



Modelling Mines Using CALMET/CALPUFF

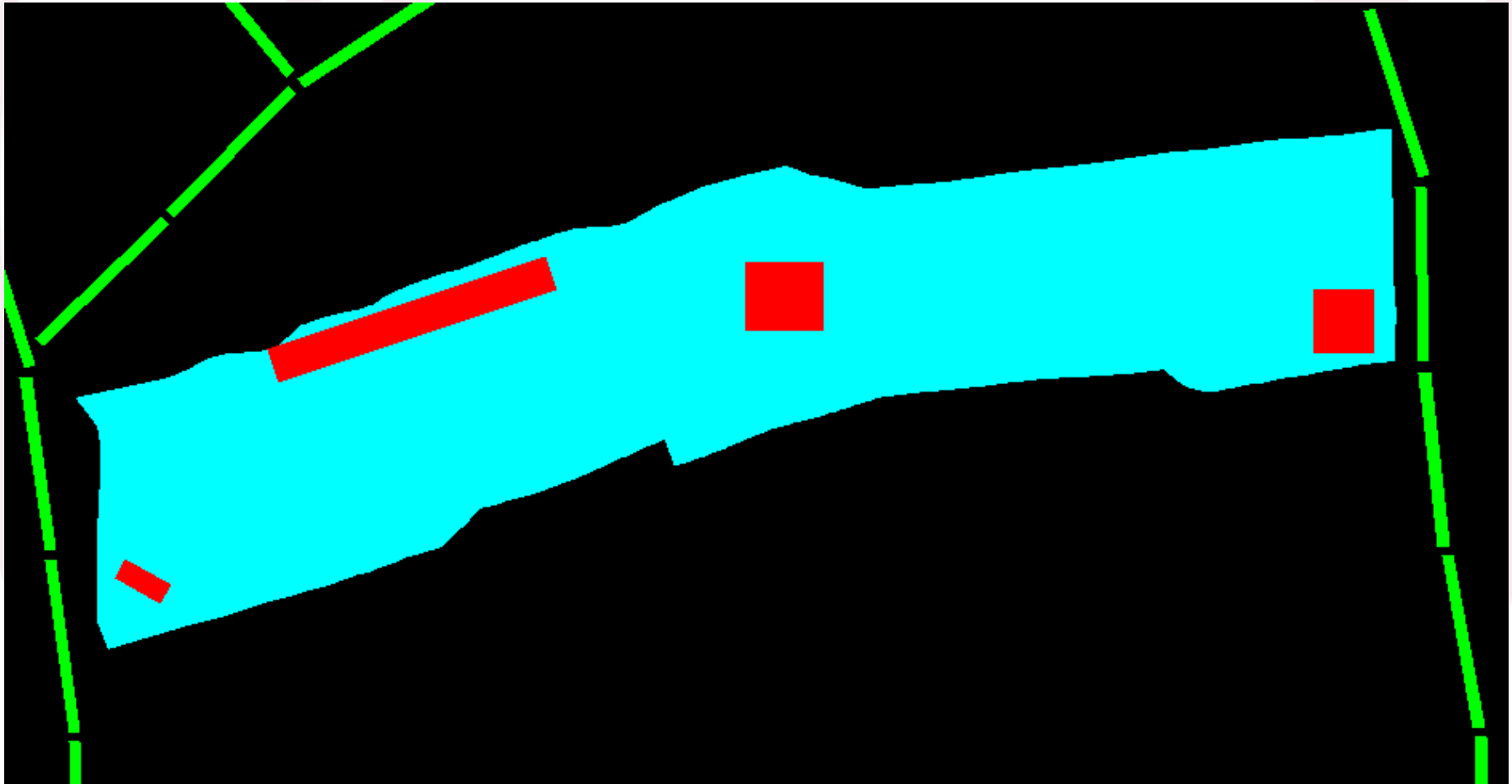
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Area sources: Haul roads, Drill rig, Bench Blast, Dragline and Active pit area



Haul road 30m x 300m
Dragline 200m x 200m

Active pit 150m x 150m
Drill rig 70m x 100m



	TSP (g/s)	PM10 (g/s)	PM2.5 (g/s)	Total
Emission	13.63	6.26	0.28	
Fraction	7.36	5.99	0.28	13.63
%	54.03	43.95	2.02	100.00

