

Lecture given at the
WCS Workshop on Land Change Modeling for REDD

October 25– 29, 2010

Wildlife Conservation Society - Bronx Zoo
Bronx, New York, USA

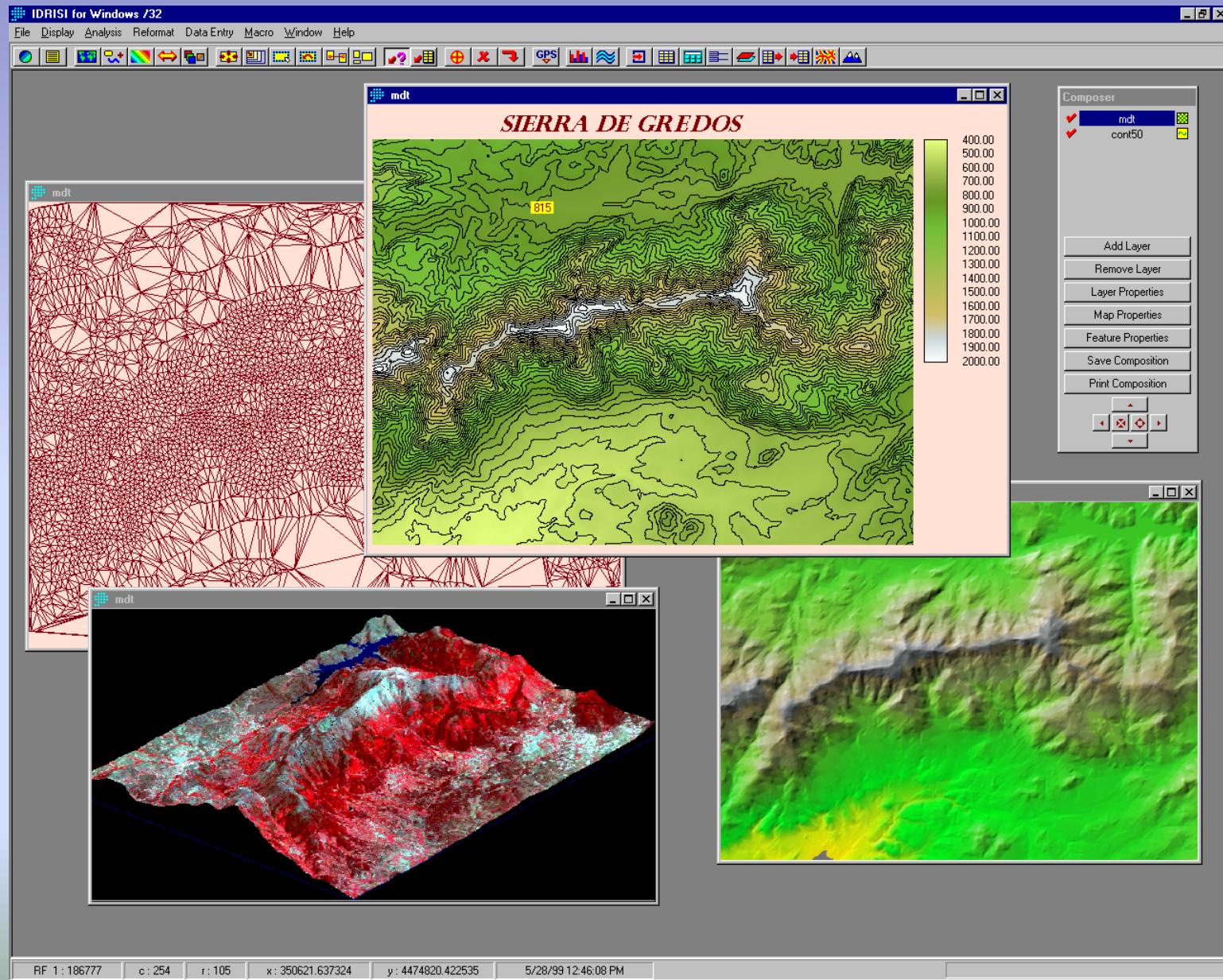
Hosted by

Clark Labs and the Wildlife Conservation Society



This workshop was generously supported by the American people through the United States Agency for International Development (USAID), under the terms of the TransLinks Cooperative Agreement No.EPP-A-00-06-00014-00 to the Wildlife Conservation Society (WCS). TransLinks is a partnership of WCS, The Earth Institute, Enterprise Works/VITA, Forest Trends and the Land Tenure Center. The contents are the responsibility of the authors and do not necessarily reflect the views of USAID or the United States government.

Surfaces in GIS



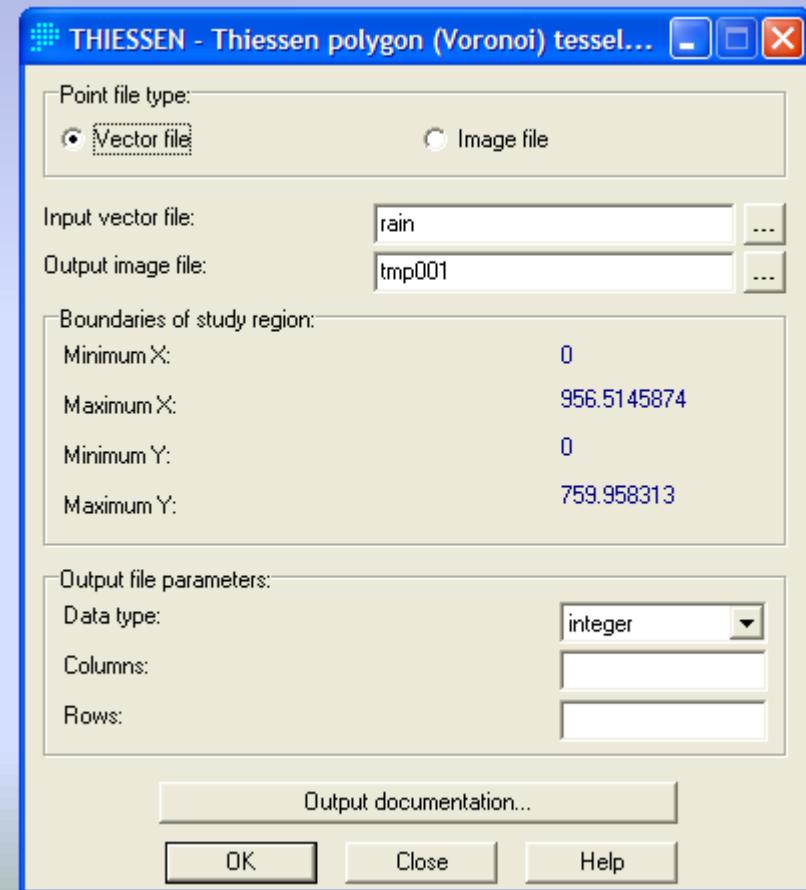
Surfaces in GIS

- in raster GIS, any continuous data layer can be considered to be a surface
- we live on a surface and thus have considerable experience with how processes are affected by surface characteristics
- thus the surface analogy is a powerful tool for thinking about spatial processes
- surface dynamics are perhaps the most powerful tool for thinking about the relationship between movement, distances and time

