

# WIND MODELLING

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Location: Casey Corner, Nova Scotia  
MTM Sheet: YRL6ML  
Weather Station: CFB Greenwood, July

Sources: NSTDB 1:10,000 ETB NTX files, Environment Canada Absolute/Percent for Wind Speed and Direction Tables, ESRI ArcGIS Help

## 1. OVERVIEW & MODEL DESCRIPTION

The model described and visualized below calculates Aerial Pesticide Spray Accumulation based on Wind Aspect and Frequency, the orchard's area and application volume. The premise is that the smaller the particle size and the stronger the wind velocity, the further a droplet of pesticide will travel.

### VARIABLES

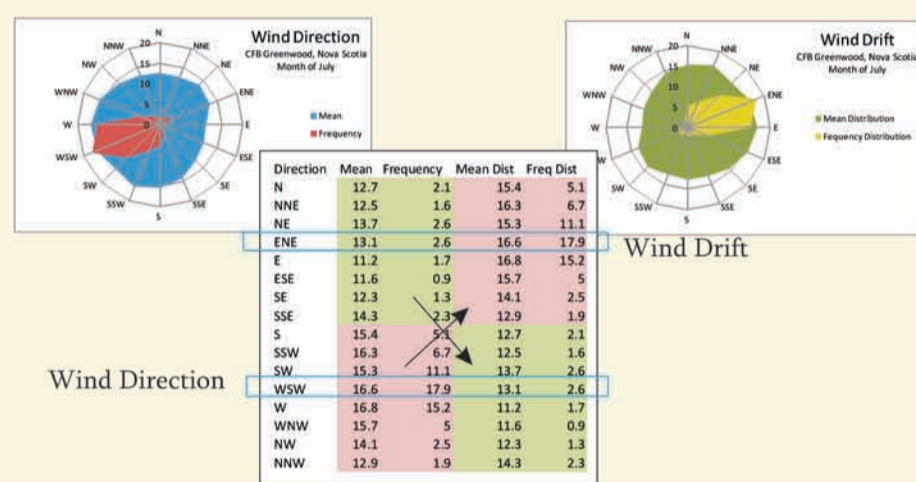
Wind Speed: 4.8 kilometres/hour  
Particle Size: 15 micron particle\*  
Application: 3.2 litres/hectare  
Spray Distance: 1080 metres

\*Droplets sizes are measured in imperial measure "microns" with are 1/25,000 inch

All steps describe below are completed at the ArcGIS Command Prompt unless otherwise stated.

## 2. WIND ROSES

Environment Canada produces "Absolute/Percent Frequency for Wind Speed" tables for various weather stations across the country. From these tables we take the mean wind speed and frequency of wind speed to create a Wind Direction Rose and then we flip these numbers to create a Wind Drift Rose. The charts are created in MS Excel using a filled radar chart.

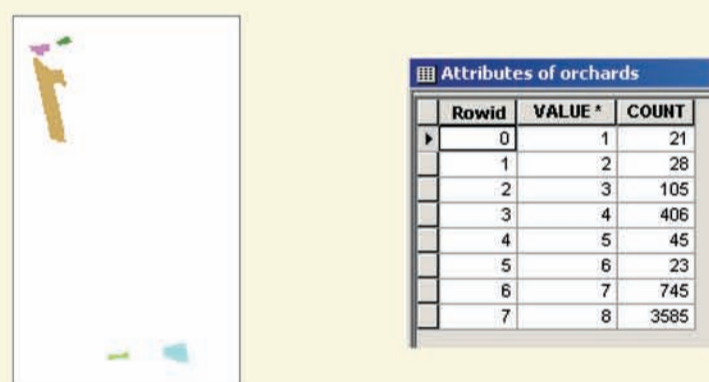


## 3. REGIONGROUP

The REGIONGROUP command is used to produce a unique number for each contiguous orchard.

