EFT/RLine Procedures

HOWTO - USE the Emissions Factor Toolkit to get emission rates for a line source model.

Step 1. Emissions Factor Toolkit

Set up the links with traffic count data and %HDV etc.
Make sure the checkbox labelled 'Air Quality Modelling (g/km/s) is checked.

Select Pollutants		Select Outputs	Additional Outputs	Advanced Options	Click
☑ NOx	☑ Carbon Dioxide	☑ Air Quality Modelling (g/km/s)	☑ Breakdown by Vehicle	☐ Euro Compositions	
☑ PM10	☐ Hydrocarbons	☐ Emissions Rates (g/km)	☐ Source Apportionment	☐ Alternative Technologies	
☑ PM2.5		☐ Annual Link Emissions	☑ PM by Source	☐ Output % Contributions from Euro Classes	

Please Select from the Following Options:	
Area	England (not London)
Year	2008
Traffic Format	Basic Split
Select 'Basic Split' or 'Detailed Option 1 to 3' above	

Export Outputs
☐ Save Output to New Workbook
File Name:

SourceID	Road Type	Traffic Flow	%HDV	Speed(kph)	No of Hours	Link Length (km)
1	Urban (not London)	10000	15	48	1	1
2	Urban (not London)	20000	15	48	1	1
3	Urban (not London)	30000	15	48	1	1
4	Urban (not London)	40000	15	48	1	1
5	Urban (not London)	50000	15	48	1	1
6	Urban (not London)	30000	20	48	1	1
7	Urban (not London)	30000	25	48	1	1
8	Urban (not London)	30000	30	48	1	1
9	Urban (not London)	30000	35	48	1	1
10	Urban (not London)	30000	40	48	1	1
11	Urban (not London)	30000	15	24	1	1
12	Urban (not London)	30000	15	39	1	1
13	Urban (not London)	30000	15	36	1	1
14	Urban (not London)	30000	15	42	1	1
15	Urban (not London)	30000	15	56	1	1

In the example above, I've set up 15 different simulations (just as an example). I'm doing a sensitivity to vehicle numbers in the first 5 simulations - the traffic flow numbers are changing in each run 1-5; a sensitivity to %HDV in the next 5 simulations (see that the traffic flow numbers stay the same but the %HDV changes in rows 15-19) ; and the last 5 simulations are checking how sensitivity to vehicle speed influences emissions - the speed is changing in rows 20-24).

Step 2 Run EFT and check Output tab

Source_Name	Pollutant_Name	All Vehicle (g/km/s)	All LDV (g/km/s)	All HDV (g/km/s)
1	NOx	3.520867	1.157118	2.363750
1	PM25	0.127739	0.062482	0.065258
1	PM10	0.186874	0.096118	0.090756
1	CO2	668.839600	387.526489	281.313110
2	NOx	7.041735	2.314235	4.727499
2	PM25	0.255479	0.124964	0.130515
2	PM10	0.373748	0.192237	0.181512
2	CO2	1337.679199	775.052979	562.626221
3	NOx	10.562602	3.471353	7.091249
3	PM25	0.383218	0.187446	0.195773
3	PM10	0.560623	0.288355	0.272268
3	CO2	2006.518799	1162.579468	843.939331
4	NOx	14.083469	4.628470	9.454999

