

Filtered RRF and DVf Calculations

SET PMTC Meeting

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Filtered RRF Project Plan

- Utilize information gained from ensemble modeling to identify and extract questionable modeling days (those where model predictions don't match observed concentrations) to generate revised RRFs for these best correlated episodes
- Allows for “better” model performance and RRFs more consistent with observed control / concentration response

Relative Response Factor

- The relative response factor (RRF) is the ratio of the future year modeled concentration predicted near a monitor (averaged over multiple days) to the base year modeled concentration predicted near the monitor (averaged over the same days)
- Calculations conducted using EPA's Modeled Attainment Test Software (MATS), v.2.5.1
 - Includes current EPA attainment test guidance methods

RRF Setup – Selecting Monitors

- If there are fewer than 10 model days at or above 85 ppb in the baseline scenario, then MATS will lower the threshold in increments of 1 ppb, until there are at least 10 days at or above this new, lower threshold
 - This process is continued, if needed, until a threshold of 70 ppb is reached
 - By default, this is the lowest allowable threshold
 - If there are fewer than 5 days at or above this threshold of 70 ppb, then the monitor site will be dropped

8-hr Ozone Attainment Test

RRF is based on modeled data
concentration change
[future modeled / base modeled]

DV_c is based on observed
concentration data

$$DV_f = RRF * DV_c$$

DV_f is resultant future year concentration data
based on DV_c and calculated RRF slope

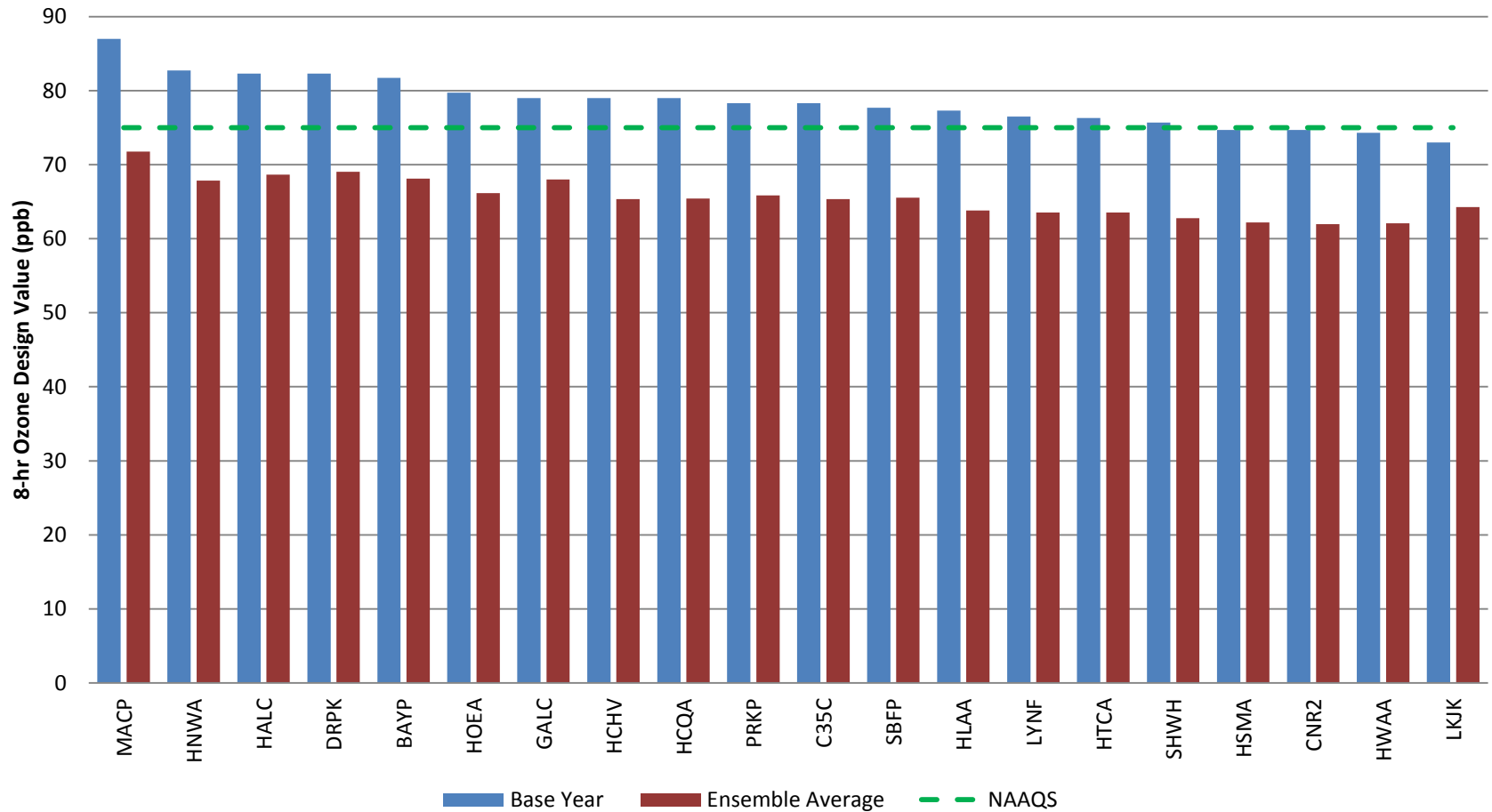
MATS RRF Results [2011-2023]