**Emission rate (g/s) / 24 hour footprint (m²)
for each size fraction**

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**Size contribution to emission in g/s/m²
ready for CALPUFF**

TSP (g/m²/s)	PM10 (g/m²/s)	PM2.5 (g/m²/s)
1.01E-03	8.25E-04	3.80E-05

•2 source groups TSP and PM10

•5 emission rates

•Dry deposition turned on

•4 areas per 1.2 km of haul road

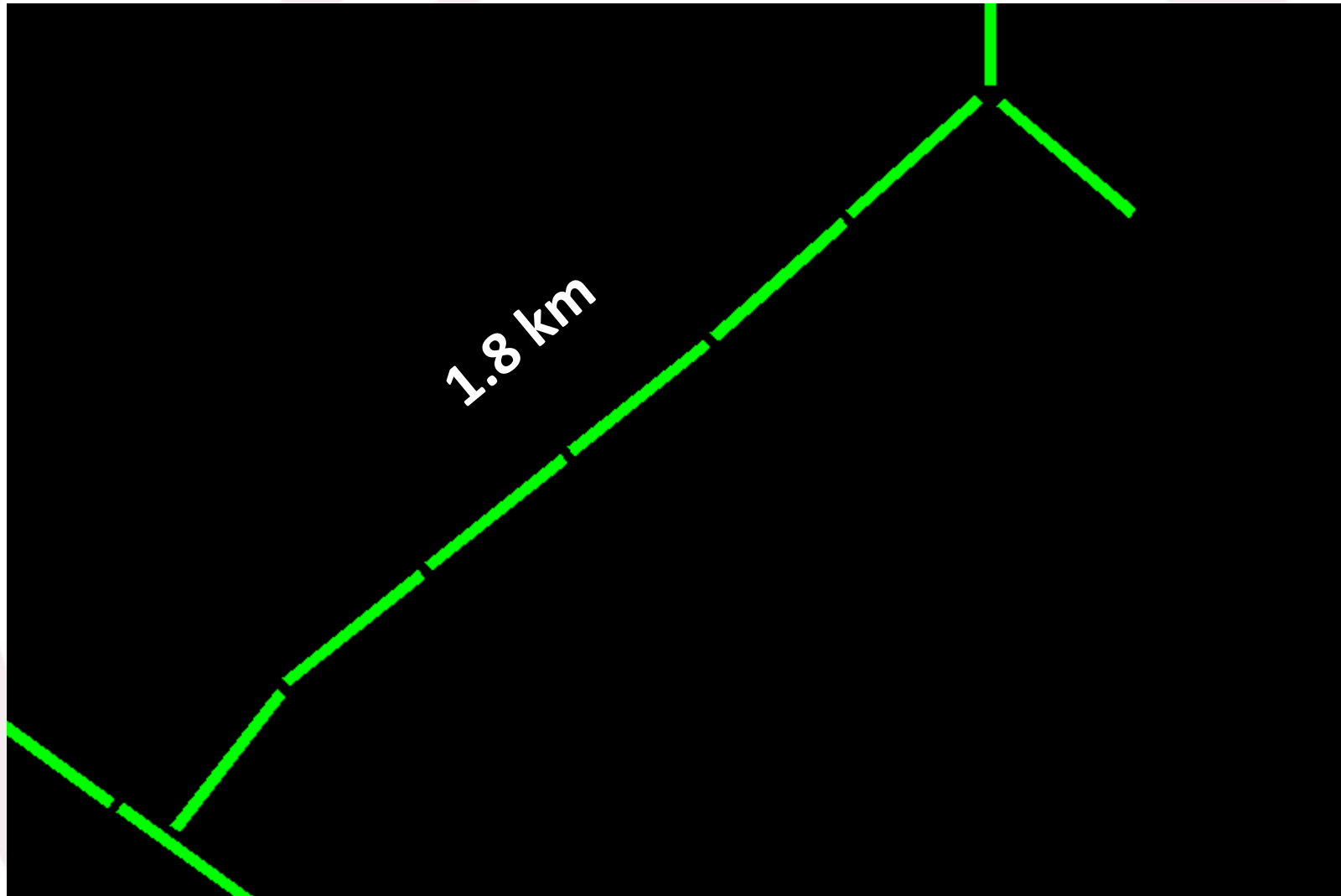
•4 areas per pit

**+ ROM pads, CHPP's Tailings dams,
erosional surfaces, conveyors ect...**

- **Labour intensive to set up**
- **Computationally expensive:**
 - 6 area sources (Haul roads),**
 - one year simulation,**
 - dual quad core 2.8 GHz, 4 GB RAM**
 - still takes 17 hours to run**