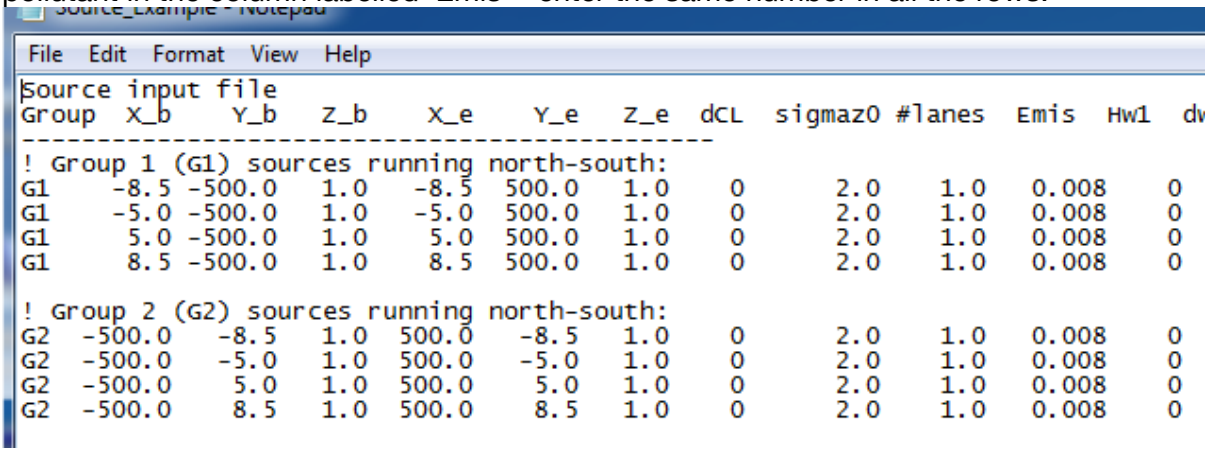
15	4	PM25	0.510958	0.249928	0.261030
16	4	PM10	0.747497	0.384473	0.363024
17	4	CO2	2675.358398	1550.105957	1125.252441
18	5	NOx	17.604338	5.785588	11.818749
19	5	PM25	0.638697	0.312410	0.326288
20	5	PM10	0.934371	0.480591	0.453779
21	5	CO2	3344.197998	1937.632446	1406.565552
22	6	NOx	12.722155	3.267155	9.454999
23	6	PM25	0.437450	0.176419	0.261030
24	6	PM10	0.634416	0.271393	0.363024
25	6	CO2	2219.444824	1094.192505	1125.252441
26	7	NOx	14.881707	3.062958	11.818749
27	7	PM25	0.491681	0.165393	0.326288
28	7	PM10	0.708210	0.254431	0.453779
29	7	CO2	2432.371094	1025.805420	1406.565552
30	8	NOx	17.041260	2.858761	14.182499
31	8	PM25	0.545912	0.154367	0.391545
32	8	PM10	0.782004	0.237469	0.544535
33	8	CO2	2645.297119	957.418396	1687.878662
34	9	NOx	19.200813	2.654564	16.546249
35	9	PM25	0.600144	0.143341	0.456803
36	9	PM10	0.855798	0.220507	0.635291
37	9	CO2	2858.223145	889.031372	1969.191895
38	10	NOx	21.360365	2.450367	18.909998
39	10	PM25	0.654375	0.132315	0.522061
40	10	PM10	0.929592	0.203545	0.726047
41	10	CO2	3071.149414	820.644348	2250.504883
42	11	NOx	14.572535	4.120646	10.451889
43	11	PM25	0.480943	0.214371	0.266572
44	11	PM10	0.663491	0.316697	0.346793
45	11	CO2	2719.649902	1500.588867	1219.061157
46	12	NOx	11.485501	3.612630	7.872871
47	12	PM25	0.406010	0.193934	0.212076
48	12	PM10	0.584614	0.295185	0.289429
49	12	CO2	2165.835205	1230.836792	934.998474
50	13	NOx	11.907165	3.684859	8.222305
51	13	PM25	0.416518	0.197059	0.219459
52	13	PM10	0.595675	0.298474	0.297201
53	13	CO2	2241.386963	1264.703491	976.683411
54	14	NOx	11.127127	3.553431	7.573696
55	14	PM25	0.397076	0.191290	0.205785
56	14	PM10	0.575209	0.292402	0.282807
57	14	CO2	2102.414307	1203.167603	899.246643
58	15	NOx	10.049713	3.430291	6.619422
59	15	PM25	0.368650	0.182300	0.186350
60	15	PM10	0.545287	0.282938	0.262349
61	15	CO2	1931.687256	1131.832764	799.854553
62					

The Output tab shows the simulation for the above 15 experiments and gives the 'all vehicle' emissions in units of g/km/s which we need for running RLine.
Take a record of each of the experiments for your chosen pollutants (probably NOX and PM10) - this is what you enter into RLine as emission rates.