4km Modeling

Monitor	Name	Abbreviation	8hr Ozone Design Values (ppb) - MATS					Ensemble Average
			Dvc	Future Year (DVf)				
			Base Year	WRF/MEGAN	WRF/GloBEIS	MM5/MEGAN	MM5/GloBEIS	
480391004	Manvel Croix Park C84	MACP	87.0	70.3	70.4	73.0	73.4	71.8
480391016	Lake Jackson C1016	LKJK	73.0	64.1	65.0	64.0	63.9	64.3
481671034	Galveston 99th St. C1034/A320/X183	GALC	79.0	66.7	66.8	69.1	69.4	68.0
482010024	Houston Aldine C8/AF108/X150	HALC	82.3	66.6	67.4	70.0	70.6	68.7
482010026	Channelview C15/AH115	HCHV	79.0	62.9	62.5	67.6	68.4	65.4
482010029	Northwest Harris Co. C26/A110/X154	HNWA	82.7	66.0	66.6	68.6	70.1	67.8
482010046	Houston North Wayside C405	HWAA	74.3	60.5	60.8	63.0	64.0	62.1
482010047	Lang C408	HLAA	77.3	62.3	63.1	64.6	65.3	63.8
482010051	Houston Croquet C409	HCQA	79.0	64.3	64.4	66.3	66.7	65.4
482010055	Houston Bayland Park C53/A146	BAYP	81.7	66.5	67.4	68.8	69.7	68.1
482010062	Houston Monroe C406	HSMA	74.7	60.8	60.9	63.0	64.1	62.2
482010066	Houston Westhollow C410	SHWH	75.7	61.3	62.2	63.3	64.3	62.8
482010075	Houston Texas Avenue C411	HTCA	76.3	62.3	63.2	64.0	64.7	63.6
482010416	Park Place C416	PRKP	78.3	64.6	65.1	66.7	66.9	65.8
482011015	Lynchburg Ferry C1015/A165	LYNF	76.5	60.4	60.5	66.3	66.9	63.5
482011034	Houston East C1/G316	HOEA	79.7	64.2	64.4	67.5	68.5	66.2
482011035	Clinton C403/C304/AH113	C35C	78.3	63.9	64.5	66.1	66.9	65.4
482011039	Hou.DeerPrk2 C35/235/1001/AFH139FP239	DRPK	82.3	66.0	66.3	71.4	72.4	69.0
482011050	Seabrook Friendship Park C45	SBFP	77.7	62.5	62.9	68.2	68.5	65.5
483390078	Conroe Relocated C78/A321	CNR2	74.7	60.3	60.3	63.2	64.0	62.0

4km Attainment Test Results

2011-2023 Simulation [Ensemble Average]



