POINT-BASED CONVECTIVE OUTLOOK VERIFICATION SCHEME

"Probability of severe weather within 25 miles of a point."

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OU/SPC Career Experience Program
Final Presentation
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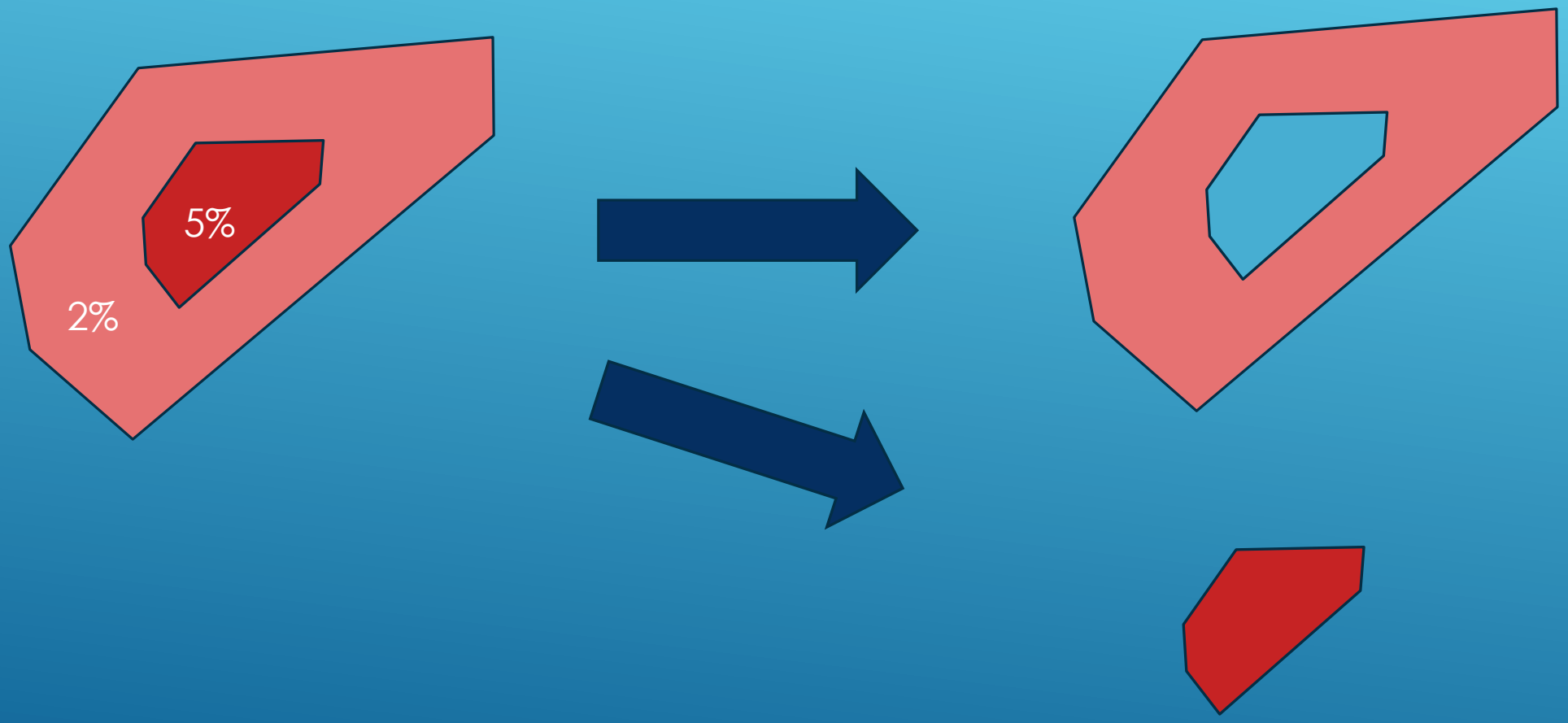
GOALS

- Develop new point-based verification method based on SPC outlook probabilities "within 25 miles of a point"
  - Current verification scheme uses 80km grids
- Calculate verification statistics with May/June 2017 dataset
- Create graphs of outlook probabilities verses actual report occurrence

