US EPA ARCHIVE DOCUMENT

DETERMINING SO2 MONITORING BY RECEPTOR RANKS

DuPont Case Presented by Kyle Spangle, TN Division of Air Pollution Control

Purpose

- SO2 monitoring site selection should account for the frequency in which a receptor sees daily maximum concentrations.
- Ranking receptors by this metric in combination with the normalized design value at each receptor will give sound justification for the selection of a permanent site location.

Guidance

- The SO2 monitoring TAD gives the following strategy:

1. Calculate the normalized design value at each receptor and rank from highest to lowest receptor. Rank of 1 means the highest design value.
2. Using the MAXDAILY output option in AERMOD, determine each day's highest normalized concentration and receptor. The MAXDAILY option in AERMOD outputs each receptor's highest concentration for each modeled day.
3. Using the output from step 2, determine the number of days each receptor is the highest concentration for the day among all receptors.
4. Rank the results from step 3 from highest to lowest number of days. Rank of 1 means the highest number of days having the daily maximum value.
5. For each receptor, add the concentration rank and the day rank. The lowest possible score is 2, meaning the receptor was the highest overall normalized design value and also had the highest number of days where the receptor was the highest concentration for the day.

Working with the MAXDAILY File

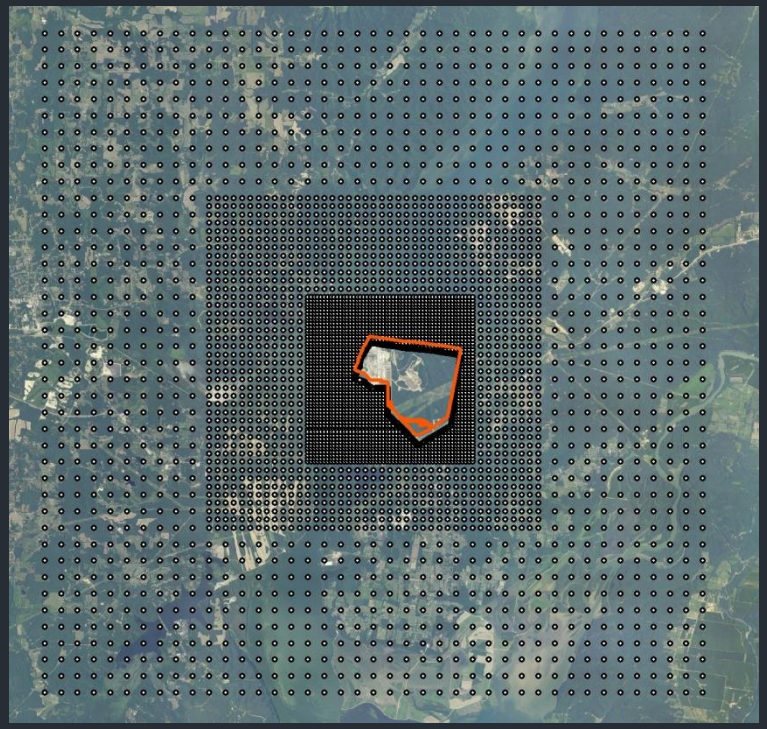
- The MAXDAILY output option will output the maximum concentration for each receptor for each day and the hour it occurred at.
- You can actually perform this analysis using Microsoft Office.
- Depending on your grid size and your run length, Excel may not be able to handle your output file.
- Row Limits:
  - Excel 2003 – 65,536 rows
  - Excel 2007-2013 – 1,048,576 rows
- Microsoft Access
  - 2 GB file size limit

Case: DuPont

- Tennessee's fuel burning rule requires any owner of a fuel burning installation having a total rated capacity greater than 1000 million BTU per hour to demonstrate SO2 attainment.
- DuPont submitted a 5-yr maximum impact site location which we compared against the new SO2 guidance using combined ranks.