Usage: (out\_int\_grid) REGIONGROUP (<grid>,{out\_remap\_table},{FOUR | EIGHT},{WITHIN | CROSS},{excluded\_value},{LINK | NOLINK})

Command: orchards = regiongroup ([caseycorner\_poly], #, EIGHT)

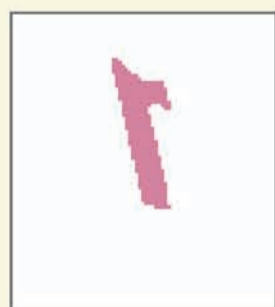


## 4. SELECT

The SELECT command is used to select one orchard. In the command below we are selecting the orchard with the unique value of 4 from the orchards grid.

Usage: (out\_grid) SELECT (<grid>,<logical\_expression>,{o\_value\_item})

Command: orchard\_4 = select ([orchards], "value = 4")

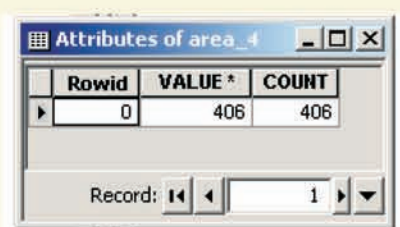


## 5. RECLASS

The RECLASS command uses the .vat file to obtain COUNT values assigned to value. This will give a derivative of area as each pixel represents 0.1 hectares (10 \* 10(assumed cell size) = 100/10,00 = 0.1)

Usage: out\_int\_grid RECLASS (<grid>,<remap\_table>,{DATA | NODATA},{in\_item},{out\_item})

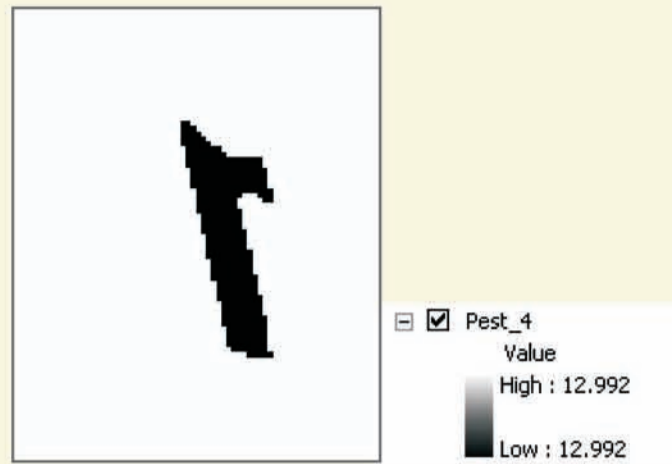
Command: area\_4 = reclass ([orchard\_4], orchard\_4.vat, NODATA, VALUE, COUNT)



## 6. PESTICIDE GRID

Assuming 3.2 litres/hectare application and each pixel is 0.01 hectares, the volume of pesticide can be calculated for the orchard.

Command: Pest\_4 = 3.2 \* [area\_4] \* 0.01

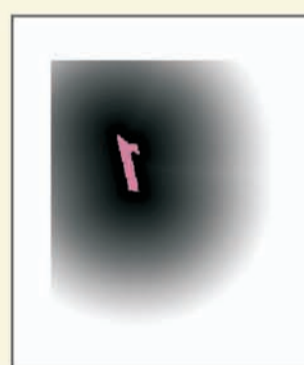


## 7. DISTANCE GRID

The distance grid calculates the maximum extent in all directions of the spray cover using the EUCDISTANCE command. In the following example we are finding the total affected area assuming a 15 micron particle in 4.8km/h wind. Where 1080 is the maximum drift distance in metres.

Usage: (out\_float\_grid) EUCDISTANCE (<source\_grid>,{out\_direction\_grid},{out\_allocate\_grid},{max\_distance},{value\_grid})

Command: Distance\_4 = eucdistance([orchard\_4], #, #, 1080)

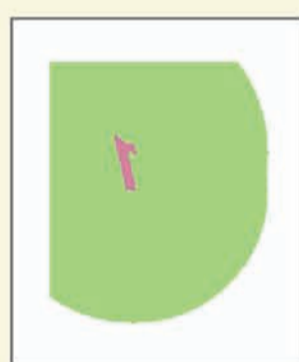


## 8. DRIFT CONCENTRATE

The Drift Concentrate grid takes the integer value of the total litres of pesticide in Pest\_4 and allocates it over the 1080 metres from the orch\_4 grid. This is done using the EUCALLOCATION command.