Is there a better way ?

AREA vs LINE



Road Dimensions and Truck Dimensions



**Maximum number of segments used to model
each line (MXNSEG)**

Default: 7 ! MXNSEG = 7 !

**The following variables are required only if NLINES > 0. They are
used in the buoyant line source plume rise calculations.**

**Number of distances at which
transitional rise is computed**

Default: 6 ! NLRISE = 6 !

**Average building length (XL)
(in meters)**

No default ! XL = 13.0 !

**Average building height (HBL)
(in meters)**

No default ! HBL = 13.0 !

**Average building width (WBL)
(in meters)**

No default ! WBL = 8.0 !

**Average line source width (WML)
(in meters)**

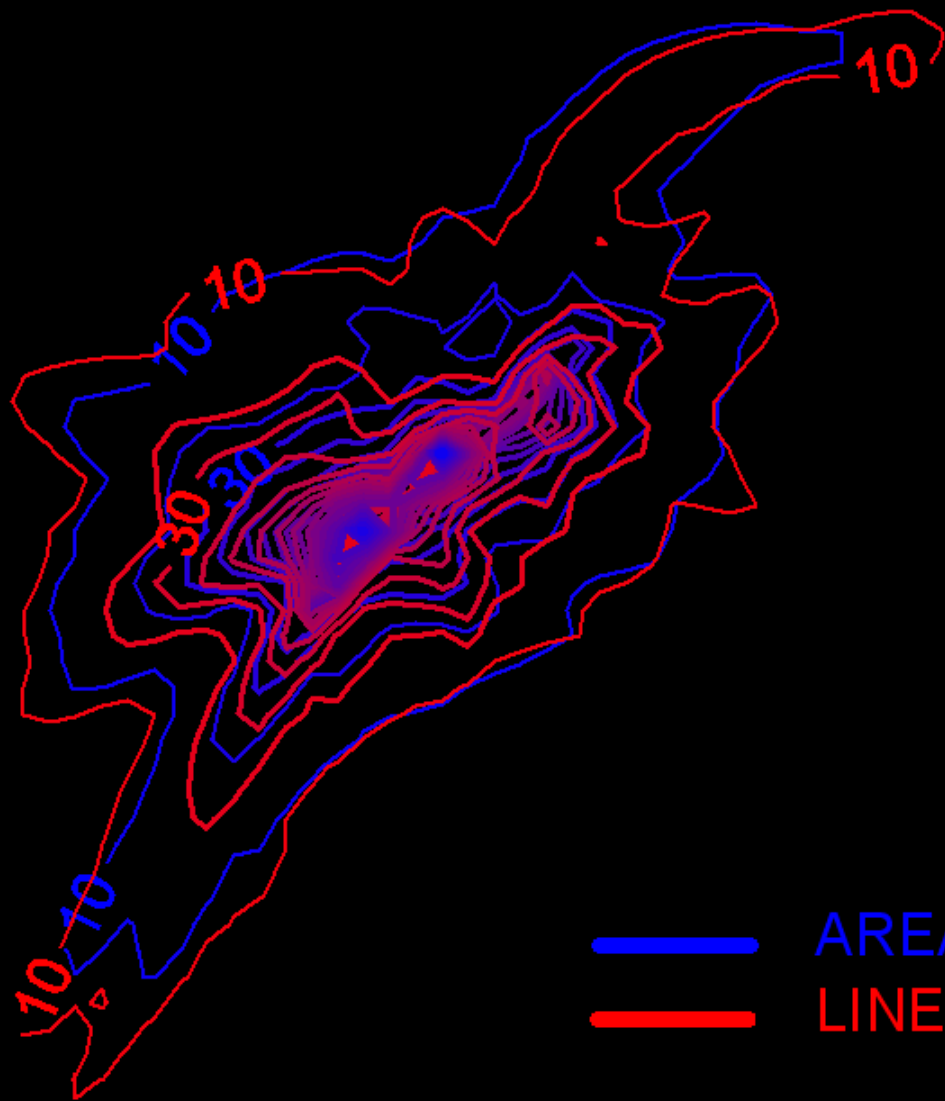
No default ! WML = 30.0 !

