



VISTAS Modeling Updates

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Georgia EPD – Air Protection Branch

2007 Region 4 Modelers Workshop

March 29, 2007

Outline

- VISTAS Modeling
- Area of Influence Sensitivity Modeling
- Georgia EPD Sensitivity Modeling

VISTAS Modeling

VISTAS Modeling

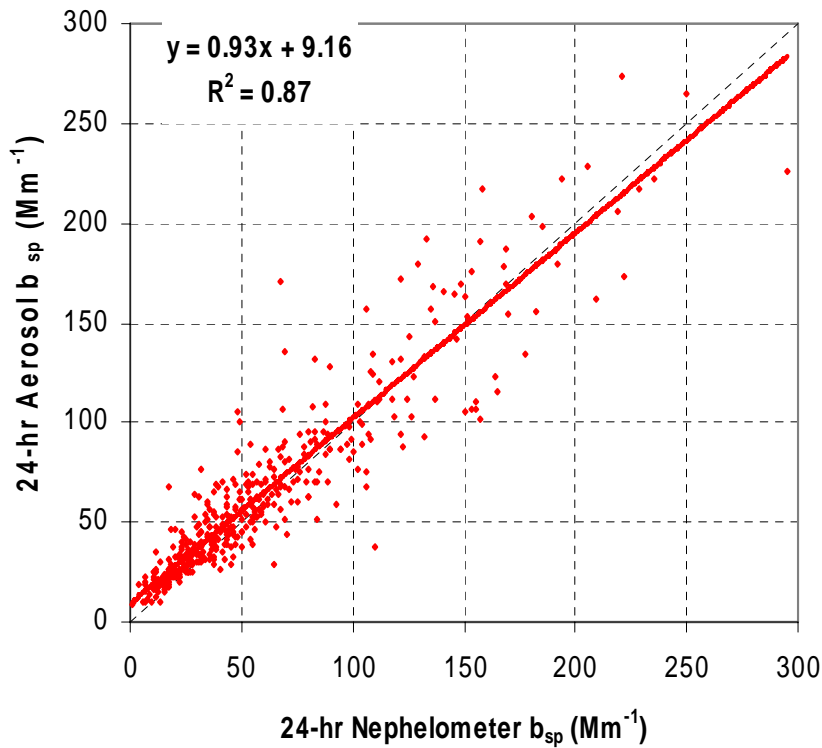
- Visibility Improvement State and Tribal Association of the Southeast
 - AL, GA, FL, MS, SC, NC, TN, KY, VA, WV
 - EPA, FLMs, Industry
- Modeling Contractors
 - ENVIRON International Corporation
 - Alpine Geophysics, LLC
 - University of California at Riverside
 - Georgia Tech
- Annual Regional Haze Modeling with the CMAQ Photochemical Grid Model at 36 and 12 km grid resolutions

2018 Base G Visibility Projections

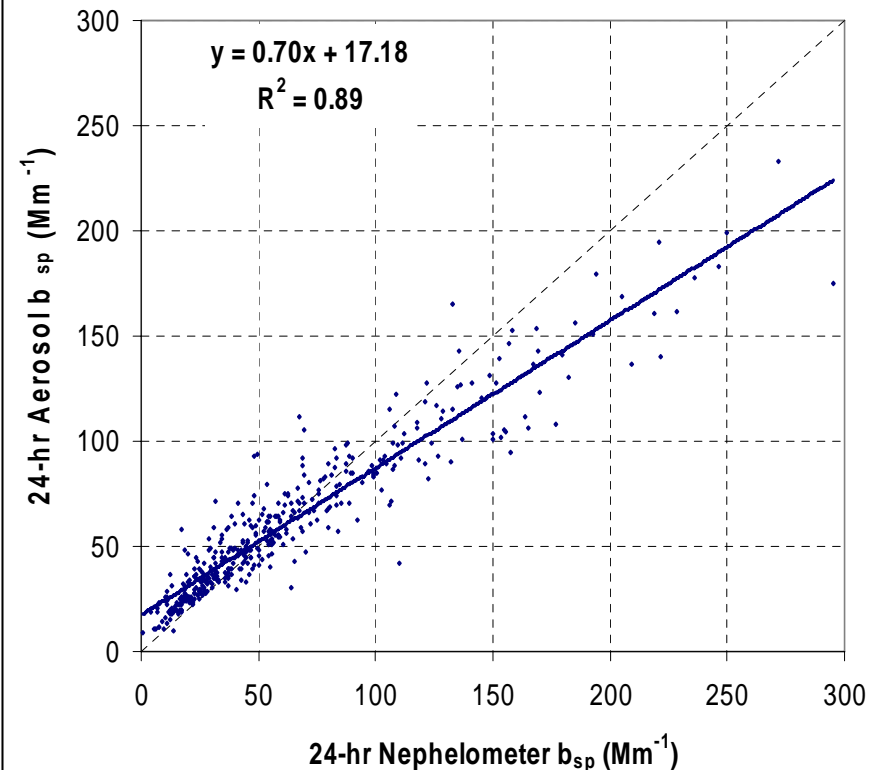
- Data Substitution
 - Data substitution for sites with less than 3 complete years of data: BRET, COHU, CHAS, SAMA, SHRO, SWAN
- 2018 36/12 km Base G Base Case
 - With CAIR, without BART
 - Neighboring RPO inventories effective Aug 06
- New and Old IMPROVE equation
 - New Natural Conditions for New IMPROVE from VIEWS

Aerosol Scattering vs. Nephelometer Scattering Using New or Old IMPROVE Algorithm and Daily f(RH) Great Smoky Mtns, 2000 - 2004