Usage: (out\_int\_grid) EUCALLOCATION (<source\_grid>,{out\_distance\_grid},{out\_direction\_grid},{max\_distance},{value\_grid})

Command: drift\_con\_4 = eucallocation([orchard\_4], #, #, 1080, int([Pest\_4]))

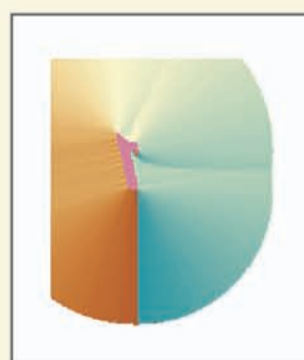


## 9. ASPECT MAP

In the following step we will perform aspect analysis of the Distance Grid as a surface.

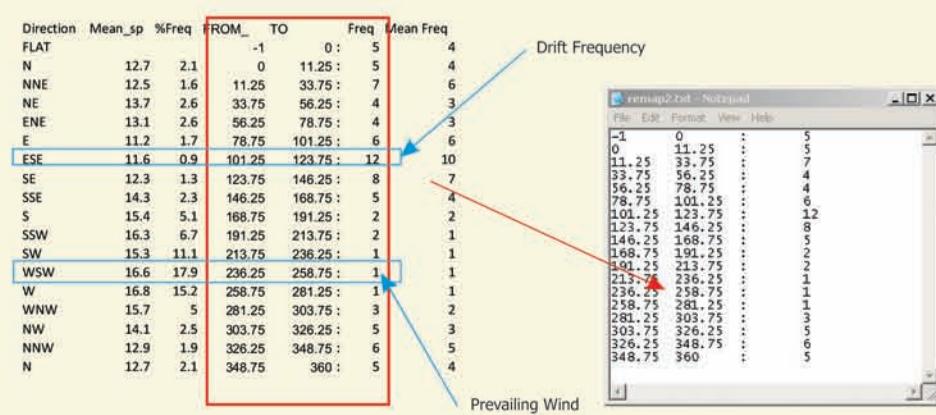
Usage: (out\_float\_grid) ASPECT (<grid>)

Command: aspect\_4 = aspect([distance\_4])



## 10. THE REMAP TABLE

The remap table calculates Wind Drift Impedances based on wind direction and frequency. The remap table represents the 16 points of a compass where higher values of frequency represent the direction of wind drift. This table is then used to reclass the 360 degree Aspect Grid into the 16 points of the compass.

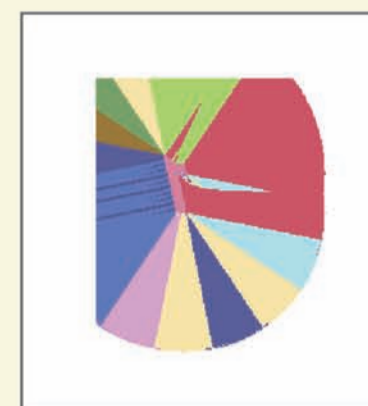


## 11. RECLASS GRID

The RECLASS command reclasses the ASPECT grid using the REMAP table in the previous step and assigns one of the sixteen directions of N to NNW.

