9-1-2011

3-D Radar Sampling Methods for Ornithology and Wildlife Management

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Bird Strike Committee USA Meeting

7:00 AM – 9:00 AM Oakes South Room
John E. Ostrom

Session 3: Radar Part 1

9:00 AM – 10:30 AM
Moderator: Scott Snow

Bird Strike Prevention version 3.0

9:00 AM
Arie Dekker

Traditionally, bird strike prevention involves the removal of birds from airfields, using a variety of scaring techniques. In time this has been supplemented with habitat management as a more preventive method. These approaches can be considered as bird strike prevention version 1.0 and 2.0. Bird strike statistics indicate that a minimum ratio is reached. For a further decrease the traditional measures have to be complemented with attention towards birds overflying airports. This implicates that apart from legal and ethical issues much more knowledge on bird mobility needs to be acquired. Satellite tracking of birds show that home ranges not only vary between seasons but also between and within species. In a number of examples we show that home ranges vary enormously. Breeding Buzzards on Leeuwarden airbase occupy an areas varying from 25 to 70 Hectares while non breeding Buzzards in the same season wander distances of more than 200 kilometres. A breeding Lesser Black backed Gull travelled from the colony in the Waddensea to Amsterdam (100 Km) and back in a single day. Because of the complicated mobility and often extreme large source areas of flying birds, large scale lethal methods are likely to be both ineffective and inefficient in dealing with overflying birds. Instead, aircraft avoiding flocks of flying birds is a promising alternative strategy. Effort should be put on the development of concepts of operations that include the use of avian radars in a real time setting.

Update on the Avian Radar Performance Assessment Program

9:30 AM
Edwin E. Herricks

In 1999 the Federal Aviation Administration initiated a program with the University of Illinois Center of Excellence for Airport Technology to assess new safety technologies for commercial airports. The emphasis in that program shifted to the assessment of commercially available sensors and systems in 2006 resulting in the deployment of avian radar systems at the Naval Air Station Whidbey Island, Seattle Tacoma International Airport, Vancouver International Airport, O'Hare International Airport, John F. Kennedy International Airport, and Dallas Fort Worth International Airport. In the assessment, multiple sensors in S-band, and X-band, including magnetron and solid state marine radars, and multiple configurations of avian radar systems, including advanced L-band and Frequency Modulated Continuous Wave radars have been assessed. The program has operated avian radars continuously for up to 4 ½ years, amassed over 6 tera bytes of data, and has supported the publication of an Advisory Circular (AC 150-5220-25) in November 2010. Issues of deployment, operations and maintenance, data management, and integration into airport operations have been assessed. This paper will review the status of the avian radar performance assessment program and provide examples of applications in wildlife management at airports and the use of avian radar data in operations at civil airports.

3-D Radar Sampling Methods for Ornithology and Wildlife Management

10:00 AM
Robert C. Beason

Ornithologists and wildlife biologists have used visual and auditory sampling techniques to monitor the composition of avian communities for decades, even centuries. These sampling techniques have been standardized to compare among different communities and geographical locations. From these temporally and spatially restricted samples, biologists have extrapolated to local avian communities, although not all species, individuals, or behaviours were detected and recorded. Avian radar complements the limitations of visual and auditory sampling with greater temporal and geographic sample sizes. Radar operates continuously and has a greater detection range. Its sampling volume is dictated by the coverage pattern projected by its antenna as it scans. Dish antennas provide 3-D data and standard array antennas provide 2-D data in either a horizontal or vertical plane within the volume of interest. We present new radar sampling methods that provide 3-D data of birds within a full cylinder of coverage, with typical dimensions of 6-mile radius, 10,000-ft tall representing a volume of interest at most airfields. Like the standardized visual and auditory sampling methods, these methods allow users to make comparisons among samples from different locations, systems with different configurations, and with visual sampling techniques. These methods provide rich and complete datasets of avian behaviour that can be presented visually in a grid format for conceptual overview or numerically for statistical analyses. Examples include densities (birds/sq mile) in selected habitats or Traffic Rates of migration. These analyses enhance a biologist's ability to manage birds within the landscape of his/her responsibility.

Coffee Break

10:30 AM – 11:00 AM Oakes North Room & Foyer

3-D Radar Sampling Methods for Ornithology and Wildlife Management

Bird Strike North America 2011

Niagara Falls, Canada, 12-15 September 2011

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Avian Community Sampling

- Visual techniques
- Auditory techniques
- Migration monitoring

Visual Sampling Techniques

- Fixed radius, fixed time sampling
- Fixed radius, variable time sampling
- Unlimited radius, variable time sampling
- Incidental observations
- Trained observer can identify species

Auditory Sampling

- Supplement to visual sampling techniques
- Aid to species identification

- Used in conjunction with migration sampling for species identificaiton

Migration Sampling Techniques

- Visual techniques
  - Moon watching
  - Ceilometer watching
- Auditory techniques
  - Record & review nocturnal calls
  - Automatic identification & logging
- Radar techniques
  - WSR-88D
  - Avian radars

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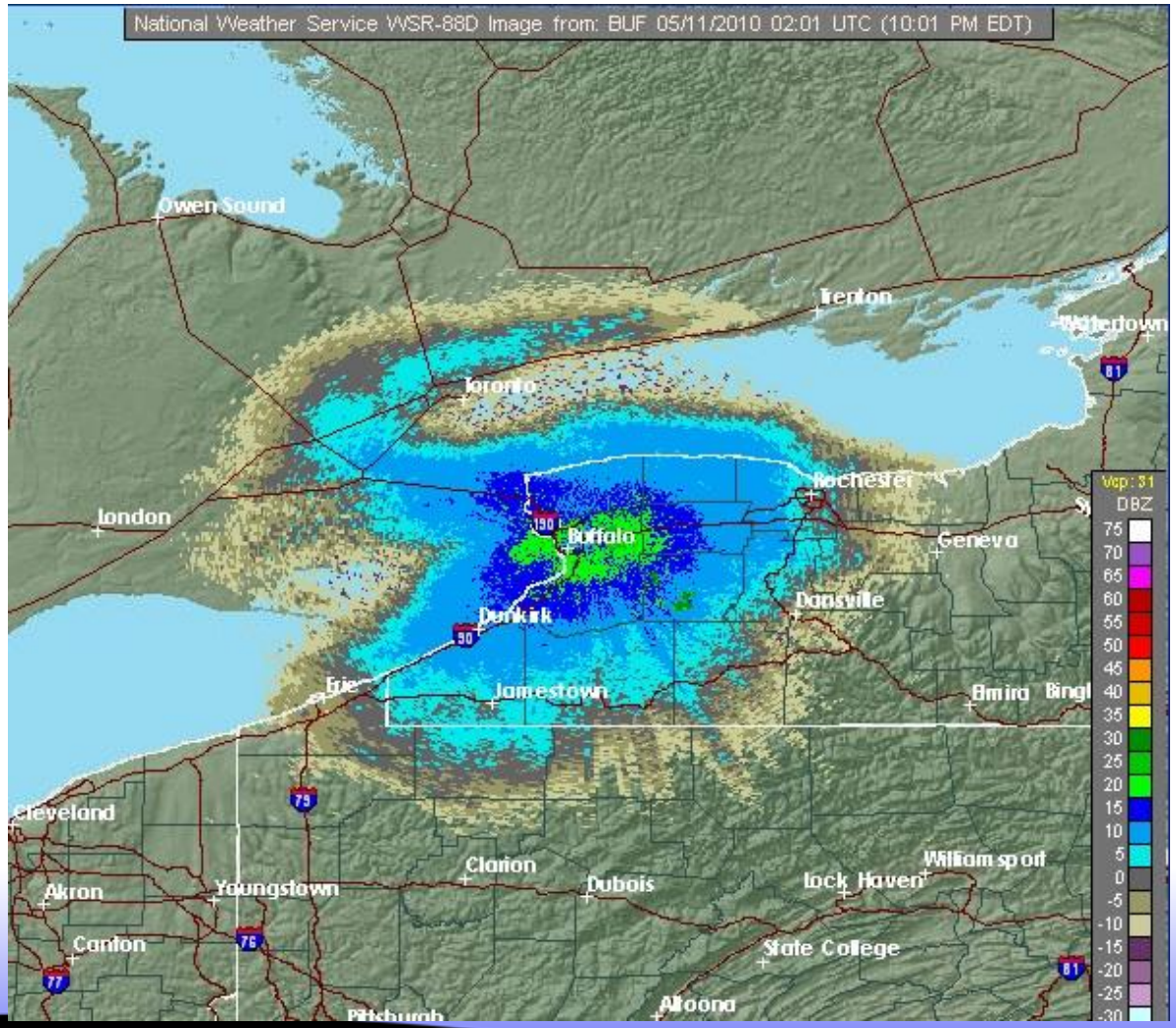
Wildlife Hazards

- White-tailed deer
- Coyote
- Canada goose
- Waterfowl
- Gulls
- Herons & egrets

Buffalo Weather Radar



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Avian Radar Complements Visual & Auditory Techniques

- Continuously samples avian community
- Detection at greater distances
- Detect and monitor nocturnal migration
- Automatically record avian behaviors