Surface Development

Interpolation from Points

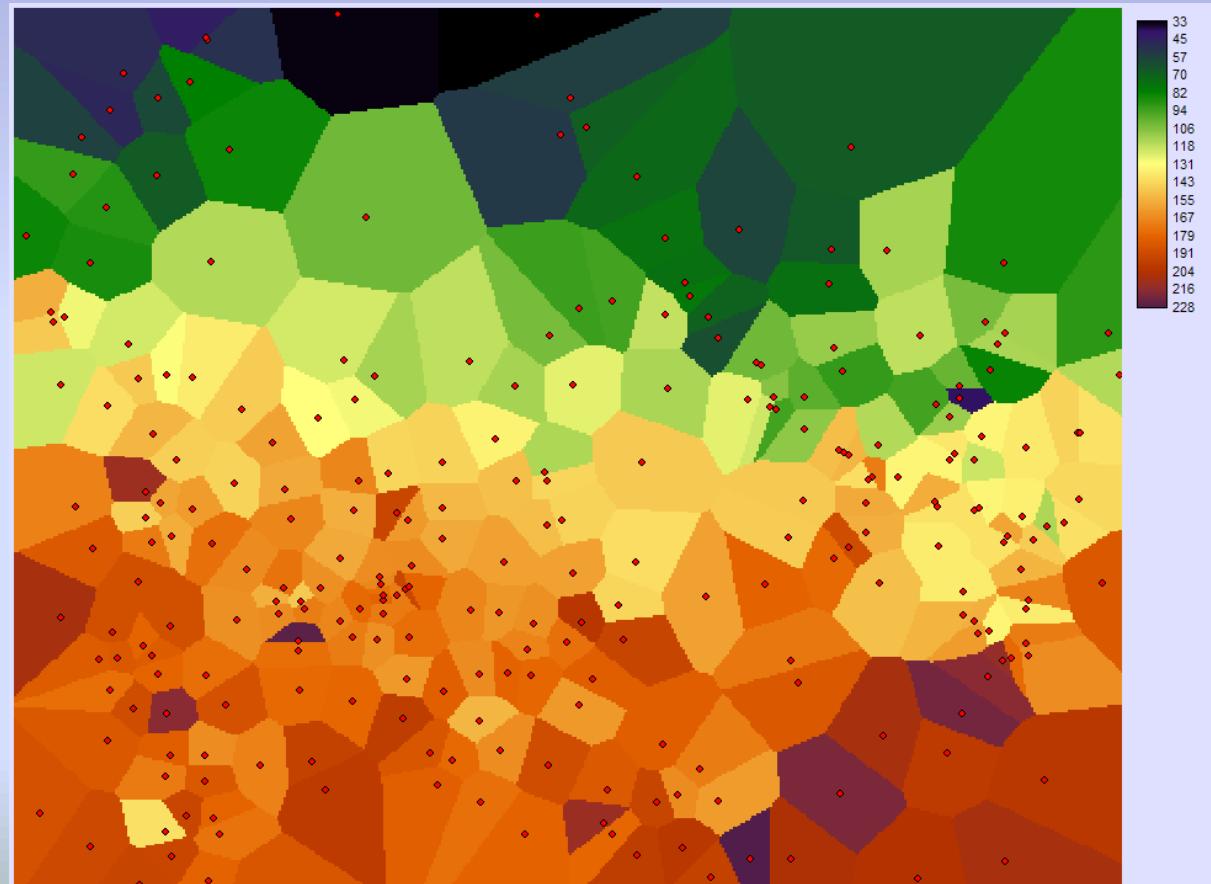
- Thiessen



Surface Development

Interpolation from Points

- Thiessen

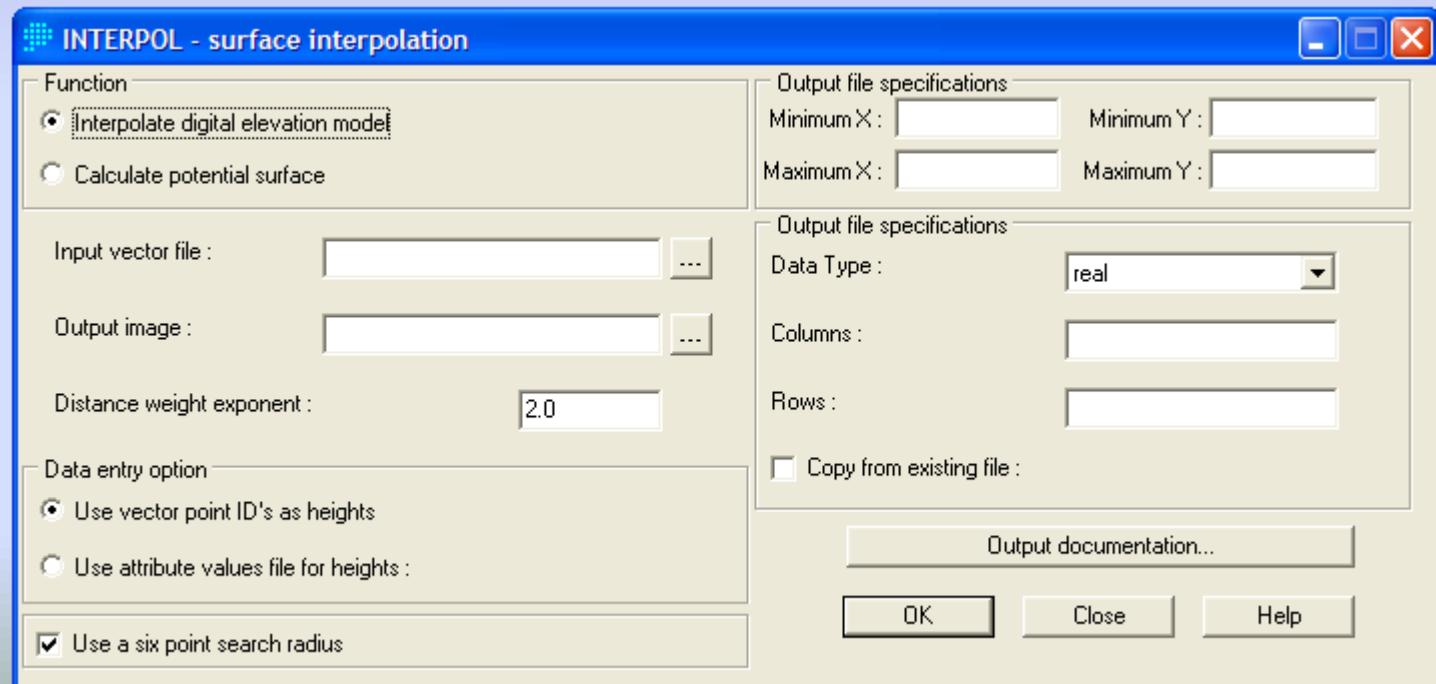


Surface Development

Interpolation from Points

- Thiessen
- Interpol

$$z_j = \frac{\sum w_i Z_i}{\sum w_i} \quad \text{where } w_i = \frac{1}{d^k}$$

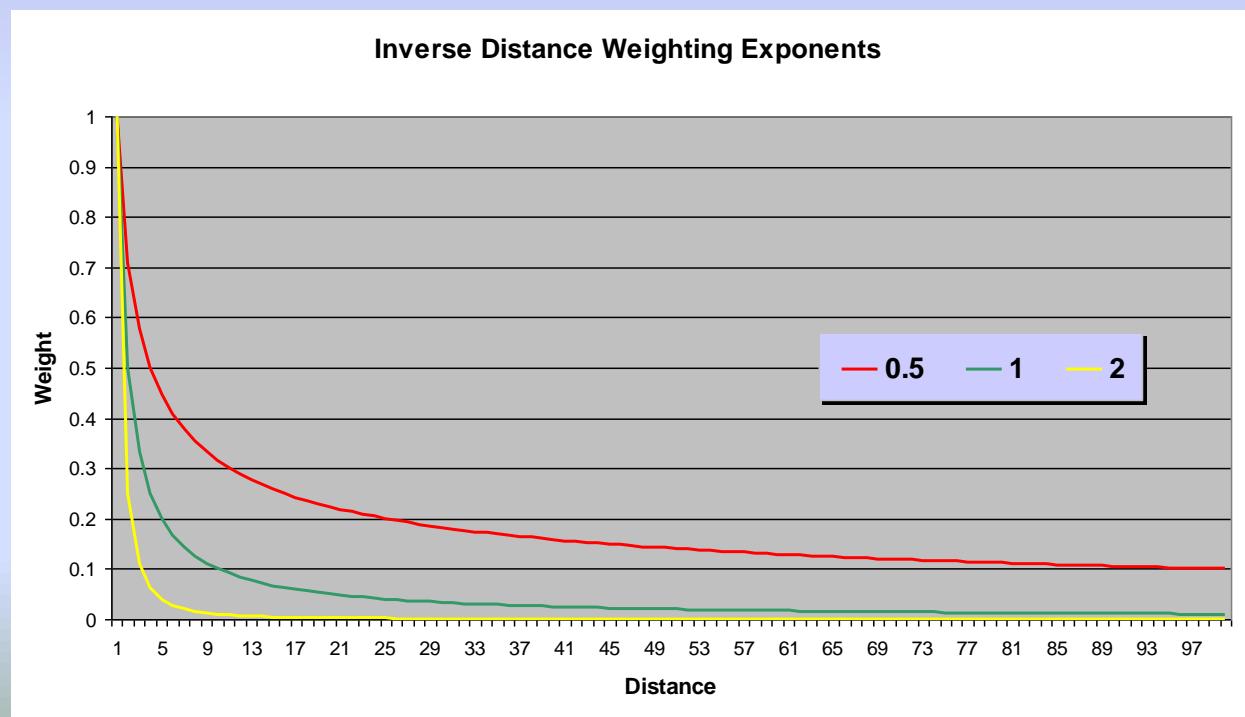


Surface Development

Interpolation from Points

- Thiessen
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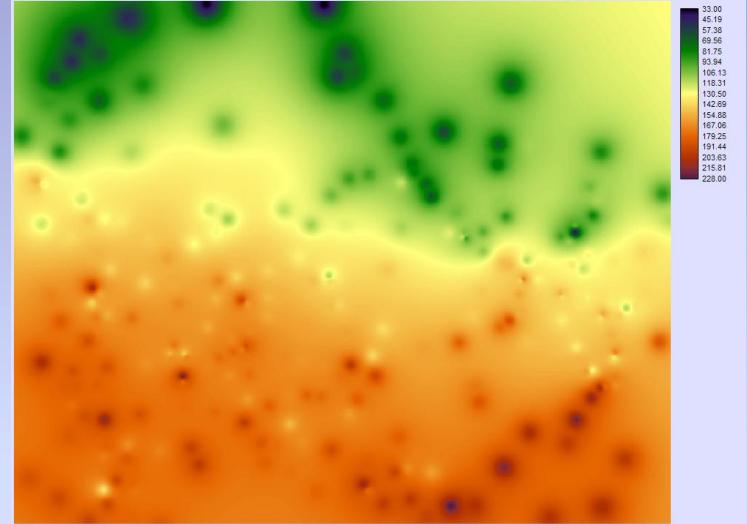