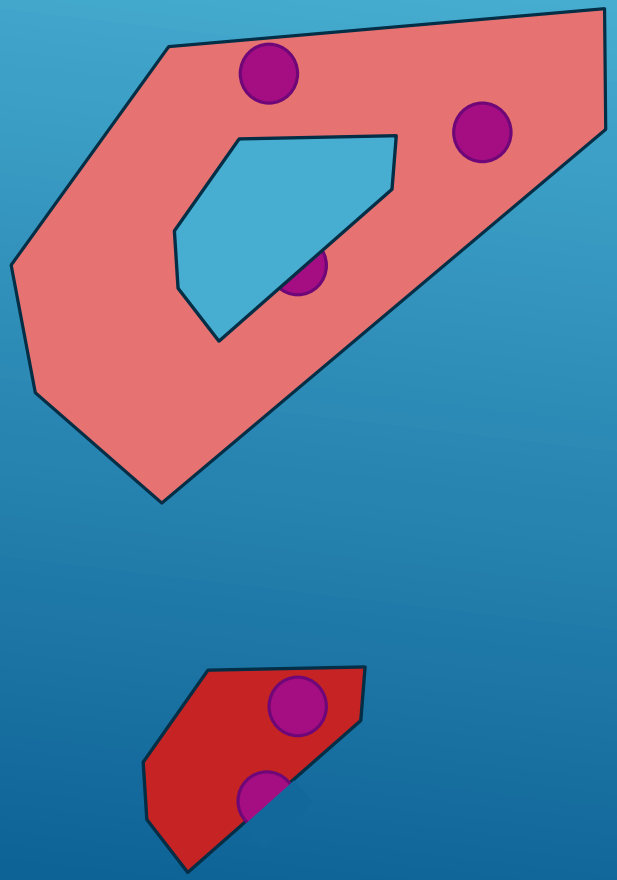
METHODOLOGY

- Python for ease of adoption and extensibility
- Ad-hoc scripts that load outlook and report data with output statistics
- PostgreSQL 9.3 for verification data storage
- Migrated solution to web framework (bottle)
  - Verification results can be reviewed by any forecaster on any computer, without the need of scripts.
  - Statistics can be regenerated through the browser
  - Provides OS-independent medium for displaying graphs, images and statistics
  - Statistics data can be exported to CSV for further spreadsheet processing

