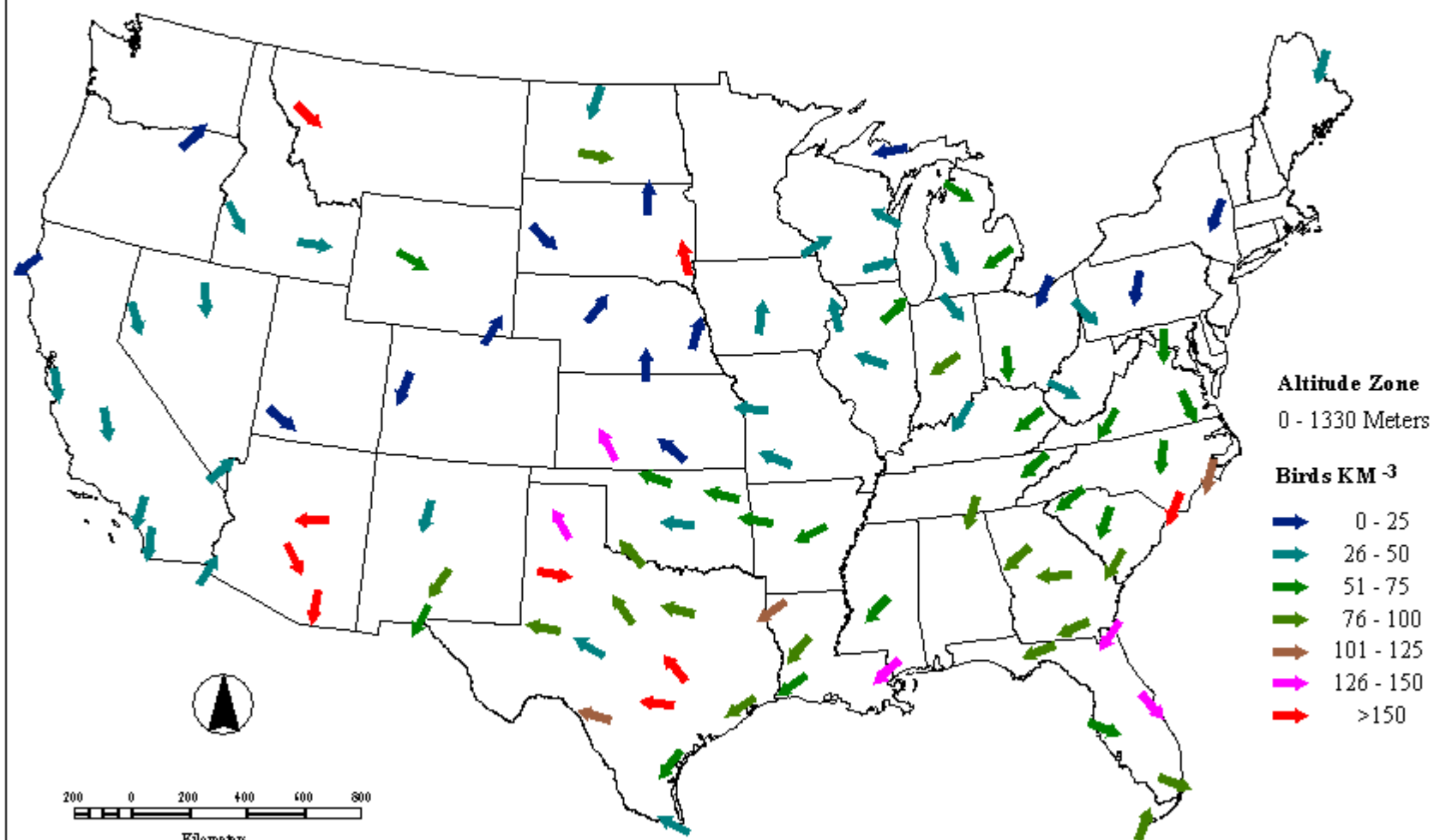
Base Velocity

0 1000 Kilometers



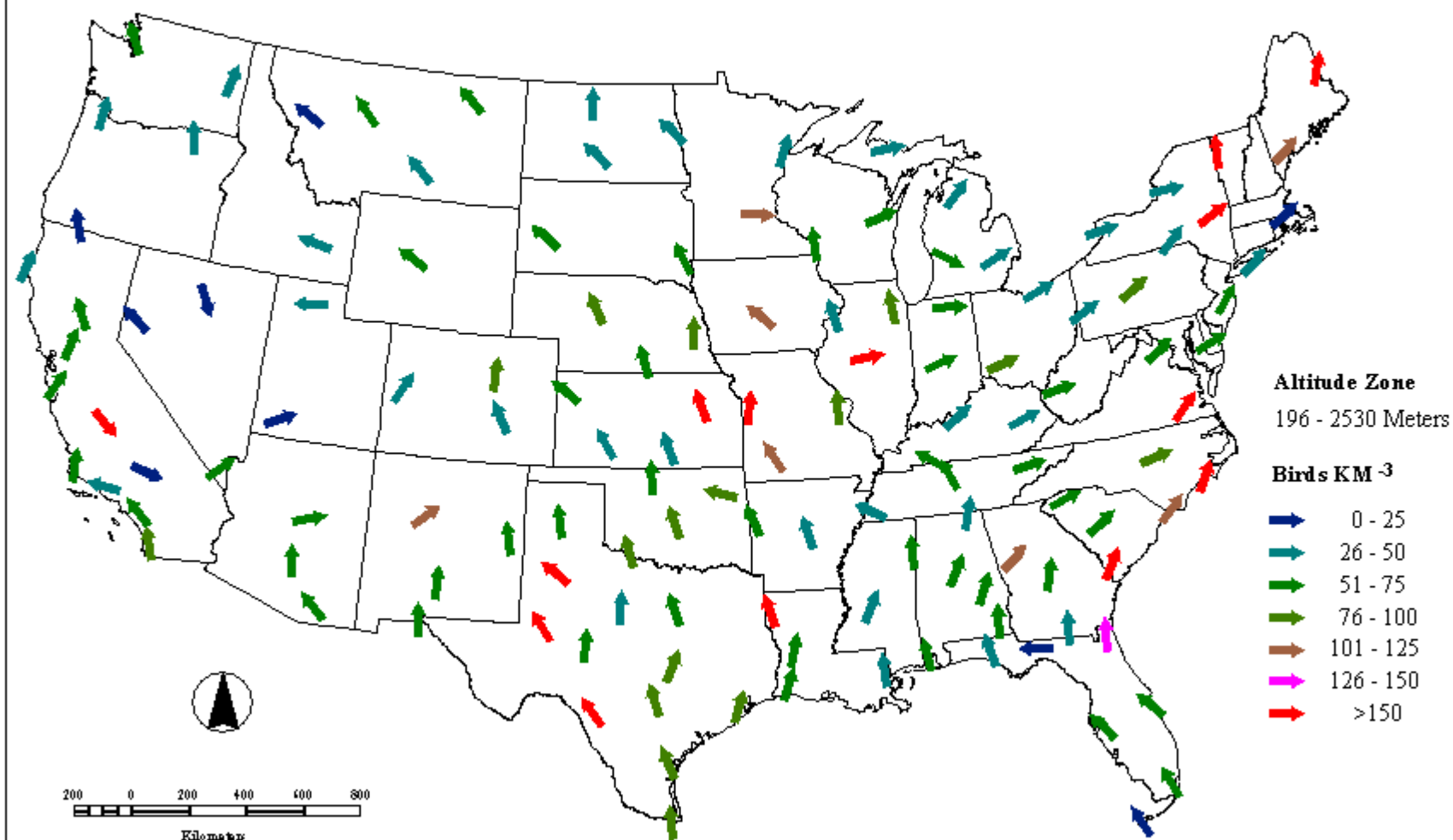
Continent - Wide Bird Migration for the 0 - 1330 Meter Altitude Zone