Surface Development

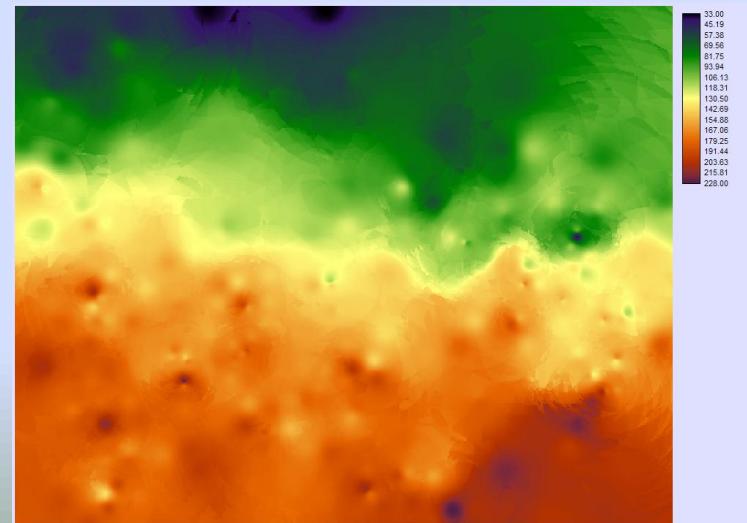
Interpolation from Points

- Thiessen
- Interpol

all points



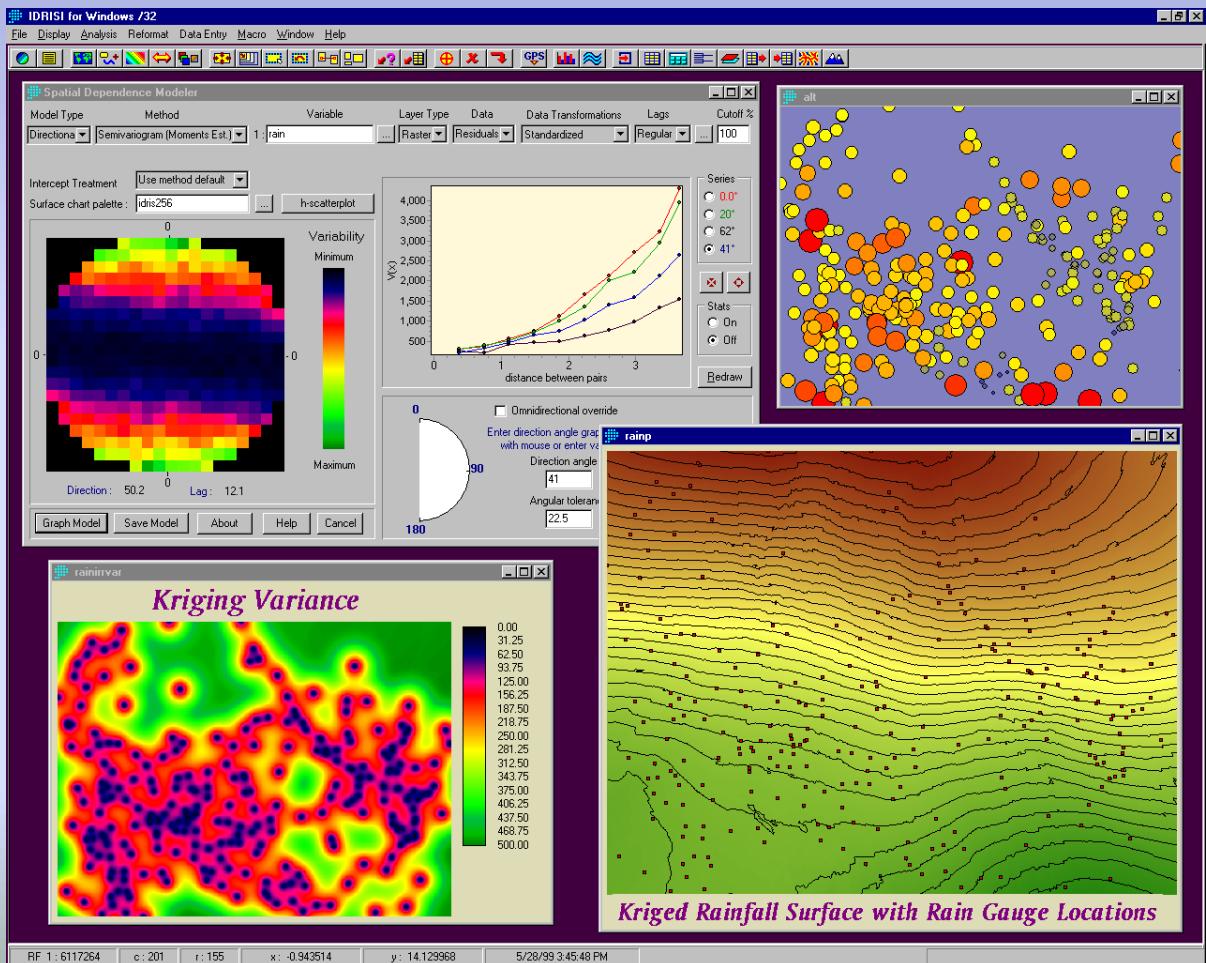
near
points
using
search
radius



Surface Development

Interpolation from Points

- Thiessen
- Interpol
- Kriging

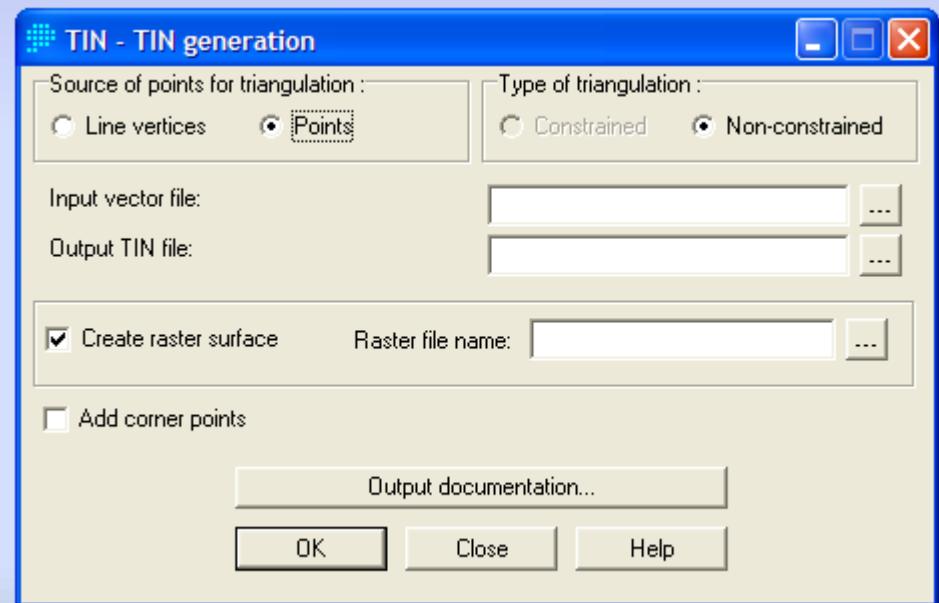


Surface Development

Interpolation from Points

- Thiessen
- Interpol
- Kriging
- TIN

$$z = \alpha + \beta_1 X + \beta_2 Y$$

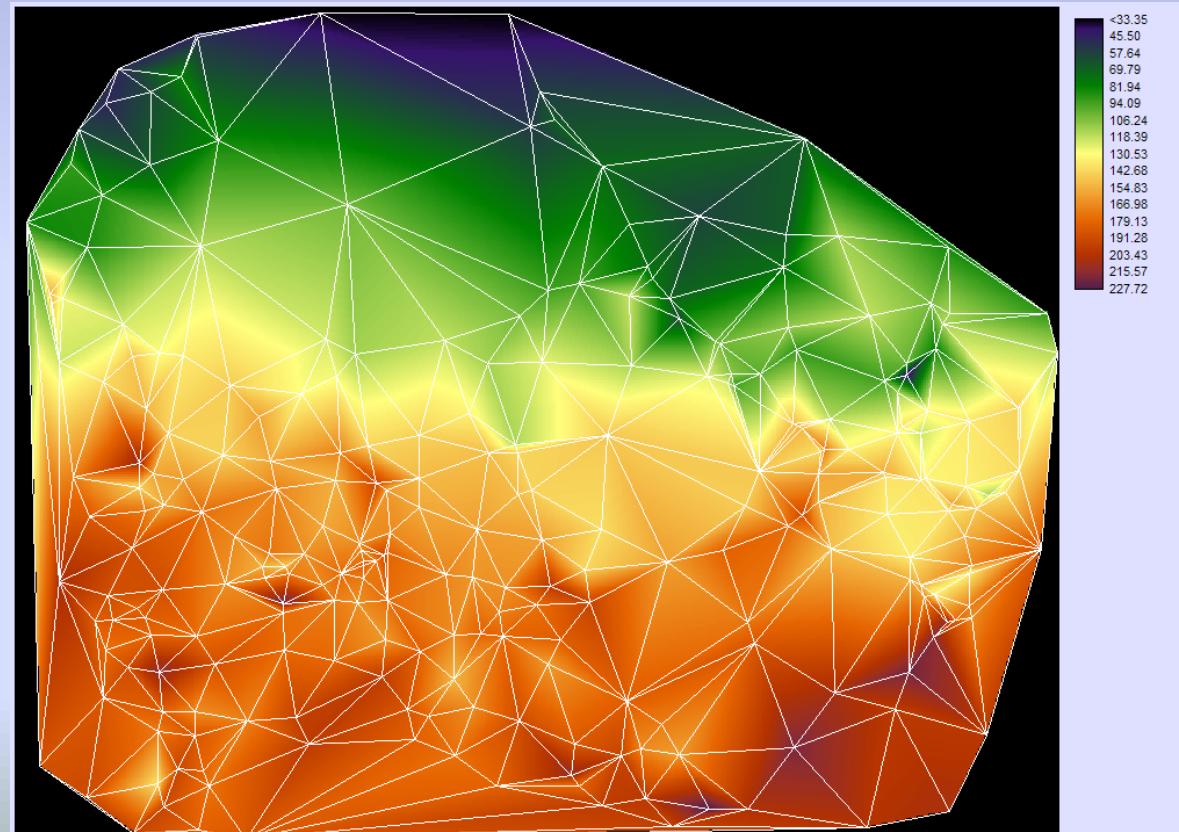


Surface Development

Interpolation from Points

- Thiessen
- Interpol
- Kriging
- TIN

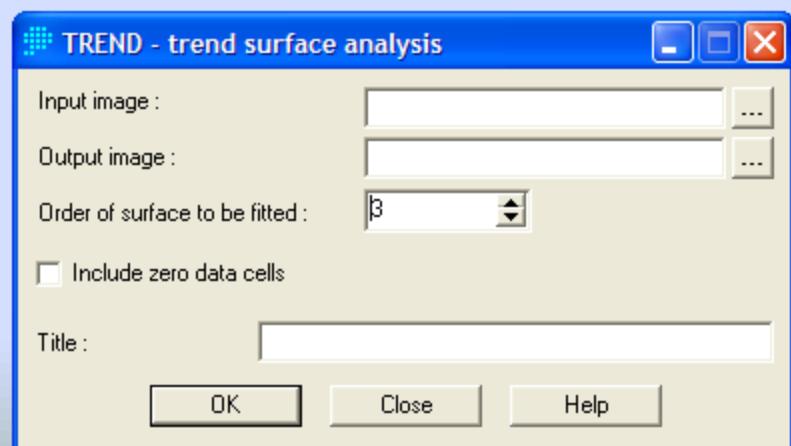
$$z = \alpha + \beta_1 X + \beta_2 Y$$



Surface Development

Interpolation from Points

- Thiessen
- Interpol
- Kriging
- TIN
- Trend Surface Analysis



Surface Development

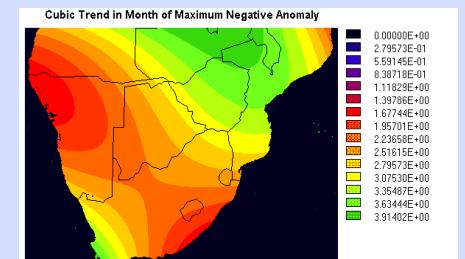
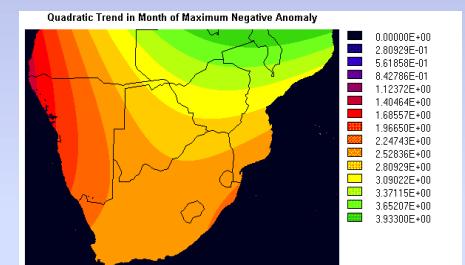
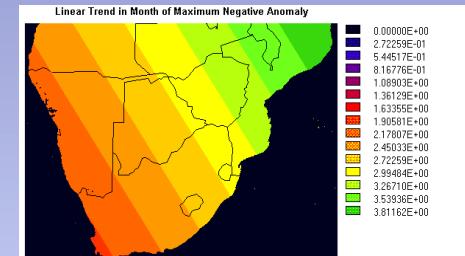
Interpolation from Points

- Thiessen
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- Trend Surface Analysis

$$z = \beta_0 + \beta_1 X + \beta_2 Y$$

$$z = \beta_0 + \beta_1 X + \beta_2 Y + \beta_3 X^2 + \beta_4 XY + \beta_5 Y^2$$

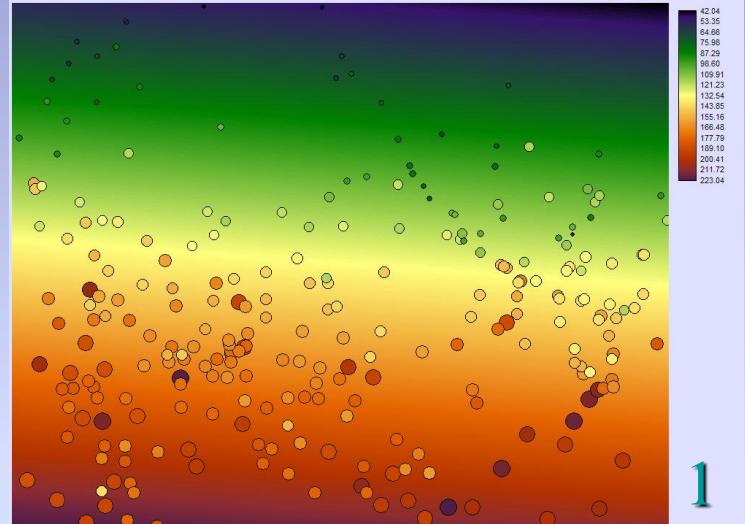
$$z = \beta_0 + \beta_1 X + \beta_2 Y + \beta_3 X^2 + \beta_4 XY + \beta_5 Y^2 + \beta_6 X^3 + \beta_7 X^2 Y + \beta_8 X Y^2 + \beta_9 Y^3$$



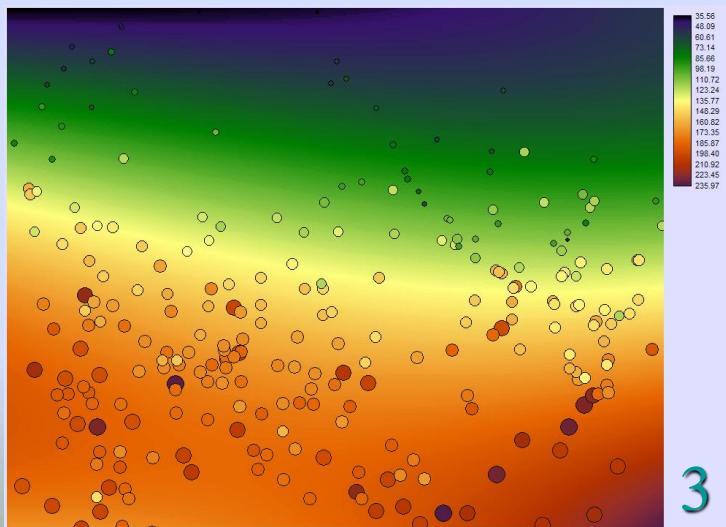
Surface Development

Interpolation from Points

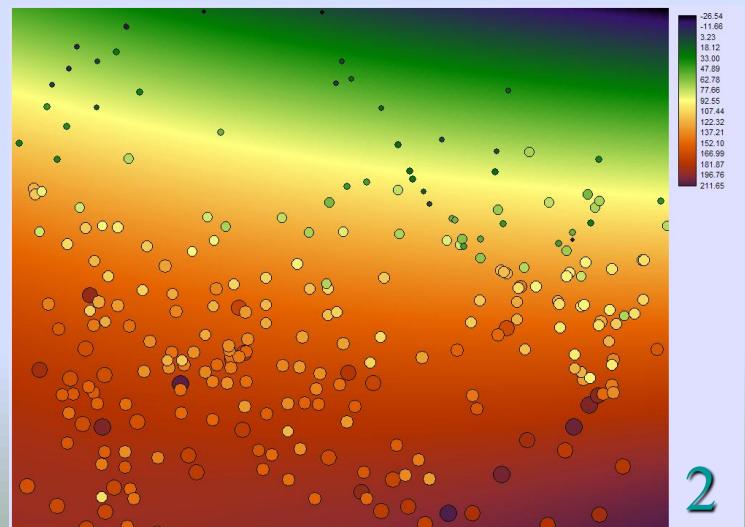
- Thiessen
- Interpol
- Kriging
- TIN
- Trend Surface Analysis