METHODOLOGY



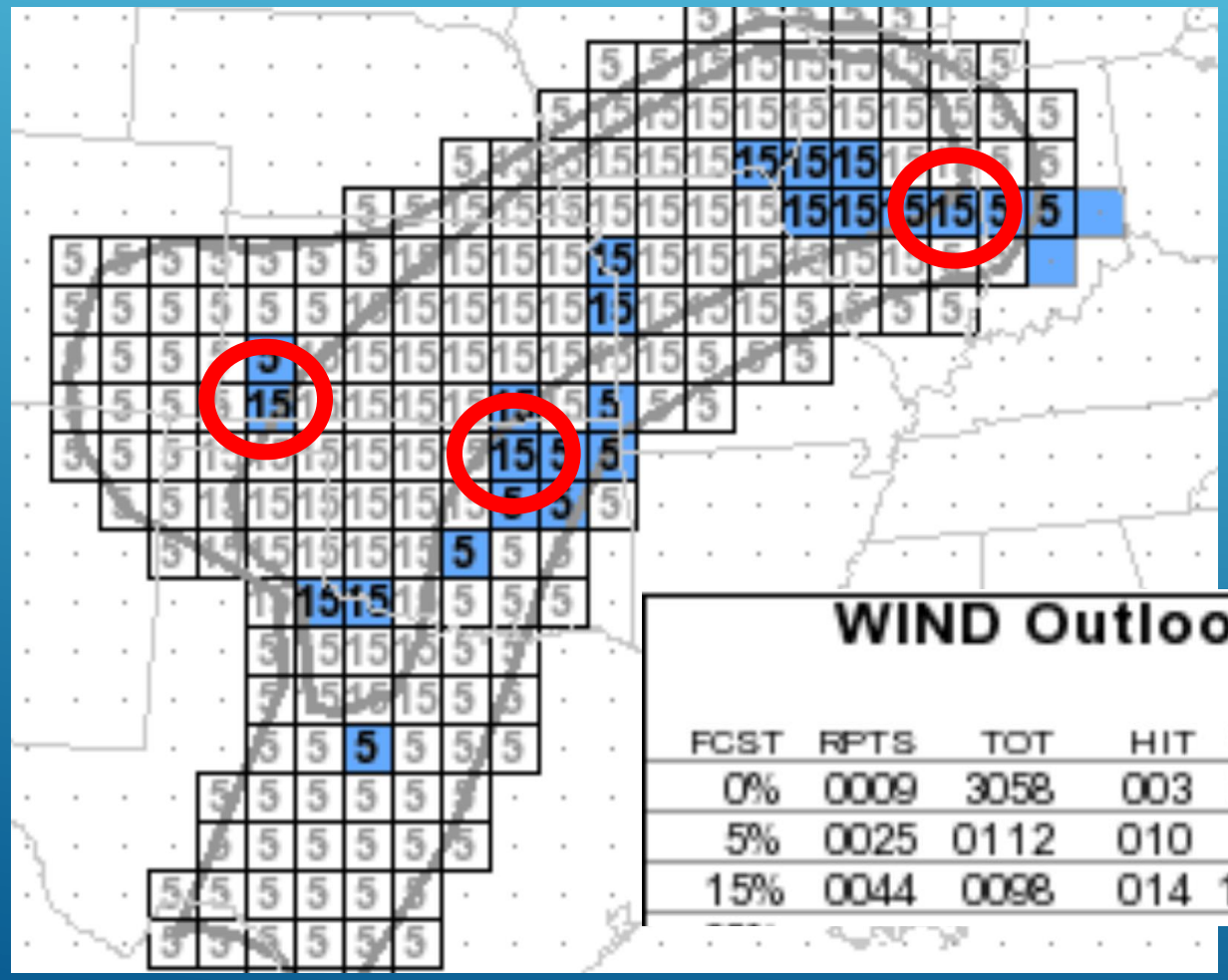
METHODOLOGY



- Area polygons are overlaid with reports
- Area statistics are generated and saved to the database

CASE STUDY #1: 5/10/2017 12Z

- Grid boxes that cross probability areas default to higher risk area (At least three 15% grid boxes should be 5%)