**Average separation between buildings (DXL)
(in meters)**

No default ! DXL = .0 !

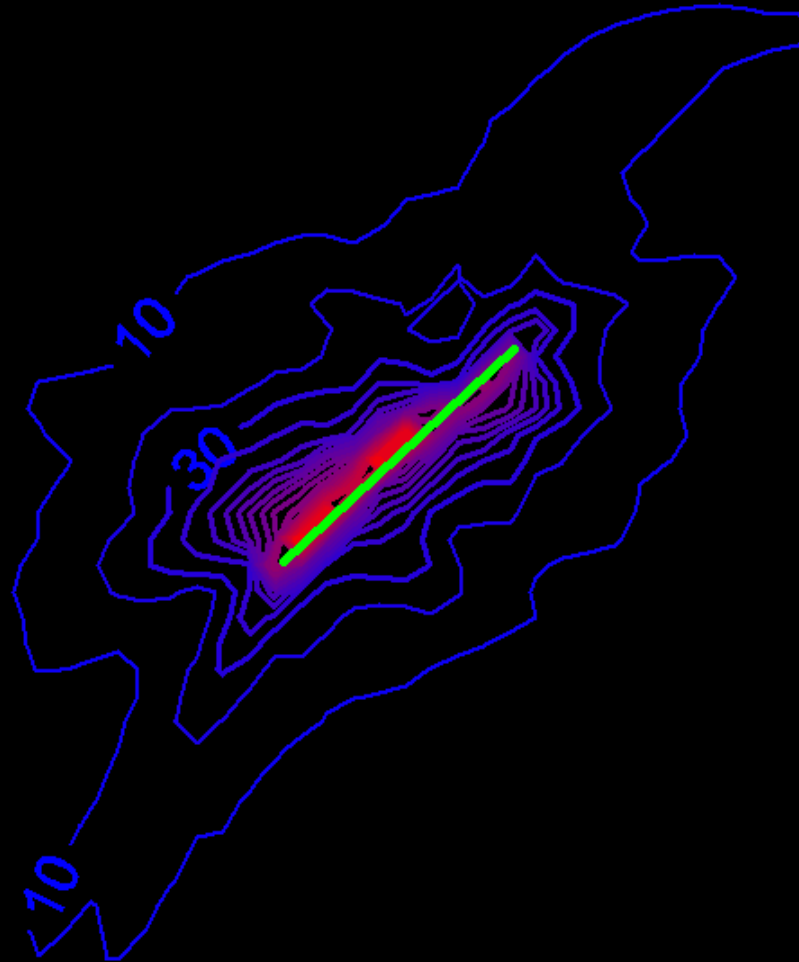
**Average buoyancy parameter (FPRIMEL)
(in m^{**4}/s^{**3})**

No default ! FPRIMEL = .0 !