1



3



2

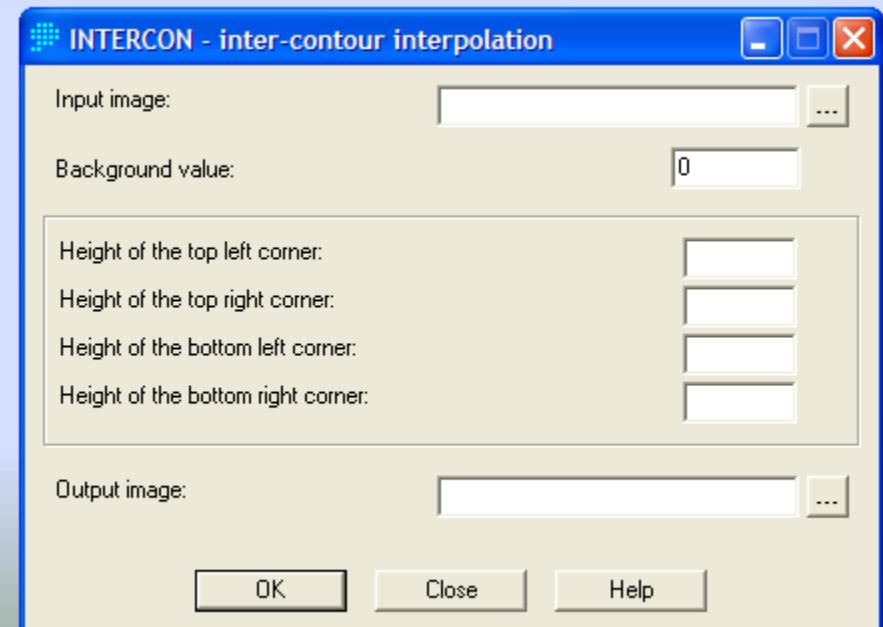
Surface Development

Interpolation from Points

- Thiessen
- Interpol
- Kriging
- TIN
- Trend Surface Analysis

Interpolation from Contours

- Intercon



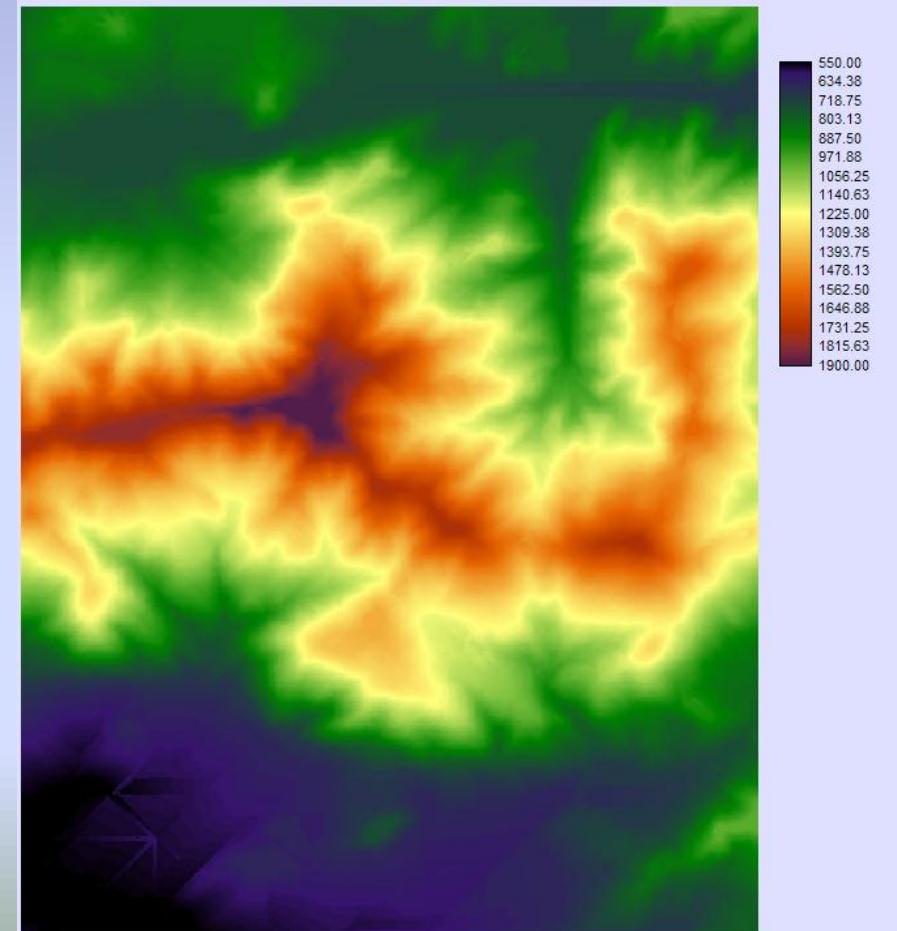
Surface Development

Interpolation from Points

- Thiessen
- Interpol
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- TIN
- Trend Surface Analysis

Interpolation from Contours

- Intercon



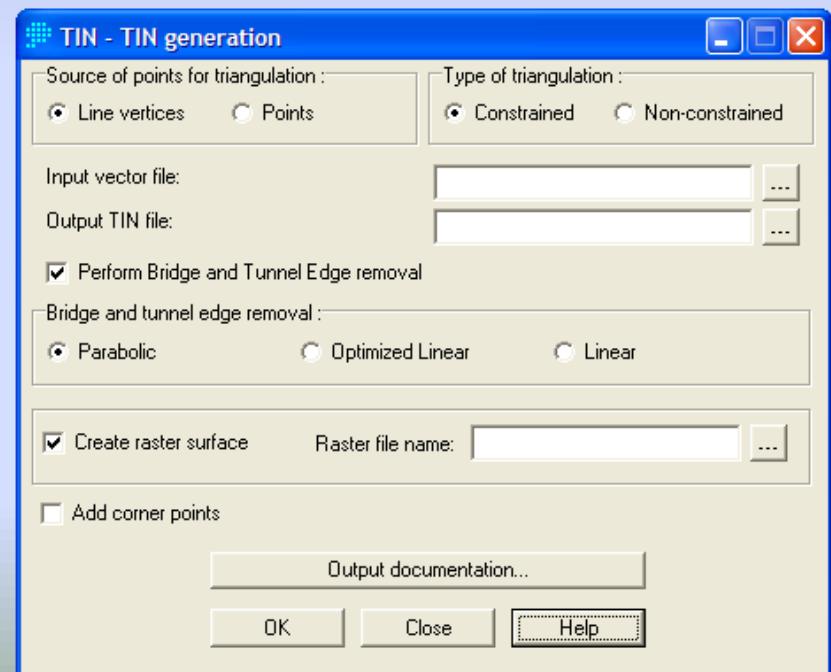
Surface Development

Interpolation from Points

- Thiessen
- Interpol
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Interpolation from Contours

- Intercon
- TIN



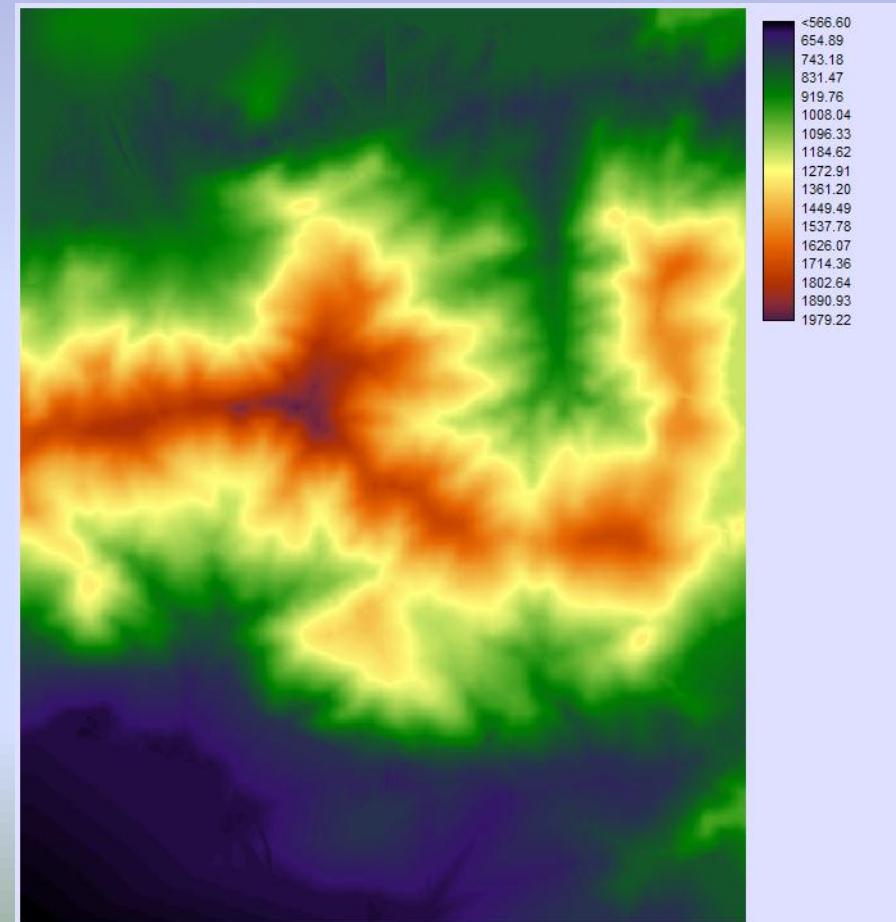
Surface Development

Interpolation from Points

- Thiessen
- Interpol
- Kriging
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- Trend Surface Analysis

Interpolation from Contours

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Surface Development

Interpolation from Points

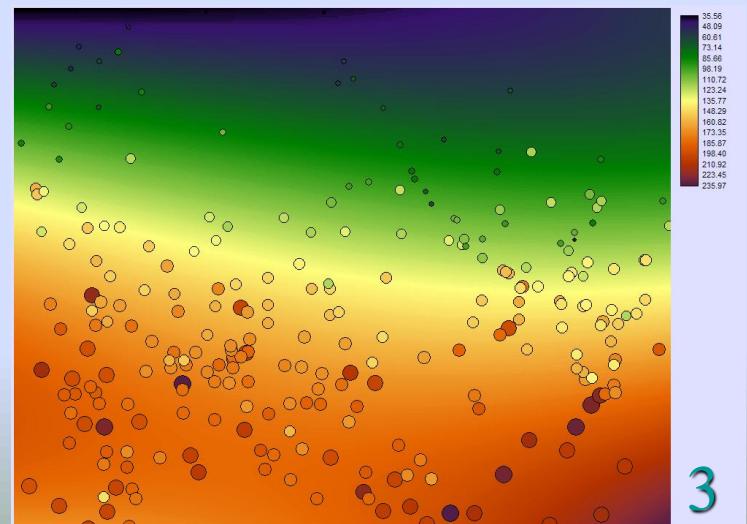
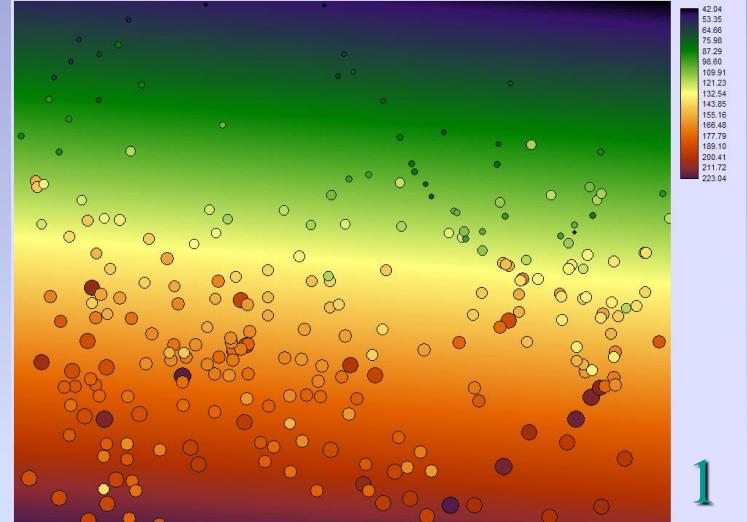
- Thiessen
- Interpol
- Kriging
- TIN
- Trend Surface Analysis