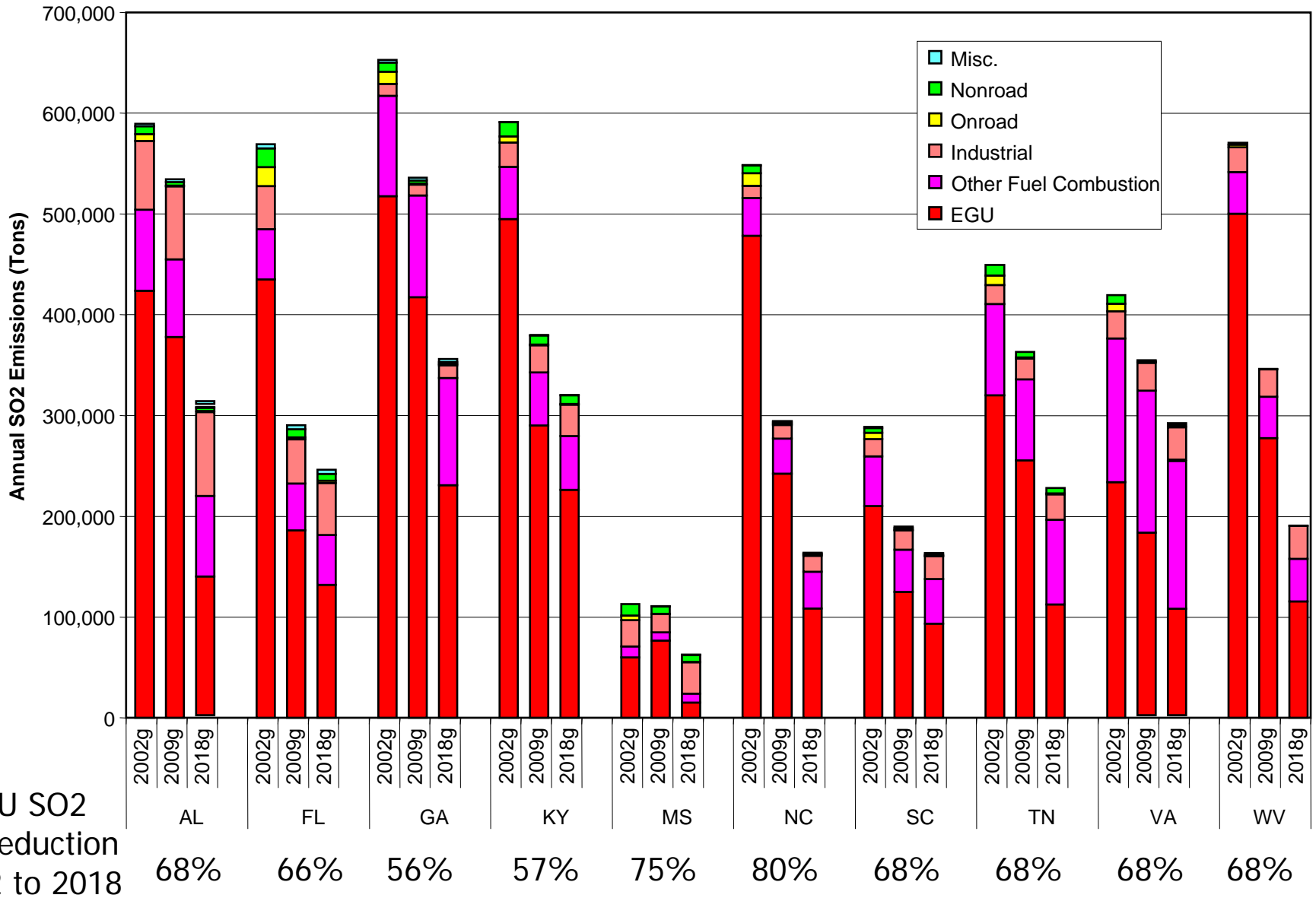
New IMPROVE



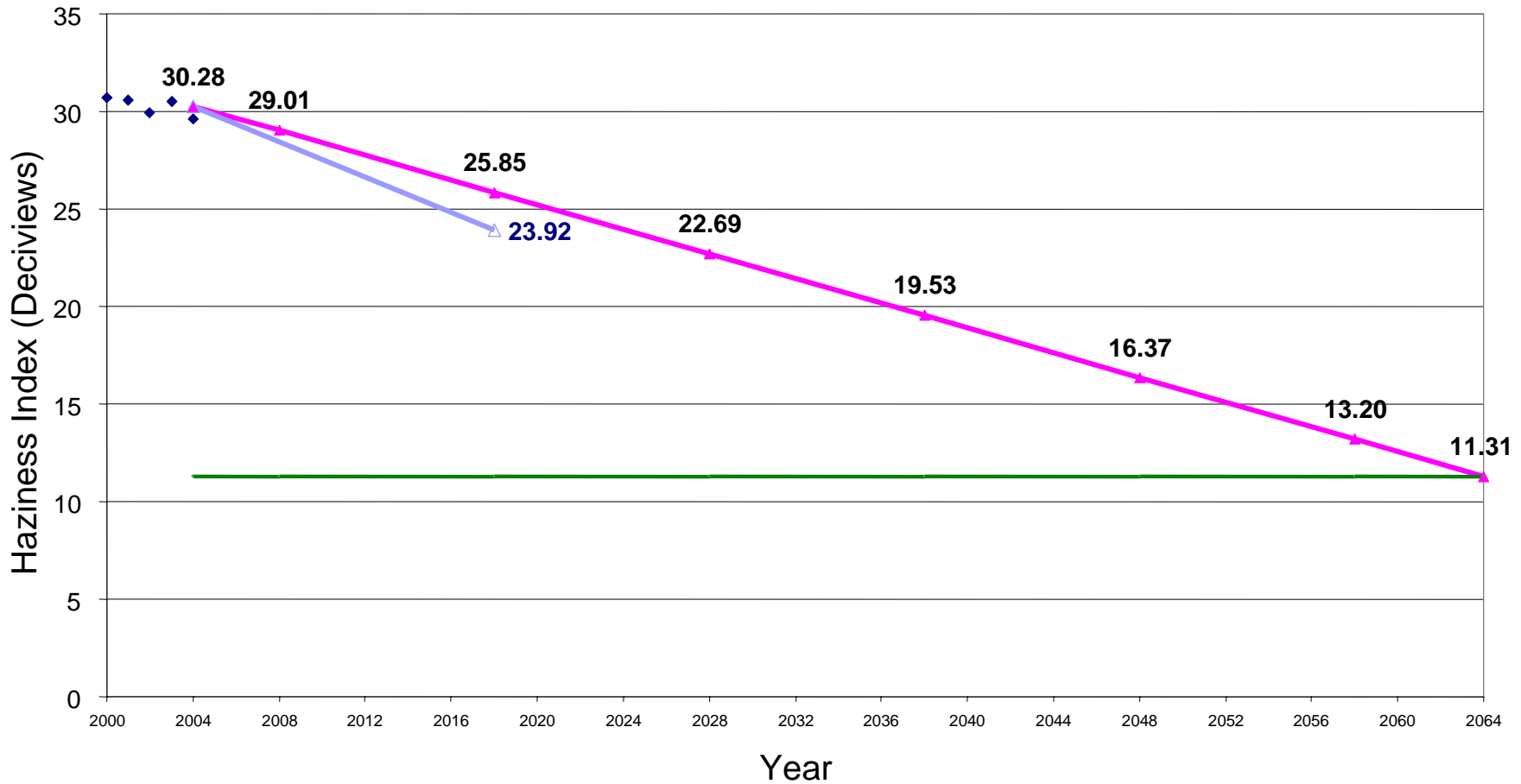
Old IMPROVE



BaseG - Annual SO2 Emissions (Tons)

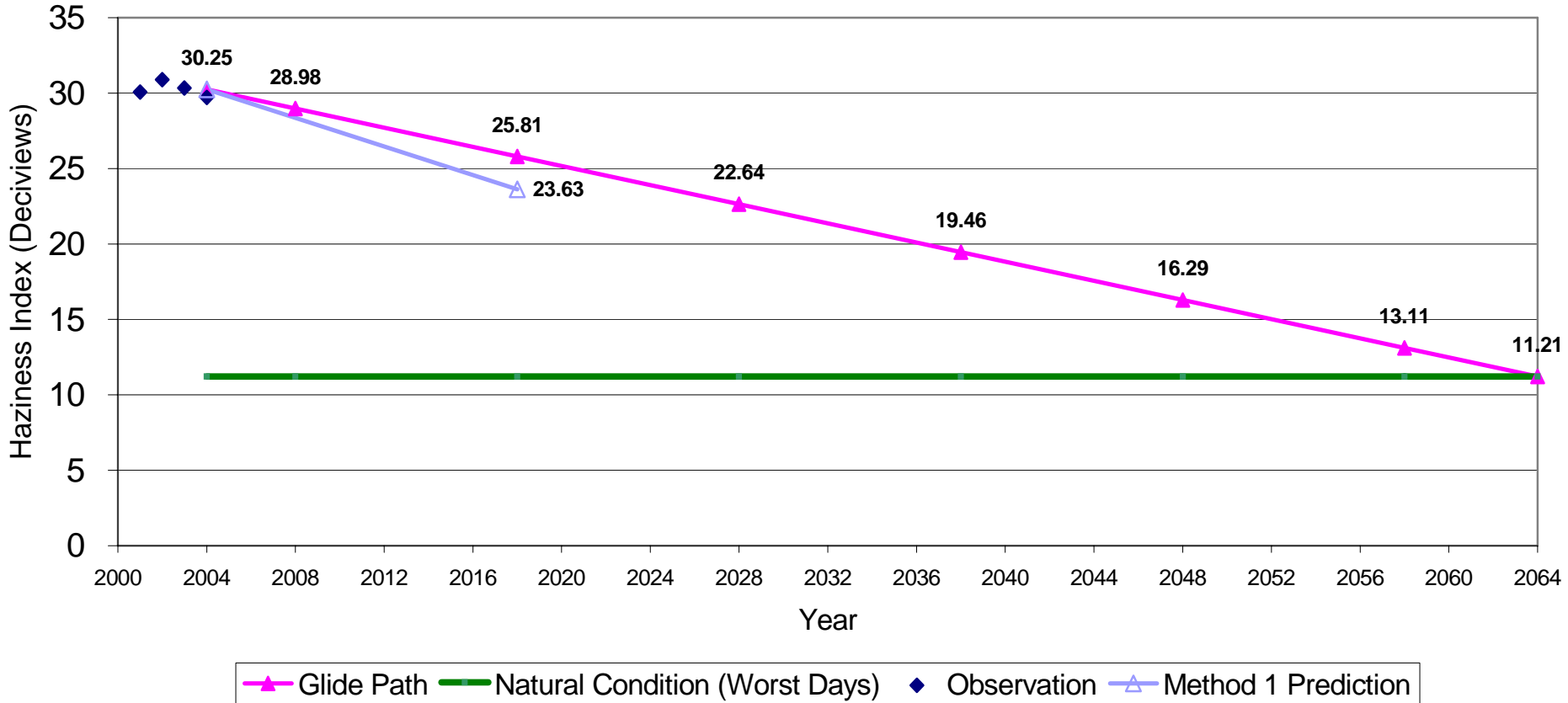


Uniform Rate of Progress Glide Path Great Smoky Mountains - 20% Worst Days

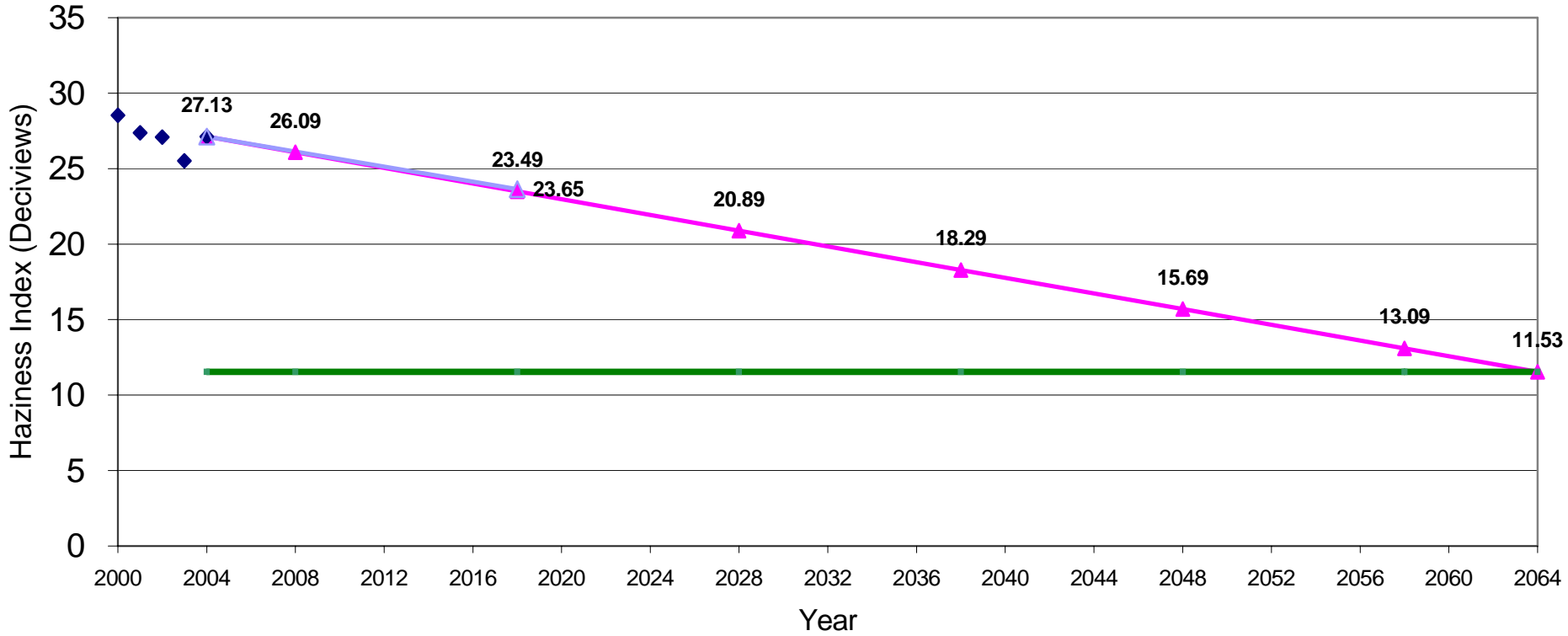


◆ Observation ▲ Glide Path — Natural Condition (Worst Days) △ Method 1 Prediction