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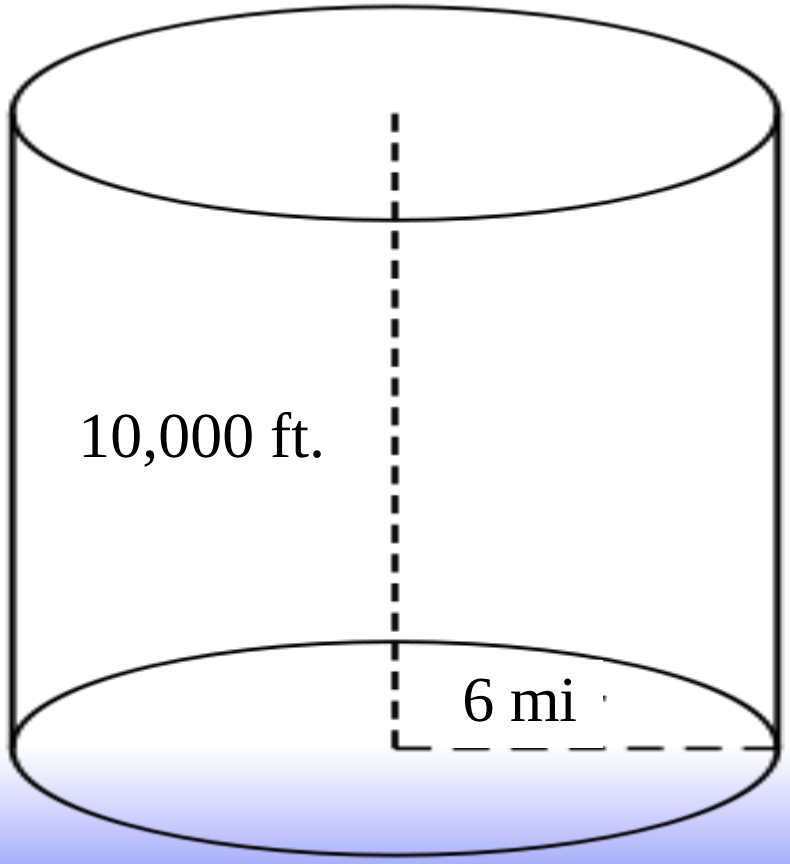
Visual & Auditory Techniques Complement Avian Radar

- Identification to species
- Monitor birds sitting on the ground or in vegetation
- Detect and monitor birds flying low to the ground

3D Sampling Radar



- Greater sample size
- Better data on altitudinal distribution
- More complete knowledge of sizes
- Cylindrical coverage
- Programmable scan patterns

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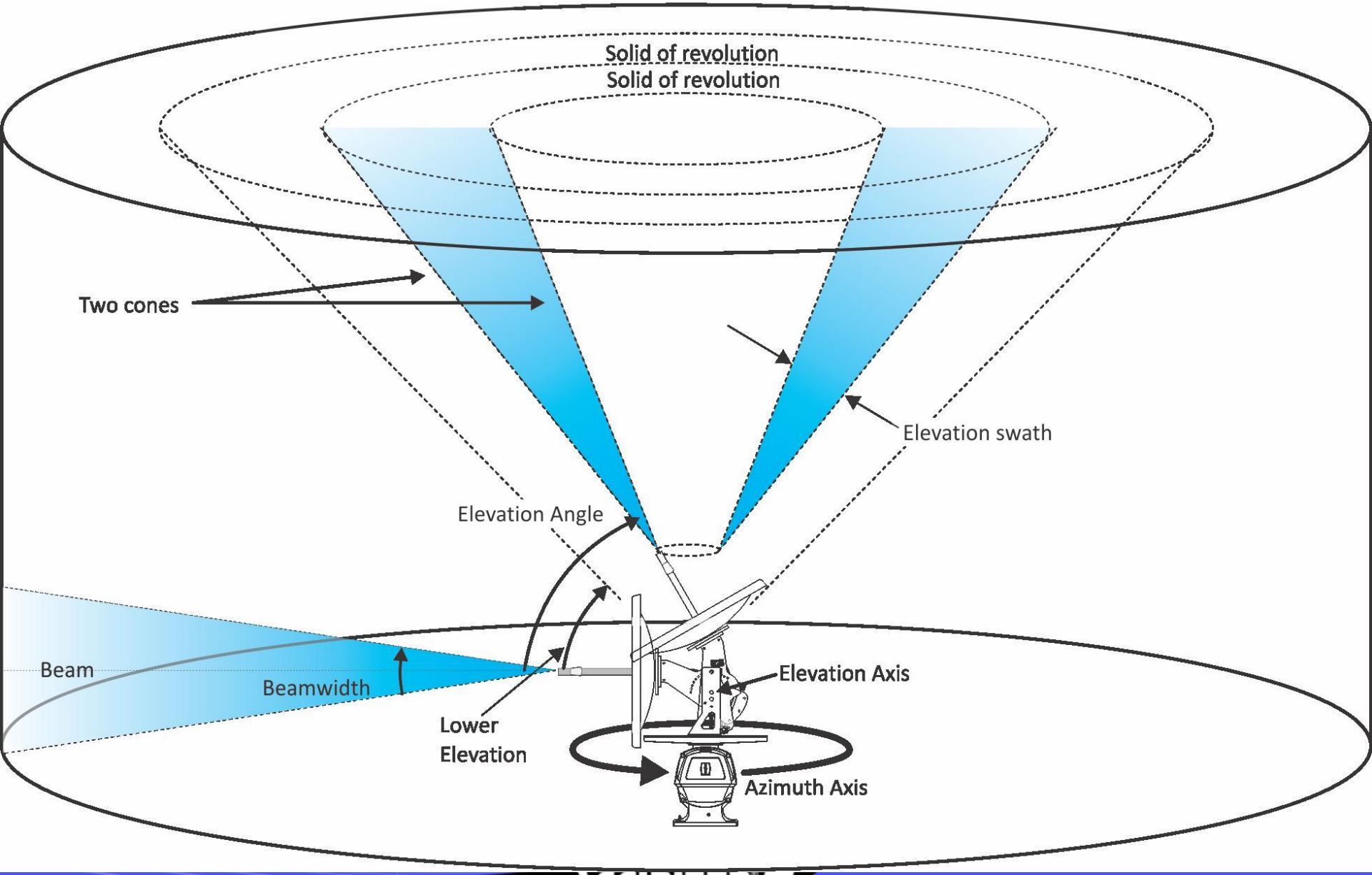

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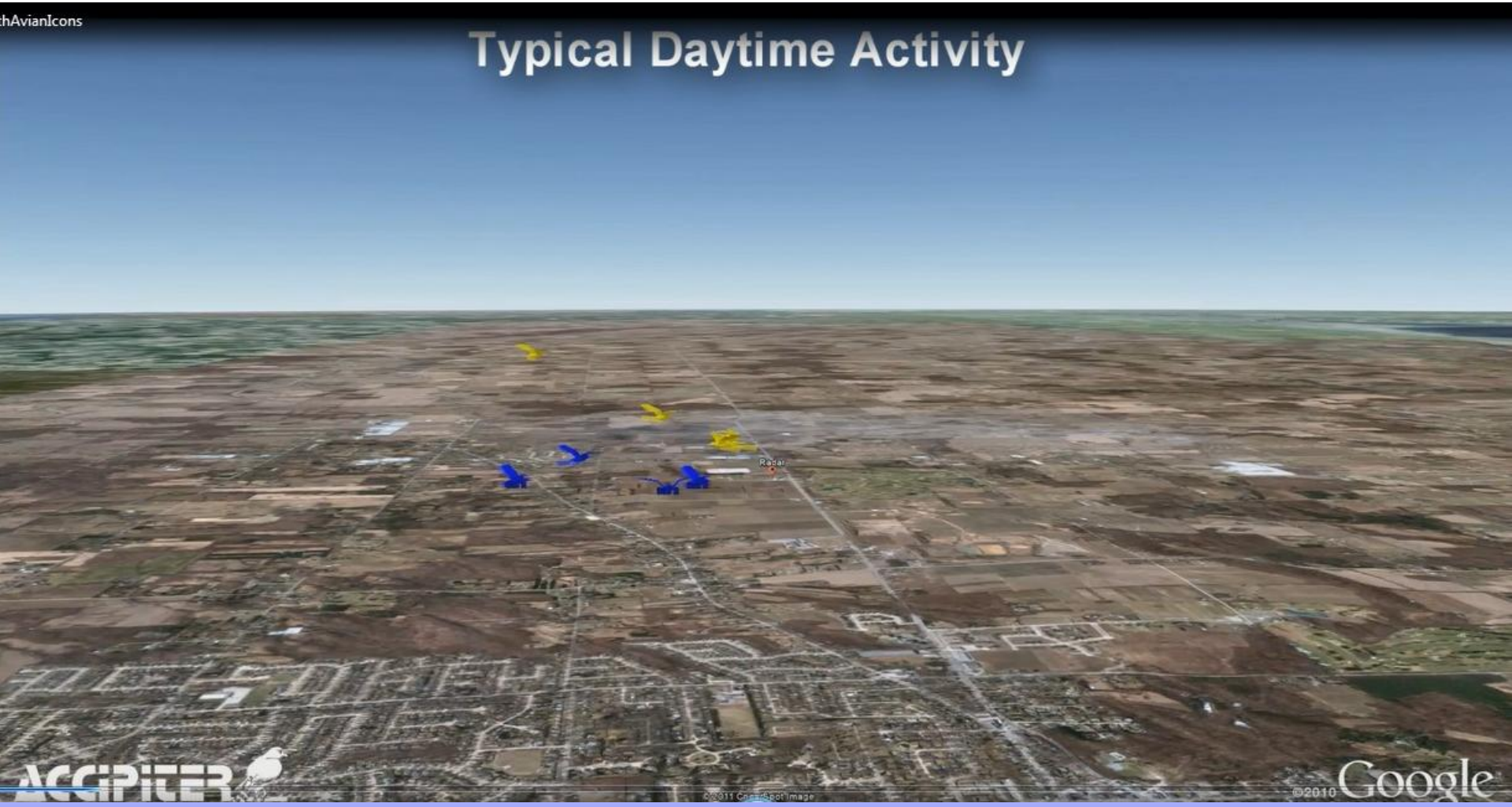
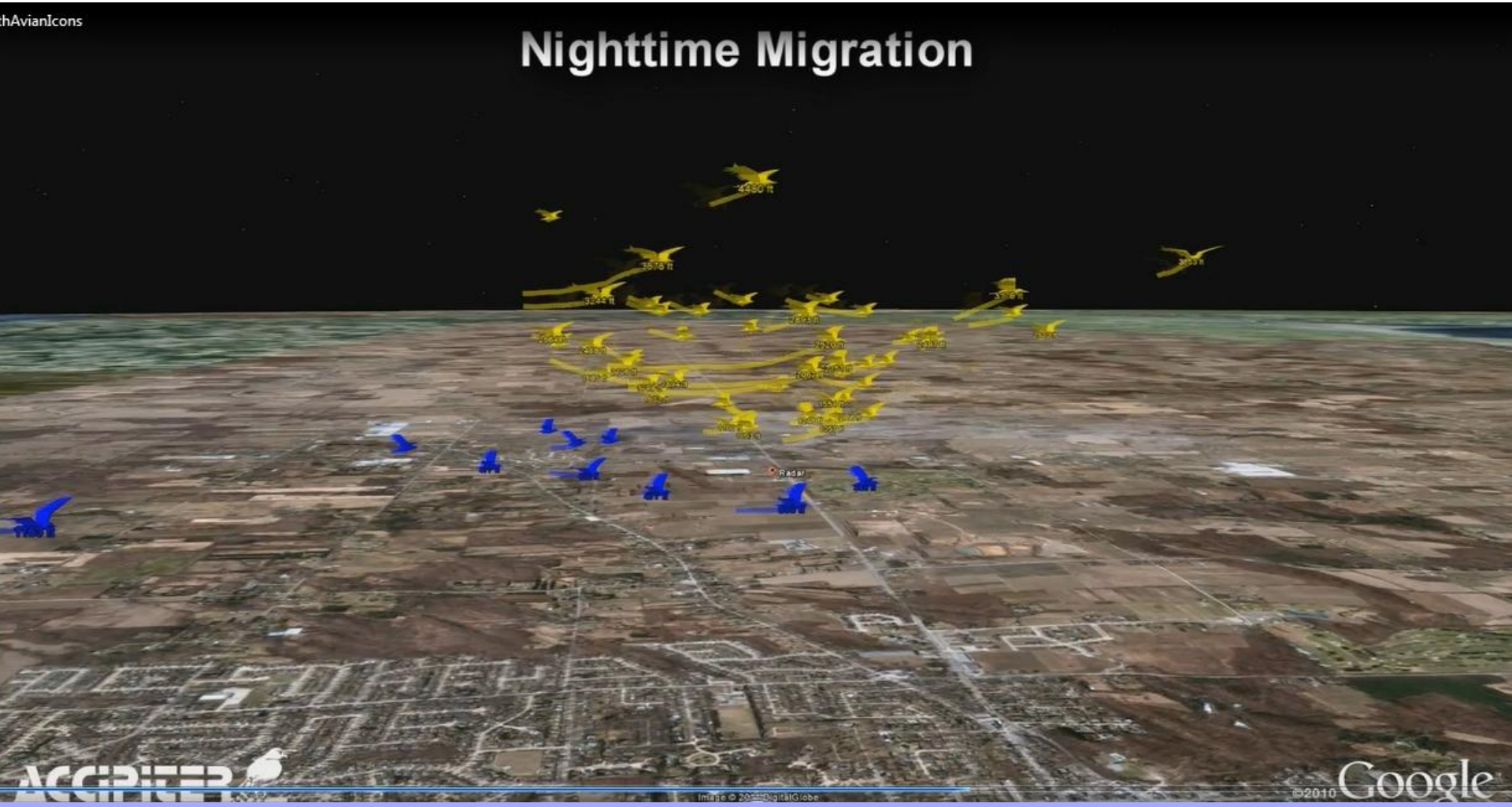
3D Sampling Example