Step 3 Run RLine

FOR EACH SIMULATION RUN (eg this would be done 15 times if you were following my example above)

3.1 First, edit the source file (called ‘Source_Example.txt’) to reflect the new emission rates in g/km/s from the EFT output -enter the number for any simulation for whatever pollutant in the column labelled ‘Emis’ - enter the same number in all the rows.



File Edit Format View Help

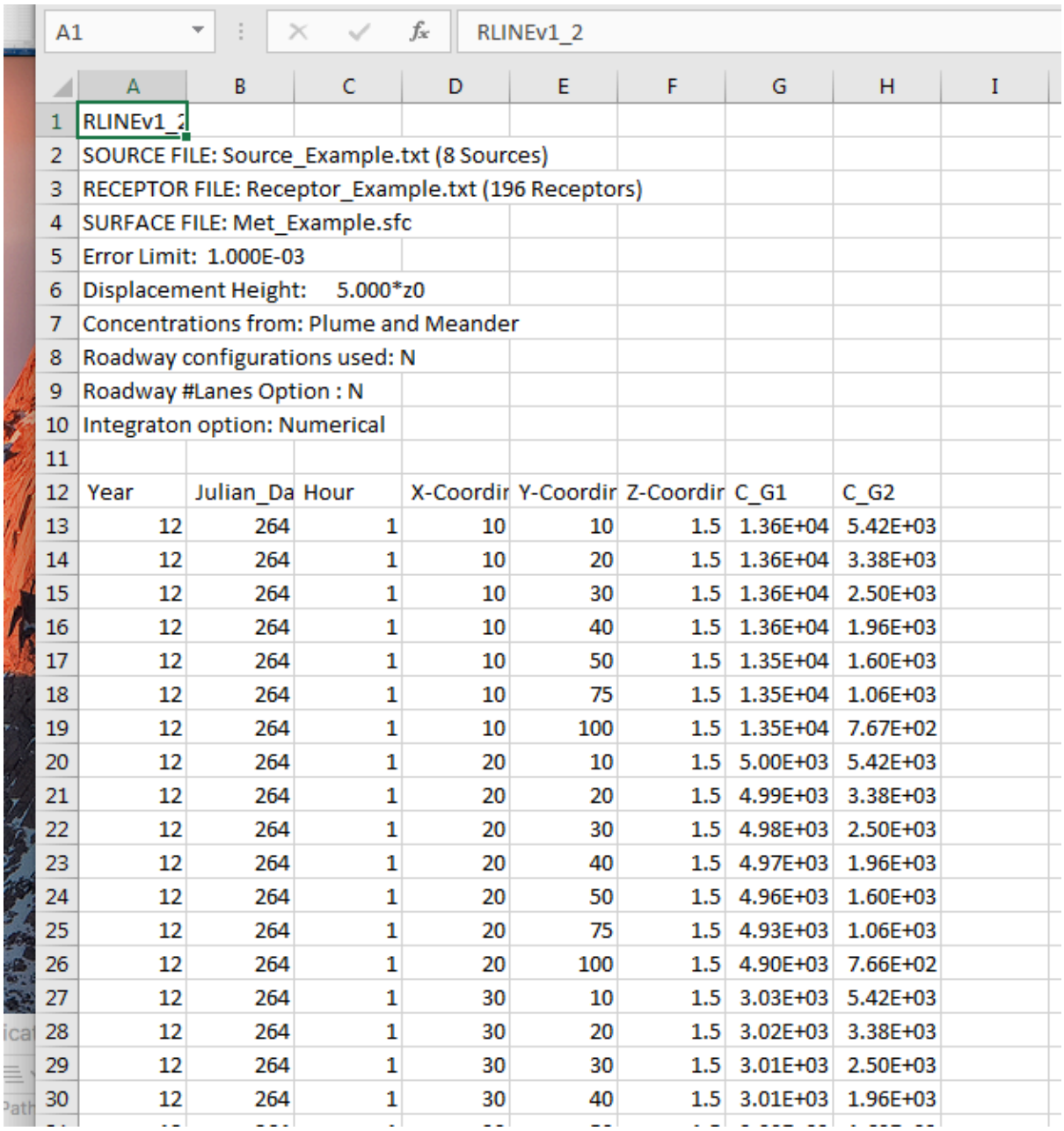
```
Source input file
Group  X_b     Y_b    Z_b     X_e     Y_e    Z_e   dCL   sigmaz0 #lanes   Emis   Hw1   dw
-----------------------------------------------
! Group 1 (G1) sources running north-south:
G1     -8.5 -500.0    1.0    -8.5   500.0    1.0     0       2.0     1.0   0.008     0
G1     -5.0 -500.0    1.0    -5.0   500.0    1.0     0       2.0     1.0   0.008     0
G1      5.0 -500.0    1.0     5.0   500.0    1.0     0       2.0     1.0   0.008     0
G1      8.5 -500.0    1.0     8.5   500.0    1.0     0       2.0     1.0   0.008     0

! Group 2 (G2) sources running north-south:
G2   -500.0    -8.5    1.0   500.0    -8.5    1.0     0       2.0     1.0   0.008     0
G2   -500.0    -5.0    1.0   500.0    -5.0    1.0     0       2.0     1.0   0.008     0
G2   -500.0     5.0    1.0   500.0     5.0    1.0     0       2.0     1.0   0.008     0
G2   -500.0     8.5    1.0   500.0     8.5    1.0     0       2.0     1.0   0.008     0
```