Uniform Rate of Reasonable Progress Glide Path Cohutta - 20% Data Days

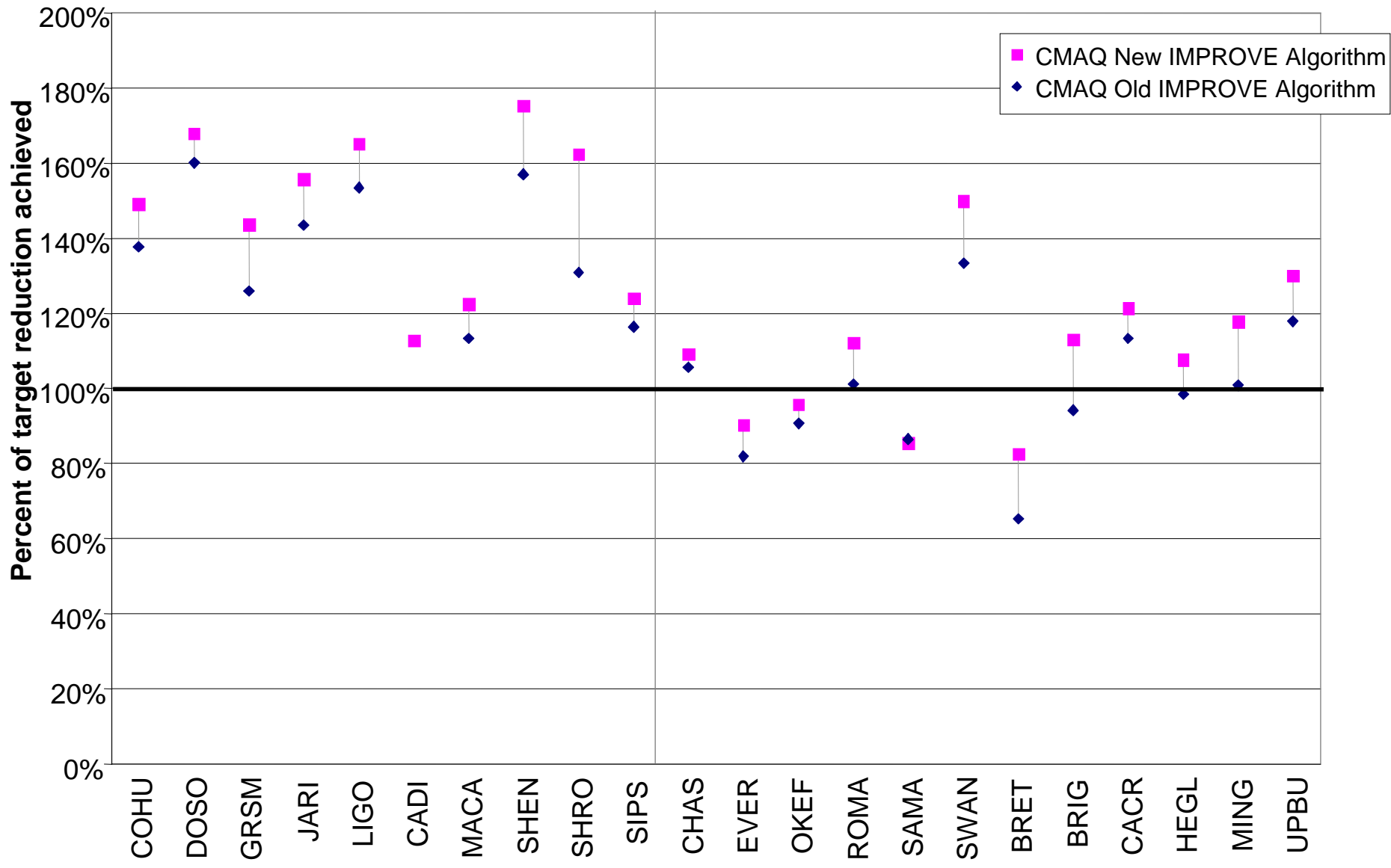


Uniform Rate of Reasonable Progress Glide Path Okefenokee - 20% Data Days



—▲— Glide Path — Natural Condition (Worst Days) ◆ Observation —△— Method 1 Prediction

CMAQ 2018g1a/Typ02g Method 1 predictions for VISTAS+ sites (12-km)