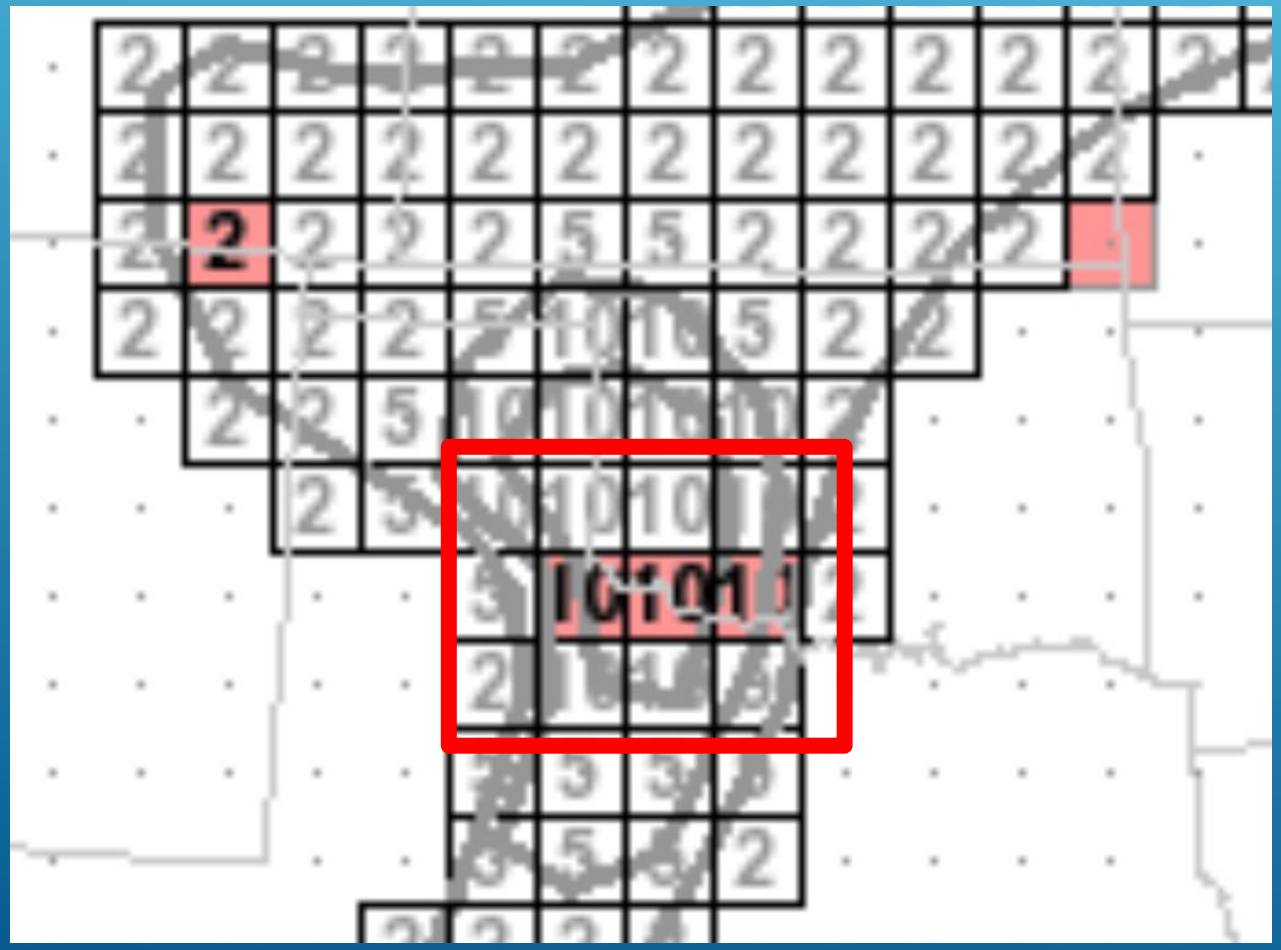


WIND Outlook Verification - 20170510/1200

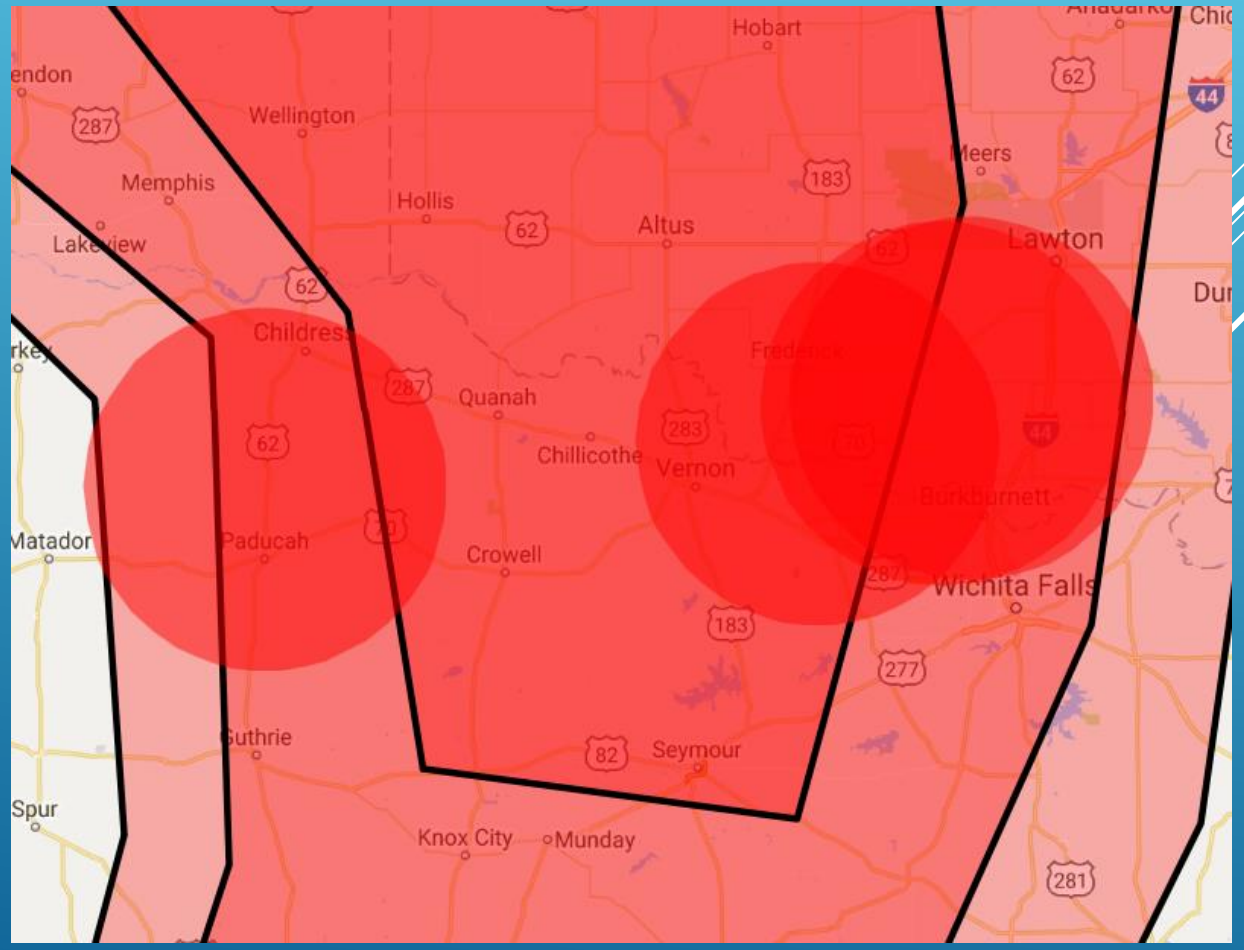
FCST	RPTS	TOT	HIT	VERF	CALIB	GOOD	BIAS	%GOOD	BRIER
0%	0009	3058	003	0.1%	122	2939	97.5%	96.1%	0.00%
5%	0025	0112	010	8.9%	016	106	37.5%	94.6%	0.15%
15%	0044	0098	014	14.3%	028	084	50.0%	85.7%	0.01%