8/ 7/ 2004



Continent - Wide Bird Migration for the 196 - 2530 Meter Altitude Zone

5/ 10/ 2002 - 5/ 11/ 2002



Continent - Wide Migration for the Highest Two Altitude Zones

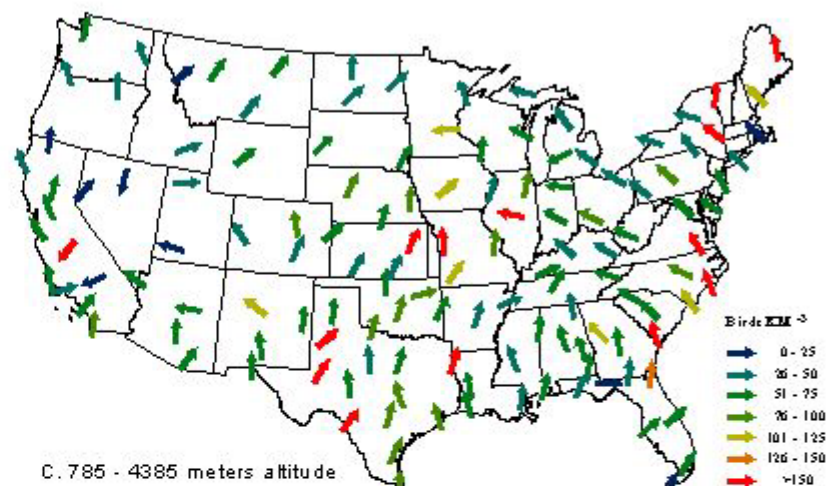
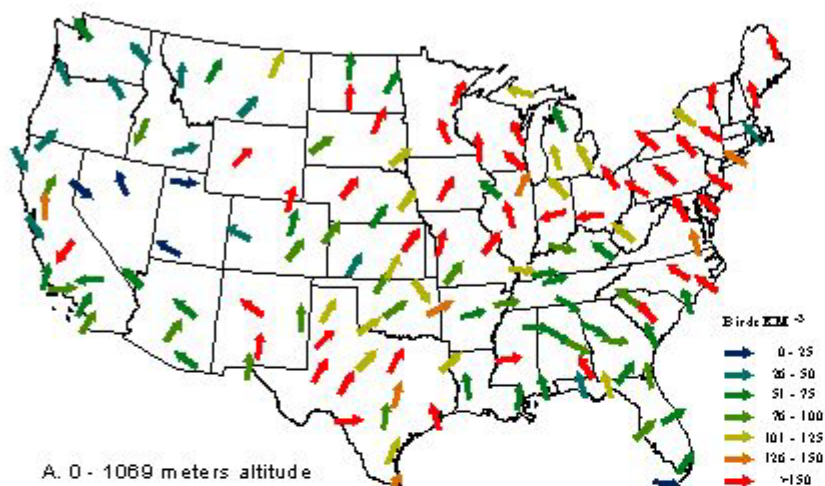
5/ 10/ 2002 - 5/ 11/ 2002



300 0 300 600 900 1200 Miles

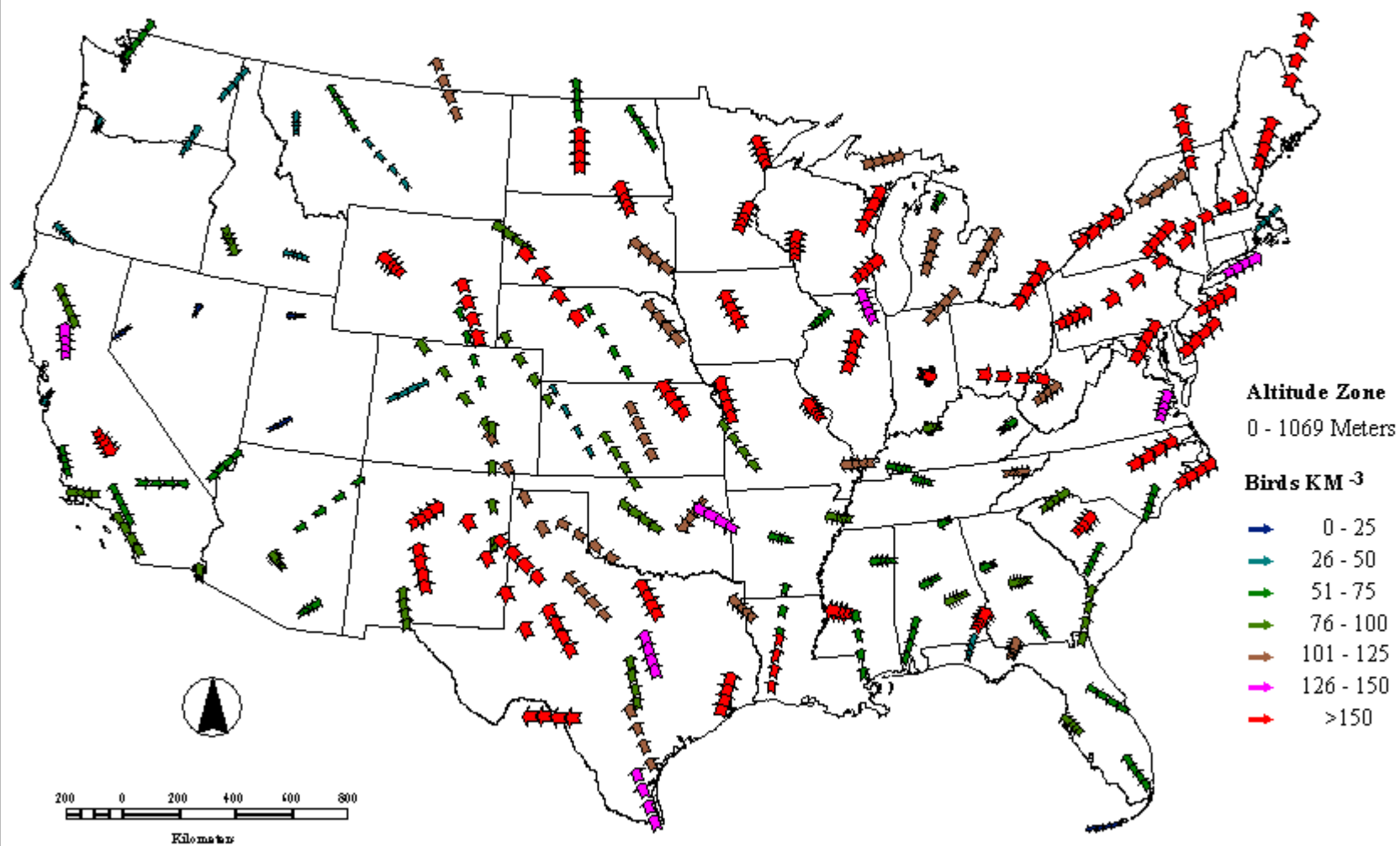
Continent - Wide Migration for the Lowest Four Altitude Zones