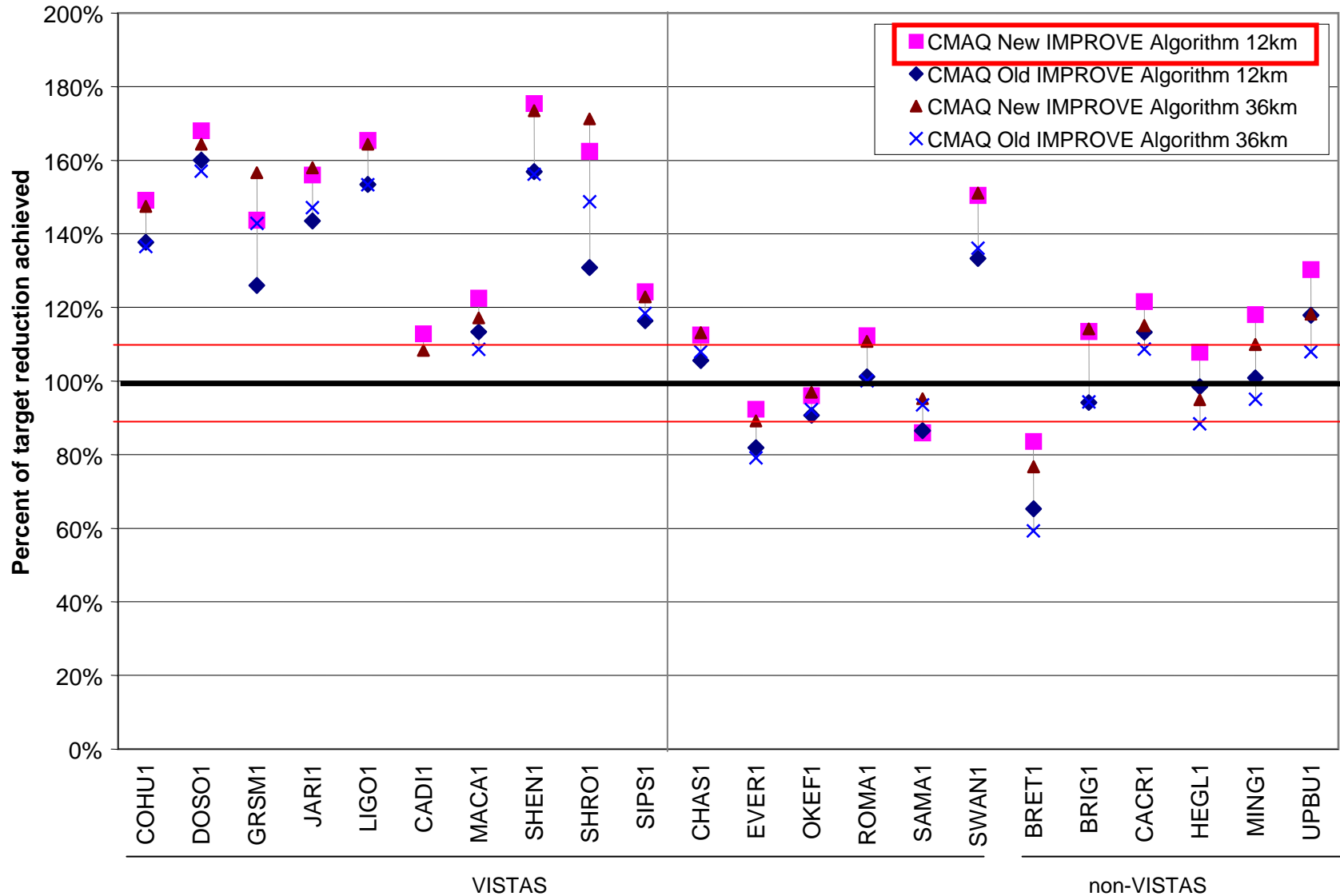


VISTAS

Georgia Environmental Protection Division

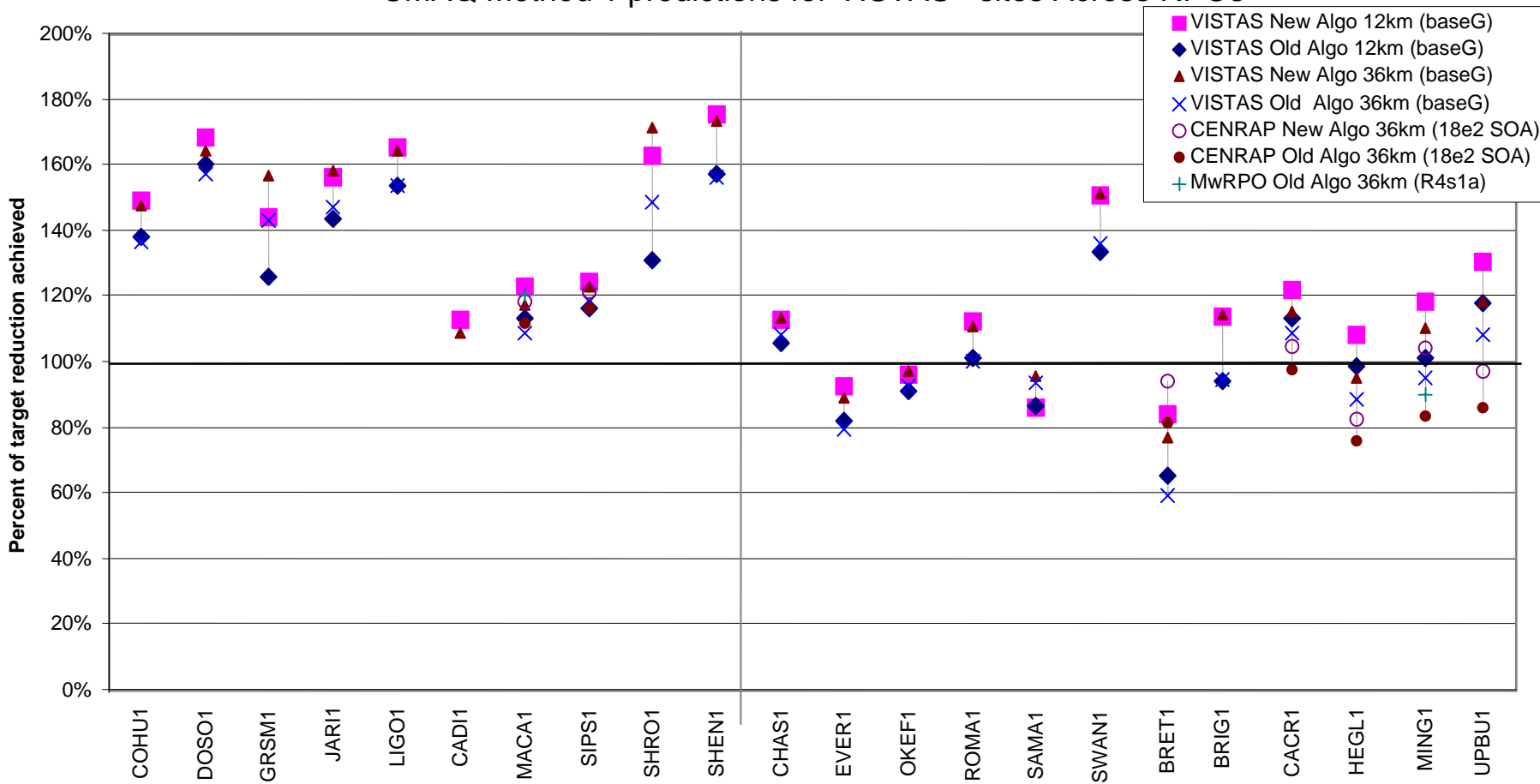
non-VISTAS

Comparison of VISTAS 2018 36/12 km Base G New/Old IMPROVE Projections



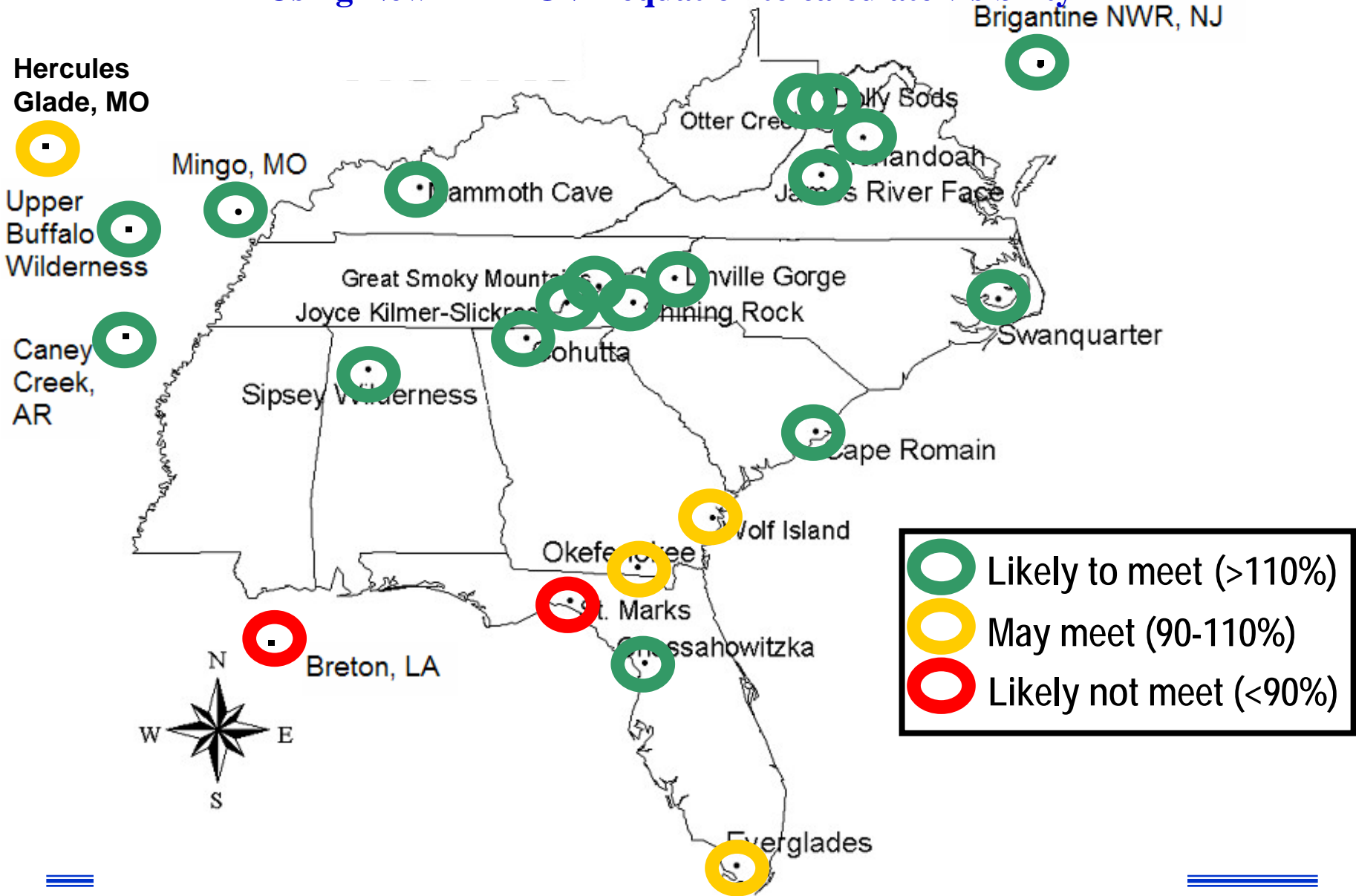
Comparison of VISTAS 2018 36/12 km Base G New/Old IMPROVE projections with CENRAP 36 km New/Old and MRPO 36 km Old IMPROVE projections