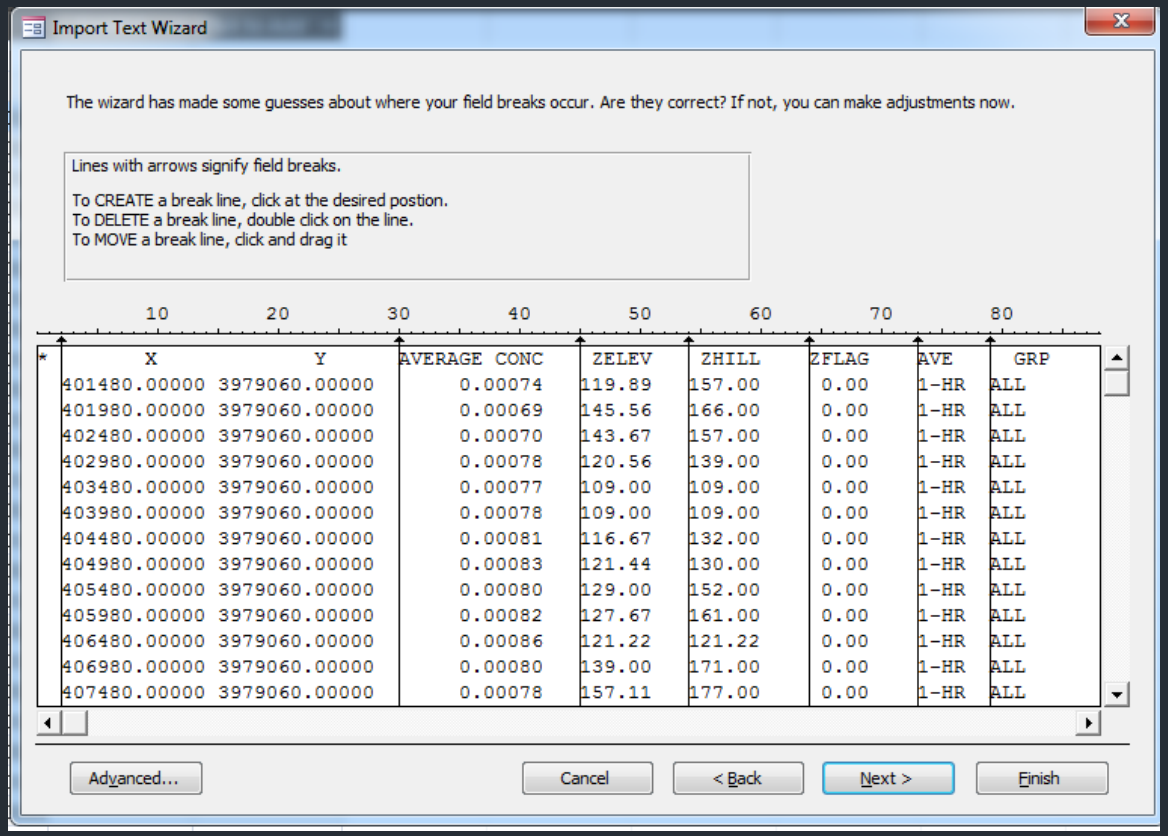
Case: DuPont

- DuPont Example
  - 4,745 receptors
  - 5 year run
  - 365 days X 5 years X 4745 receptors = **8,659,625 rows, 991 MB**



Using Access to Query

- You can import the MAXDAILY file into Access, keeping the receptor coordinates together and treating the date as a text field.