Interpolation from Contours

- Intercon
- TIN

Generalization of Surfaces

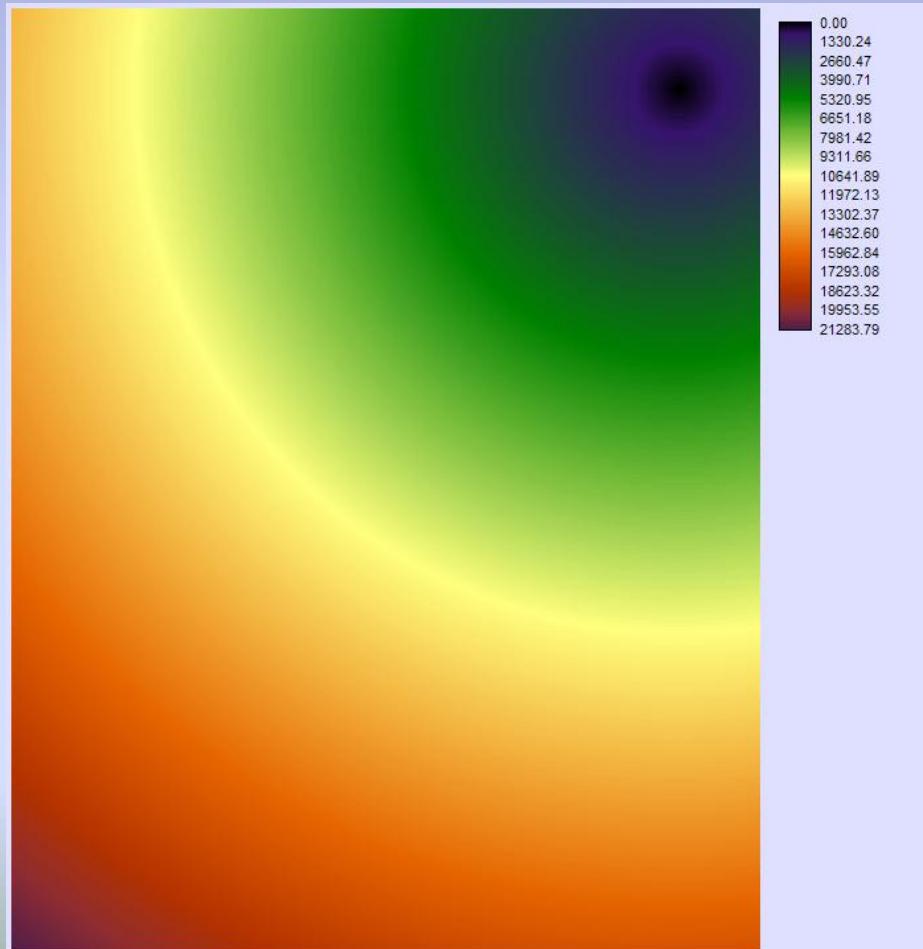
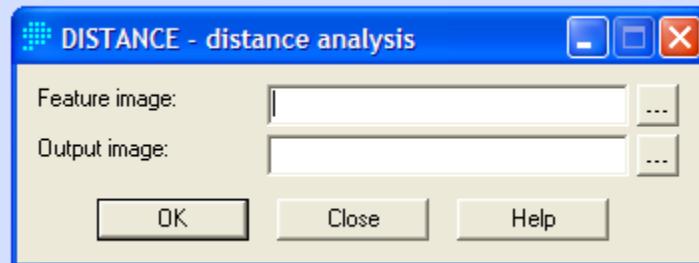
- Trend Surface Analysis



Surface Processes

Distance

- Distance



Surface Processes

Distance

- Distance

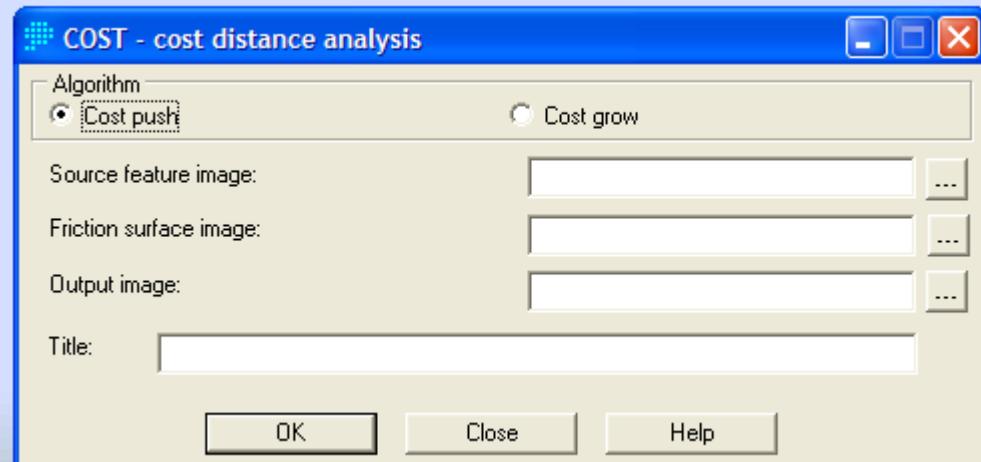
Cost Distance

- Cost

friction = 1 = base value

friction > 1 = resistance

friction < 1 = force



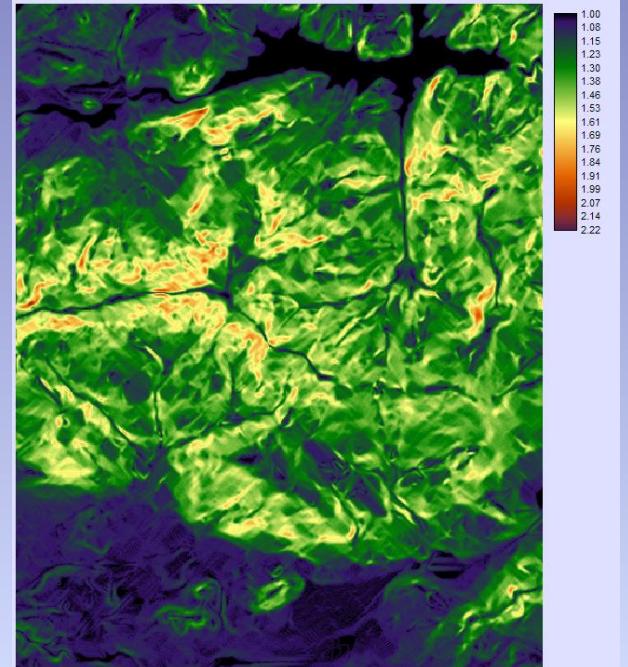
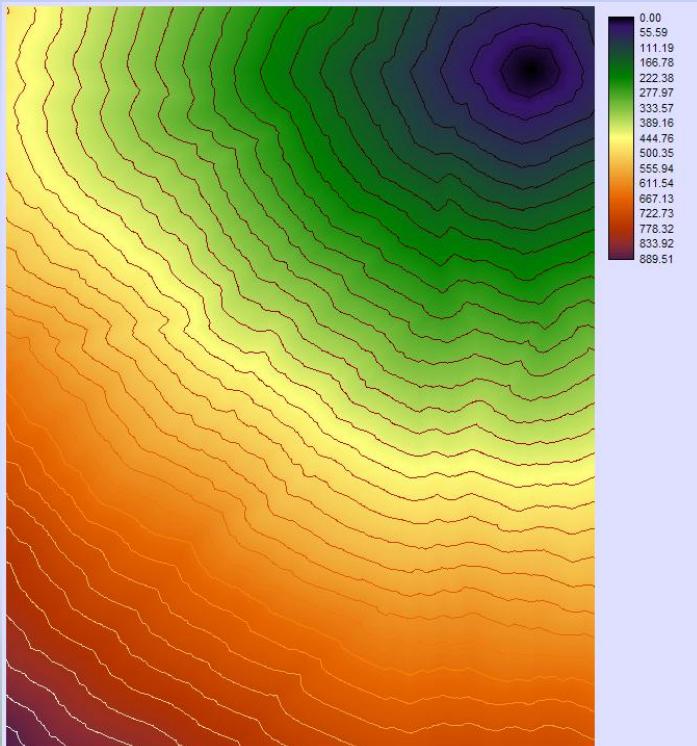
Surface Processes