- Dual-axis scanning antenna
- 4˚ conical beam pattern
- 360˚ azimuth scanning
- Elevation scanning from 7˚ to 47˚ vertically
- 10 programmed elevation angles, 3 minute sampling at each elevation

3D Tracks


hAvianIcons
Typical Daytime Activity
Radar
ACCIPITER
Google

3D Tracks


thAvianIcons
Nighttime Migration
Radar
ACCIPITER
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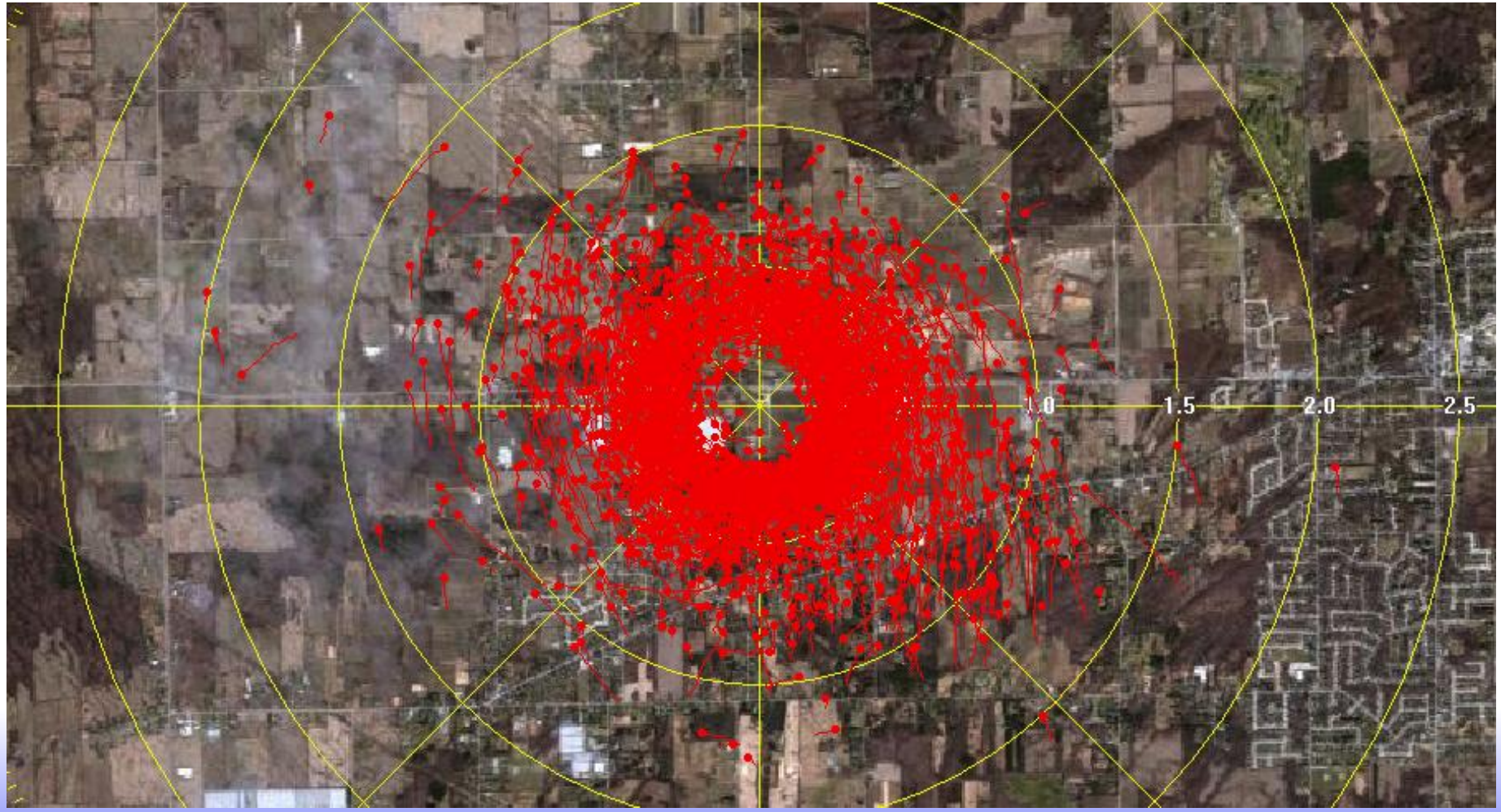
Histories



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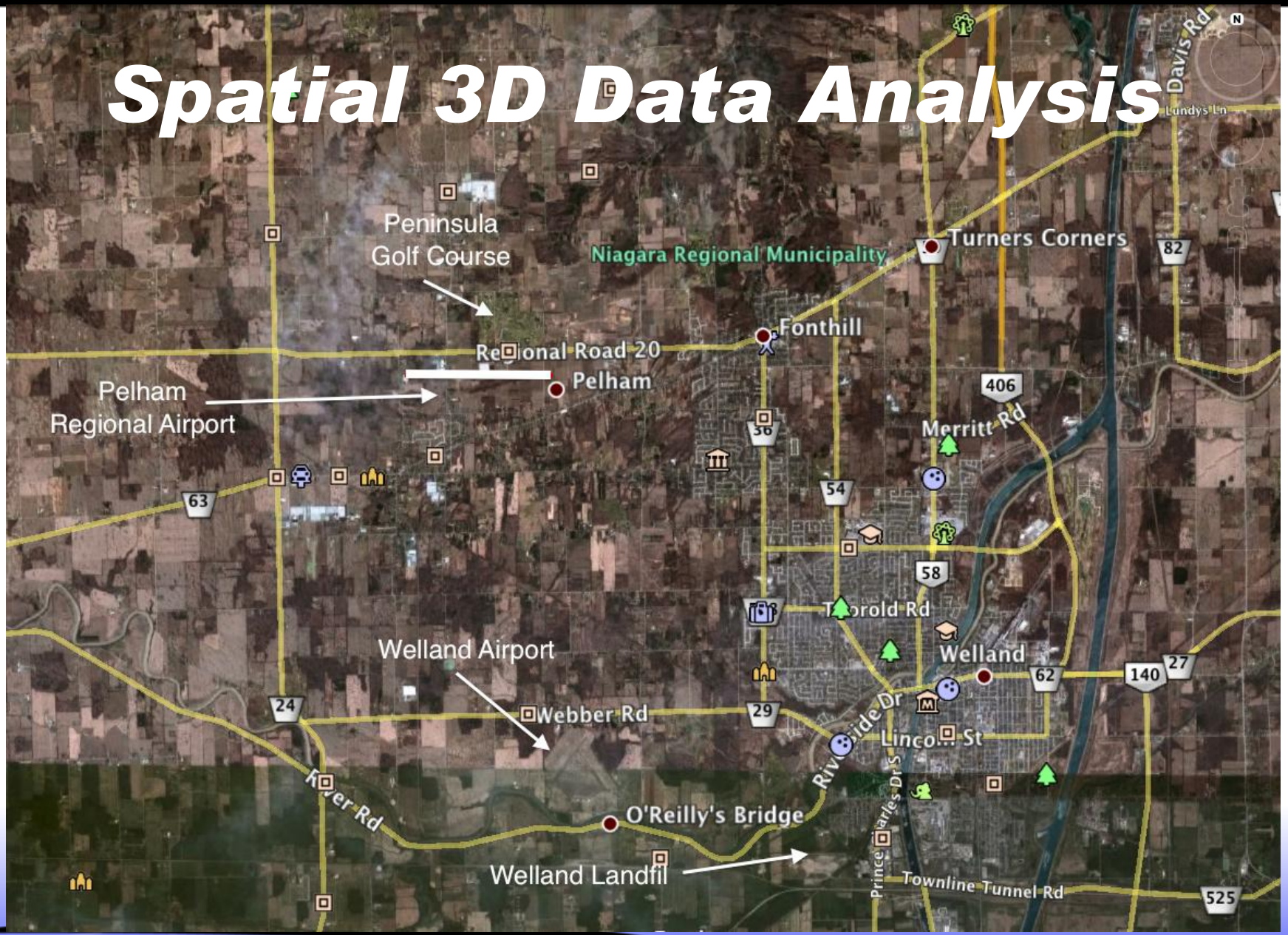
Spatial 3D Data Analysis