X	Y	AVERAGE CONC	ZELEV	ZHILL	ZFLAG	AVE	GRP
401480.00000	3979060.00000	0.00074	119.89	157.00	0.00	1-HR	ALL
401980.00000	3979060.00000	0.00069	145.56	166.00	0.00	1-HR	ALL
402480.00000	3979060.00000	0.00070	143.67	157.00	0.00	1-HR	ALL
402980.00000	3979060.00000	0.00078	120.56	139.00	0.00	1-HR	ALL
403480.00000	3979060.00000	0.00077	109.00	109.00	0.00	1-HR	ALL
403980.00000	3979060.00000	0.00078	109.00	109.00	0.00	1-HR	ALL
404480.00000	3979060.00000	0.00081	116.67	132.00	0.00	1-HR	ALL
404980.00000	3979060.00000	0.00083	121.44	130.00	0.00	1-HR	ALL
405480.00000	3979060.00000	0.00080	129.00	152.00	0.00	1-HR	ALL
405980.00000	3979060.00000	0.00082	127.67	161.00	0.00	1-HR	ALL
406480.00000	3979060.00000	0.00086	121.22	121.22	0.00	1-HR	ALL
406980.00000	3979060.00000	0.00080	139.00	171.00	0.00	1-HR	ALL
407480.00000	3979060.00000	0.00078	157.11	177.00	0.00	1-HR	ALL

Using Access to Query

- For the concentration ranks, sort the data by concentration and output as many of the top entries as your software can handle.
- To compute the max days frequency, you can query the data to filter out the receptors that had the maximum value for each day in your output.
  - Truncate the 2-digit hour from the date YYMMDDHH
  - Select the maximum concentration for each day
  - Find the corresponding receptor for each max concentration.
- Now you can output your data for statistical analysis.

Ranks

- Concentration Ranks

ReceptorXY	X	Y	Rank	Concentration	Occur_date
413994.57000 39884	413994.57	3988467.79	1	9.03798	9/4/2007
414280.00000 39884	414280.00	3988460.00	2	8.34785	9/4/2007
414380.00000 39884	414380.00	3988460.00	3	7.9281	9/4/2007
413987.41000 39884	413987.41	3988418.31	4	7.58388	6/25/2005
414380.00000 39886	414380.00	3988660.00	5	7.44923	8/9/2007
414280.00000 39885	414280.00	3988560.00	6	7.20739	8/1/2006
414180.00000 39883	414180.00	3988360.00	7	6.32088	6/25/2005
414001.73000 39885	414001.73	3988517.27	8	6.117	9/4/2007
414080.00000 39882	414080.00	3988260.00	9	5.45766	8/6/2008
414180.00000 39886	414180.00	3988660.00	10	5.03897	8/9/2007
413980.25000 39883	413980.25	3988368.82	11	4.59837	8/9/2007
413980.00000 39883	413980.00	3988360.00	12	4.32805	8/6/2008
414480.00000 39886	414480.00	3988660.00	13	4.29646	8/9/2007
414180.00000 39885	414180.00	3988560.00	14	4.25112	8/1/2006
414280.00000 39887	414280.00	3988760.00	15	4.23476	7/11/2008
414480.00000 39883	414480.00	3988360.00	16	4.13236	9/4/2007
414380.00000 39887	414380.00	3988760.00	17	4.11741	7/11/2008
414380.00000 39885	414380.00	3988560.00	18	4.02745	8/1/2006
413978.00000 39883	413978.00	3988353.30	19	4.02013	8/6/2008
414380.00000 39889	414380.00	3988960.00	20	3.41207	8/7/2007
414280.00000 3988860.00000	**VALUE(LEFT(A22,12))**	**VALUE(RIGHT(A22,13))**	**RANK.EQ(E22,$E$2:$E$1907)**	**3.16338**	**6/27/2009**