CMAQ Method 1 predictions for VISTAS+ sites Across RPOs

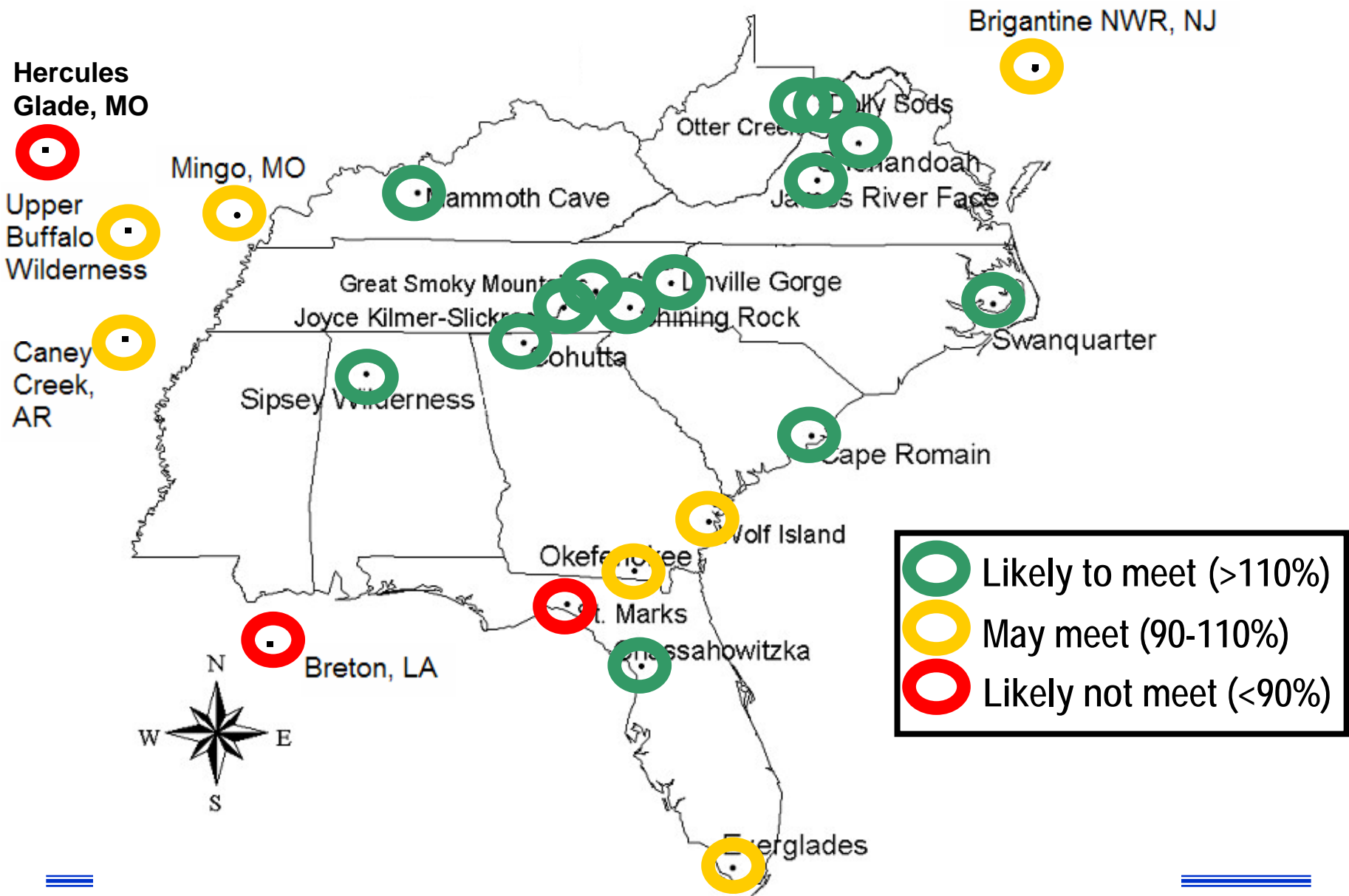


VISTAS 2018 Base G Uniform Rate of Progress Assessment

Using New IMPROVE equation to calculate visibility



2018 RPO Composite Uniform Rate of Progress Results



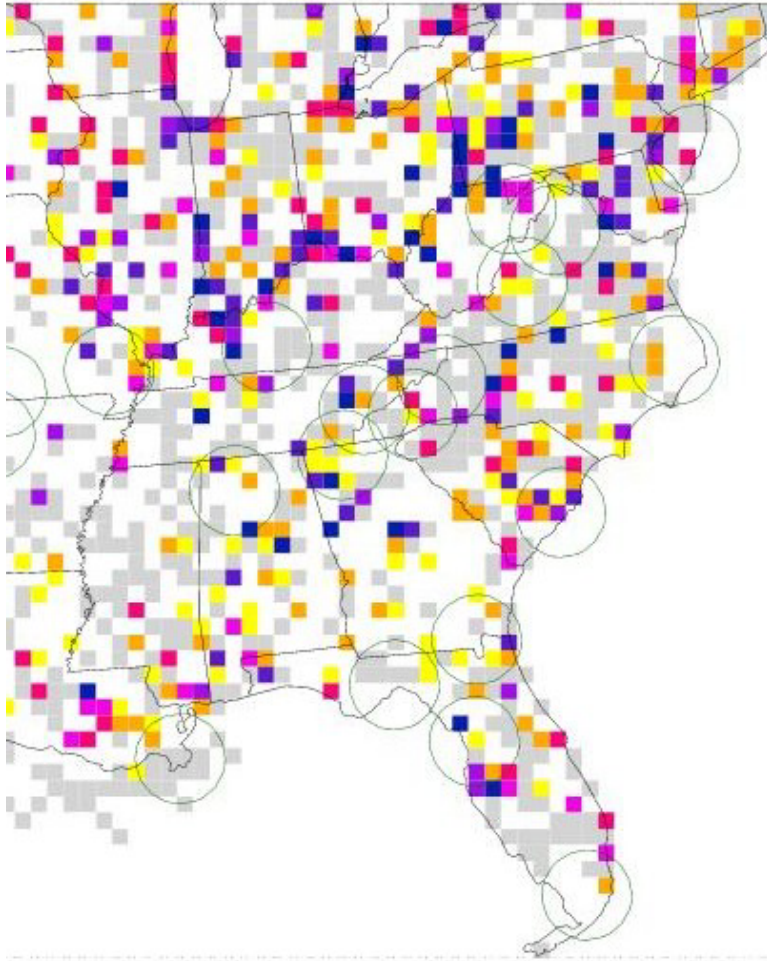
Next Steps for VISTAS Modeling

- Correcting Errors in Emissions and BCs
 - Missing SOA species in BCs
 - Misallocation of fires in Georgia
 - Updated 2018 EGU emissions
- Redo Glide Slope Calculations with BaseG2 Emissions
- Final Modeling Demonstration after States Submit Control Strategies

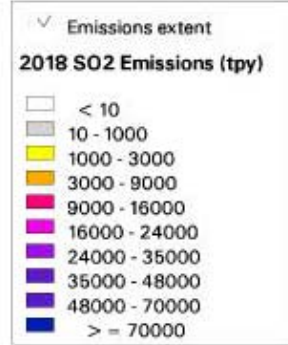
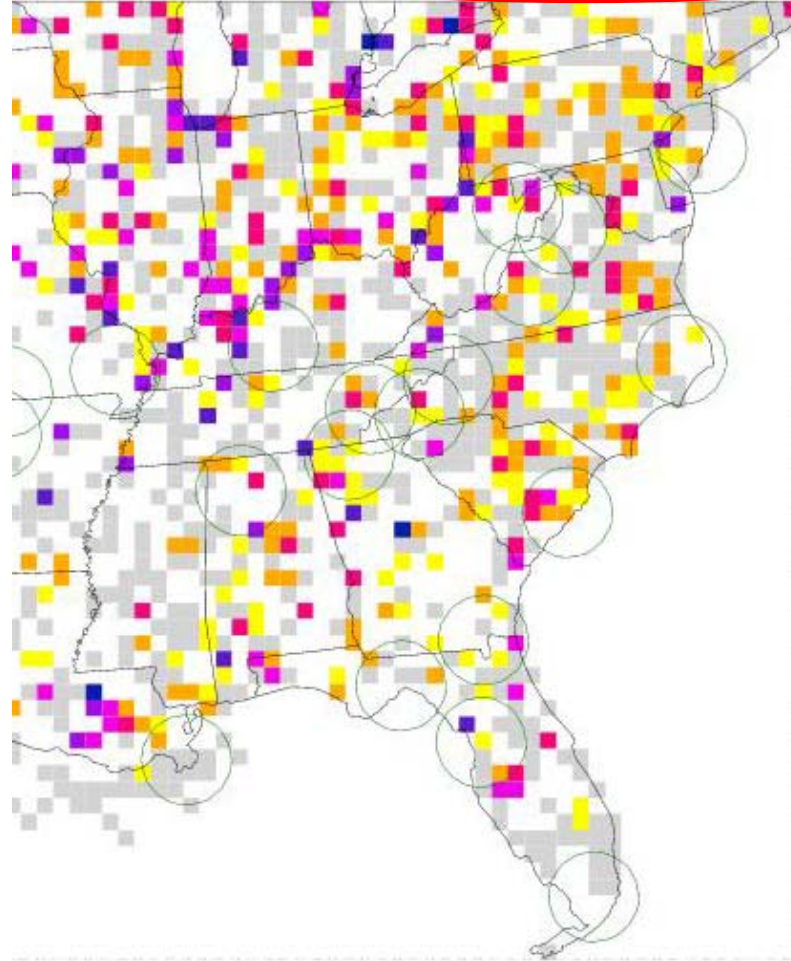
Area of Influence Sensitivity Modeling