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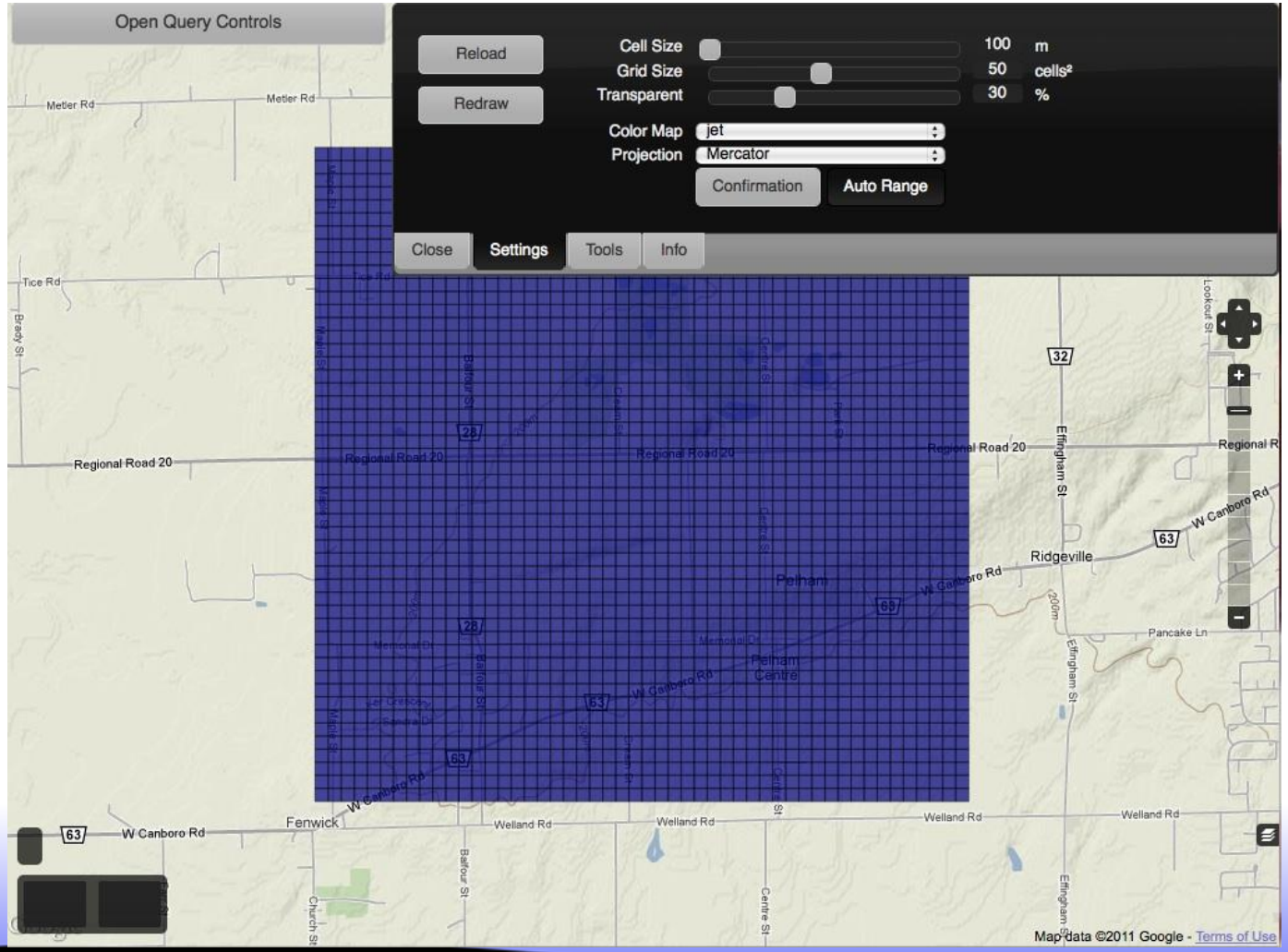
Select Resolution



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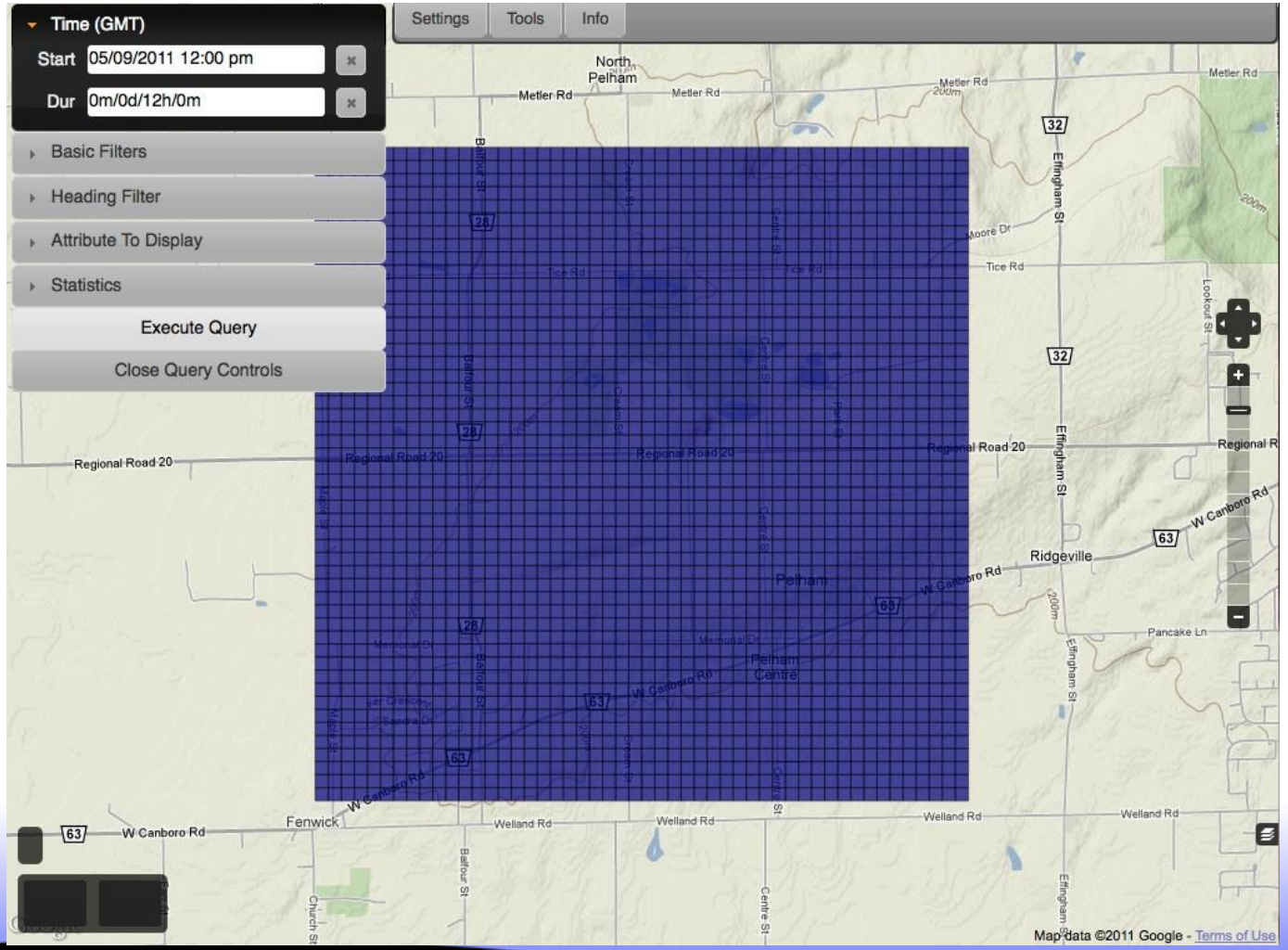
Spatial Analysis