5/ 10/ 2002 - 5/ 11/ 2002



Continent - Wide Bird Migration for the 0 - 1069 Meter Altitude Zone

5/ 10/ 2002 - 5/ 11/ 2002



Single WSR-88D Station

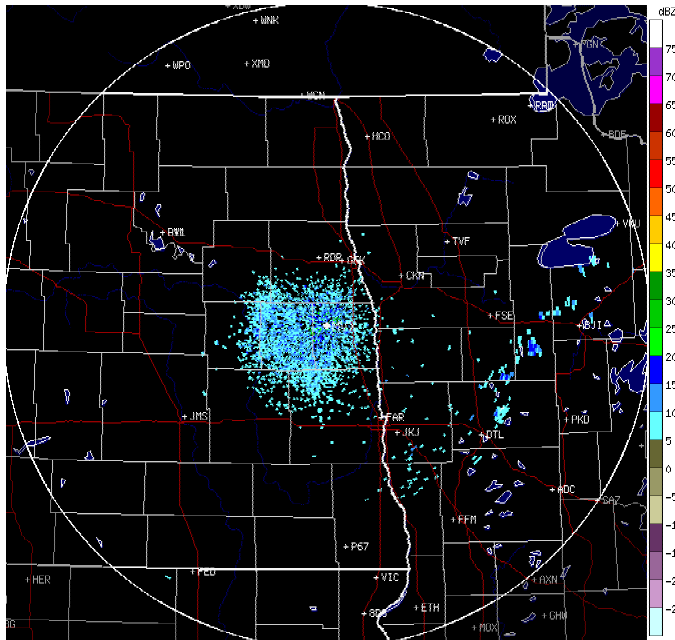
- Analysis of the relationship between weather variables (surface and aloft) and migration intensity and the development of migration forecast models based on forecast weather variables.
- These models will enable natural resource personnel to forecast the best time to census migratory birds on base.

KMVX -- Grand Forks, ND/Mayville

03:58:41 UTC Tue 04 May 2004

Base Reflectivity: 0.5 degrees, Precip Mode

(c) UCAR: <http://www.rap.ucar.edu/weather/radar/>

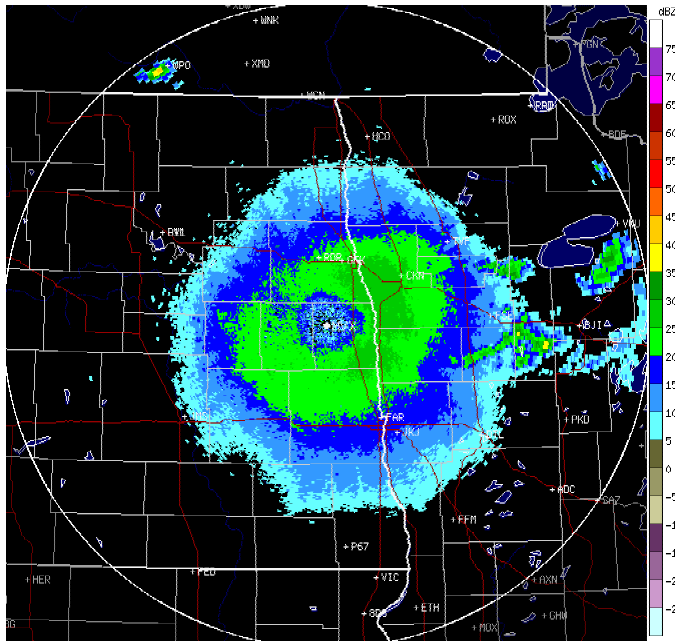


KMVX -- Grand Forks, ND/Mayville

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Base Reflectivity: 0.5 degrees, Precip Mode

(c) UCAR: <http://www.rap.ucar.edu/weather/radar/>

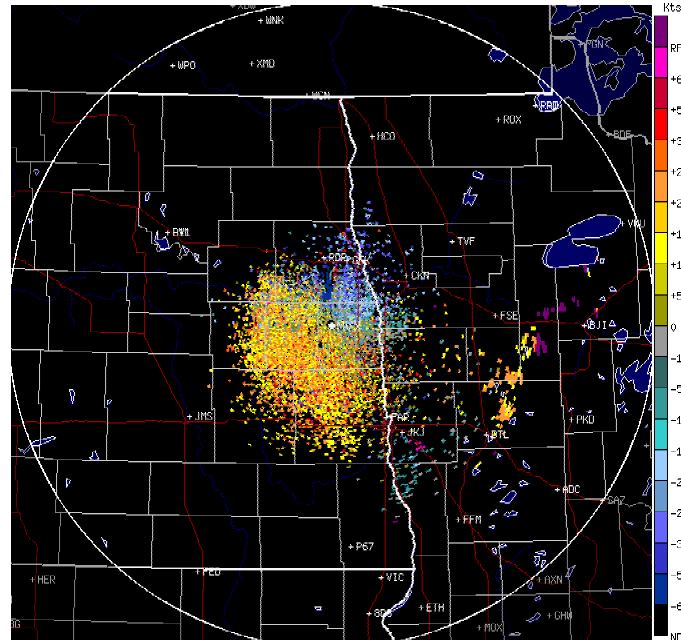


KMVX -- Grand Forks, ND/Mayville

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Base Velocity: 0.5 degrees, Precip Mode