2002 vs. 2018 SO₂ Emissions

VISTAS 2002 Point Source SO₂ Emis

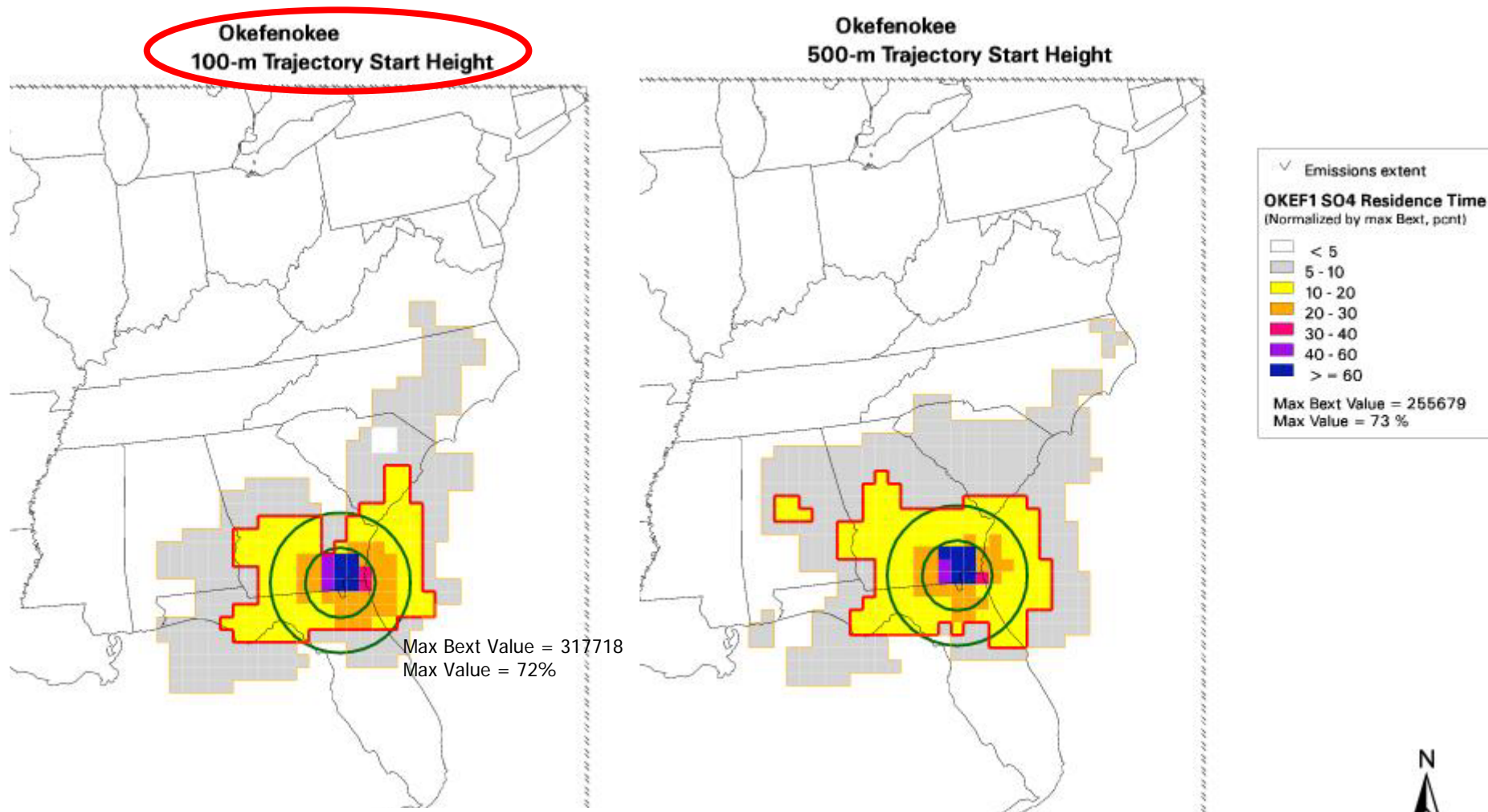


VISTAS 2018 Point Source SO₂ Emissions



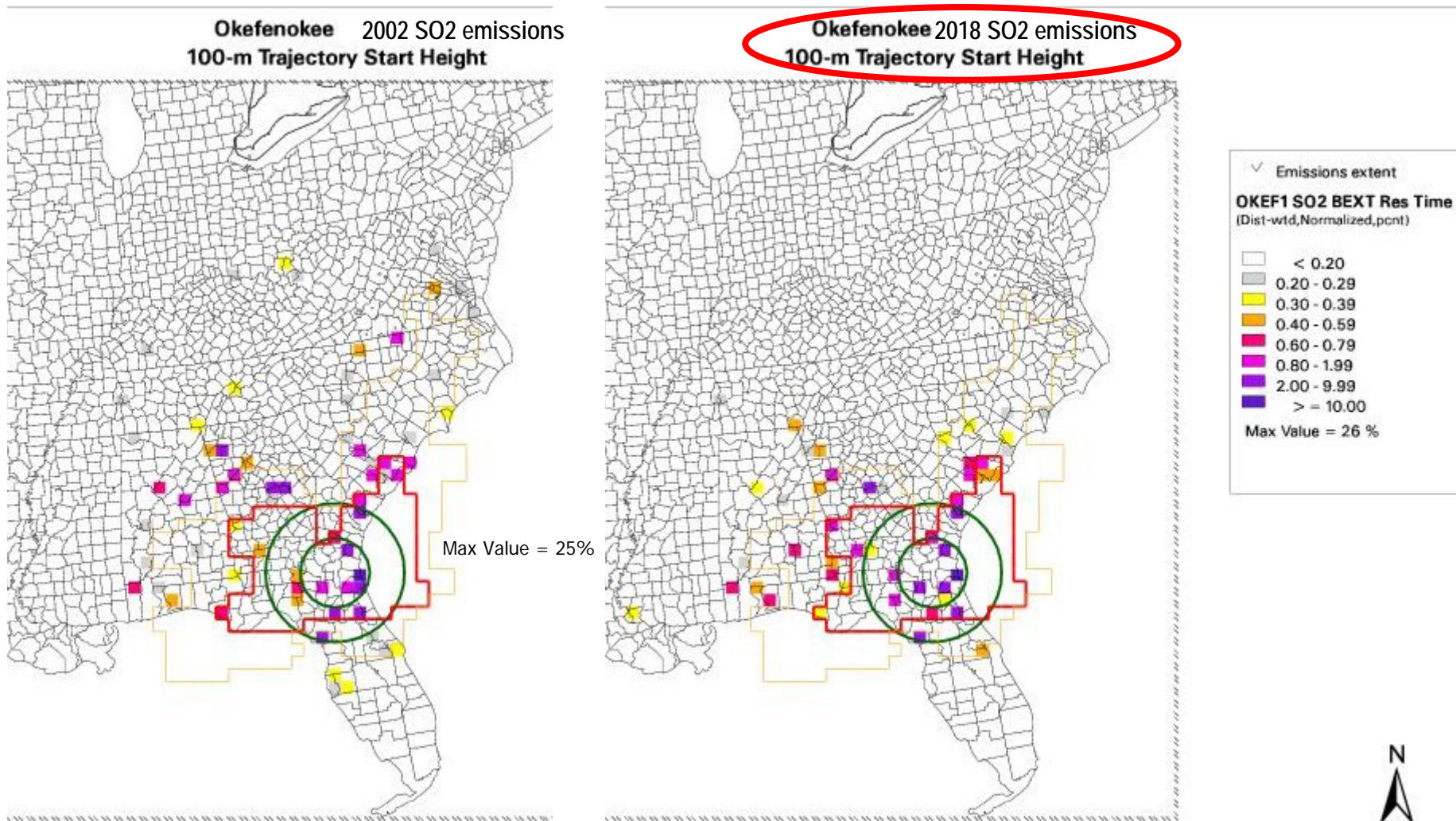
Green circles indicate 100-km radii from Class I areas.

SO₄ Weighted Residence Times



Green circles indicate 100-km and 200-km radii from Class I area.
Red line perimeter indicate Area of Influence with Residence Time $\geq 10\%$.
Orange line perimeter indicate Area of Influence with Residence Time $\geq 5\%$.

RT * (Q/d) Plots



Green circles indicate 100-km and 200-km radii from Class I area.

Red line perimeter indicate Area of Influence with Residence Time $\geq 10\%$.

Orange line perimeter indicate Area of Influence with Residence Time $\geq 5\%$.