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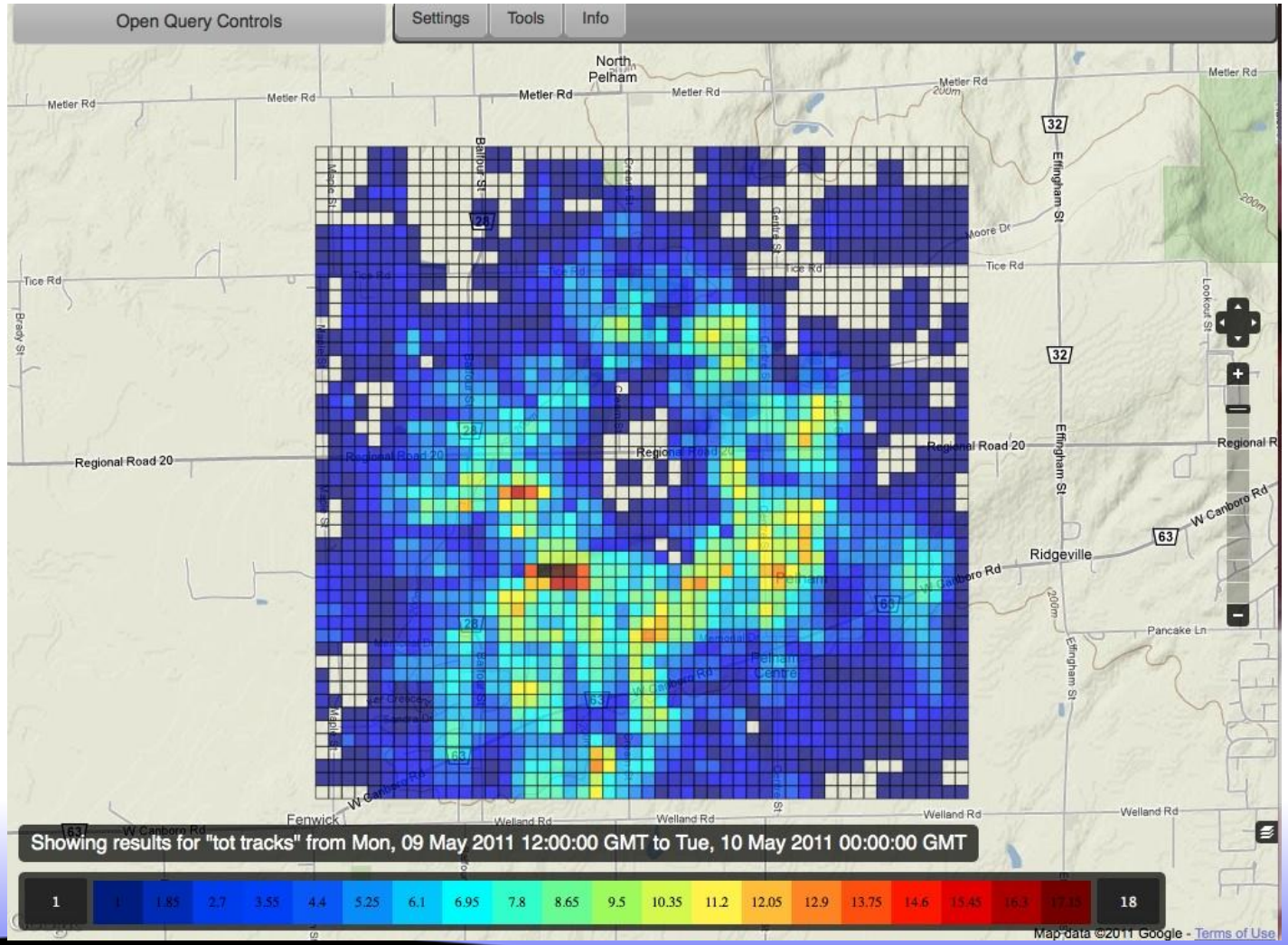
Number of Diurnal Bird Tracks



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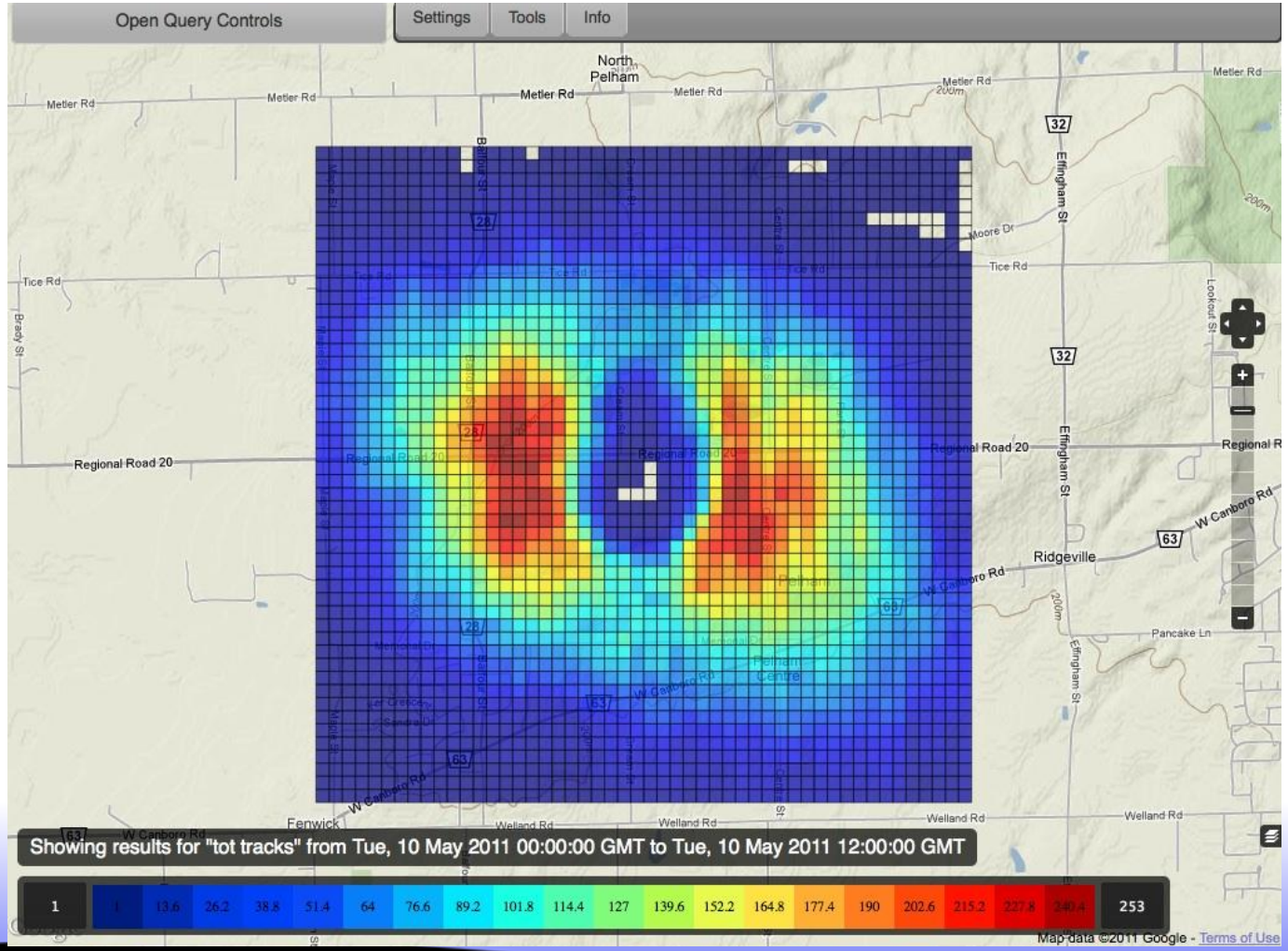
Number of Nocturnal Bird Tracks



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Count Data Exported in Excel Format

Km West (-) to East of Radar

Km North (-) to South of Radar	-2.5	-2	-1.5	-1	-0.5	0.5	1	1.5	2	2.5
-2.5	66	115	29	129	83	18	48	16	126	4
-2	53	33	441	6	240	196	426	105	14	395
-1.5	40	831	920	718	688	253	1283	5	75	253
-1	19	3	14	5	24	7	18	6	12	9
-0.5	1111	265	776	1749	550	167	1128	78	37	834
0.5	683	129	306	1187	858	729	25	1590	550	85
1	281	63	9	445	235	488	451	107	555	29
1.5	3	1	2	1	2	1	3	1	4	
2	3	45	5	7	48	3	13	19	22	40
2.5	18	789	96	768	73	1073	283	1332	315	1169

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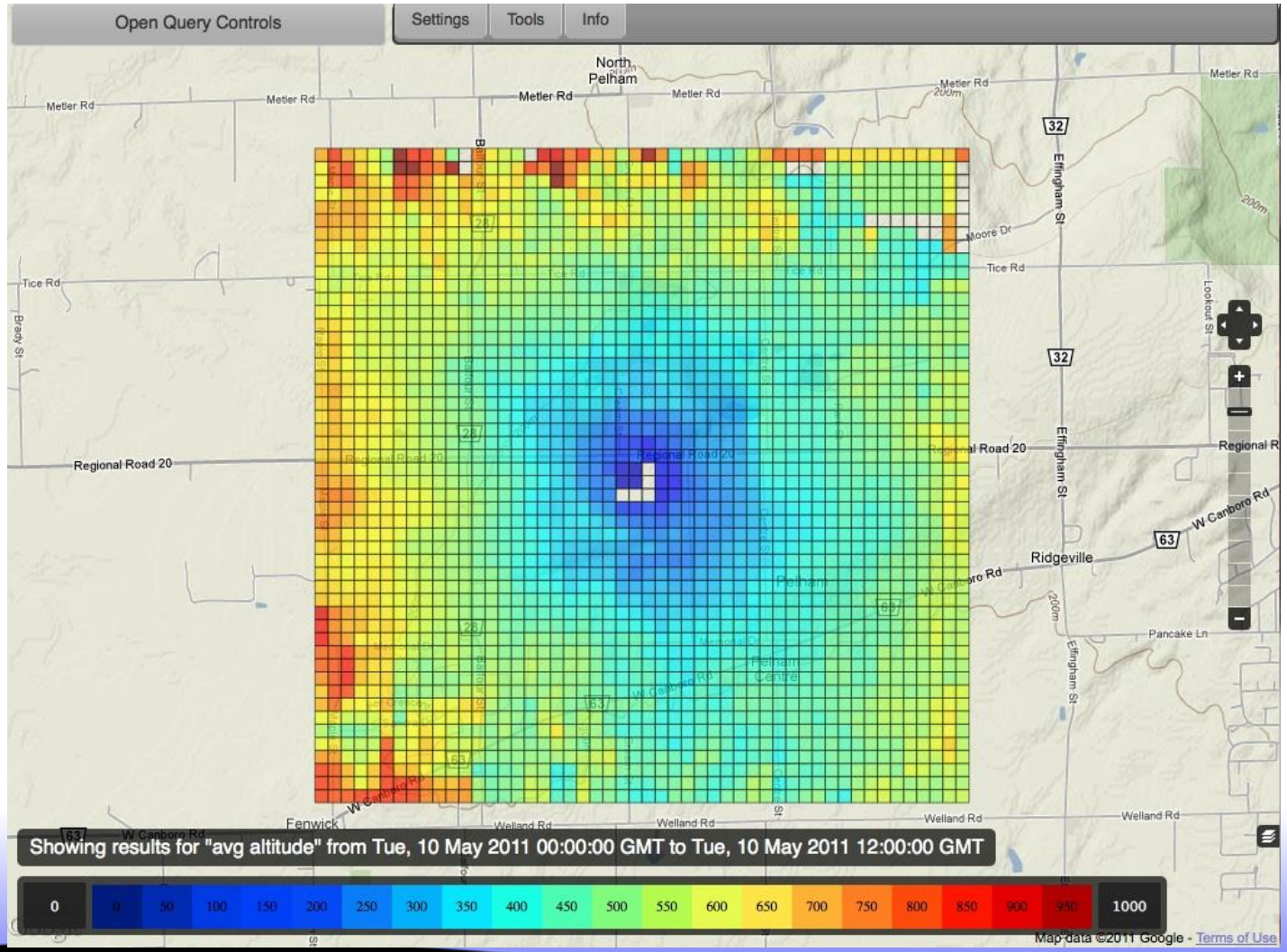
Mean Nocturnal Altitude



