Finding your own wind

Using terrain analysis in site selection for a new sailing club in Portland

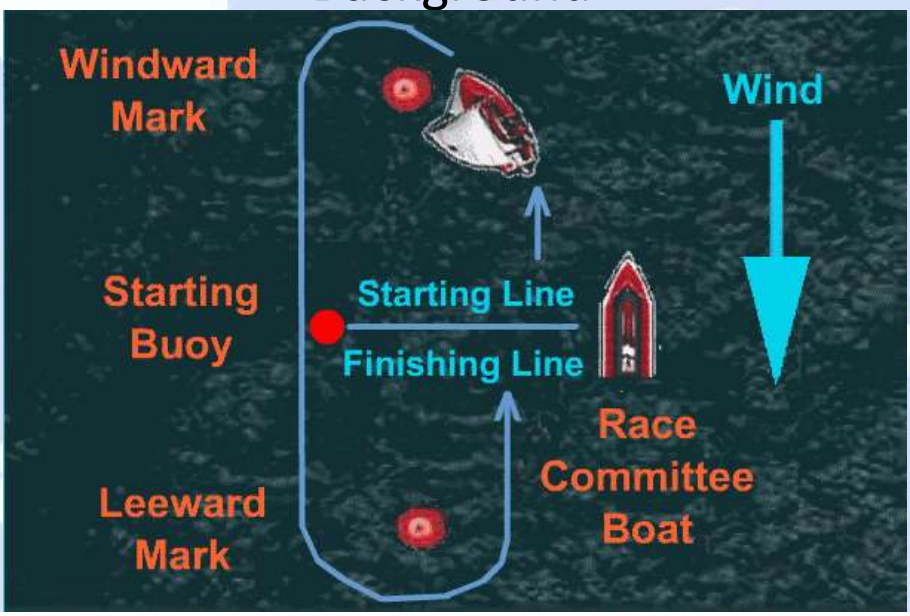
By Nick Stockton

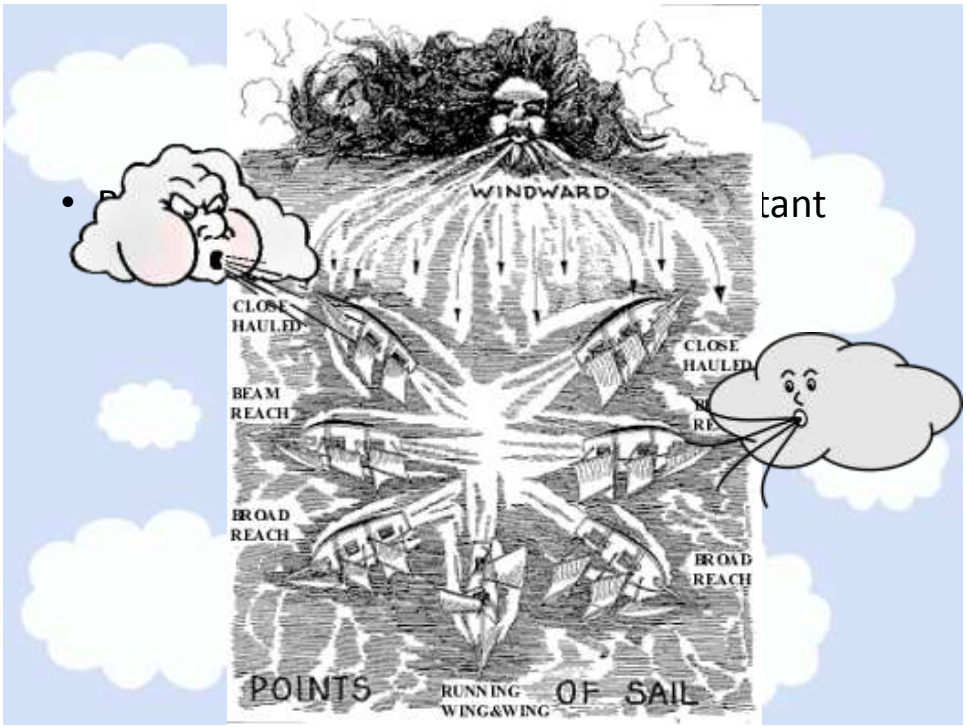
Background

- http://www.youtube.com/watch?v=Ndx_IGb-fBE

Background

Background





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Background

Background

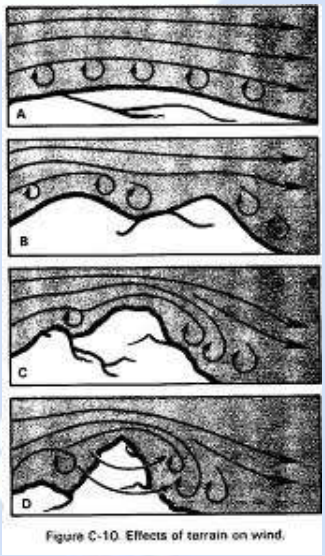
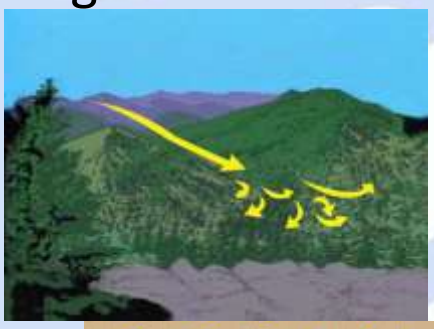
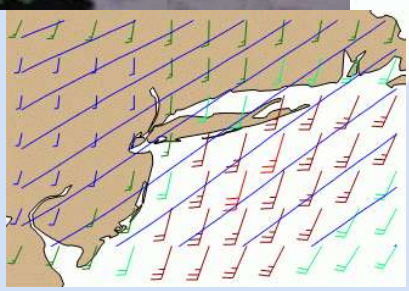