CASE STUDY #1: 5/10/2017 12Z

Grid-Based



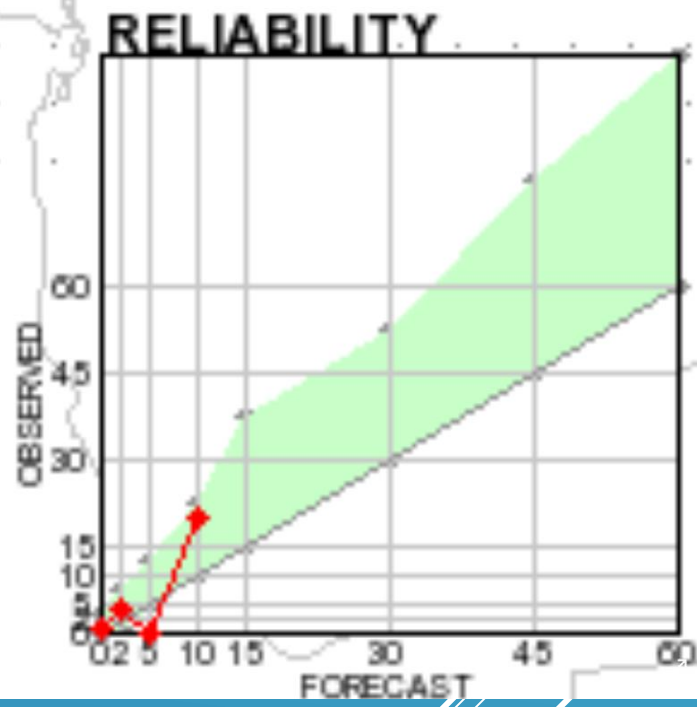
Point-Based



Brier Score = 0.00229
Total Quality = 97.902%
Total Bias = 12.500%

TORN Outlook Verification - 20170510/1200

FCST	RPTS	TOT	HIT	VERF	CALIB	GOOD	BIAS	%GOOD	BRIER
0%	0001	3125	001	0.0%	031	3095	96.8%	99.0%	0.00%
2%	0006	0113	004	3.5%	005	112	20.0%	99.1%	0.02%
5%	0000	0015	000	0.0%	001	014	100.0%	93.3%	0.25%
10%	0004	0015	003	20.0%	002	014	-50.0%	93.3%	1.00%
15%									
30%									
45%									
60%									