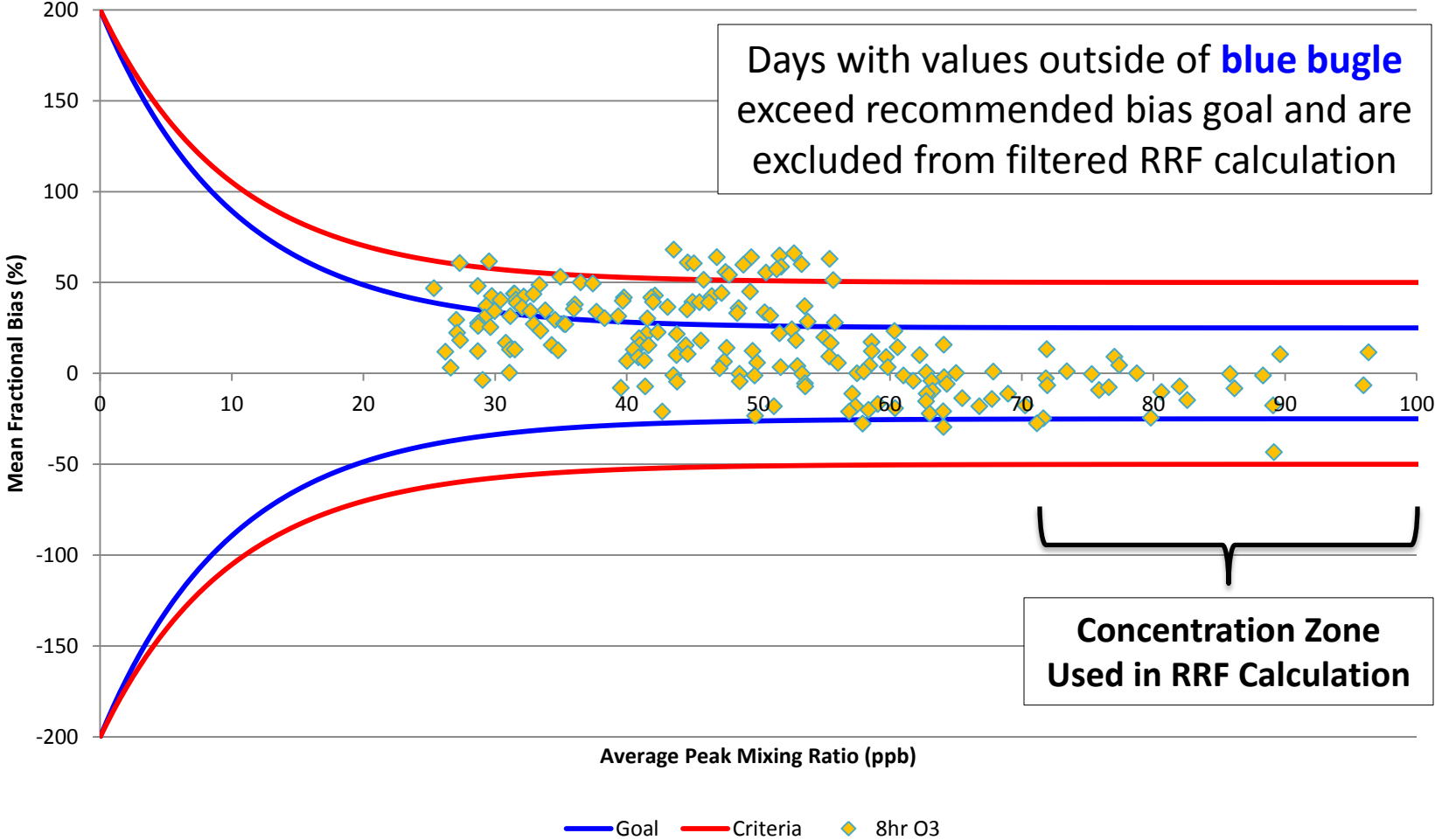
Analysis Objective

- Determine if removal of high bias days provides higher confidence in model performance and response to changes in emissions
 - Filter set at MDA8 fractional bias less than +/-15% for observations > 40ppb
- Use results to inform policy makers that filtered RRF calculations are/are not preferred in determining control strategy development