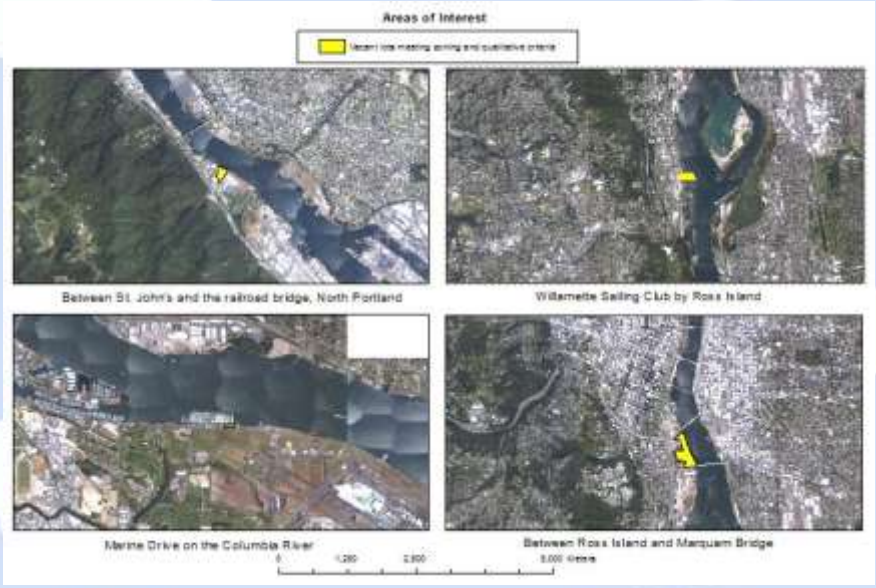
Figure C-10. Effects of terrain on wind.





Background

Site Selection



WindSIM

- Module 1: Terrain
  - Generates a 3D model of the area around your wind farm based on elevation and roughness data.

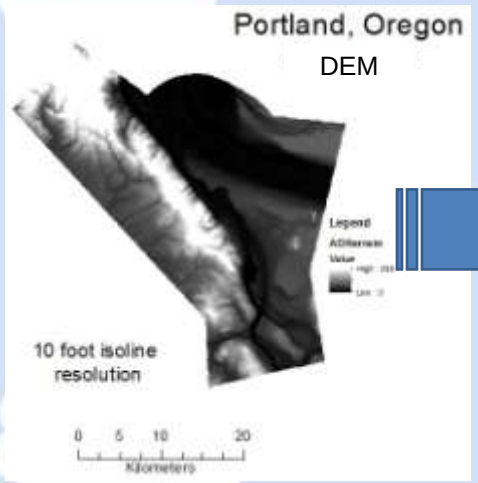
• Module 2: Wind Field
- Generates the wind database. The module simulates how the terrain affects local wind conditions in terms of speed-ups, direction shifts, and turbulence.