12:00:00	2017-05-11 12:00:00Z	Tornado	0.02	211863.3163	8455.1297	25	0.0399
12:00:00	2017-05-11 12:00:00Z	Tornado	0.05	27525.4369	2401.2997	25	0.0872
12:00:00	2017-05-11 12:00:00Z	Tornado	0.1	15800.7198	1866.7892	25	0.1181

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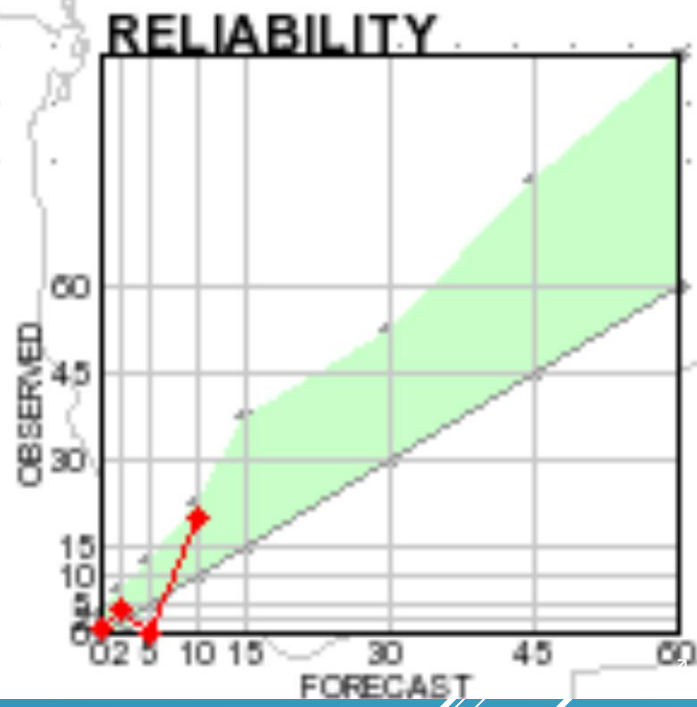
5%	0000	0015	000	0.0%	001	014	100.0%	93.3%	0.25%
15%	0004	0015	003	20.0%	002	014	-50.0%	93.3%	1.00%
15%									
30%									
45%									
60%									



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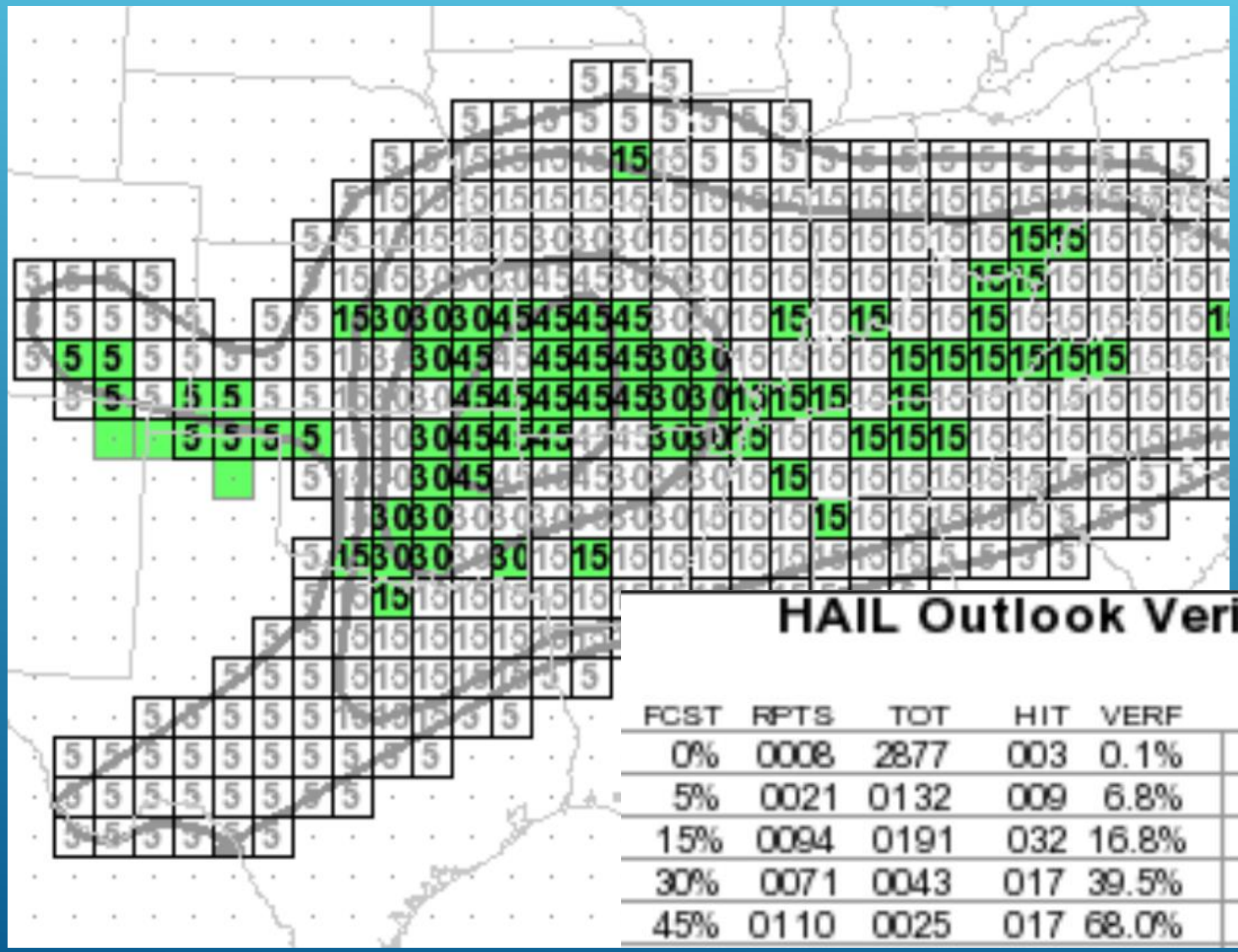
CASE STUDY #2: 5/27/2017 12Z