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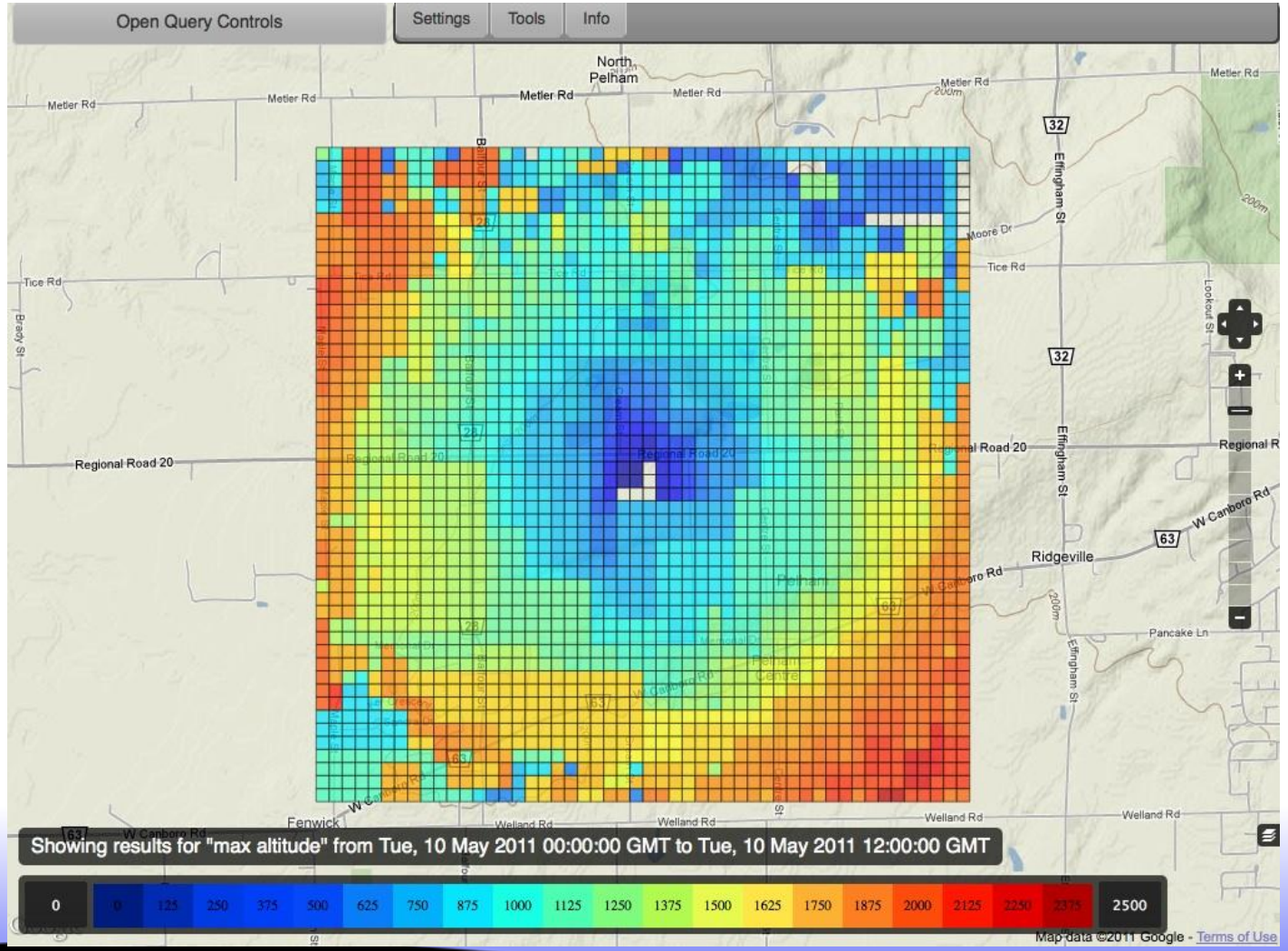
Maximum Nocturnal Altitudes



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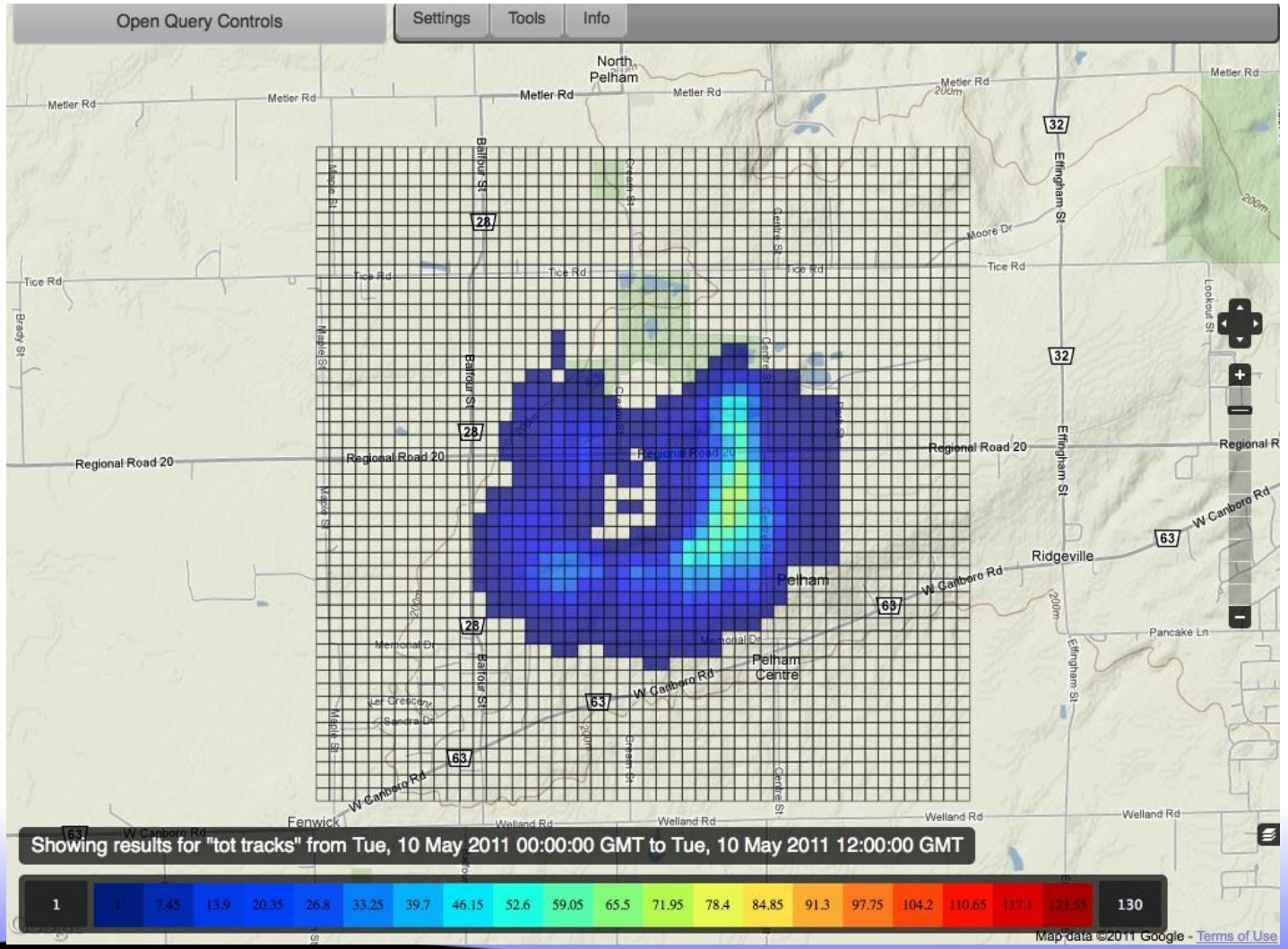
0 – 500 ft