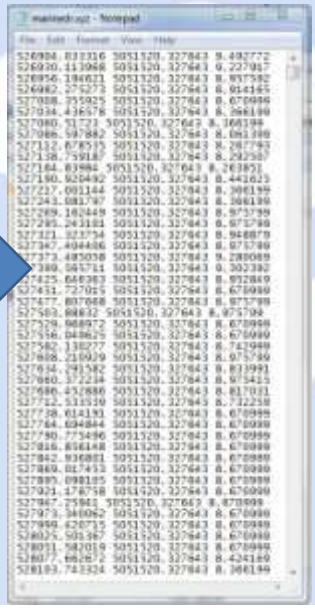
Module 3: Objects
- Placement of turbines and measurement points

Module 4: Results
allows inspection of flow variables such as wind speed, directional shifts, turbulent intensity, and the vertical component of the wind.

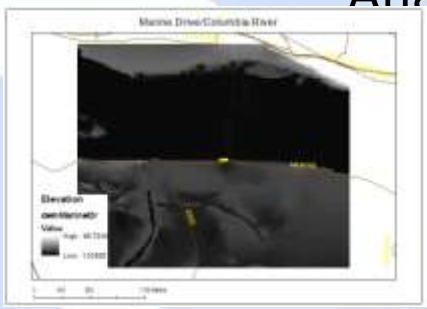
There are two additional Modules: Wind Resources and Energy, though these are used specifically for Wind farm planning.