Distance

- Distance

Cost Distance

- Cost



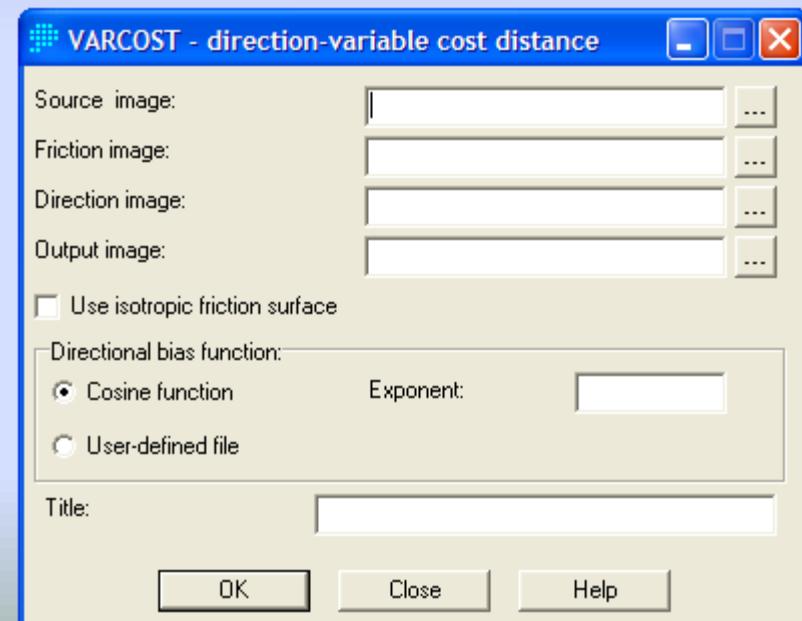
Surface Processes

Distance

- Distance

Cost Distance

- Cost
- Varcost



Surface Processes

Distance

- Distance

Cost Distance

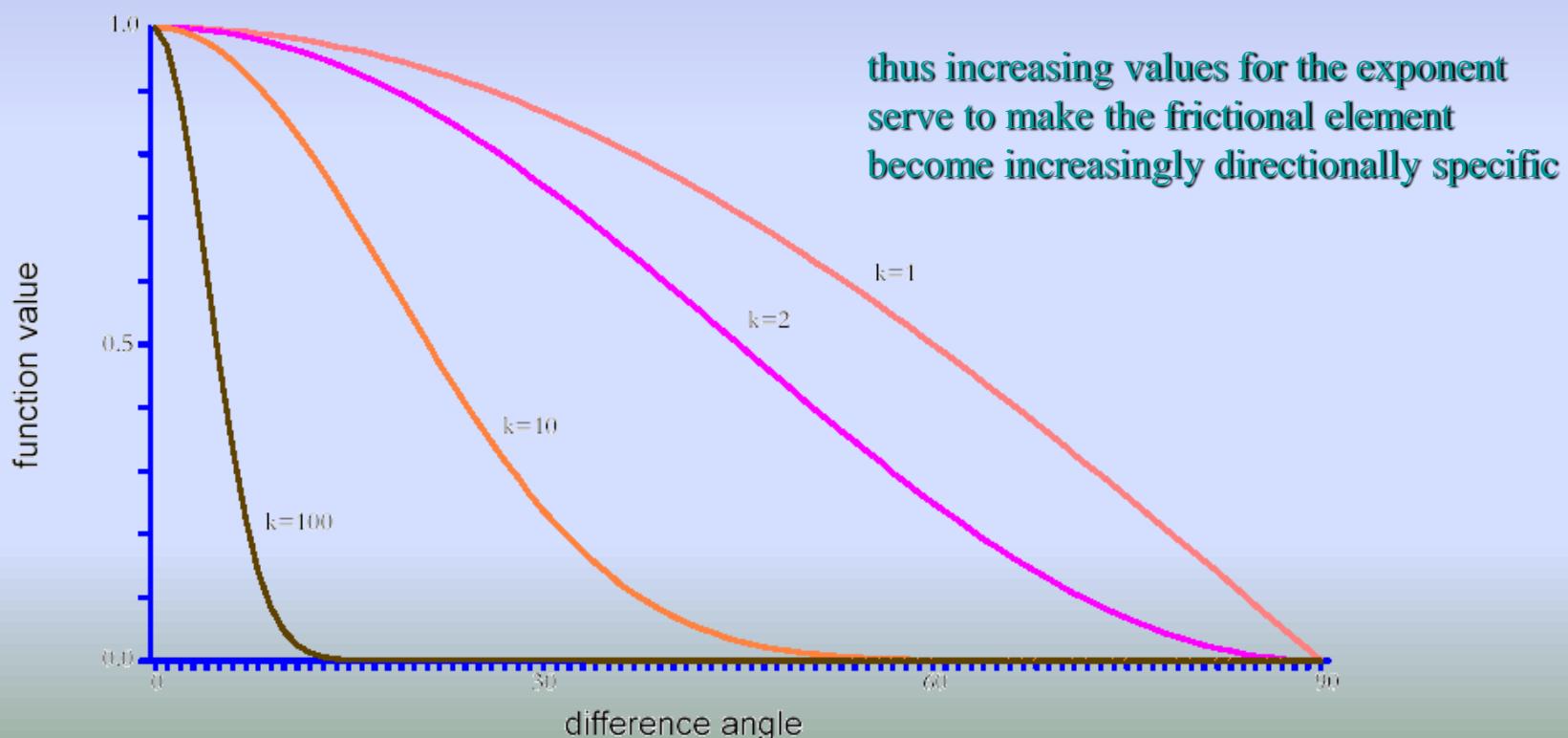
- Cost

- Varcost

$$\text{effective friction} = (\text{stated friction})^f$$

$$\text{where } f = \cos^k \alpha$$

where α is the difference angle – the angle between the direction being considered for movement and the direction from which the friction is acting



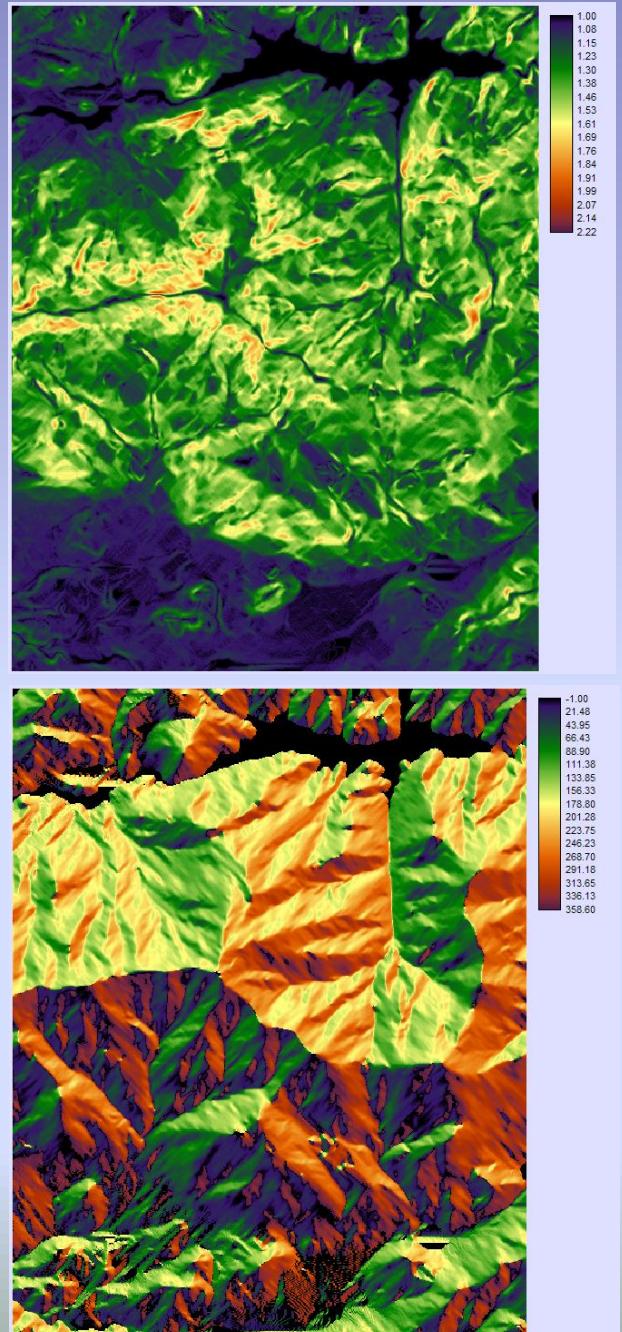
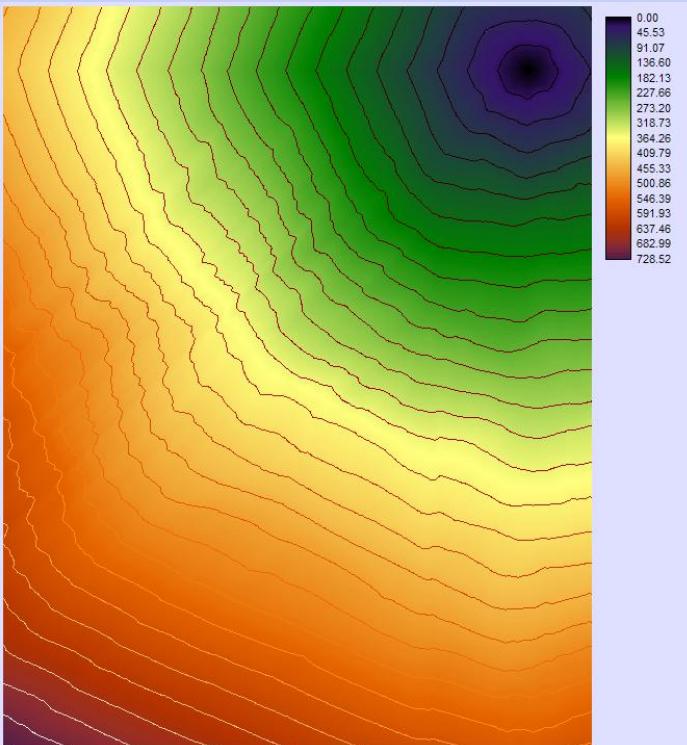
Surface Processes

Distance

- Distance

Cost Distance

- Cost
- Varcost



Surface Processes

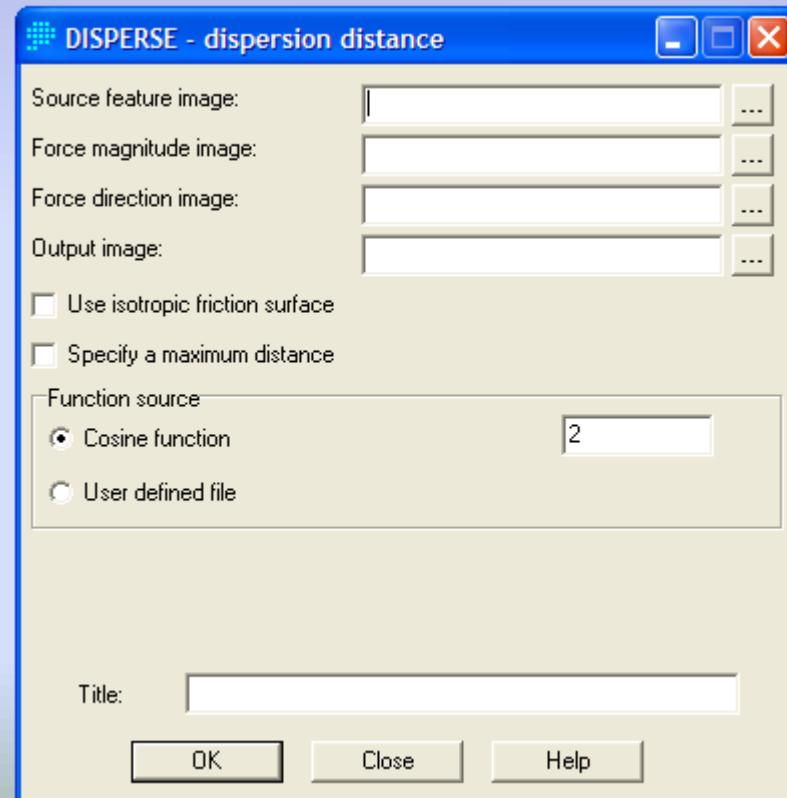
Distance

- Distance

Cost Distance

- Cost
- Varcost
- Disperse

similar to VARCOST but with a different function that restricts movement in a manner consistent with the dispersal of a liquid or gas