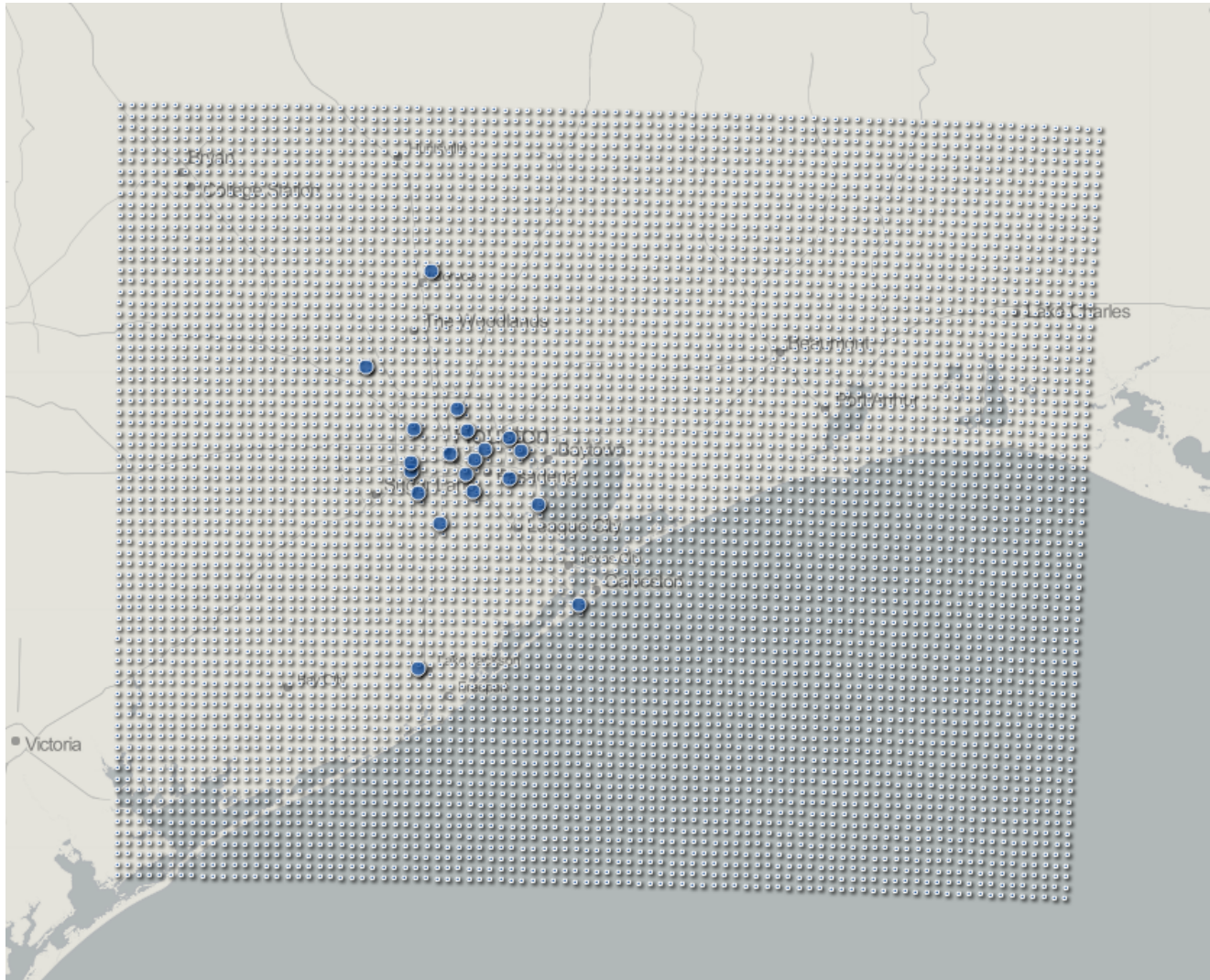
Applied Method

- On days where MPE indicated high bias, concentrations set to 40 ppb
 - Prevented MATS from selecting these days as part of RRF calculation