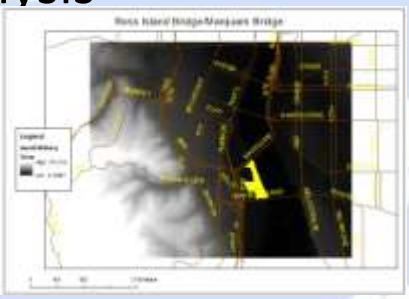
Analysis

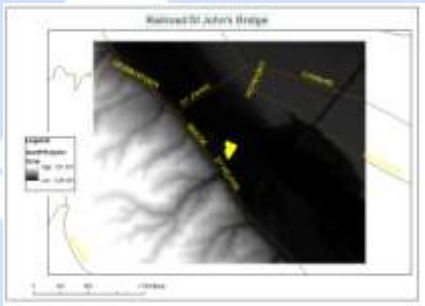


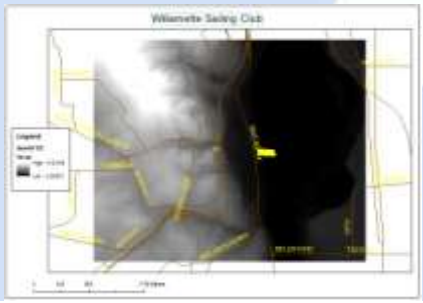


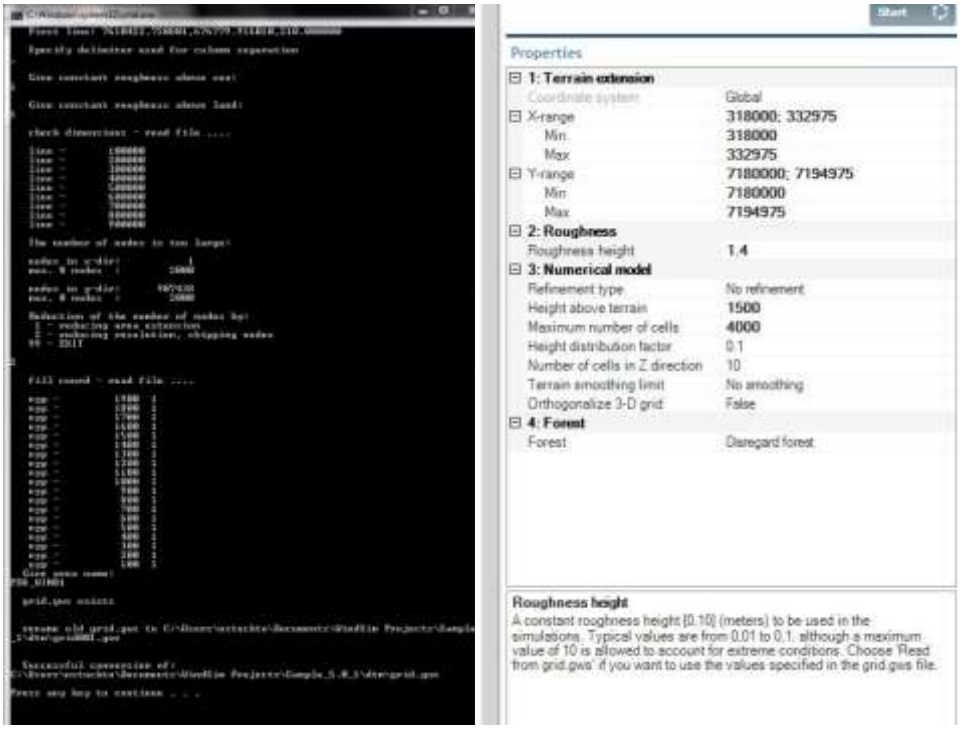
Analysis



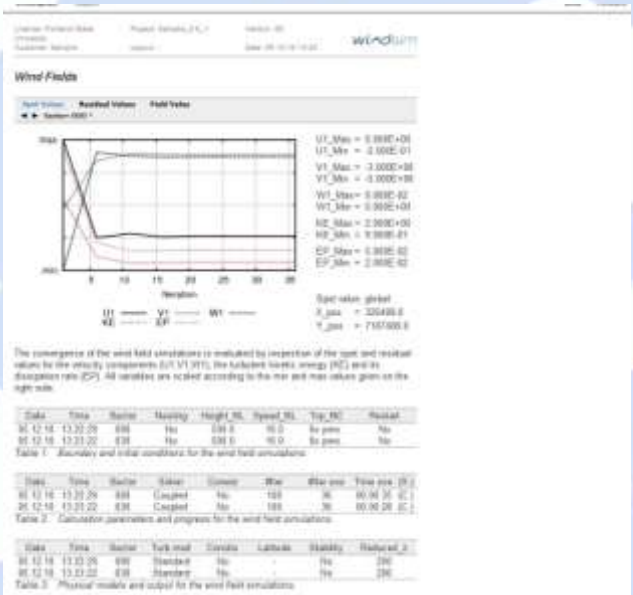




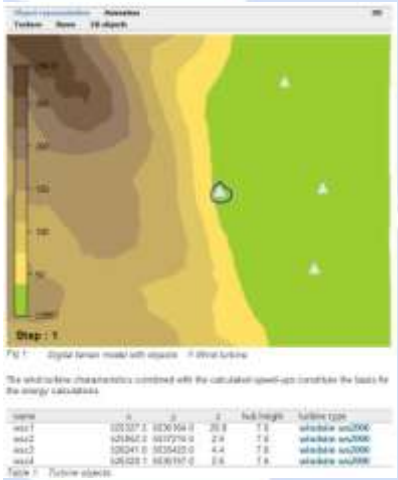


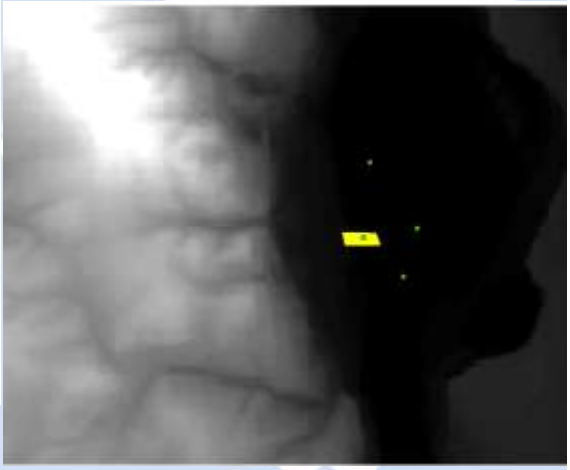

Start
Properties
1: Terrain extension
Coordinate system
Global
X-range
318000; 332975
Min
318000
Max
332975
Y-range
7180000; 7194975
Min
7180000
Max
7194975
2: Roughness
Roughness height
1.4
3: Numerical model
Refinement type
No refinement
Height above terrain
1500
Maximum number of cells
4000
Height distribution factor
0.1
Number of cells in Z direction
10
Terrain smoothing limit
No smoothing
Orthogonalize 3-D grid
False
4: Forest
Forest
Disregard forest
Roughness height
A constant roughness height [0.10] (meters) to be used in the simulations. Typical values are from 0.01 to 0.1, although a maximum value of 10 is allowed to account for extreme conditions. Choose 'Read from grid.gws' if you want to use the values specified in the grid.gws file.