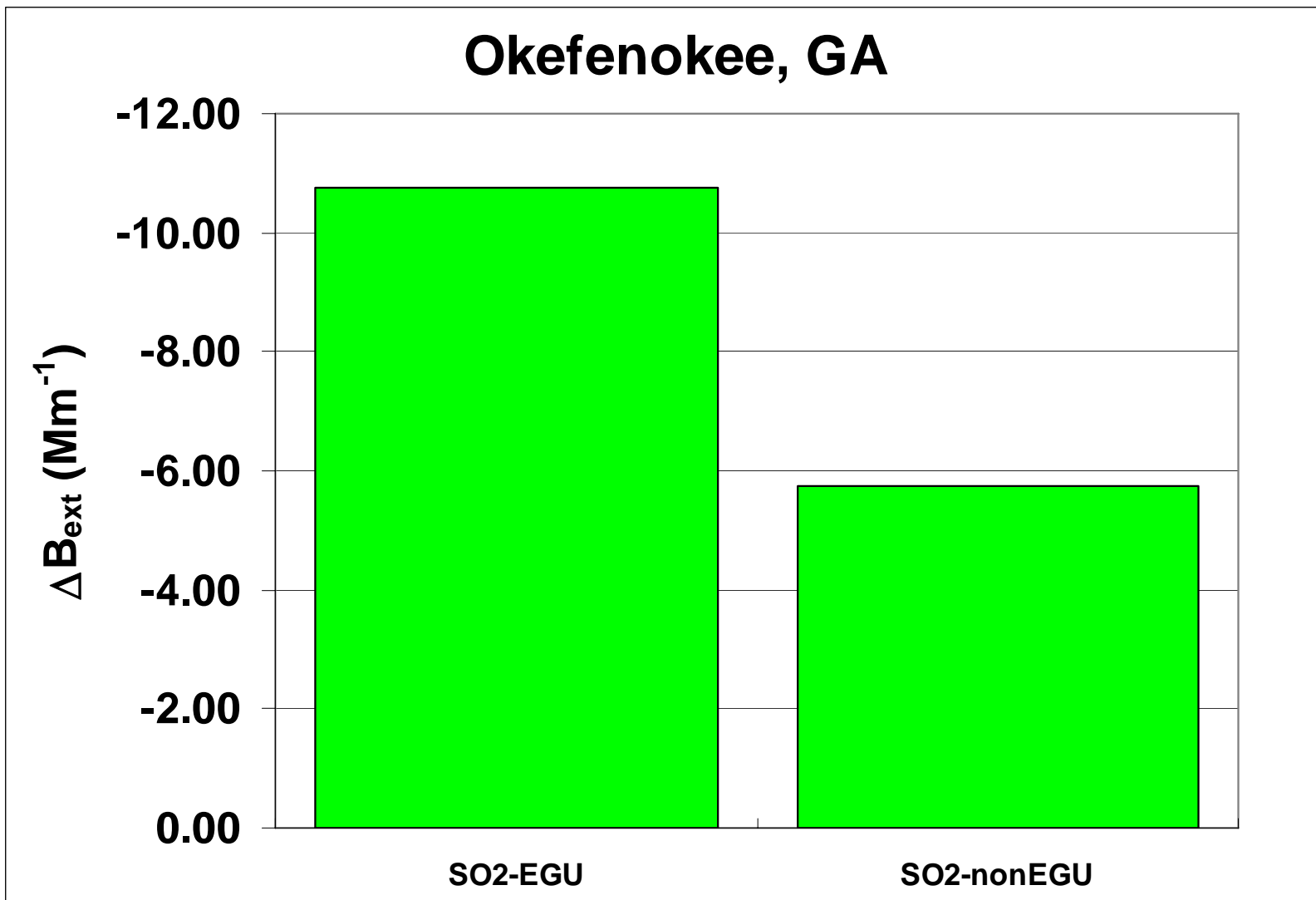
Aol Sensitivity Apportionment

- Define Aol
 - **$RT \geq 10$ for non-EGU and $RT \geq 5$ for EGU**
- Multiply $RT^*(Q/d)$ for each source (i) in Aol
 - $x_i = RT_i^*(Q/d_i)$
- Normalize x_i for each source by sum total of x_i for all sources in Aol
 - $\text{Fraction}_i = x_i / \sum x_i$
- Emission sensitivity run with 100% reduction in SO_2 emissions in Aol (EGU and non-EGU separate)
 - EXAMPLE: EGU Sensitivity = 11 Mm^{-1} at OKEF
- Apportion 100% SO_2 emission sensitivity (Mm^{-1}) to each source by fractional contribution
 - $\text{Impact}_i (\text{Mm}^{-1}) = \text{Sensitivity} * \text{Fraction}_i$

CMAQ Modeling

- Annual VISTAS 36 km modeling with Base G emissions
 - Zero-out SO₂ emissions
- Batch1: EGU and non-EGU
 - BRET, BRIG, MING, OKEF, SAMA, WOLF
 - 12 runs
- Batch2: EGU and non-EGU
 - CHAS, DOSO, EVER, MACA
 - 8 runs