(c) UCAR: <http://www.rap.ucar.edu/weather/radar/>

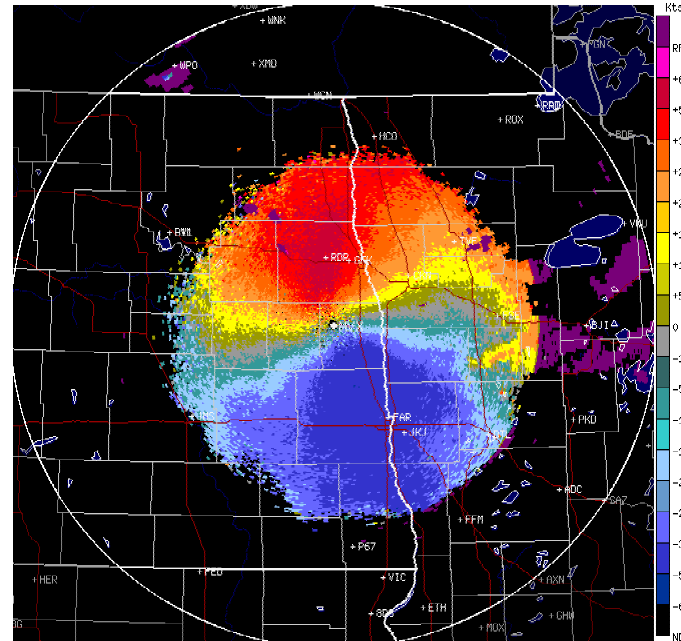


KMVX -- Grand Forks, ND/Mayville

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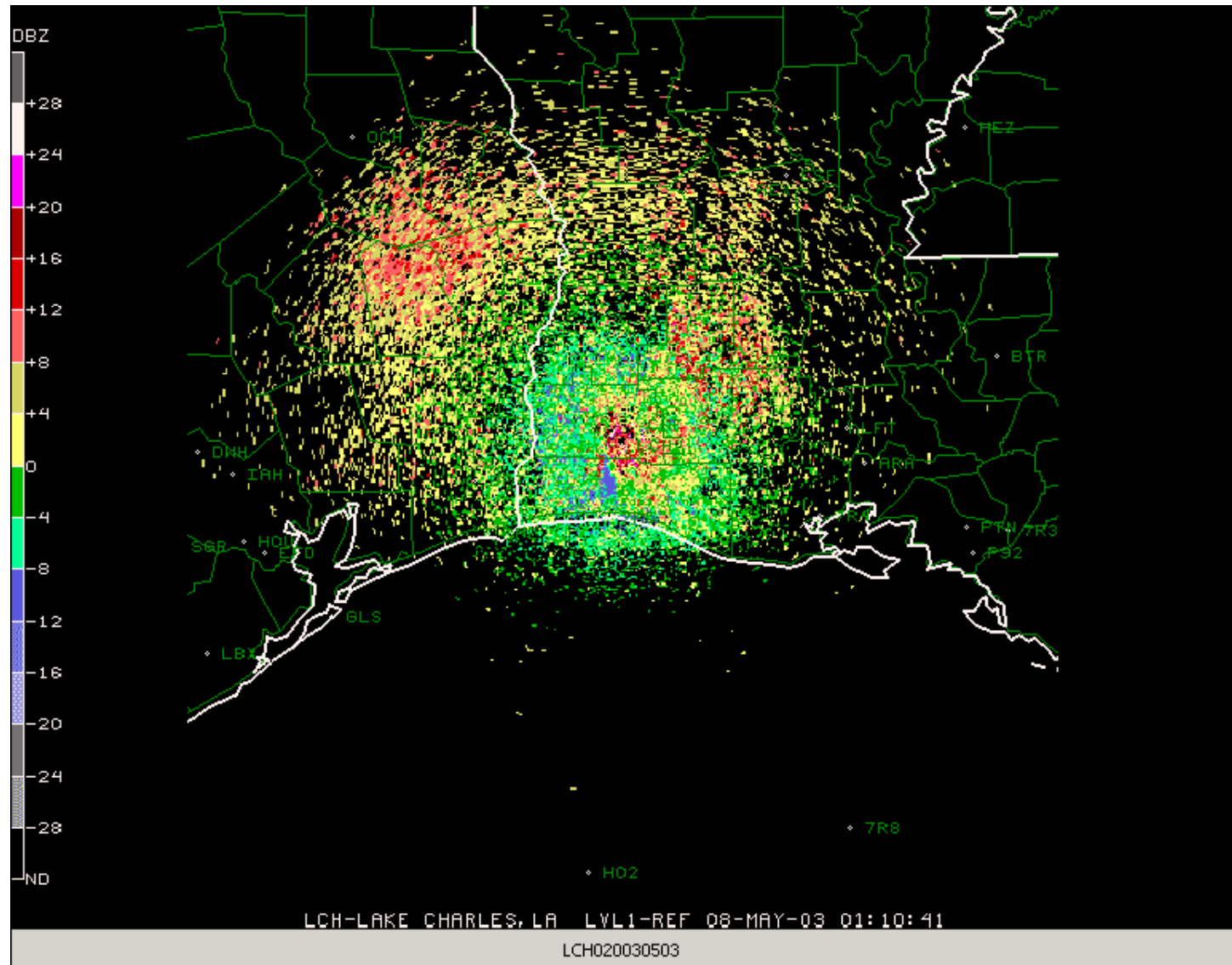
(c) UCAR: <http://www.rap.ucar.edu/weather/radar/>