Fractional Bias in MDA8 Ozone Manvel Croix – 2011 WRF/MEGAN

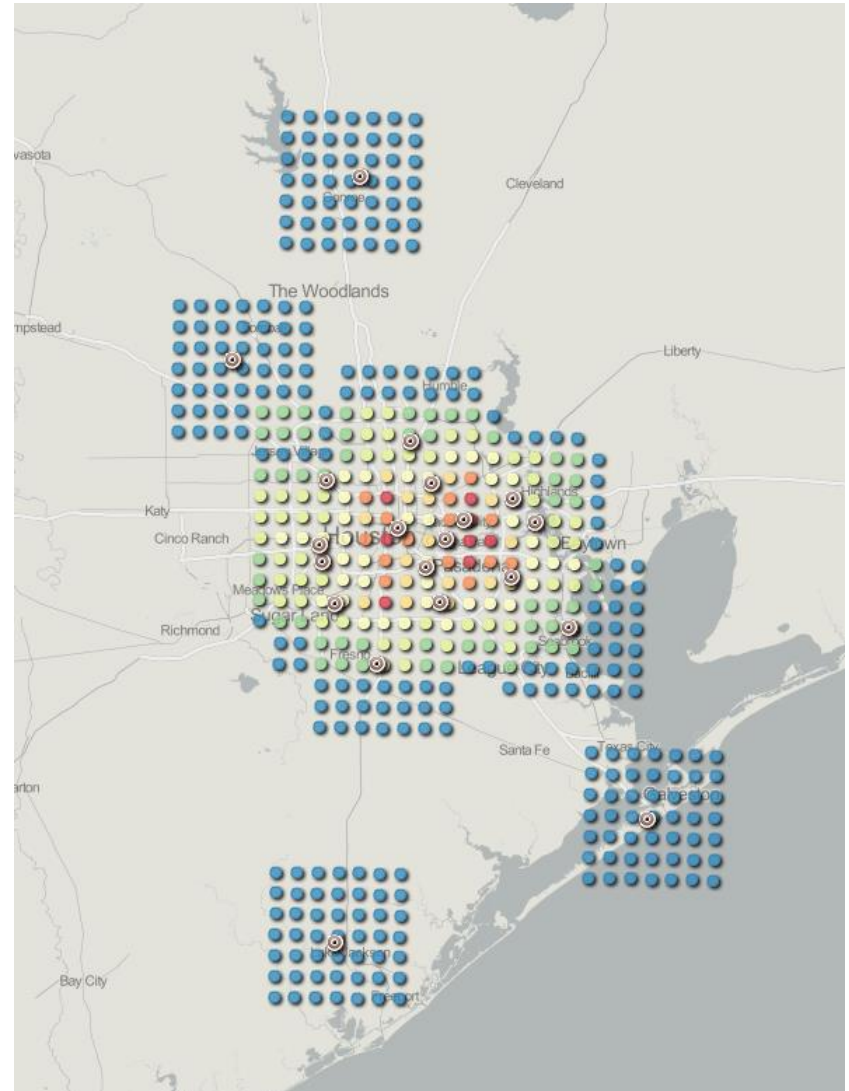


HGB 4km Modeling Domain with Key Monitor Locations



RRF 7x7 Grid Spatial Field and Overlap

- Grids indicate the MATS “neighborhood” from which RRF are calculated
- Blue grid indicate single monitor association
- Warmer colors (reds) indicate multiple monitors share grid cell
- Results indicates that MATS runs for each individual monitor are required to capture correct filter days



Neighborhood Overlap Issue

- Our first run resulted in RRFs that were very unreasonable based on what we expected
- Reason: Because of 7x7 neighborhood overlap, a poor performing day at one monitor was not necessarily poor for another monitor
- Solution: Run MATS for each monitor filtering only those days impacting that neighborhood

Manvel Croix Bias Calculations

Highest Ozone Concentration Days (2011)

Days where MDA8
frac bias greater
+/- 15% (highlight)

Comparison of
monitor specific
predictions and 7x7
grid maximum
prediction

Highest Modeled Ozone Days					
	Monitor			7x7 Grid	
Date	Obs. (ppb)	Model (ppb)	Bias (%)	Max (ppb)	Bias (%)
6/6/2011	90.81	101.89	10.9	110.49	17.8
8/29/2011	84.95	94.32	9.9	112.27	24.3
8/28/2011	99.18	92.77	-6.9	104.48	5.1
9/9/2011	88.91	87.76	-1.3	94.45	5.9
9/22/2011	86.00	85.66	-0.4	88.22	2.5
8/26/2011	89.74	82.59	-8.7	102.57	12.5
5/26/2011	96.96	81.22	-19.4	89.72	-8.1
8/30/2011	73.59	80.52	8.6	97.77	24.7
9/30/2011	75.66	79.15	4.4	85.98	12.0
9/21/2011	84.99	79.00	-7.6	87.06	2.4
9/23/2011	78.74	78.75	0.0	84.14	6.4
10/11/2011	67.17	76.64	12.4	80.85	16.9
8/27/2011	88.66	76.50	-15.9	90.64	2.2
6/2/2011	84.79	76.46	-10.9	80.37	-5.5
9/15/2011	75.53	75.12	-0.5	83.87	9.9
4/27/2011	73.02	73.84	1.1	76.04	4.0
9/10/2011	79.56	73.69	-8.0	83.80	5.1
4/19/2011	37.98	72.85	47.9	73.45	48.3
6/5/2011	79.42	72.35	-9.8	85.42	7.0
10/4/2011	72.85	70.83	-2.9	72.37	-0.7
8/24/2011	35.31	70.10	49.6	74.68	52.7