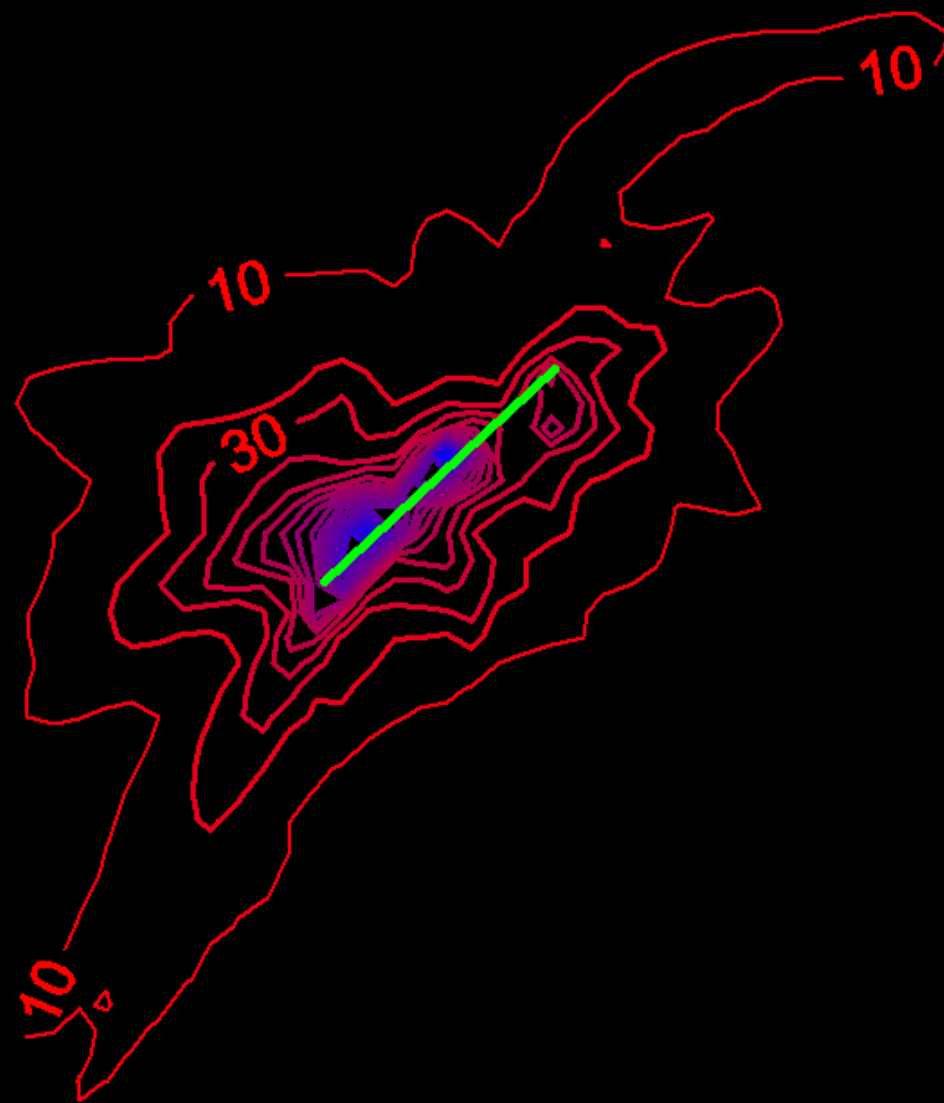


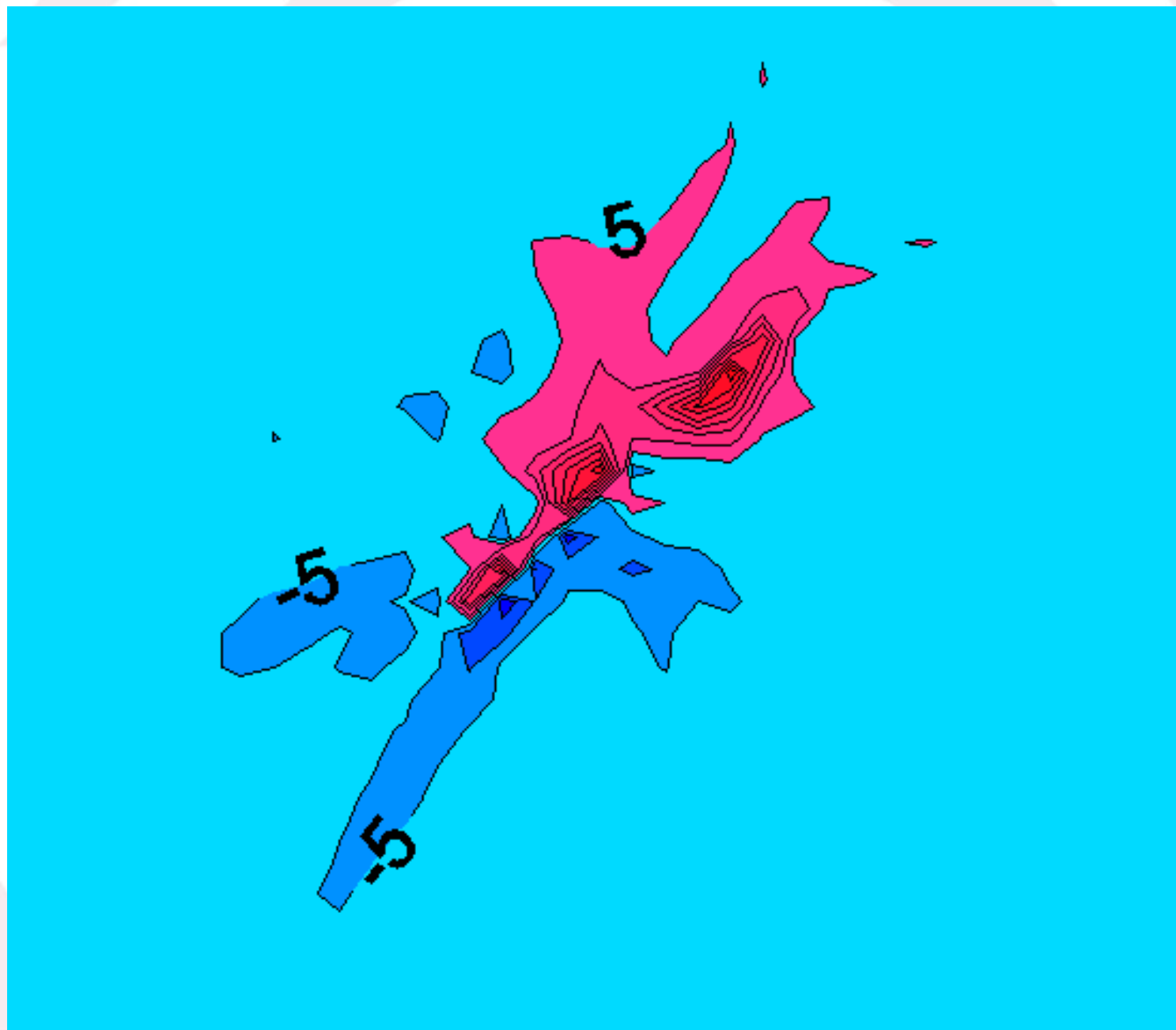
— AREA
— LINE

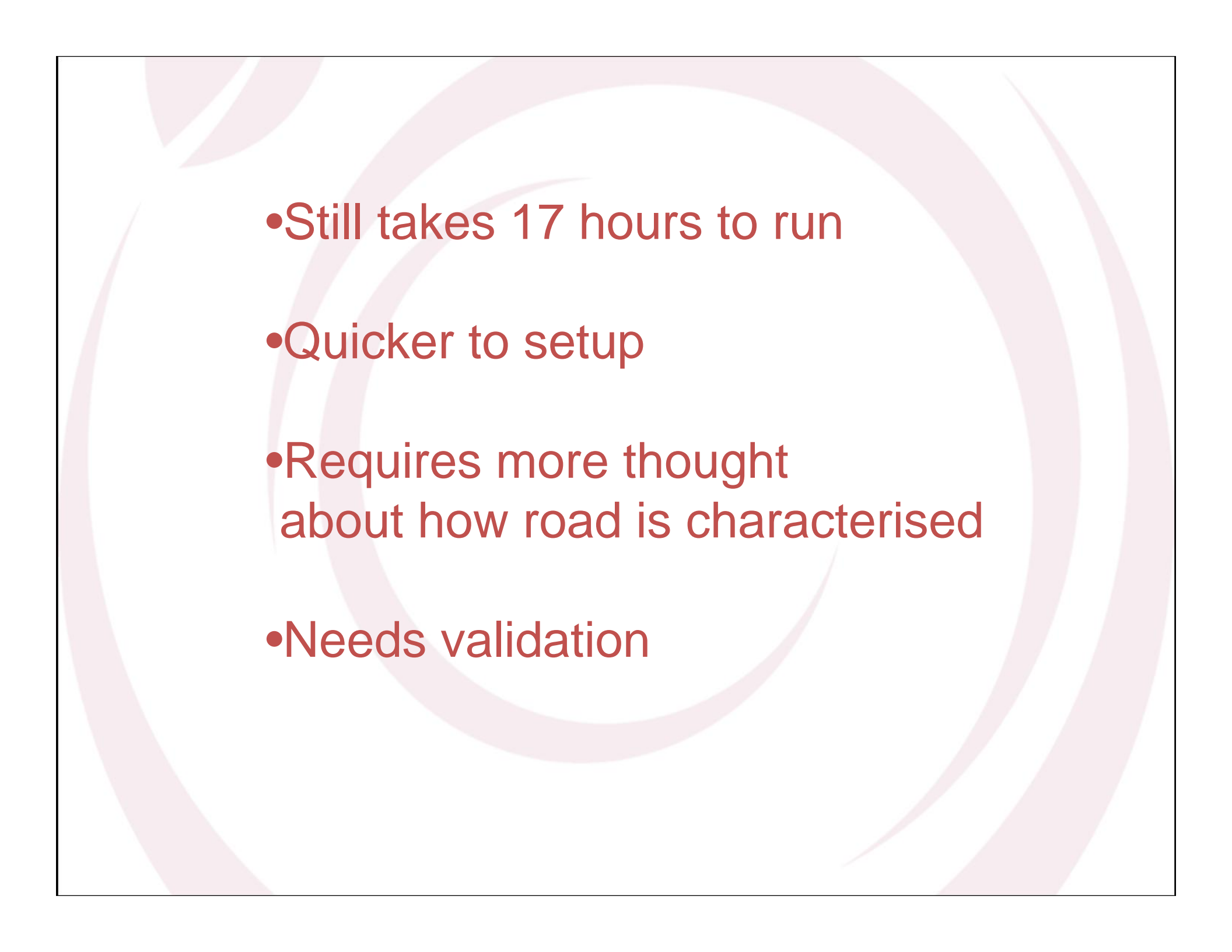
AREA



LINE





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- Still takes 17 hours to run
 - Quicker to setup
 - Requires more thought about how road is characterised
 - Needs validation

TAPM to MM5 conversion program

(1) Land use category.

This bit of code converts the TAPM land use category to a Calmet land use category by means of a look-up table. The contents of the table were arrived at manually.

(2) Coordinate conversions.