Single WSR-88D Station

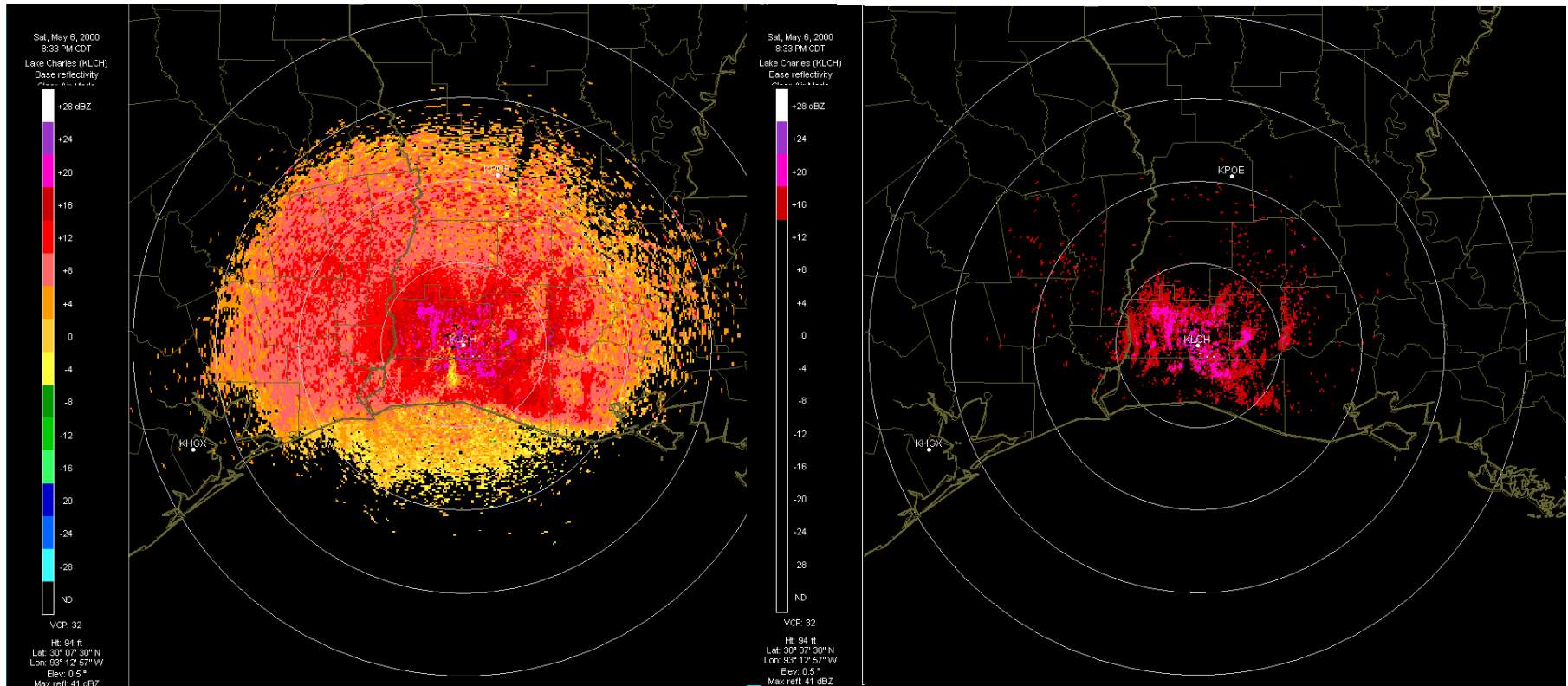
- Delimiting important migration stopover areas by detecting migrants as they depart stopover areas at the beginning of a flight segment.
- Identifying the type of habitat associated with the stopover areas based on classified satellite imagery