Unfiltered vs Filtered RRF Results WRF/MEGAN

Name	DVc (ppb) Base Year	2011-2023 WRF/MEGAN RRF Calculation Ensemble Results				Delta (ppb)	Number of Total Days Mod > 85 ppb	Number of Filtered Days Mod > 85 ppb
		Unfiltered		Filtered				
		DVf (ppb)	RRF	DVf (ppb)	RRF			
Manvel Croix Park C84	87.0	70.3	0.808	70.0	0.805	-0.3	5	0
Lake Jackson C1016	73.0	64.1	0.878	62.8	0.861	-1.3	2	1
Galveston 99th St. C1034/A320/X183	79.0	66.7	0.845	68.1	0.863	1.4	7	4
Houston Aldine C8/AF108/X150	82.3	66.6	0.810	69.4	0.844	2.8	18	16
Channelview C15/AH115	79.0	62.9	0.796	65.4	0.829	2.5	8	7
Northwest Harris Co. C26/A110/X154	82.7	66.0	0.798	65.8	0.796	-0.2	10	8
Houston North Wayside C405	74.3	60.5	0.815	62.9	0.847	2.4	14	12
Lang C408	77.3	62.3	0.806	65.3	0.845	3.0	20	20
Houston Croquet C409	79.0	64.3	0.815	64.7	0.820	0.4	6	3
Houston Bayland Park C53/A146	81.7	66.5	0.815	67.5	0.827	1.0	5	4
Houston Monroe C406	74.7	60.8	0.814	61.5	0.824	0.7	8	6
Houston Westhollow C410	75.7	61.3	0.810	62.2	0.822	0.9	9	7
Houston Texas Avenue C411	76.3	62.3	0.817	62.3	0.817	0.0	10	9
Park Place C416	78.3	64.6	0.825	66.1	0.844	1.5	8	8
Lynchburg Ferry C1015/A165	76.5	60.4	0.790	62.7	0.821	2.3	7	6
Houston East C1/G316	79.7	64.2	0.806	65.7	0.825	1.5	7	4
Clinton C403/C304/AH113	78.3	63.9	0.817	64.2	0.820	0.3	7	5
Hou.DeerPrk2 C35/235/1001/AFH139FP239	82.3	66.0	0.802	67.8	0.825	1.8	8	4
Seabrook Friendship Park C45	77.7	62.5	0.806	65.3	0.841	2.8	8	5
Conroe Relocated C78/A321	74.7	60.3	0.808	61.0	0.817	0.7	5	4

Future Year DVf (Unfiltered)

Name	DVc (ppb)	Unfiltered DVf (ppb)				
	Base Year	WRF-GLOBEIS	WRF-MEGAN	MM5-GLOBEIS	MM5-MEGAN	AVG
Manvel Croix Park C84	87.0	70.4	70.3	73.4	73.0	71.8
Lake Jackson C1016	73.0	65.0	64.1	63.9	64.0	64.3
Galveston 99th St. C1034/A320/X183	79.0	66.8	66.7	69.4	69.1	68.0
Houston Aldine C8/AF108/X150	82.3	67.4	66.6	70.6	70.0	68.7
Channelview C15/AH115	79.0	62.5	62.9	68.4	67.6	65.4
Northwest Harris Co. C26/A110/X154	82.7	66.6	66.0	70.1	68.6	67.8
Houston North Wayside C405	74.3	60.8	60.5	64.0	63.0	62.1
Lang C408	77.3	63.1	62.3	65.3	64.6	63.8
Houston Croquet C409	79.0	64.4	64.3	66.7	66.3	65.4
Houston Bayland Park C53/A146	81.7	67.4	66.5	69.7	68.8	68.1
Houston Monroe C406	74.7	60.9	60.8	64.1	63.0	62.2
Houston Westhollow C410	75.7	62.2	61.3	64.3	63.3	62.8
Houston Texas Avenue C411	76.3	63.2	62.3	64.7	64.0	63.6
Park Place C416	78.3	65.1	64.6	66.9	66.7	65.8
Lynchburg Ferry C1015/A165	76.5	60.5	60.4	66.9	66.3	63.5
Houston East C1/G316	79.7	64.4	64.2	68.5	67.5	66.2
Clinton C403/C304/AH113	78.3	64.5	63.9	66.9	66.1	65.4
Hou.DeerPrk2 C35/235/1001/AFH139FP239	82.3	66.3	66.0	72.4	71.4	69.0
Seabrook Friendship Park C45	77.7	62.9	62.5	68.5	68.2	65.5
Conroe Relocated C78/A321	74.7	60.3	60.3	64.0	63.2	62.0