The latitudes and Longitudes were calculated using Redfearn's formula.

- (3) Sigma P values.
- These are calculated using a method based on the hypsometric equation (see <http://mtp.jpl.nasa.gov/notes/altitude/altitude.html>)
- (4) Receptor elevations.
- The elevation of the "cross array points" are the average of the surrounding four "dot array points".

(5) Specific humidity.

This is calculated using $SH = (621.97 * avp) / (baro_press - (0.37803 * avp))$

where SH = Specific Humidity, avp = vapour pressure,

baro_press = barometric pressure;

avp = a real long expression - better if you google it !!

(6) Other parameters (mixing ratios, pressures etc) were calculated using the usual bunch of formulae.

	OBS_ WS	U_OBS	V_OBS	MOD_ WS	U_MOD	V_MOD
mean	3.36	-2.04	0.38	3.23	-2.20	0.59
min	0.10	2.66	1.96	0.07	2.21	1.94
max	10.65	-10.65	-7.04	7.62	-7.46	-5.61
stdev	1.99	3.98	4.64	1.35	4.40	5.23

	WS	WD	U	V
intercept	1.69	33.32	-0.72	0.27
slope	0.53	0.69	0.72	0.84
rmse	1.26	59.32	1.32	1.08
rmse_s	0.94	25.08	0.75	0.37
rmse_u	0.84	53.76	1.08	1.01
ioa	0.85	0.84	0.92	0.92
se	0.42	0.72	0.41	0.52
sv	0.68	1.00	0.83	0.99
sr	0.64	0.79	0.49	0.55
MAE	1.03	29.03	1.06	0.83