RLIne REQUIRES three other files to run - a source file (the file you just edited above), a meteorology file and a list of receptors. You can keep the last two files just as I gave you them - they don’t need editing for this exercise but they DO have to be in the same folder as the Line executable program.

On a Windows PC, the program to double-click is: `RLinev1_2_g95.exe`

3.2 The Output_Example.csv file needs to have the first11 lines deleted for the python code to work



A1 RLINEv1_2

	A	B	C	D	E	F	G	H	I
1	RLINEv1_2								
2	SOURCE FILE: Source_Example.txt (8 Sources)								
3	RECEPTOR FILE: Receptor_Example.txt (196 Receptors)								
4	SURFACE FILE: Met_Example.sfc								
5	Error Limit: 1.000E-03								
6	Displacement Height: 5.000*z0								
7	Concentrations from: Plume and Meander								
8	Roadway configurations used: N								
9	Roadway #Lanes Option : N								
10	Integraton option: Numerical								
11									
12	Year	Julian_Da	Hour	X-Coordir	Y-Coordir	Z-Coordir	C_G1	C_G2	
13	12	264	1	10	10	1.5	1.36E+04	5.42E+03	
14	12	264	1	10	20	1.5	1.36E+04	3.38E+03	
15	12	264	1	10	30	1.5	1.36E+04	2.50E+03	
16	12	264	1	10	40	1.5	1.36E+04	1.96E+03	
17	12	264	1	10	50	1.5	1.35E+04	1.60E+03	
18	12	264	1	10	75	1.5	1.35E+04	1.06E+03	
19	12	264	1	10	100	1.5	1.35E+04	7.67E+02	
20	12	264	1	20	10	1.5	5.00E+03	5.42E+03	
21	12	264	1	20	20	1.5	4.99E+03	3.38E+03	
22	12	264	1	20	30	1.5	4.98E+03	2.50E+03	
23	12	264	1	20	40	1.5	4.97E+03	1.96E+03	
24	12	264	1	20	50	1.5	4.96E+03	1.60E+03	
25	12	264	1	20	75	1.5	4.93E+03	1.06E+03	
26	12	264	1	20	100	1.5	4.90E+03	7.66E+02	
27	12	264	1	30	10	1.5	3.03E+03	5.42E+03	
28	12	264	1	30	20	1.5	3.02E+03	3.38E+03	
29	12	264	1	30	30	1.5	3.01E+03	2.50E+03	
30	12	264	1	30	40	1.5	3.01E+03	1.96E+03	

4. Run `python drawLine.py` in a terminal window to get the graphical output. Just note the concentration at any one of the receptors for each of the four main stability categories.