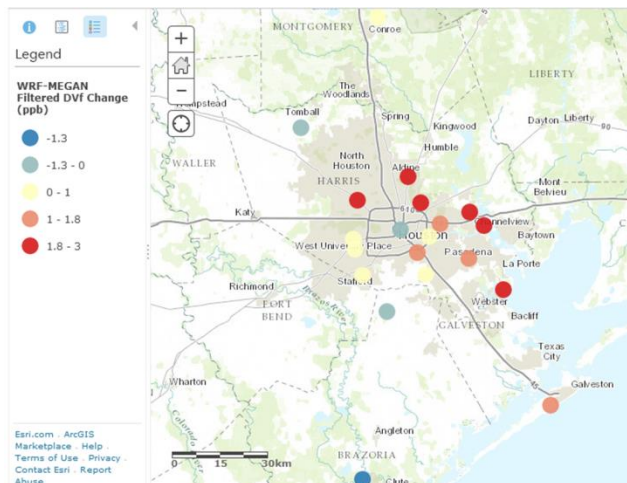
Future Year DVf (Filtered)

Name	DVc (ppb)	Filtered DVf (ppb)				
	Base Year	WRF-GLOBEIS	WRF-MEGAN	MM5-GLOBEIS	MM5-MEGAN	AVG
Manvel Croix Park C84	87.0	70.0	70.0	73.3	72.7	71.5
Lake Jackson C1016	73.0	61.7	62.8	65.9	64.9	63.8
Galveston 99th St. C1034/A320/X183	79.0	69.9	68.1	72.1	72.2	70.6
Houston Aldine C8/AF108/X150	82.3	69.8	69.4	71.8	71.3	70.6
Channelview C15/AH115	79.0	64.8	65.4	69.8	69.4	67.4
Northwest Harris Co. C26/A110/X154	82.7	65.6	65.8	69.3	69.6	67.6
Houston North Wayside C405	74.3	62.4	62.9	64.9	64.7	63.7
Lang C408	77.3	66.4	65.3	65.8	65.6	65.8
Houston Croquet C409	79.0	65.0	64.7	67.0	66.4	65.8
Houston Bayland Park C53/A146	81.7	67.1	67.5	70.3	69.4	68.6
Houston Monroe C406	74.7	61.3	61.5	63.0	63.9	62.4
Houston Westhollow C410	75.7	62.2	62.2	63.8	64.3	63.1
Houston Texas Avenue C411	76.3	63.4	62.3	64.8	65.5	64.0
Park Place C416	78.3	64.9	66.1	67.0	67.9	66.5
Lynchburg Ferry C1015/A165	76.5	62.0	62.7	67.0	66.4	64.5
Houston East C1/G316	79.7	65.9	65.7	68.8	69.4	67.5
Clinton C403/C304/AH113	78.3	64.8	64.2	66.6	66.1	65.4
Hou.DeerPrk2 C35/235/1001/AFH139FP239	82.3	67.9	67.8	73.6	72.7	70.5
Seabrook Friendship Park C45	77.7	64.5	65.3	68.4	69.6	67.0
Conroe Relocated C78/A321	74.7	61.7	61.0	62.7	62.4	62.0

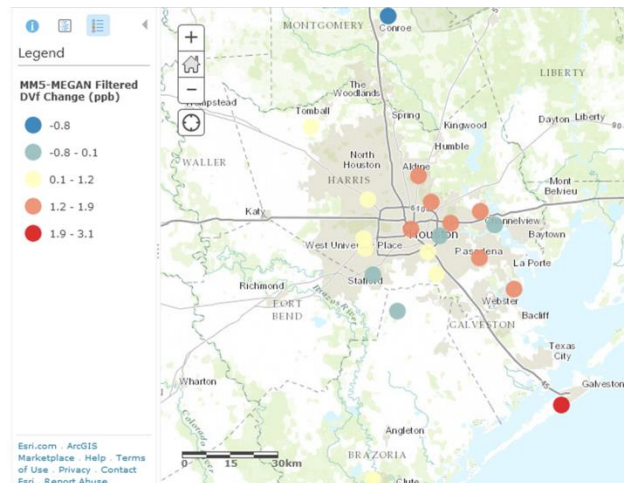
Future Year DVf Change (Filtered)