Single WSR-88D Station (Lake Charles, LA) Showing a Migration Exodus Event

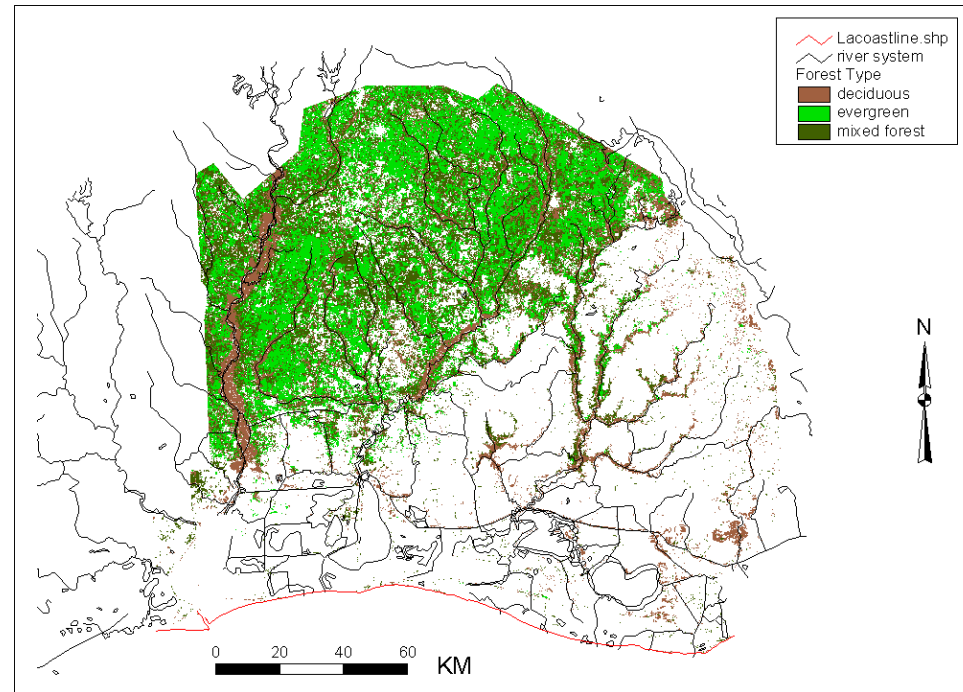


Lake Charles, LA WSR-88D Station

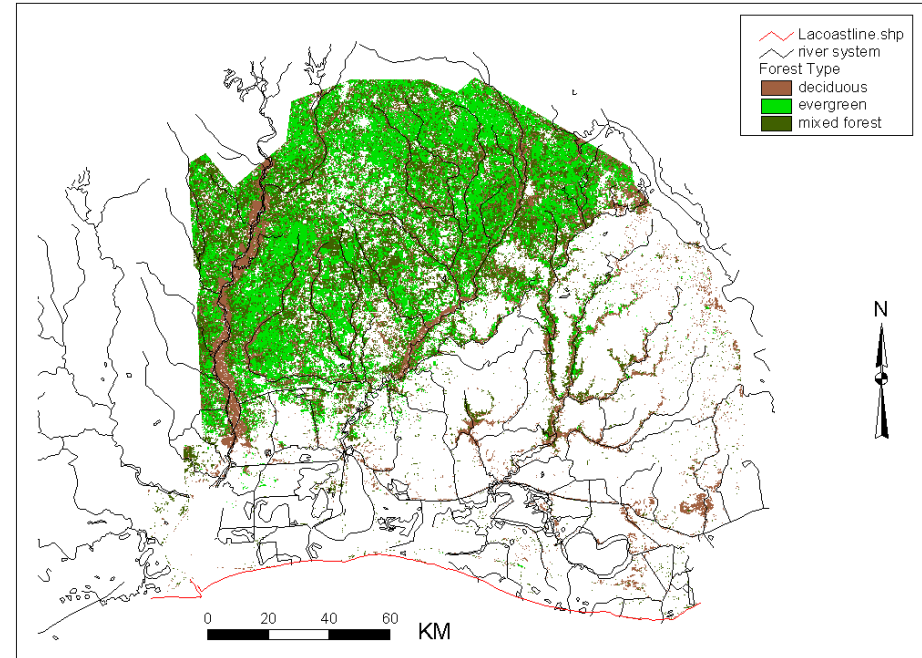
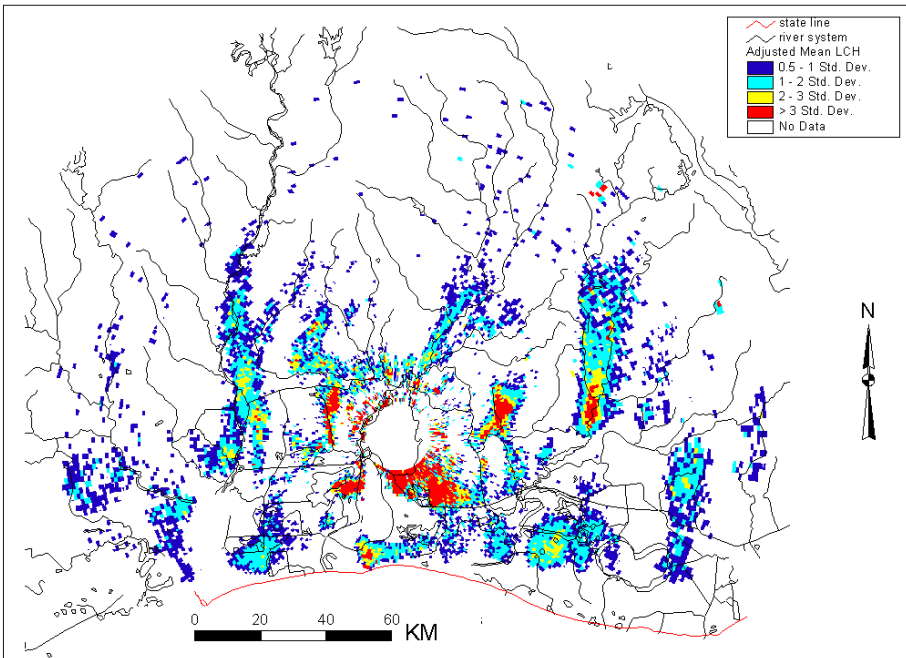
Concentrations of departing migratory birds indicate locations of important migration stopover areas



Satellite imagery and Vegetation Classification



Bird Data from Radar Compared with Forest Type from Classified Satellite Imagery



Mobile high-resolution bird-detecting radar BIRD RAD

- Furuno 50 kW marine radar
- 3 cm (X-band) wavelength
- parabolic antenna (1 meter)
- echo-trail feature
- GPS data



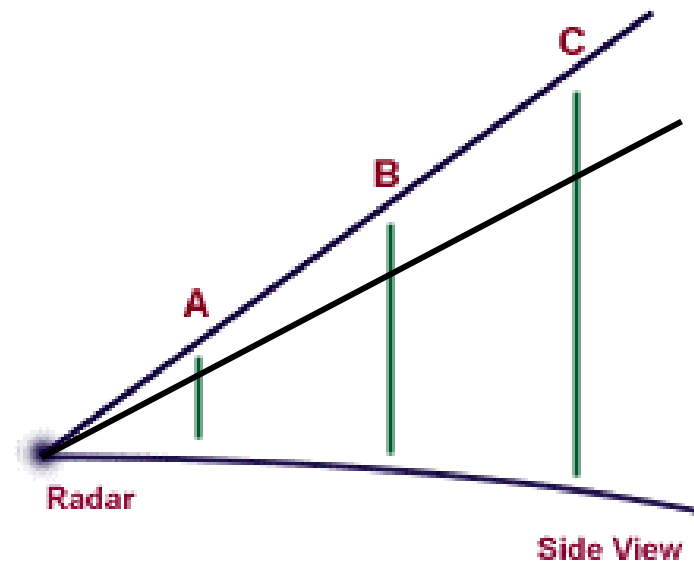
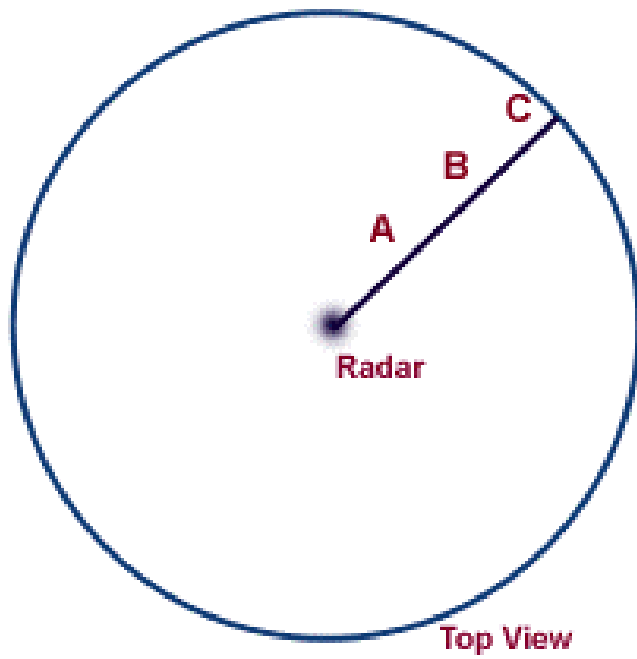
Mobile high-resolution bird-detecting radar