Surface Processes

Distance

- Distance

Cost Distance

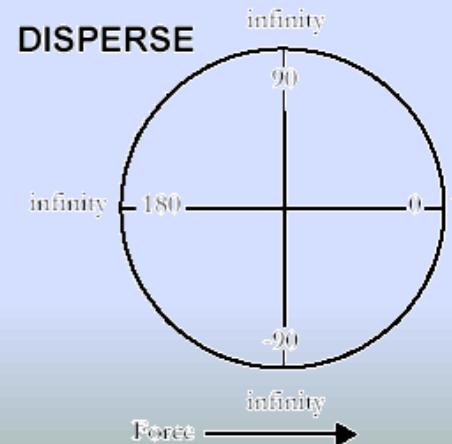
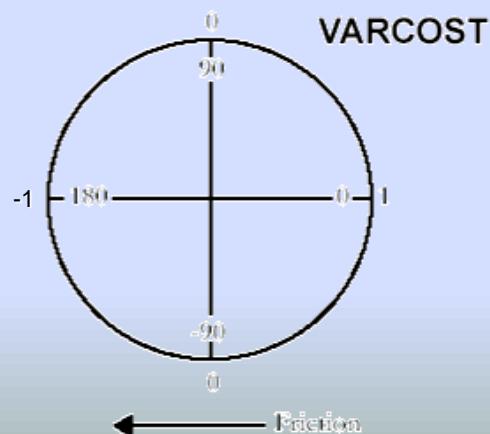
- Cost
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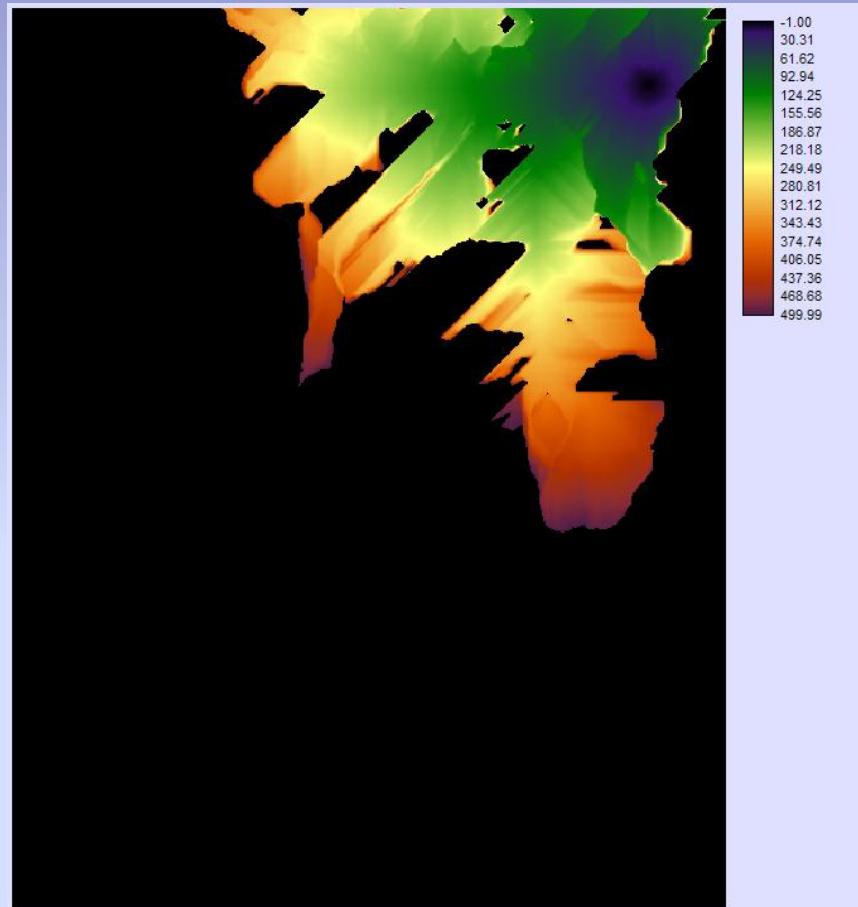
Surface Processes

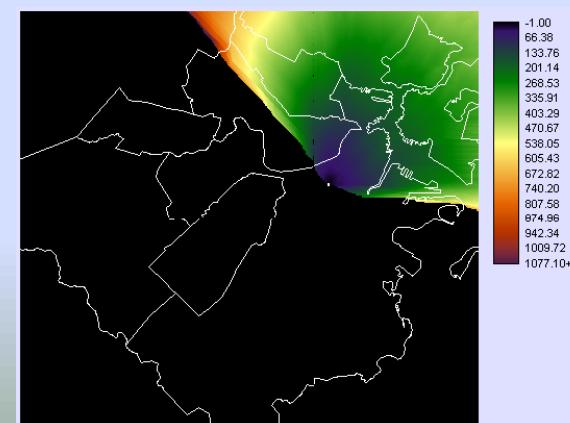
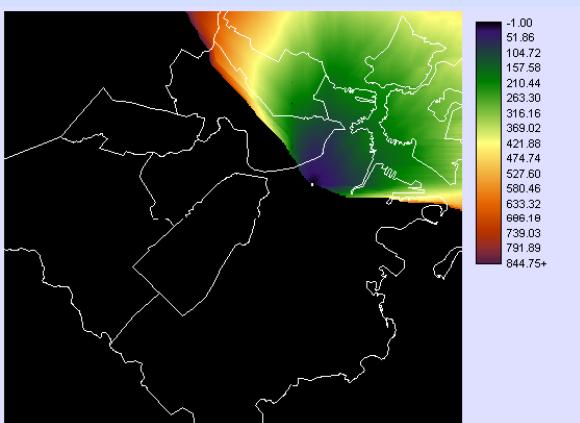
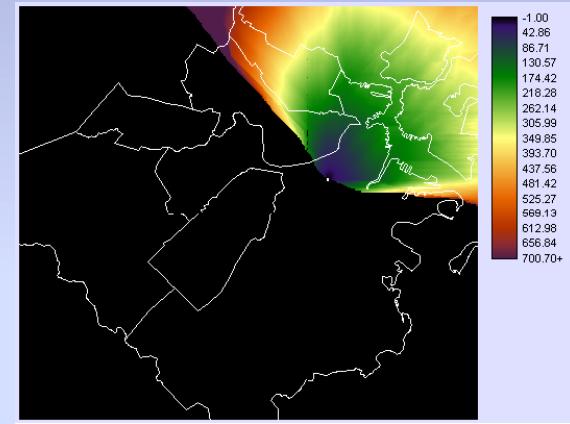
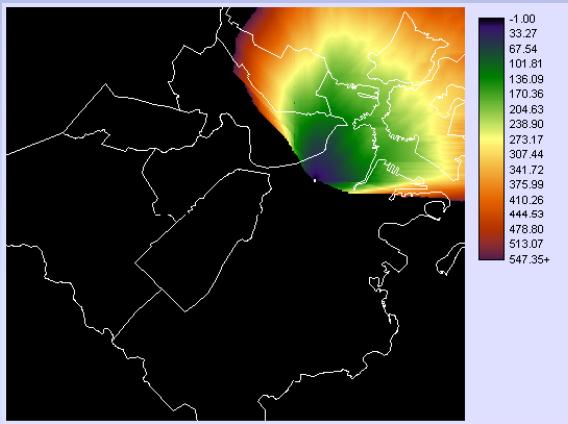
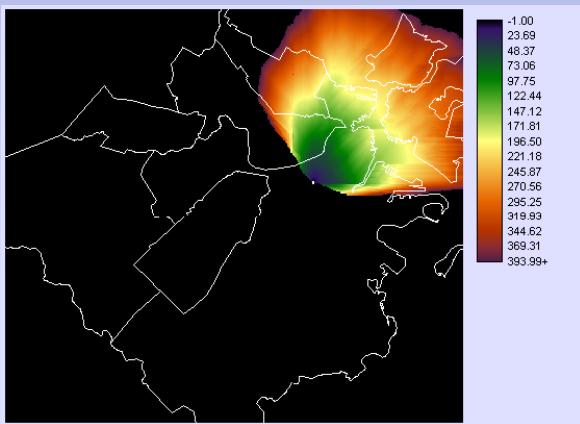
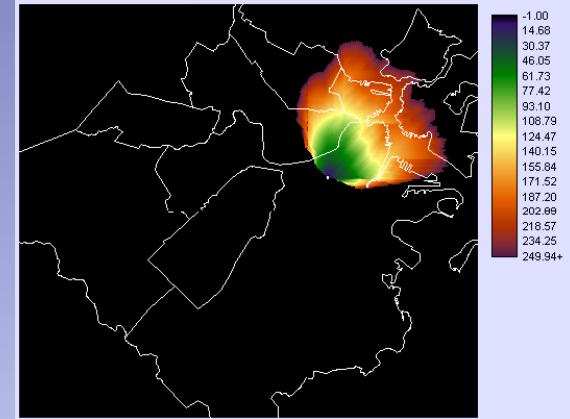
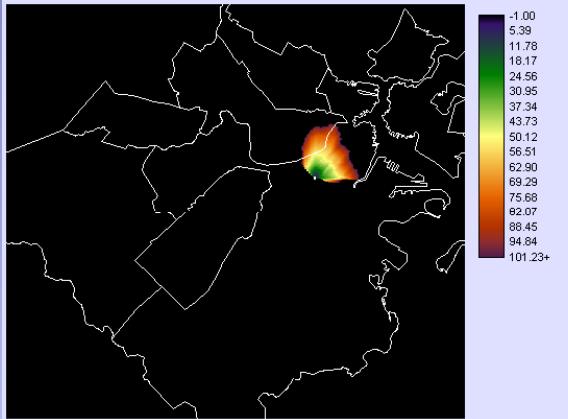
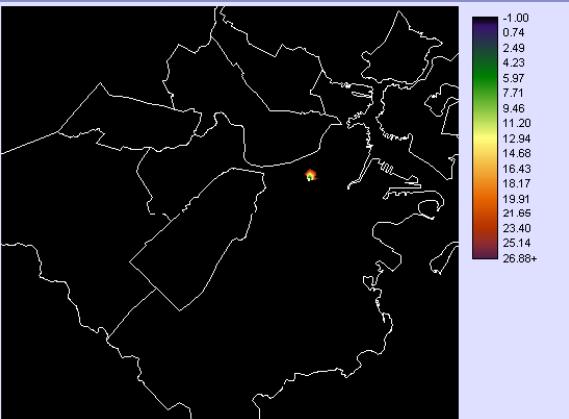
Distance

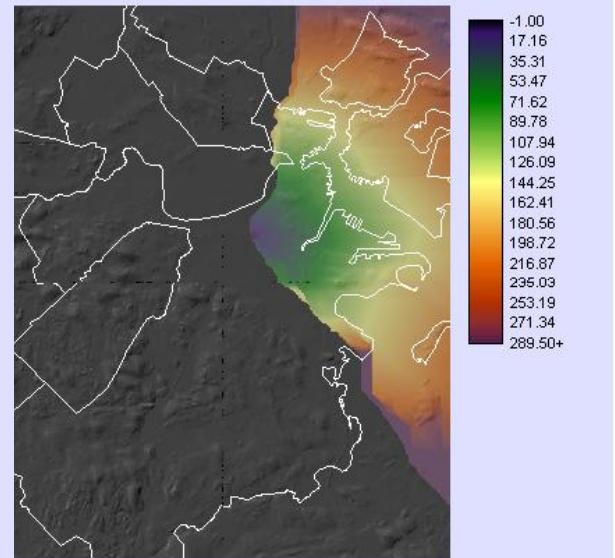
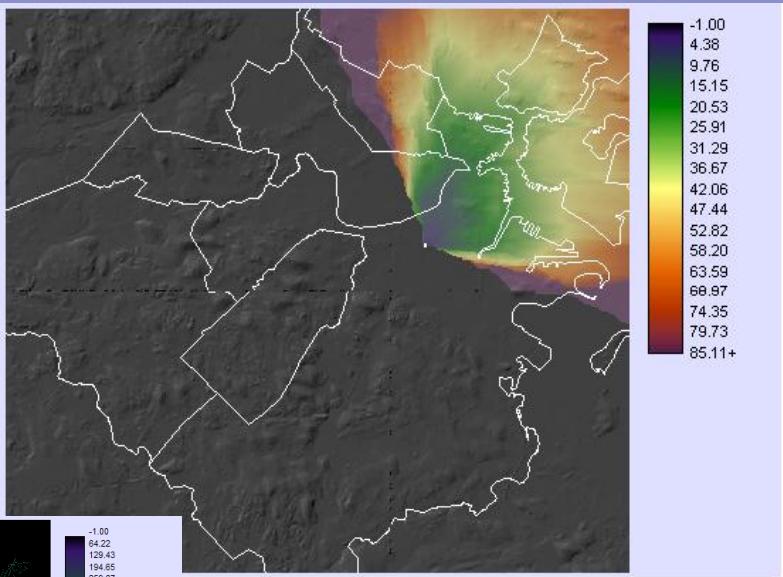
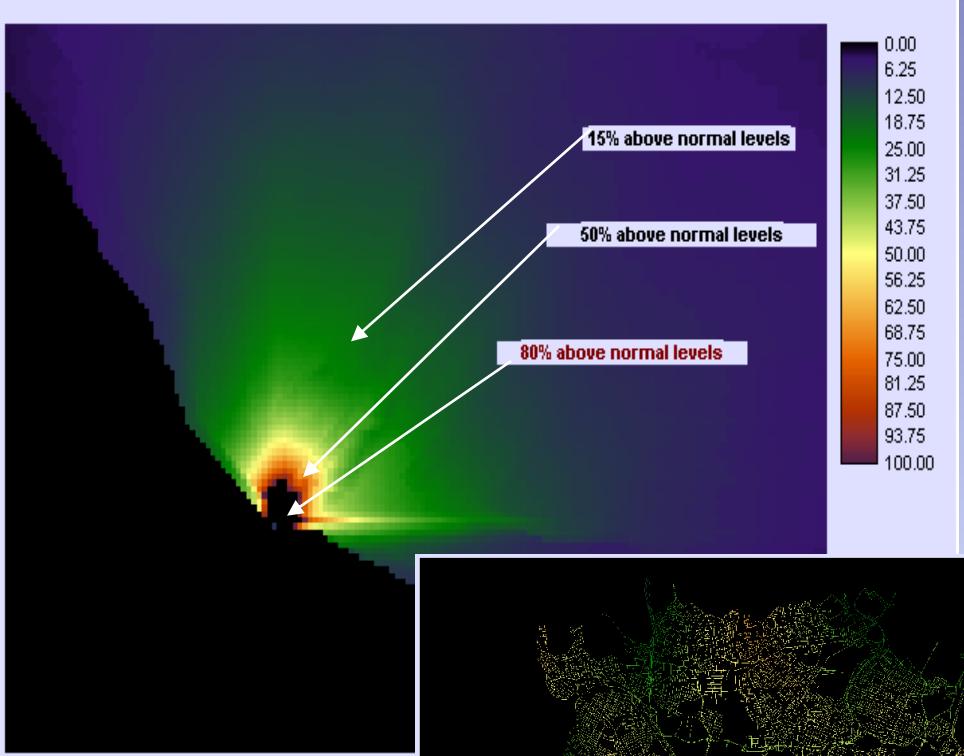
- Distance