Analysis


Wind Fields

Analysis

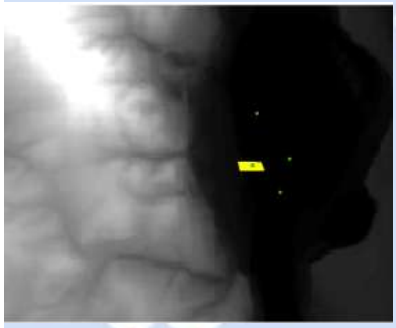


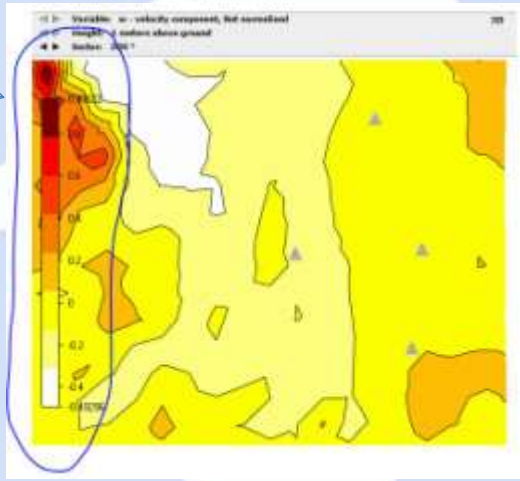


Results!

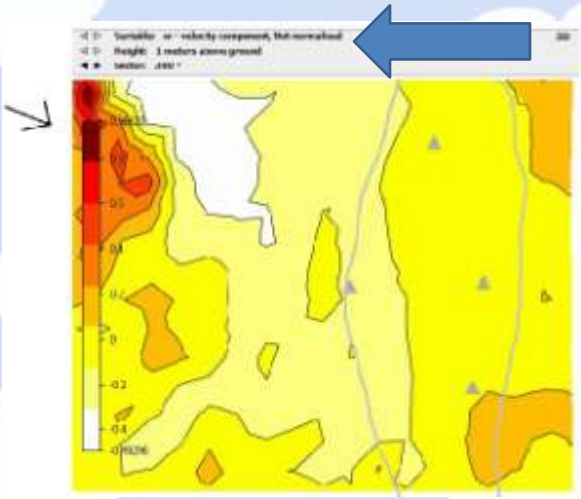
The high point on the hill peak has less than a knot of wind?

1 knot = .54 m/s





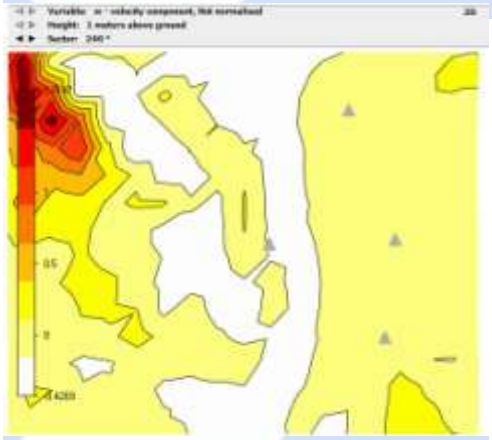
Results?

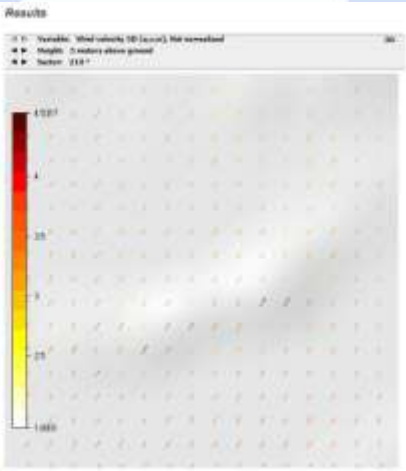


What does it mean?

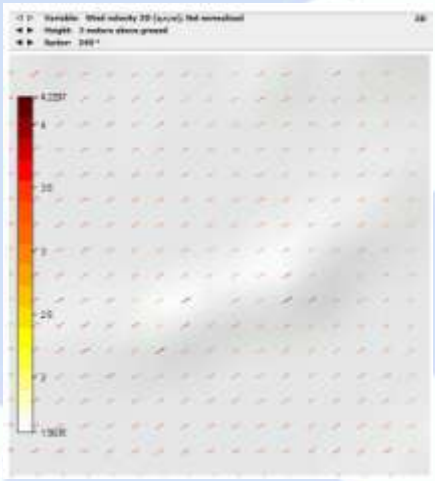
- No X-Y measurements made
- Only measurements made on Z values.

But…





Results



Results-Failure???

No!

Special thanks to…

Bethany Pratt and
Cate Clark

Professor Duh

Ulrik Welle-Strand Horn