Usage: (out\_int\_grid) RECLASS (<grid>,<remap\_table>,{DATA | NODATA},{in\_item},{out\_item})

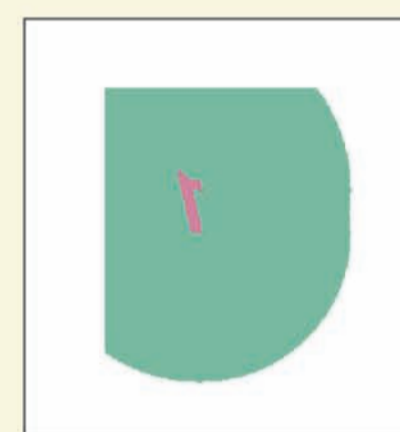
Command: reclass\_4 = reclass([aspect\_4], remap2.txt, value)



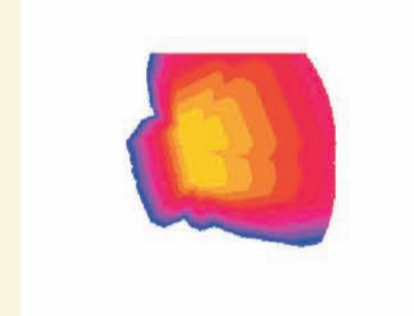
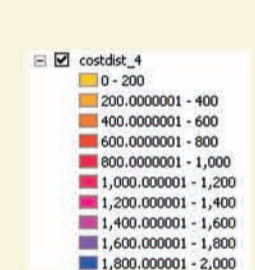
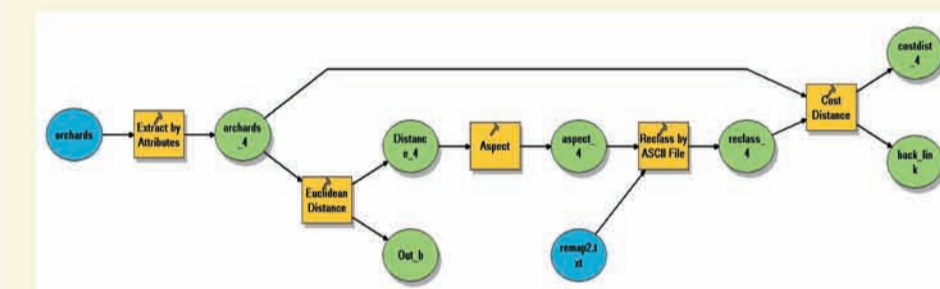
## 12. MEAN FREQUENCY CONCENTRATION GRID

The MEAN DISTRIBUTION CONCENTRATION GRID finds the proportional distribution by direction of the allocated volume of pesticide.

Command: mfreq\_4 = [reclass\_4] / 100 \* [drift\_con\_4]



## 13. MODEL BUILDER



## 14. AML

```

cumulative Spray
! orch2_mod2.aml
! orch2_mod2.aml orchard_grid <output_grid> <number_orchards> <remap_table> <distance> <litres_per_ha>
! final summary output grid named according to the number of successfully summed grids eg. outgrid31

&args orch_grid outgrid orch_num rmt drift_dist lpha
&echo &on
&messages &on
&type 'looping through orchards'

&do i = 1 &to %orch_num% &by 1
  grid
  orch%i% = select (%orch_grid%, "value = %i%")
  area%i% = reclass(orch%i%, orch%i%.vat, NODATA, VALUE, COUNT)
  pest%i% = %alpha% * area%i% * 0.01
  distance%i% = eucdistance(orch%i%, #, #, %drift_dist%)
  drift_con%i% = (eucallocation(orch%i%, #, #, %drift_dist%, int(10 * pest%i%))) / 10.000
  aspect%i% = aspect(distance%i%)
  reclass%i% = reclass(aspect%i%, %rmt%, value)
  mytemp%i% = con(snull(mfreq%i%), 0, mfreq%i%)
  &if %i% = 1 &then
    %outgrid%i% = mytemp%i%
  &else
    &do
      &sv prev = %i% - 1
      %outgrid%i% = %outgrid%i%prev% + mytemp%i%
    &end
  &end
  kill orch%i% all
  kill area%i% all
  kill pest%i% all
  kill distance%i% all
  kill drift_con%i% all
  kill aspect%i% all
  kill reclass%i% all
  kill mfreq%i% all
  kill mytemp%i% all
  quit
&end
  
```

## 15. CUMULATIVE PESTICIDE CONCENTRATION GRID

The output from AML above.