Name	Filtered DVf Change (ppb)				
	WRF-GLOBEIS	WRF-MEGAN	MM5-GLOBEIS	MM5-MEGAN	AVG
Manvel Croix Park C84	-0.4	-0.3	-0.1	-0.3	-0.3
Lake Jackson C1016	-3.3	-1.3	2	0.9	-0.4
Galveston 99th St. C1034/A320/X183	3.1	1.4	2.7	3.1	2.6
Houston Aldine C8/AF108/X150	2.4	2.8	1.2	1.3	1.9
Channelview C15/AH115	2.3	2.5	1.4	1.8	2.0
Northwest Harris Co. C26/A110/X154	-1	-0.2	-0.8	1	-0.3
Houston North Wayside C405	1.6	2.4	0.9	1.7	1.7
Lang C408	3.3	3	0.5	1	2.0
Houston Croquet C409	0.6	0.4	0.3	0.1	0.4
Houston Bayland Park C53/A146	-0.3	1	0.6	0.6	0.5
Houston Monroe C406	0.4	0.7	-1.1	0.9	0.2
Houston Westhollow C410	0	0.9	-0.5	1	0.4
Houston Texas Avenue C411	0.2	0	0.1	1.5	0.4
Park Place C416	-0.2	1.5	0.1	1.2	0.7
Lynchburg Ferry C1015/A165	1.5	2.3	0.1	0.1	1.0
Houston East C1/G316	1.5	1.5	0.3	1.9	1.3
Clinton C403/C304/AH113	0.3	0.3	-0.3	0	0.1
Hou.DeerPrk2 C35/235/1001/AFH139FP239	1.6	1.8	1.2	1.3	1.5
Seabrook Friendship Park C45	1.6	2.8	-0.1	1.4	1.4
Conroe Relocated C78/A321	1.4	0.7	-1.3	-0.8	0.0
Average Change (ppb)	0.8	1.2	0.4	1.0	0.8

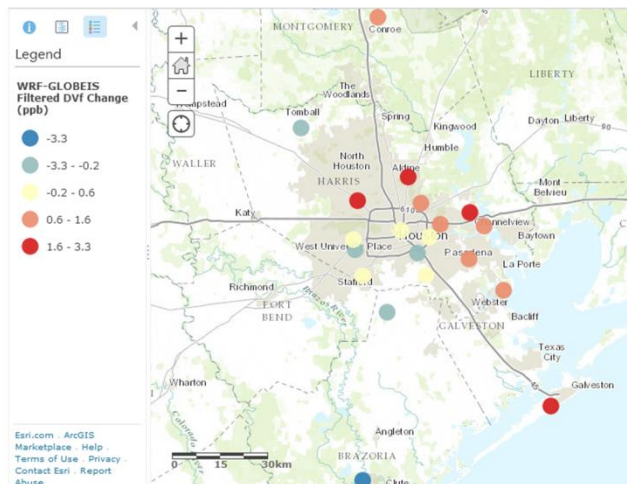
Change in DVf (ppb) with Filtering



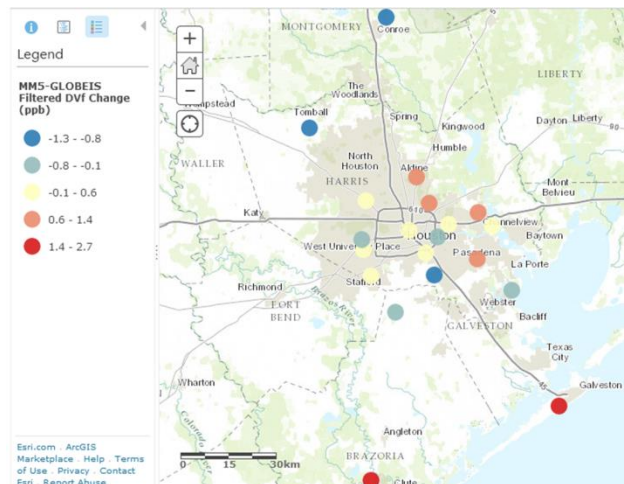
WRF/MEGAN



MM5/MEGAN



WRF/GloBEIS



MM5/GloBEIS

Observations

- Future design value is sensitive (both positive and negative) to days in calculation
- Manvel Croix Park only monitor where design value decrease with filter applied in every ensemble
- Largest filtered increases are typically seen to the north and east of city center and along the shipping channel
 - Emissions and met challenges in this region
- Applying the filter increases the confidence in the modeling
- Important component in reviewing TCEQ SIP modeling
 - Filtering may have as significant a ppb change as control strategies at some monitors