HAIL Outlook Verification - 20170527/1200

FCST	RPTS	TOT	HIT	VERF	CALIB	GOOD	BIAS	%GOOD	BRIER
0%	0008	2877	003	0.1%	115	2765	97.4%	96.1%	0.00%
5%	0021	0132	009	6.8%	018	123	50.0%	93.2%	0.03%
15%	0094	0191	032	16.8%	055	168	41.8%	88.0%	0.03%
30%	0071	0043	017	39.5%	019	041	10.5%	95.3%	0.91%
45%	0110	0025	017	68.0%	015	023	-13.3%	92.0%	5.29%

CASE STUDY #2: 5/27/2017 12Z

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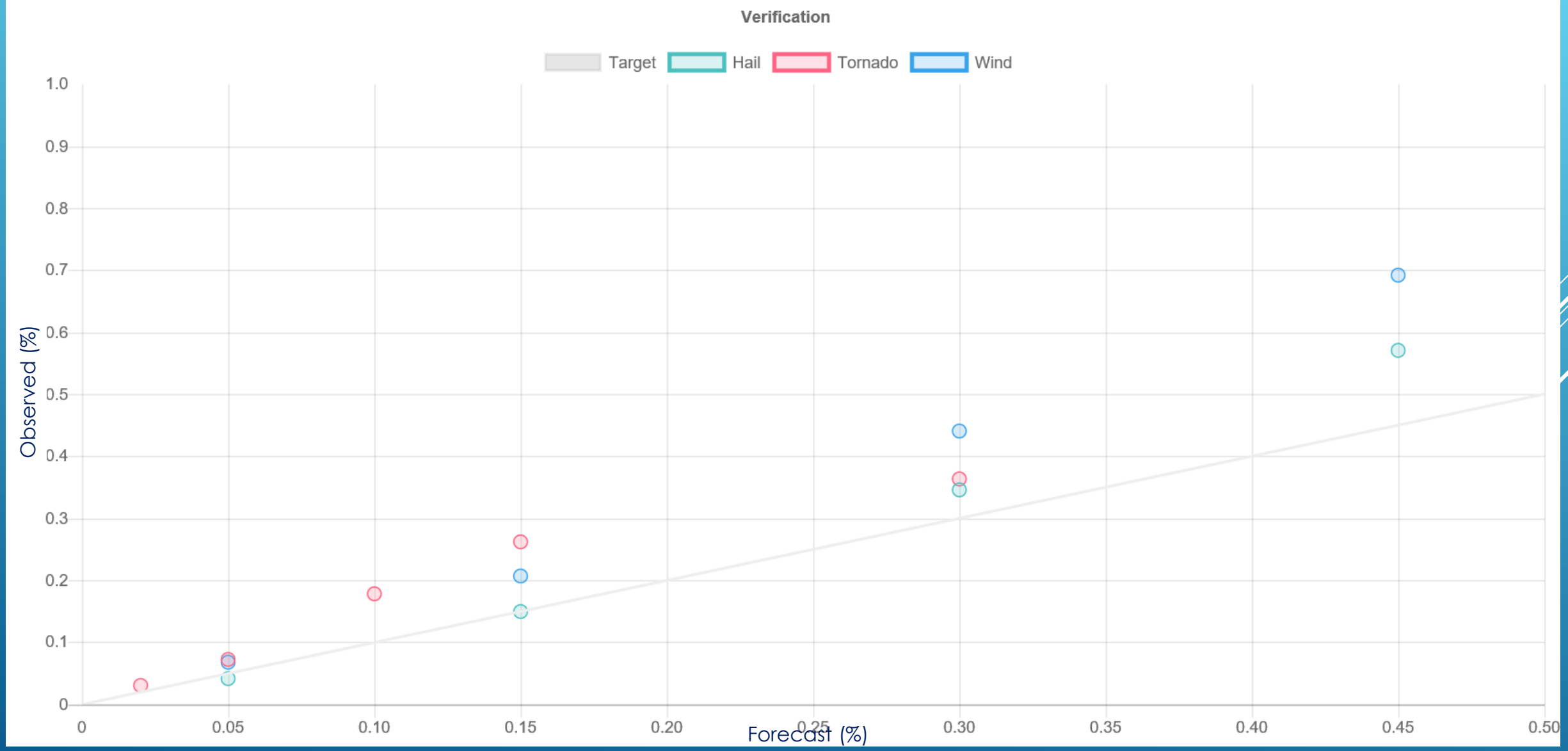
45%	0110	0025	017	68.0%	015	023	-13.3%	92.0%	5.29%

Time	Expires	Type	Probability	Outlook Area (sq. mi)	Report Area (sq. mi)	Radius (mi)	Verification
12:00:00	2017-05-28 12:00:00Z	Hail	0.05	270400.2556	13719.1916	25	0.0507
12:00:00	2017-05-28 12:00:00Z	Hail	0.15	404078.1602	72494.8031	25	0.1794
12:00:00	2017-05-28 12:00:00Z	Hail	0.3	90335.7203	40045.8636	25	0.4433
12:00:00	2017-05-28 12:00:00Z	Hail	0.45	37131.0583	27805.4819	25	0.7488

MAY / JUNE 2017 RESULTS



CONCLUSIONS

- Grid-based verification favors higher probabilities (clipping a box), often decreasing verification statistics for lower probabilities
- Point-based verification better matches outlook probabilities
- Point-based verification distributes area within 25 miles of a point across all intersecting outlook boundaries for increased verification accuracy (all the more important for smaller, targeted outlooks)

LIVE DEMO

- Verification Results Page
- Run Analysis Page
- Download Page
- Reports Page
- Outlook Verification Page
  - Verification Graph
  - Data
  - SPC Outlook / Reports
  - Interactive Map

FUTURE ENHANCEMENTS

- Add 0% probability statistics for reports outside of forecast area
- Perform verification for significant hail/wind 10% probabilities
- Expand dataset to full domain (multiple years)
- Update report and outlook data retrieval methods to connect directly with data warehouse (remove file based dependencies)
- Develop additional report pages / statistics
  - Display statistics across date range but aggregated by forecast hour
- Update verification page with sorting, filtering, direct navigation
- Add controls to flag and add notes to verification result set
- Save generated polygons from outlook and report area merges as geojson (for display and verification purposes)
- Upgrade project to Python 3.6

QUESTIONS?

Thanks to Dr. Patrick Marsh,
SPC Warning Coordination Meteorologist,
for providing the initial dataset!