Ranks

- Daily Max Ranks

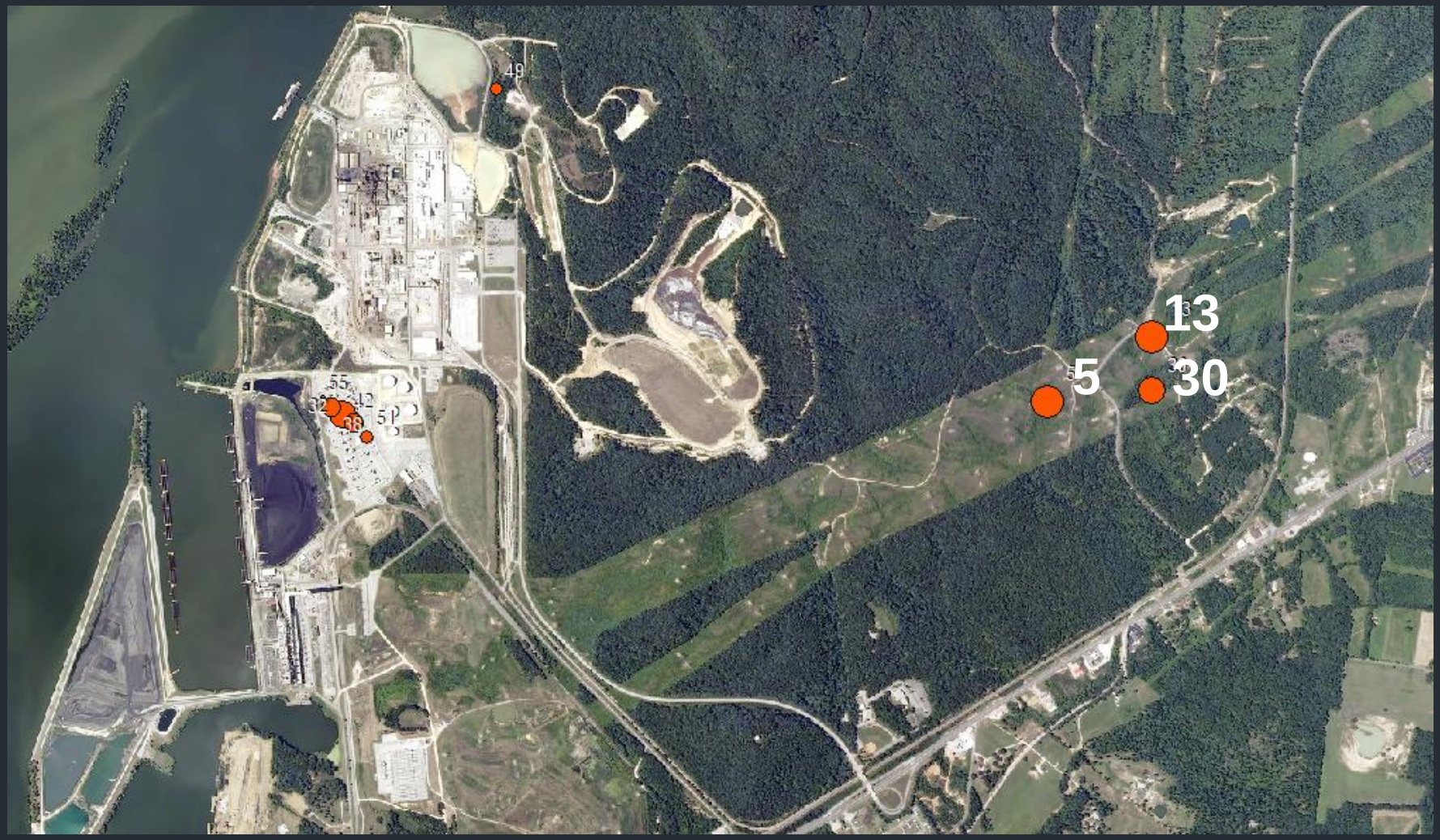
2005-2009 Daily Max Receptors					Top Hitting Receptors		
Occur_date	ReceptorXY	CONC_MAX_VAL	Frequency		ReceptorXY	Rank	Frequency
1/1/2005	412019.01000 3989575.47000	1.30247	35		413987.41000 398841	1	118
1/2/2005	411970.50000 3989587.60000	0.9716	20		413987.41000 398841	2	115
1/3/2005	411464.00000 3989653.00000	0.90888	24		411917.87000 398959	3	65
1/3/2005	411464.00000 3989653.00000	0.90888	24		411263.29000 398843	4	55
1/4/2005	411917.87000 3989591.35000	1.18896	65		411079.26000 398912	5	44
1/5/2005	411880.00000 3989660.00000	0.82242	25		411338.50000 398836	6	41
1/6/2005	412349.70000 3989514.50000	0.71436	4		411298.70000 398839	7	40
1/7/2005	410929.55000 3988600.60000	0.9119	4		411227.89000 398846	8	39
1/8/2005	411227.89000 3988467.81000	1.20272	39		414380.00000 398866	8	39
1/9/2005	412019.01000 3989575.47000	0.97949	35		412019.01000 398957	10	35
1/10/2005	414280.00000 3988460.00000	1.07273	2		411967.75000 398958	11	34
1/11/2005	411917.87000 3989591.35000	1.02773	65		411868.00000 398959	12	32
1/12/2005	411663.60000 3989616.50000	0.60811	23		411865.03000 398959	13	31
1/13/2005	411970.50000 3989587.60000	1.07057	20		411763.35000 398960	14	30
1/14/2005	411227.89000 3988467.81000	0.99203	39		411523.75000 398964	14	30
1/15/2005	411381.16000 3988338.86000	0.99635	25		411239.48000 398943	16	28
1/16/2005	411712.62000 3988295.16000	0.76684	7		411225.40000 398847	17	27
1/17/2005	411338.50000 3988368.17000	1.01741	41		411880.00000 398966	18	25
1/18/2005	411174.40000 3989317.10000	1.00403	16		411381.16000 398833	18	25
1/19/2005	411917.87000 3989591.35000	0.90654	65		411431.00000 398828	18	25
1/20/2005	414280.00000 3988560.00000	1.13457	**COUNTIF(B:B,B24)**		411464.00000 398965	**RANK.EQ(H24,$H$4:$H$219,0)**	24