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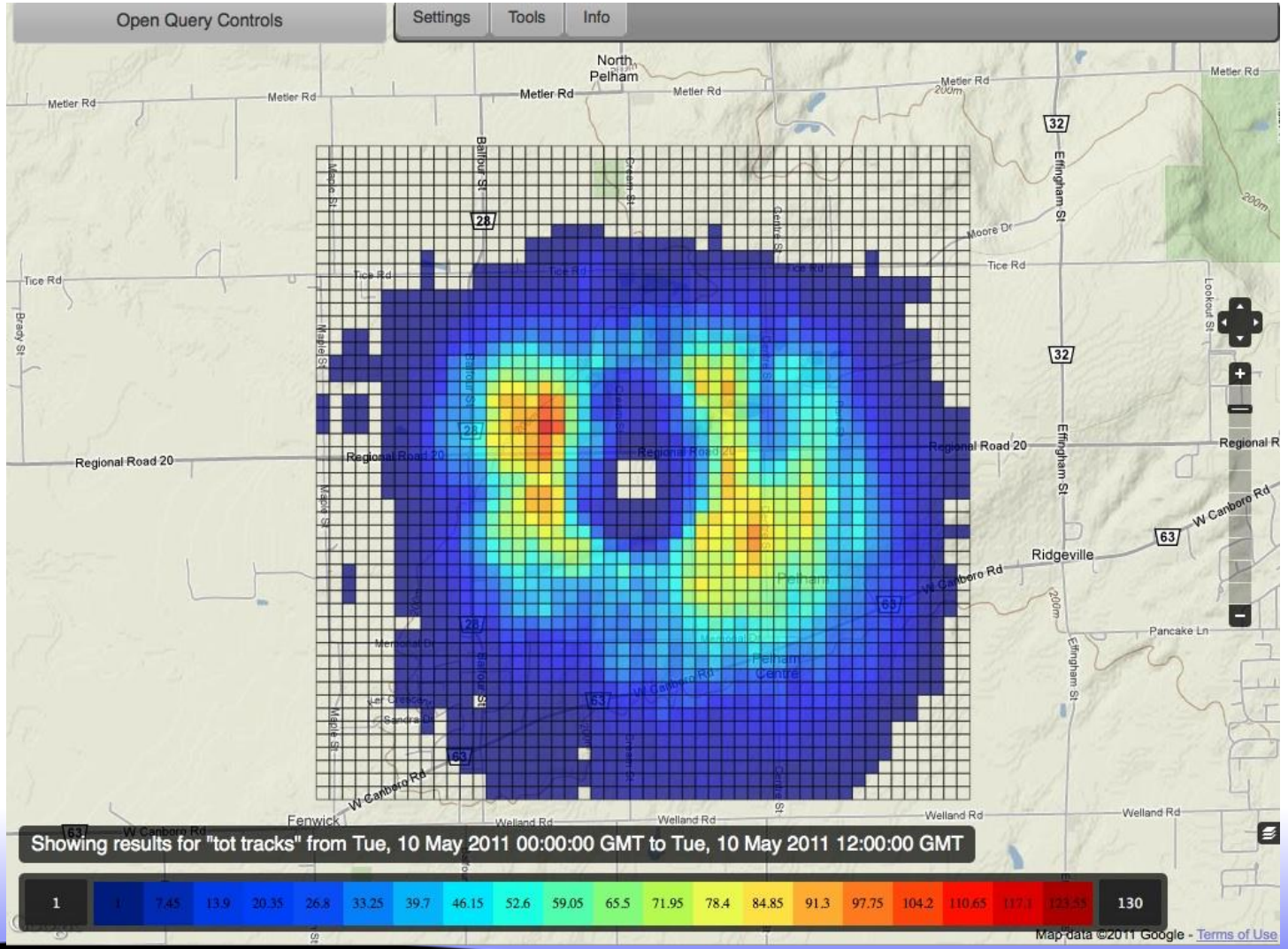
500 – 1000 ft



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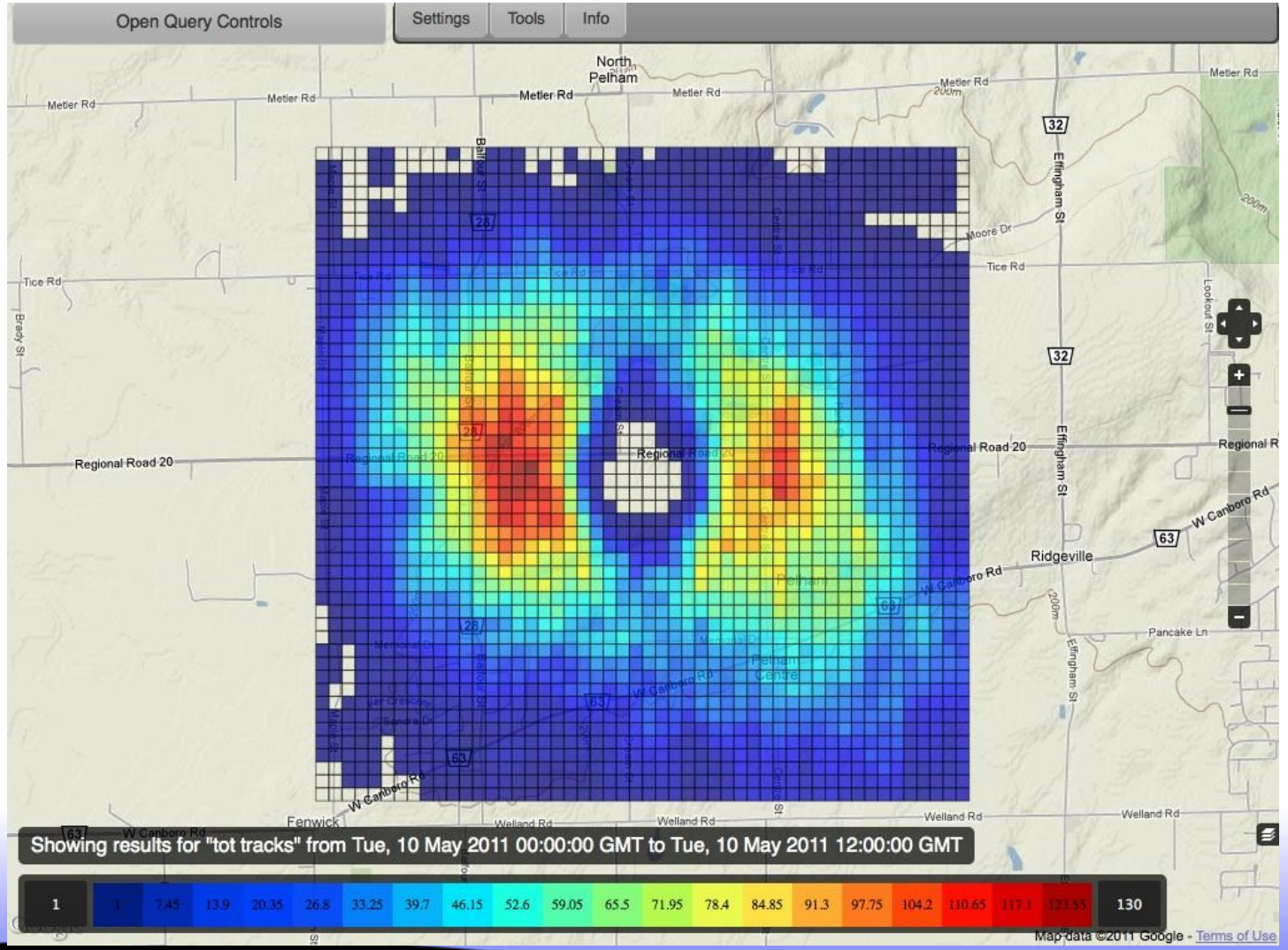
1000 – 2000 ft



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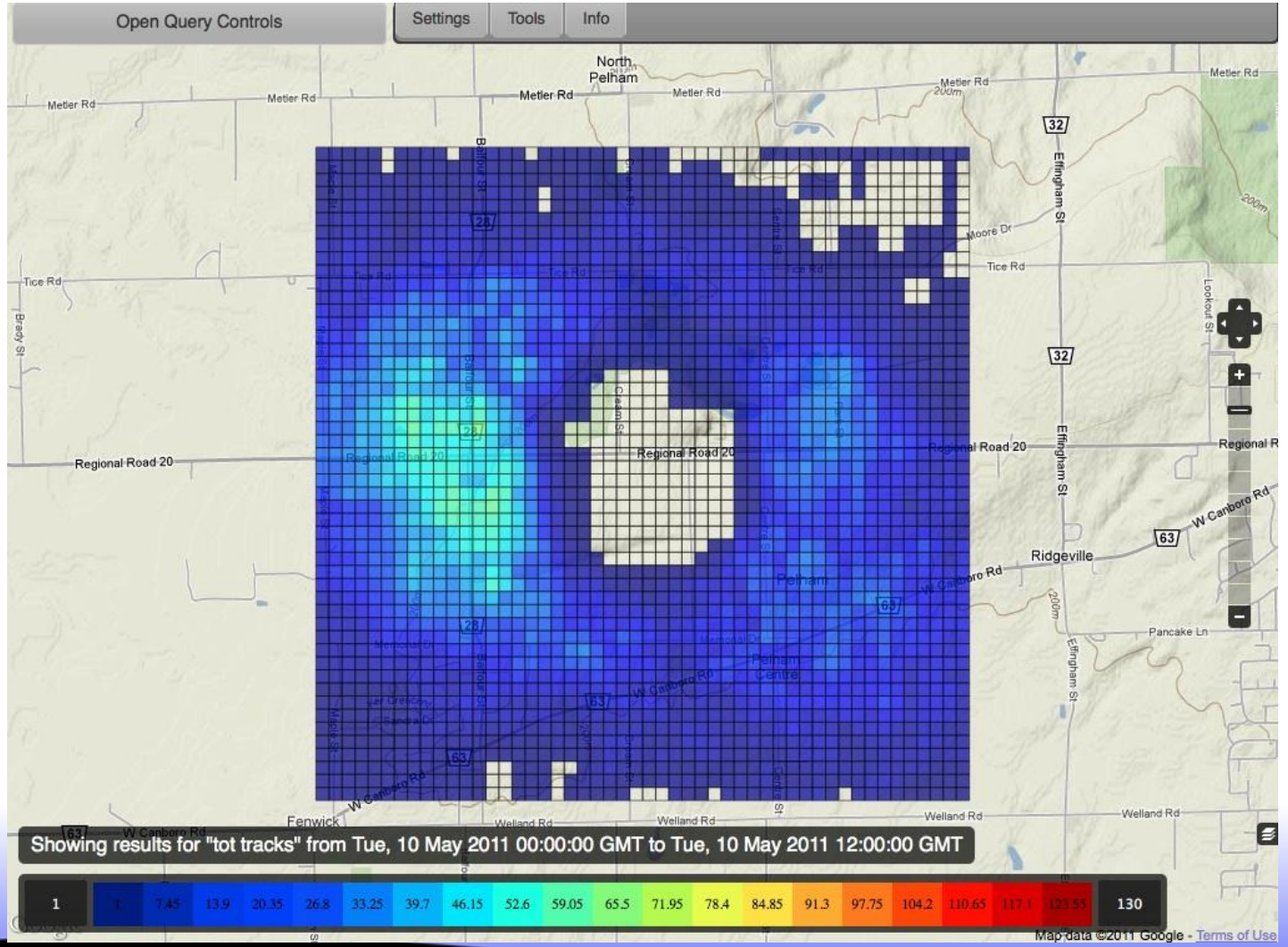
2000 – 5000 ft