BIRD RAD



Mobile high-resolution bird-detecting radar BIRD RAD



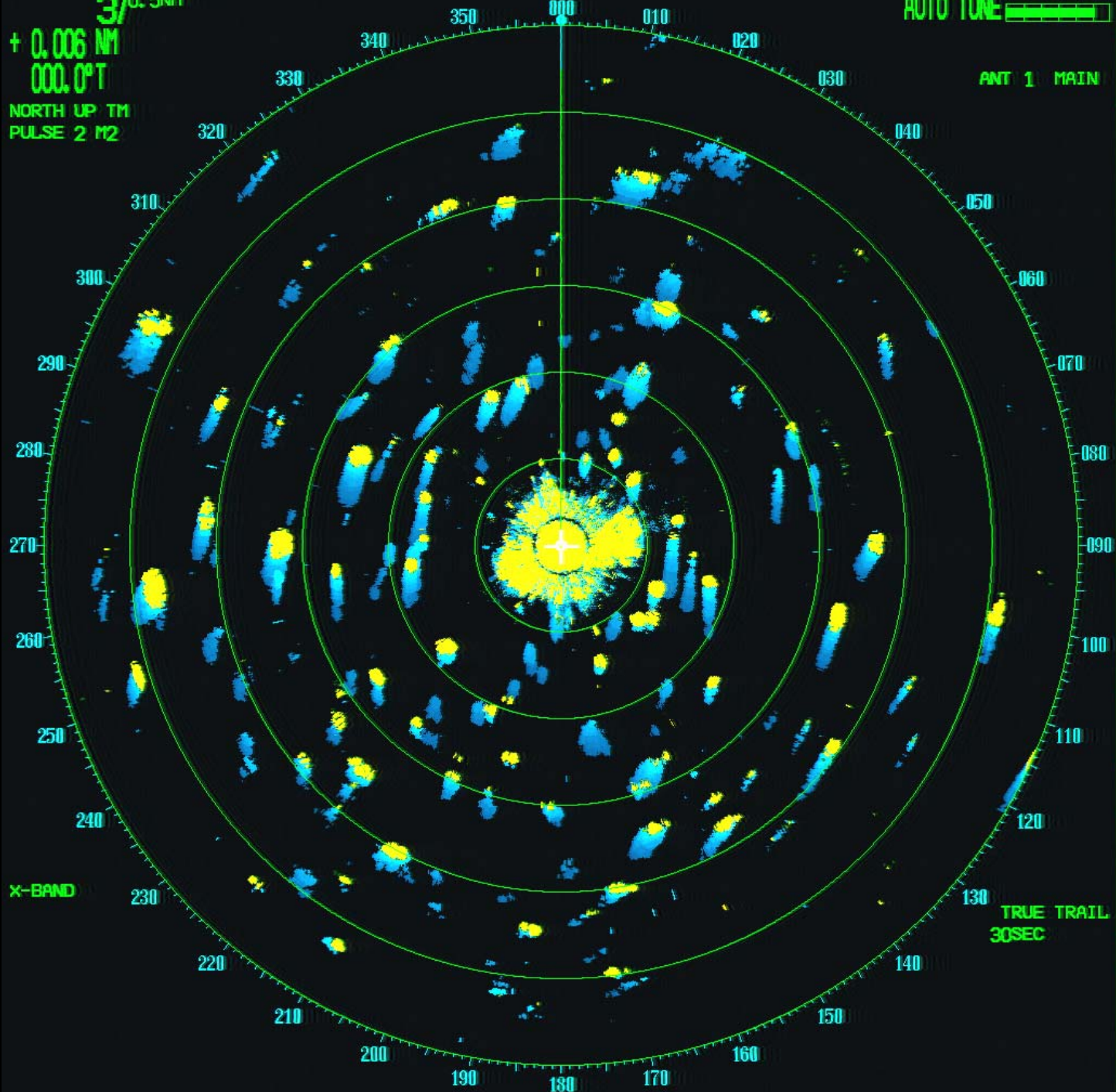


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PULSE 2 M2

AUTO TUNE 

HDG 0.0°T GYRO
SPEED 0.0KT WT LOG

EPA
TRUE VECTOR 30SEC WT



OWN SHIP [GP]
29°40.156 N
94°04.477 W
+CURSOR POSN
29°40.162 N
94°04.477 W

02-MAY-2003 00:10 UTC

3/0.5NM
+ 0.000 NM
000.0°T
NORTH UP TM
PULSE 1 M2

2ND ECHO

AUTO TUNE

HDG 0.0°T GYRO
SPEED 0.0KT WT MAN

EPA
TRUE VECTOR 30SEC WT

ANT 1 MAIN

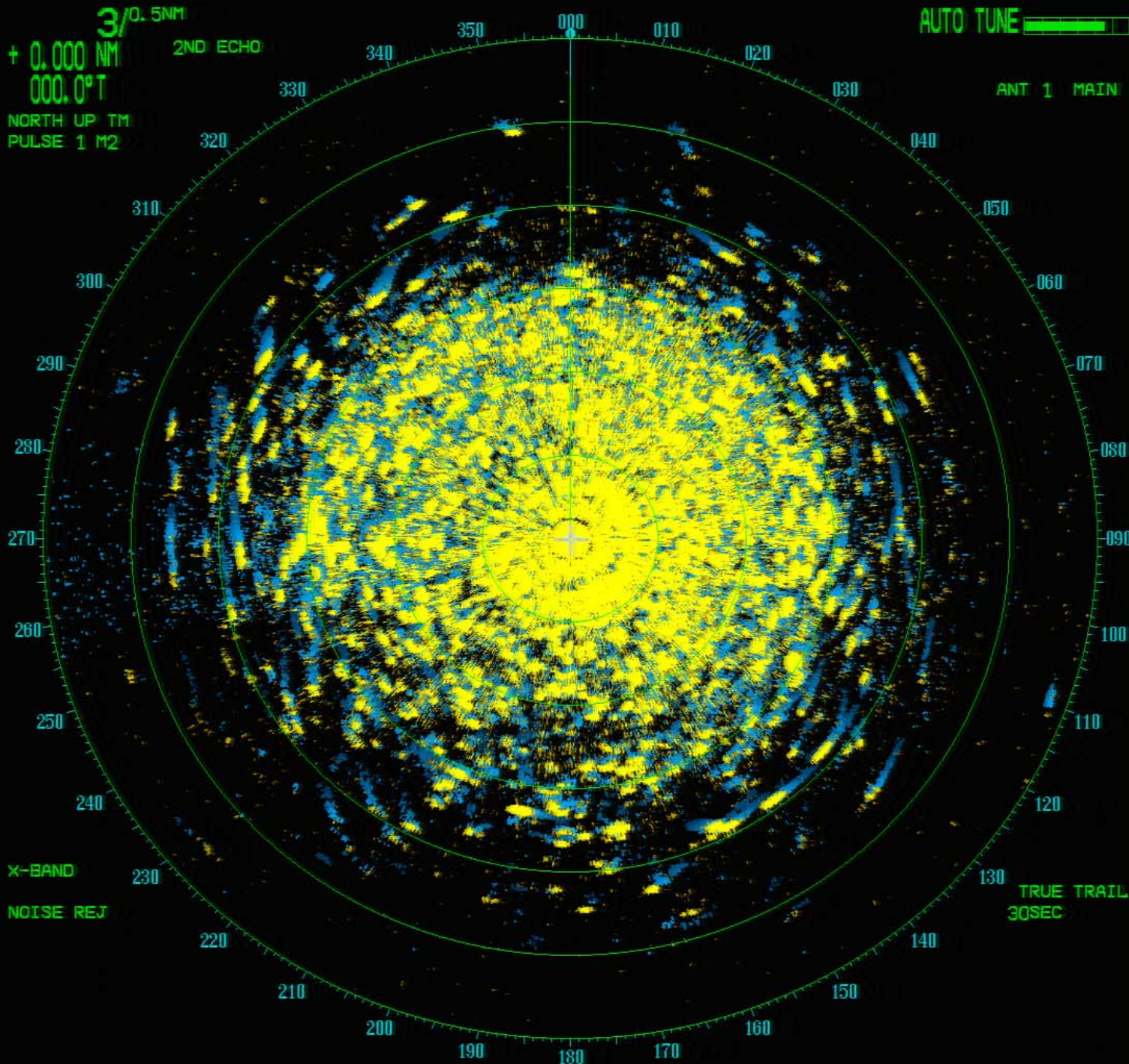
X-BAND
NOISE REJ

TRUE TRAIL
30SEC

OWN SHIP [GP]
34° 39.210 N
82° 50.247 W
+CURSOR POSN
34° 39.210 N
82° 50.247 W

13-OCT-2003 00:49 UTC

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EPFS

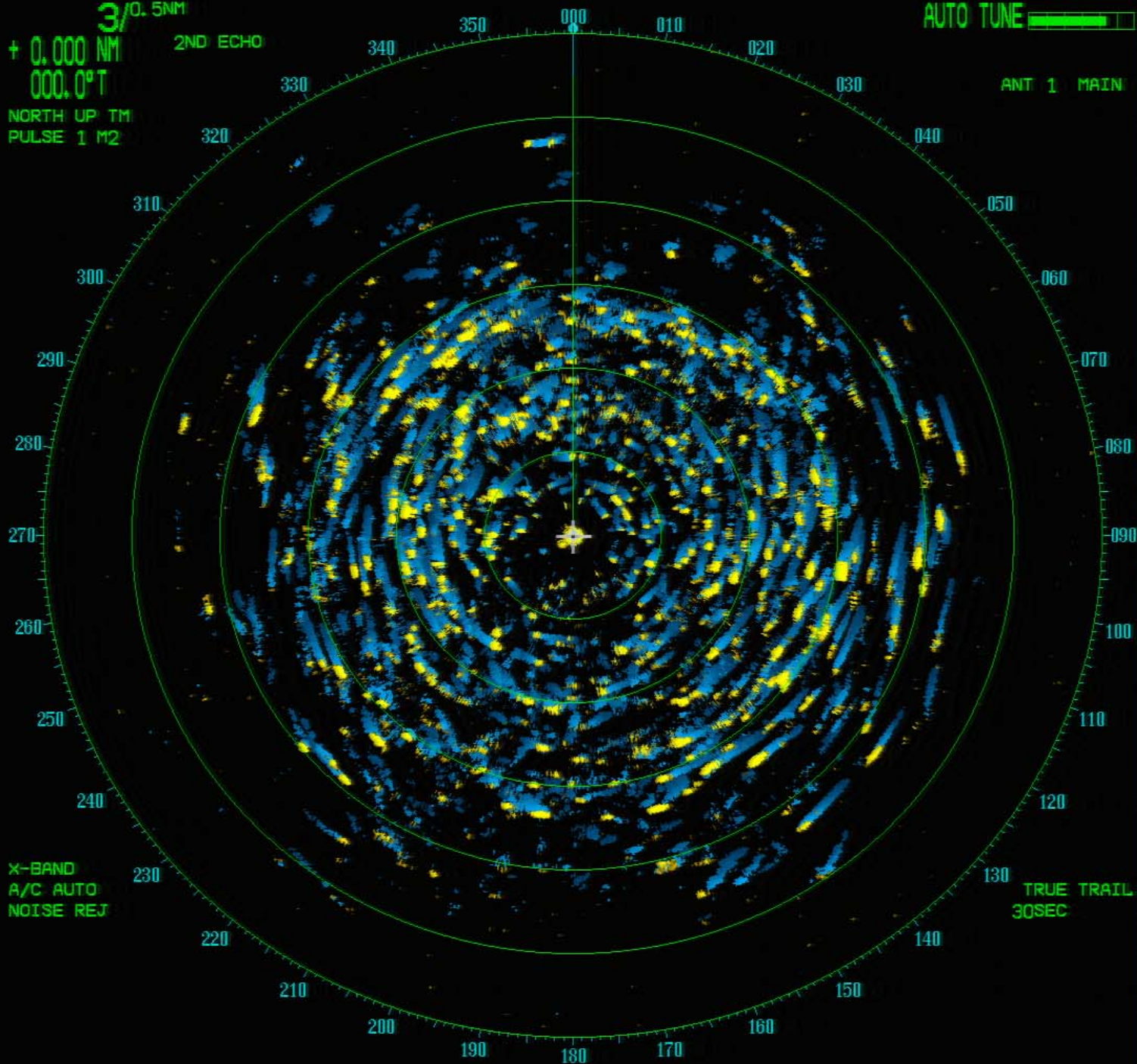


3/0.5NM
+ 0.000 NM
000.0°T
NORTH UP TM
PULSE 1 M2

AUTO TUNE

Hdg SPEED 0.0°T GYRO
0.0KT WT MAN

EPA
TRUE VECTOR 30SEC WT



TRUE TRAIL
30SEC

OWN SHIP [GP]
34°39.210 N
82°50.246 W
+CURSOR POSN
34°39.210 N
82°50.246 W