Ranks

- Overall Ranks

ReceptorXY	X	Y	Conc	Day	Combined	Overall
413987.41000 3988418.31000	413987.41	3988418.31	4	1	5	1
414380.00000 3988660.00000	414380.00	3988660.00	5	8	13	2
414380.00000 3988460.00000	414380.00	3988460.00	3	27	30	3
411338.50000 3988368.17000	411338.50	3988368.17	26	6	32	4
411298.70000 3988397.20000	411298.70	3988397.20	31	7	38	5
411381.16000 3988338.86000	411381.16	3988338.86	24	18	42	6
411917.87000 3989591.35000	411917.87	3989591.35	46	3	49	7
411431.00000 3988285.70000	411431.00	3988285.70	33	18	51	8
411263.29000 3988432.51000	411263.29	3988432.51	51	4	55	9
414280.00000 3988560.00000	414280.00	3988560.00	6	53	59	10
414080.00000 3988260.00000	414080.00	3988260.00	9	53	62	11
413994.57000 3988467.79000	413994.57	3988467.79	1	65	66	12
411865.03000 3989595.32000	411865.03	3989595.32	54	13	67	13
411868.00000 3989594.90000	411868.00	3989594.90	55	12	67	13
411967.75000 3989587.80000	411967.75	3989587.80	58	11	69	15
412019.01000 3989575.47000	412019.01	3989575.47	61	10	71	16
411880.00000 3989660.00000	411880.00	3989660.00	63	18	81	17
411970.50000 3989587.60000	411970.50	3989587.60	59	27	86	18
411378.90000 3988338.70000	411378.90	3988338.70	23	65	88	19
411480.90000 3988287.70000	411480.90	3988287.70	64	31	95	20
412058.10000 3989565.70000	412058.10	3989565.70	75	22	**D22+E22**	**RANK.EQ(F22,$F$2:$F$211,1)**

Case: DuPont



Case: DuPont

Highest Freq
Proposed
North St
929
927
1
Image Landsat
© 2014 Google
1999
Imagery Date: 11/17/2013 lat 36.039407° lon -87.968820° elev 600 ft eye alt 2893 ft
Google earth

Questions?

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