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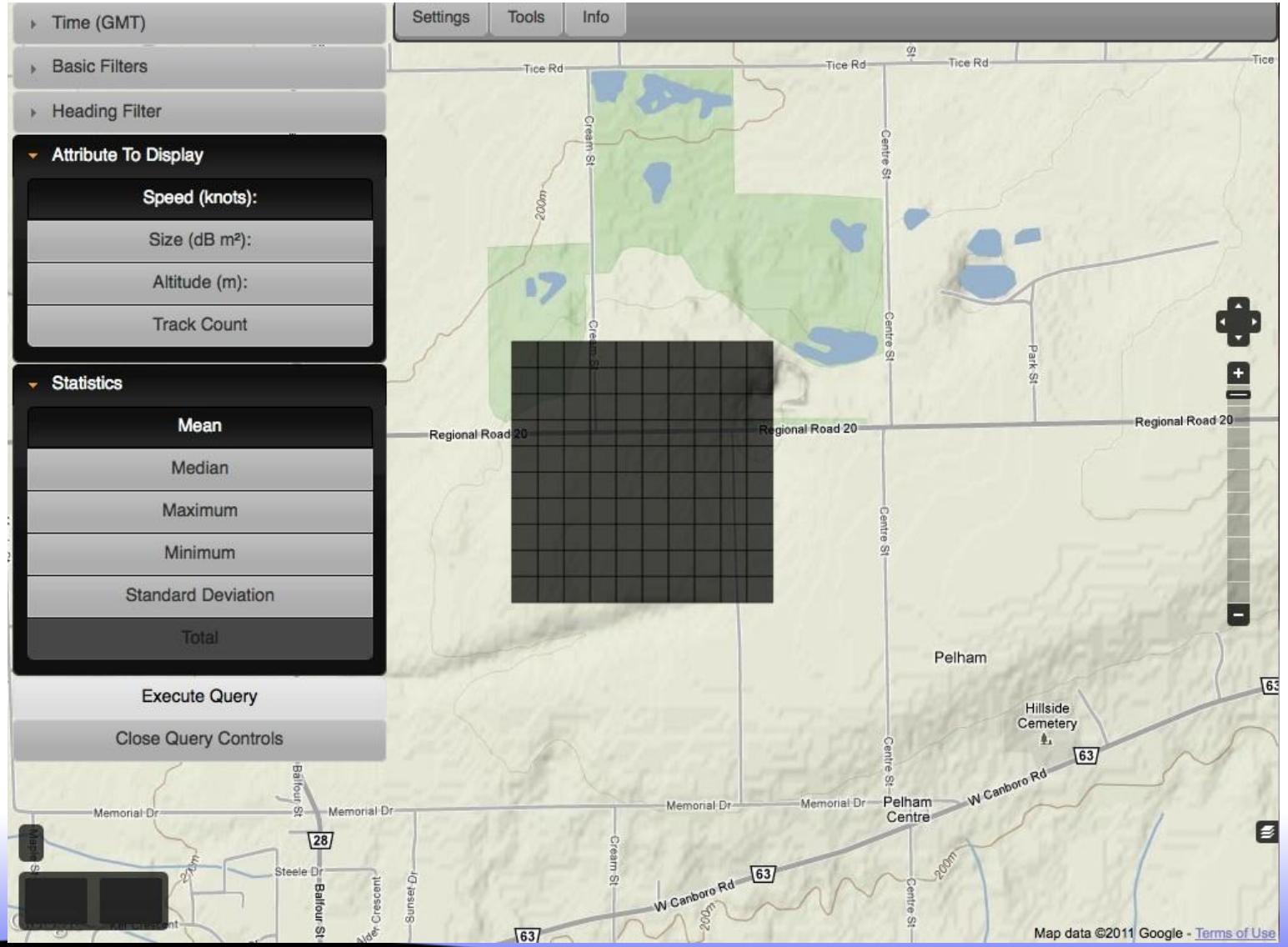
Examine by Cell

Attributes

- Track count
- Altitude
- Heading
- Speed
- Size

Statistics

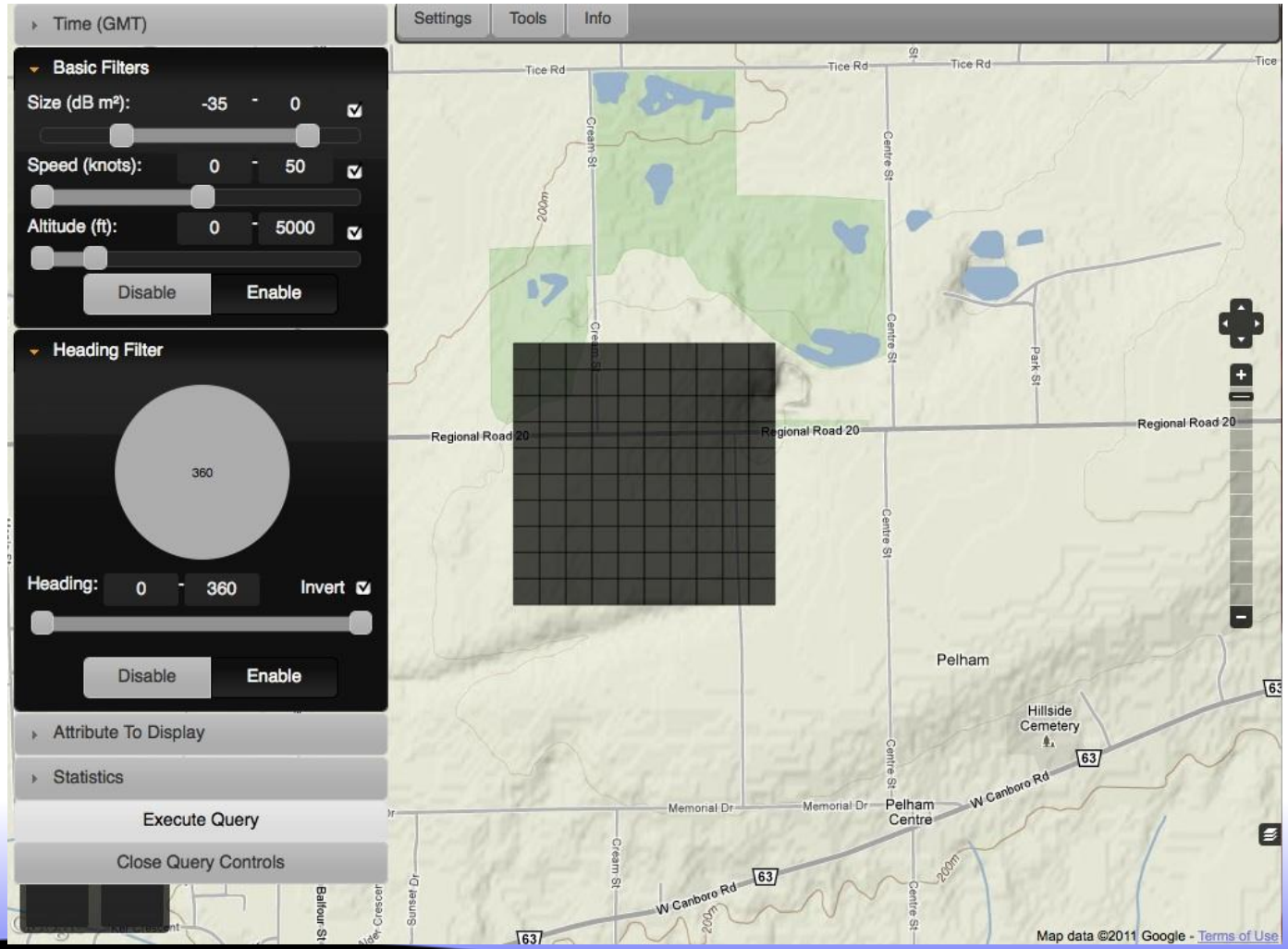
- ← Total
- Mean
- Median
- Standard Deviation
- Maximum
- Minimum


Time (GMT)
Basic Filters
Heading Filter
Attribute To Display
Speed (knots):
Size (dB m²):
Altitude (m):
Track Count
Statistics
Mean
Median
Maximum
Minimum
Standard Deviation
Total
Execute Query
Close Query Controls
Settings
Tools
Info
Tice Rd
Cream St
Centre St
Park St
Regional Road 20
Pelham
Hillside Cemetery
Pelham Centre
W Canboro Rd
Memorial Dr
Balfour St
Steele Dr
Alder Crescent
Sunset Dr
63
28
200m
Map data ©2011 Google - Terms of Use

Filter on Attributes

- Altitude
- Speed
- Heading
- Size
- Combinations of the above

Example of Filters



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Periodic Reports

- Generated Hourly, Daily, Weekly, Monthly
  - Locations of activity
  - Directions and speed of movement in each cell
- Specific queries
  - Investigate trouble spots
  - Monitor start & end of migration, density of migrants in the airspace

Data Integration

- Visual & auditory sampling
  - Periodic sampling
  - Species ID
  - Details of behavior
- Radar sampling
  - Continuous sampling
  - Quantification of flying birds
  - Altitude
  - Automatic data logging

CONCLUSIONS

- Visual and radar sampling provide complementary data on avian hazards to aviation
- New analytical tools can quantify attributes of avian activity to aid biologists in determining threat levels and monitoring hazard trends
- Automatic report generation allows biologists to spend more time in the field

Acknowledgments

We thank our colleagues at Accipiter Radar for their assistance in the development of the analytical software and preparation of illustrations for this presentation, and the numerous wildlife biologists for their ideas on the types of information they needed to help them do their jobs.

Thank You & Questions

Niagara, Ontario

Niagara, NY