13-OCT-2003 00:52 UTC

--- SIGNAL MISSING ---
EPFS

Thermal imaging and fixed vertical-beam radar

- altitude of movement
- direction of movement
- flock size







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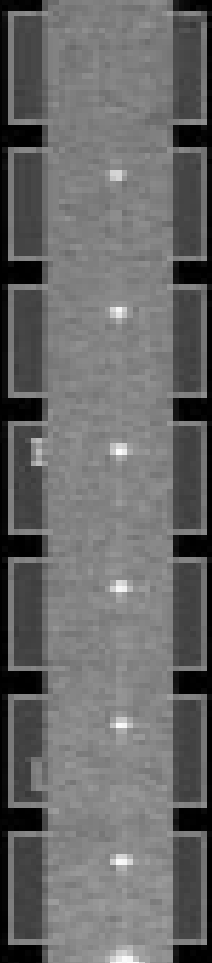
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UTDN
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Conclusions

- Radar ornithology is a valuable tool for the management of migratory birds on military installations:
 - Monitor migration at continent-wide scales
 - Delimit important migration stopover areas
 - Forecast migration intensity and facilitate on-the-ground bird identification and habitat association work
 - Enhance flight safety

Acknowledgements

- Department of Defense Legacy Resource Management Program
- Department of the Navy, Naval Facilities Engineering Command HQ
- Houston Audubon Society
- Don van Blaricom, Alan Cunningham, Kang Shou Lu, and Stephen Jones for NIDS and GIS work





<http://www.clemson.edu/birdrad>