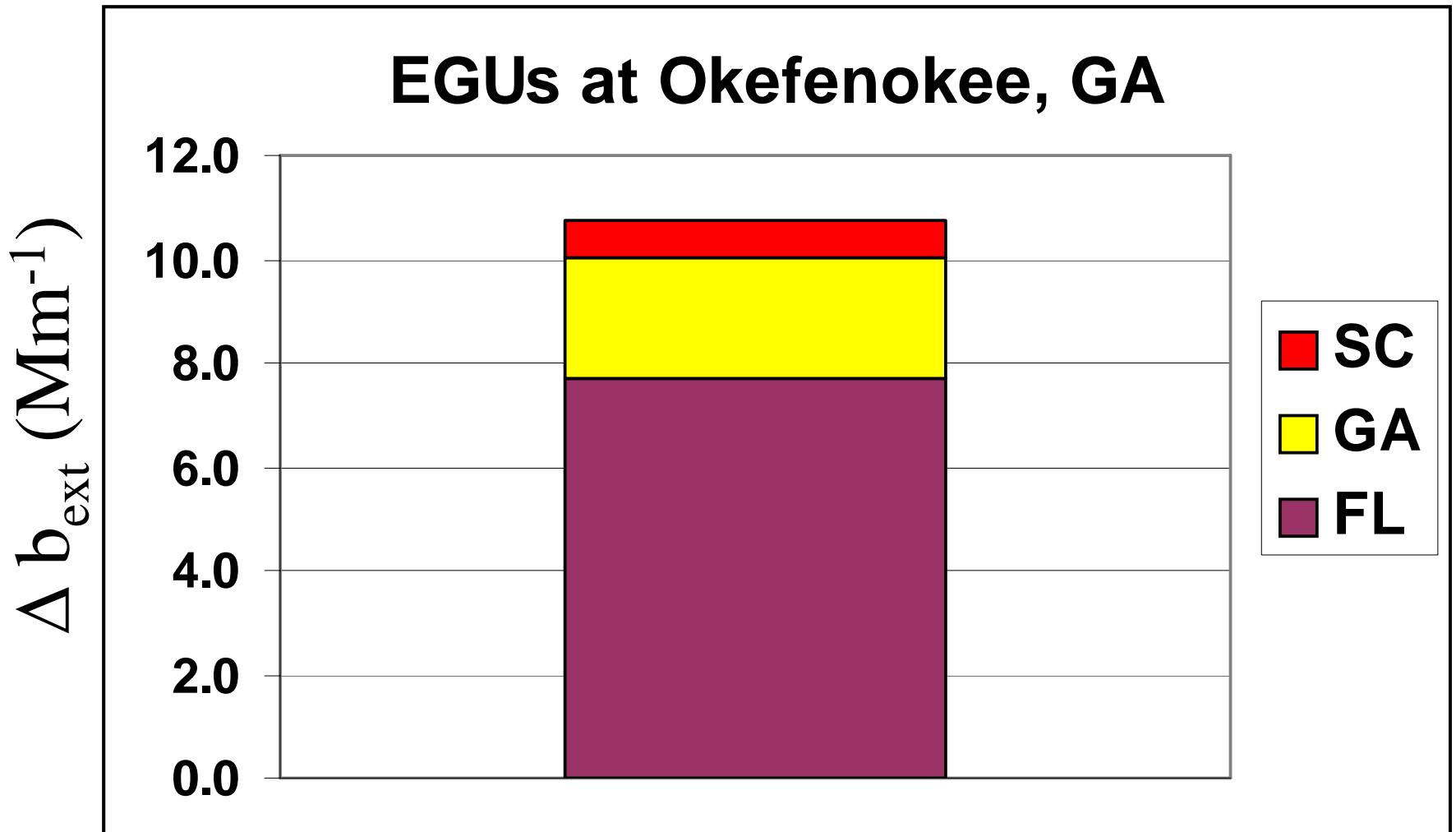
AOI Impacts at OKEF



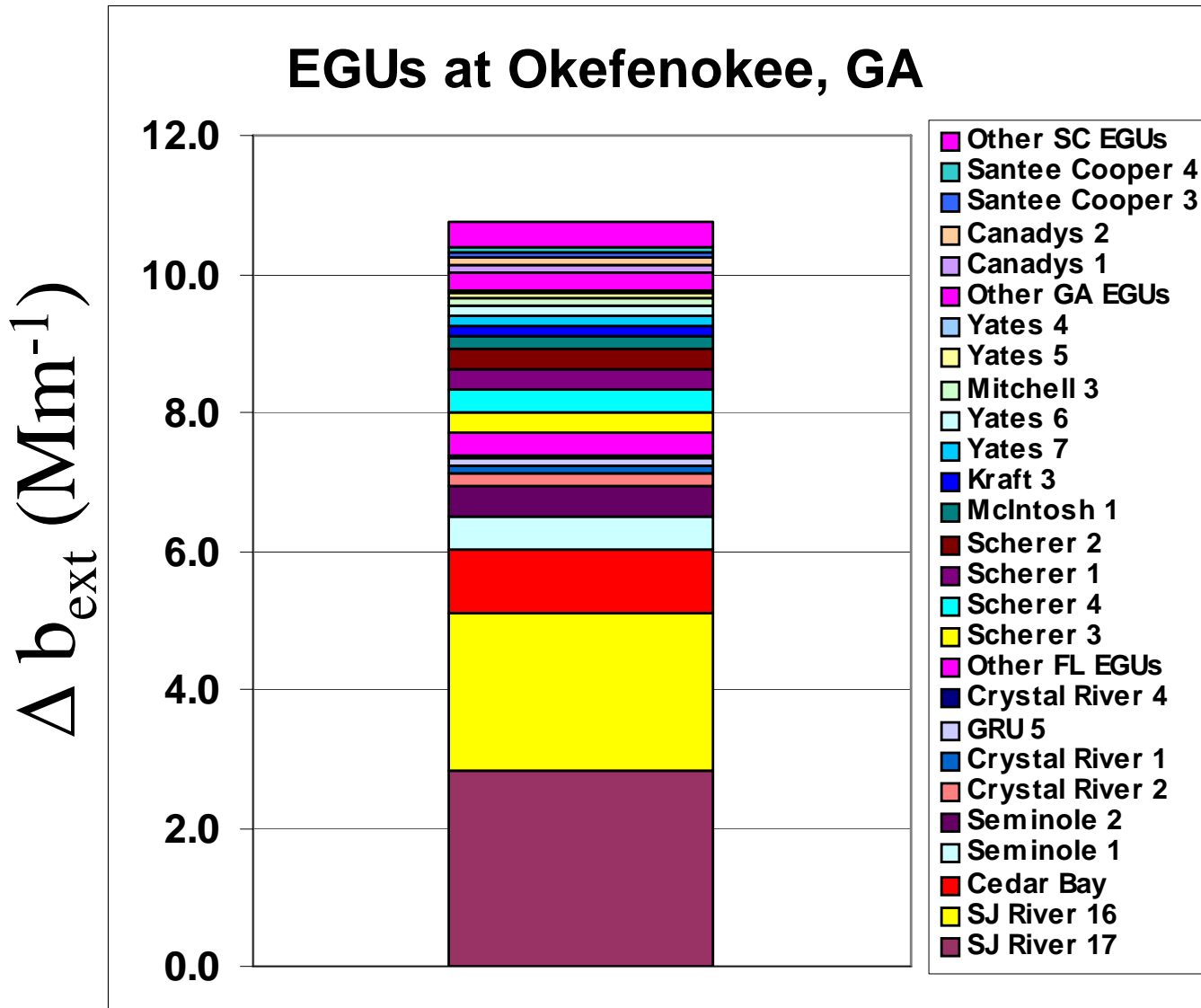
EGU Impacts at OKEF

State	Plant	Unit	SO2 Tons					28368.0					-10.76713
			(2002 G)	(2018 G)	CE	d (km)	Q/d	RT Max*	RT*Q/d	Fraction	T Mm		
FL	SAINT JOHNS RIVER	17	10,185	7,420	90	65.12	113.95	65.70	7486.5	0.2639	-2.8415		
FL	SAINT JOHNS RIVER	16	11,076	5,882	90	65.12	90.33	65.70	5934.7	0.2092	-2.2525		
FL	CEDAR BAY GENERATING COMPANY L P	GEN1	0	2,227	0	61.17	36.41	65.70	2392.1	0.0843	-0.9079		
FL	SEMINOLE ELECTRIC COOPERATIVE, INC.	1	10,912	6,779	95	121.83	55.64	22.94	1276.4	0.0450	-0.4845		
FL	SEMINOLE ELECTRIC COOPERATIVE, INC.	2	12,775	6,508	95	121.83	53.42	22.94	1225.5	0.0432	-0.4651		
FL	PROGRESS ENERGY FLORIDA, INC. CRYSTAL R	2	20,728	15,241	0	205.80	74.06	5.47	405.1	0.0143	-0.1538		
FL	PROGRESS ENERGY FLORIDA, INC. CRYSTAL R	1	18,998	13,537	0	205.80	65.78	5.47	359.8	0.0127	-0.1366		
FL	CITY OF GAINESVILLE, GRU DEERHAVEN GENE	5	6,969	1,062	0	112.18	9.47	22.94	217.2	0.0077	-0.0825		
FL	PROGRESS ENERGY FLORIDA, INC. CRYSTAL R	4	24,635	6,120	90	205.80	29.74	5.47	162.7	0.0057	-0.0617		
FL	Other FL EGUs								813.7	0.0287	-0.3088		
GA	GEORGIA POWER COMPANY, SCHERER STEAM	SG03	18,149	27,735	0	302.93	91.56	9.11	834.1	0.0294	-0.3166		
GA	GEORGIA POWER COMPANY, SCHERER STEAM	SG04	20,771	26,616	0	302.93	87.86	9.11	800.4	0.0282	-0.3038		
GA	GEORGIA POWER COMPANY, SCHERER STEAM	SG01	25,286	26,264	0	302.93	86.70	9.11	789.8	0.0278	-0.2998		
GA	GEORGIA POWER COMPANY, SCHERER STEAM	SG02	24,966	26,075	0	302.93	86.07	9.11	784.1	0.0276	-0.2976		
GA	SAVANNAH ELECTRIC: MCINTOSH STEAM - ELE	SG01	7,089	7,015	0	201.59	34.80	15.51	539.7	0.0190	-0.2049		
GA	SAVANNAH ELECTRIC: KRAFT STEAM - ELECTR	SG03	3,992	4,474	0	182.45	24.52	15.53	380.8	0.0134	-0.1445		
GA	GEORGIA POWER COMPANY, YATES STEAM-EL	SG07	14,024	16,530	0	400.52	41.27	8.49	350.4	0.0124	-0.1330		
GA	GEORGIA POWER COMPANY, YATES STEAM-EL	SG06	15,175	16,367	0	400.52	40.86	8.49	346.9	0.0122	-0.1317		
GA	GEORGIA POWER COMPANY, MITCHELL STEAM	SG03	4,173	4,930	0	206.79	23.84	14.43	344.0	0.0121	-0.1306		
GA	GEORGIA POWER COMPANY, YATES STEAM-EL	SG05	5,009	6,643	0	400.52	16.59	8.49	140.8	0.0050	-0.0535		
GA	GEORGIA POWER COMPANY, YATES STEAM-EL	SG04	4,842	6,500	0	400.52	16.23	8.49	137.8	0.0049	-0.0523		
GA	Other GA EGUs								643.5	0.0227	-0.2442		
SC	SCE&G:CANADYS	001	6,214	5,203	0	295.33	17.62	16.79	295.8	0.0104	-0.1123		
SC	SCE&G:CANADYS	002	6,585	5,144	0	295.35	17.42	16.79	292.5	0.0103	-0.1110		
SC	SANTEE COOPER JEFFERIES	003	11,315	6,761	0	344.29	19.64	10.78	211.7	0.0075	-0.0804		
SC	SANTEE COOPER JEFFERIES	004	11,789	6,609	0	344.29	19.20	10.78	207.0	0.0073	-0.0786		
SC	Other SC EGUs								994.9	0.035073	-0.3776		

State Contributions to OKEF



Source Contributions to OKEF



GA EPD Annual Emission Sensitivities

Emission Sensitivities

- Annual Regional Haze Modeling with CMAQ on ALGA 36 km grid
 - Base G Emissions
- Zero-out SO₂ emissions in grid cell containing specific EGU and non-EGU sources
 - 17 Annual Simulations (completed)
- Compare source specific results to those obtained by AOI Sensitivity Modeling

Modeled Sources

GEORGIA

- **GEORGIA-PACIFIC BRUNSWICK OPERATIONS – Units F1 and M24**
- **GEORGIA POWER COMPANY, SCHERER STEAM-ELE – Units SG01, SG02, SG03, SG04**
- **INTERNATIONAL PAPER - SAVANNAH MILL – Unit PB13**
- **SAVANNAH ELECTRIC: MCINTOSH STEAM – ELECTRIC – Unit SG01**
- **JESUP MILL, RAYONIER PERFORMANCE FIBERS – Units PB03 and PB02**
- **SAVANNAH ELECTRIC: KRAFT STEAM – ELECTRIC – Unit SG03**
- **GEORGIA-PACIFIC CORP SAVANNAH RIVER MILL – Units BO01, BO02, BO03**
- **GEORGIA POWER COMPANY, YATES STEAM-ELECTRIC – Units SG06 and SG07**
- **GEORGIA POWER COMPANY, MITCHELL STEAM- ELECTRIC – Unit SG03**
- **SAVANNAH SUGAR REFINERY – Unit U161**
- **SOUTHERN STATES PHOSPHATE & FERTILIZER – Unit SA02**

Modeled Sources

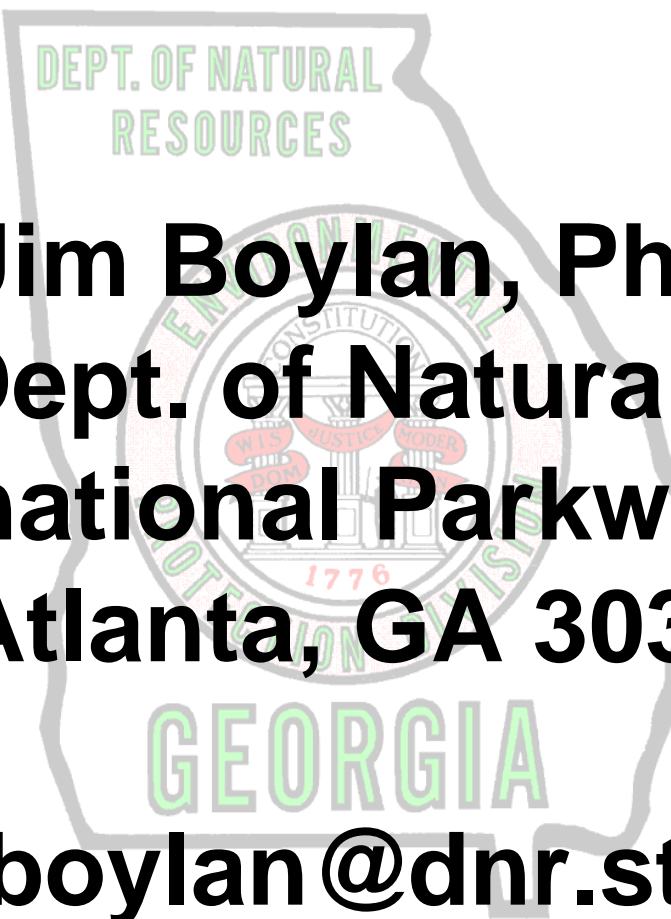
FLORIDA

- SAINT JOHNS RIVER – Units 16 and 17
- JEFFERSON SMURFIT CORPORATION (US) – Units 6 and 15
- SEMINOLE ELECTRIC COOPERATIVE, INC. – Units 1 and 2
- CEDAR BAY GENERATING COMPANY L P – Unit GEN1
- WHITE SPRINGS AGRICULTURAL CHEMICALS, INC – Units 66 and 67
- PROGRESS ENERGY FLORIDA, INC. CRYSTAL RIVER – Units 1 and 2

SOUTH CAROLINA

- SCE&G:CANADYS – Units 001 and 002
- SANTEE COOPER JEFFERIES – Units 003 and 004
- SANTEE COOPER CROSS – Unit 3
- MEADWESTVACO CORPORATION INC – Unit 006

Contact Information



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