Cost Distance

- Cost
- Varcost
- Disperse







Surface Processes

Distance

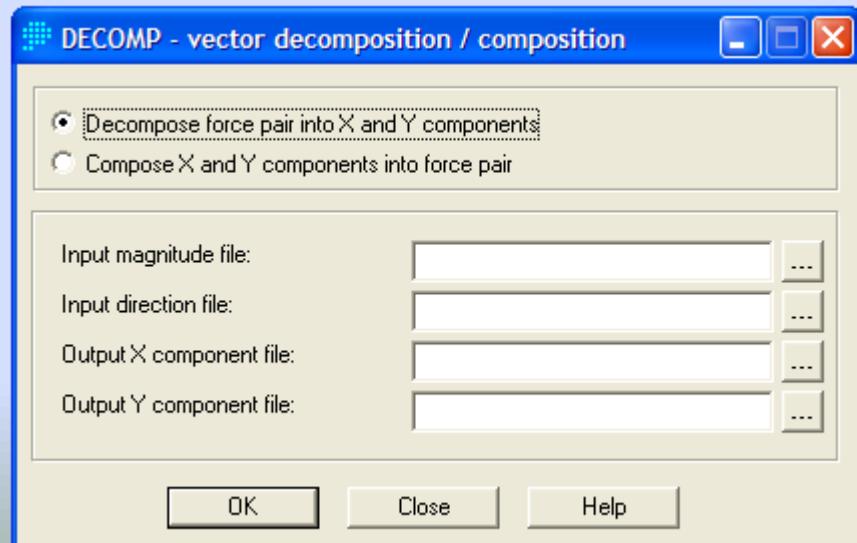
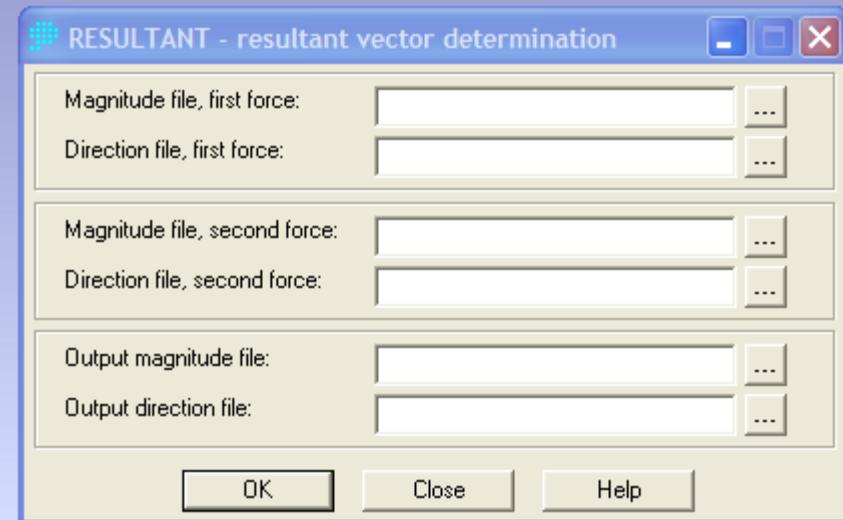
- Distance

Cost Distance

- Cost
- Varcost
- Disperse

Friction/Force Modeling

- Resultant
- Decomp



Surface Processes

Distance

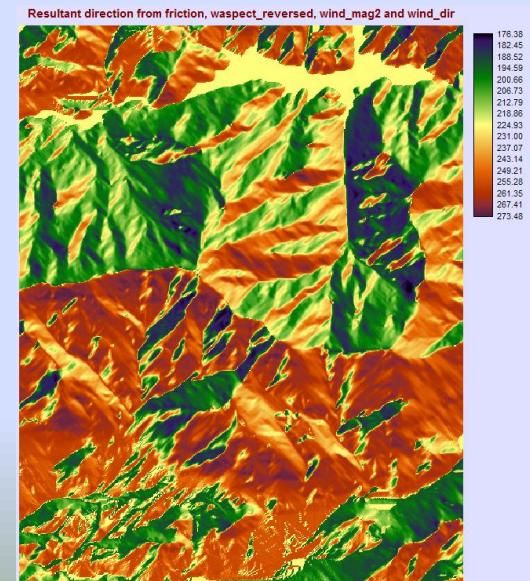
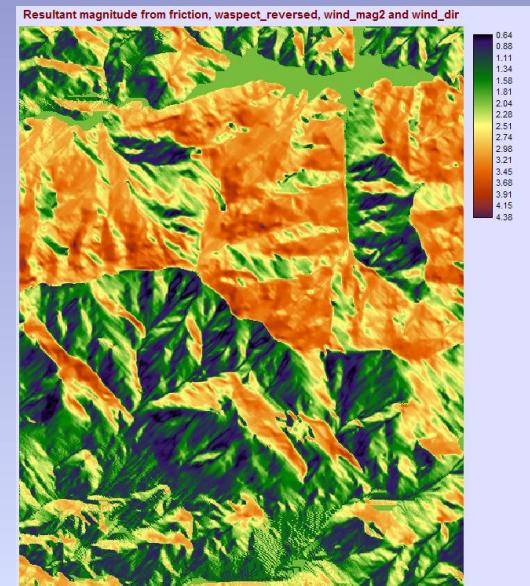
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Friction/Force Modeling

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Surface Processes

Distance

- Distance

Cost Distance

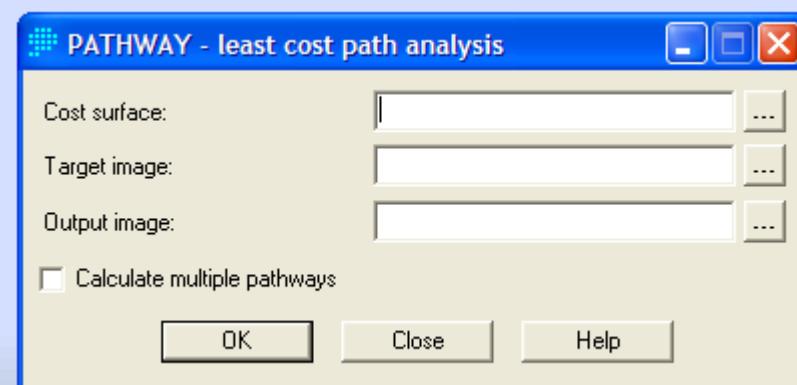
- Cost
- Varcost
- Disperse

Friction/Force Modeling

- Resultant
- Decomp

Optimal Paths

- Pathway



Surface Processes

Distance

- Distance

Cost Distance

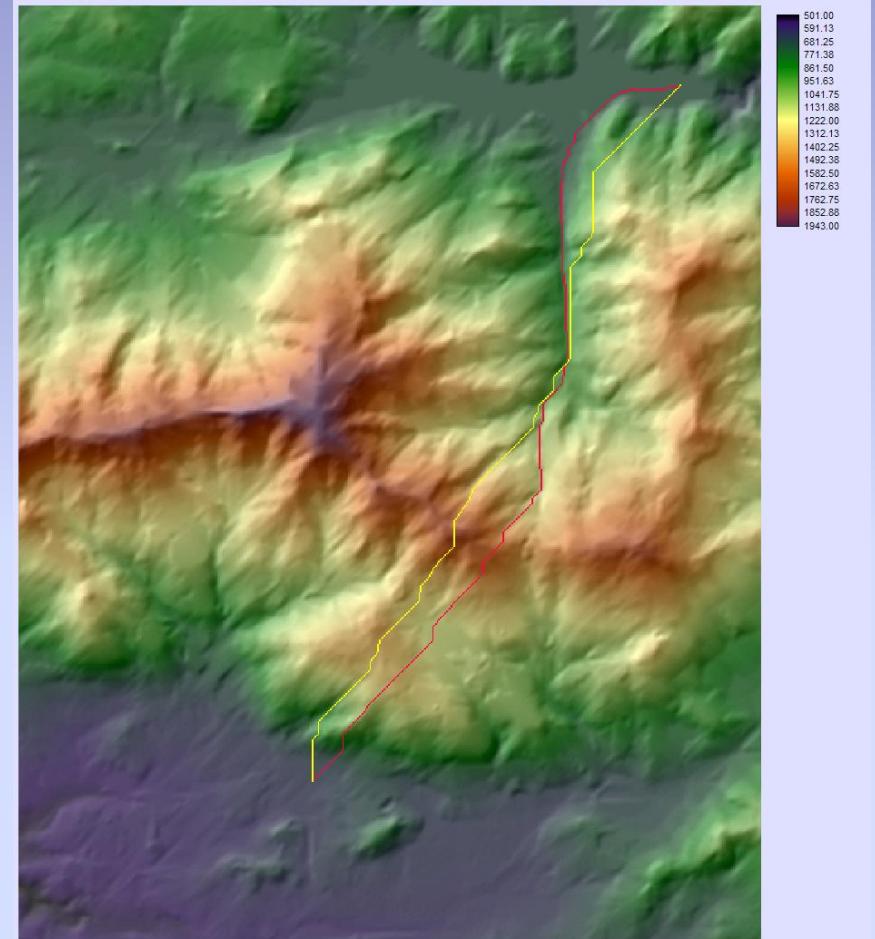
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Friction/Force Modeling

- Resultant
- Decomp

Optimal Paths

- Pathway



Surface Processes

Distance

- Distance

Cost Distance

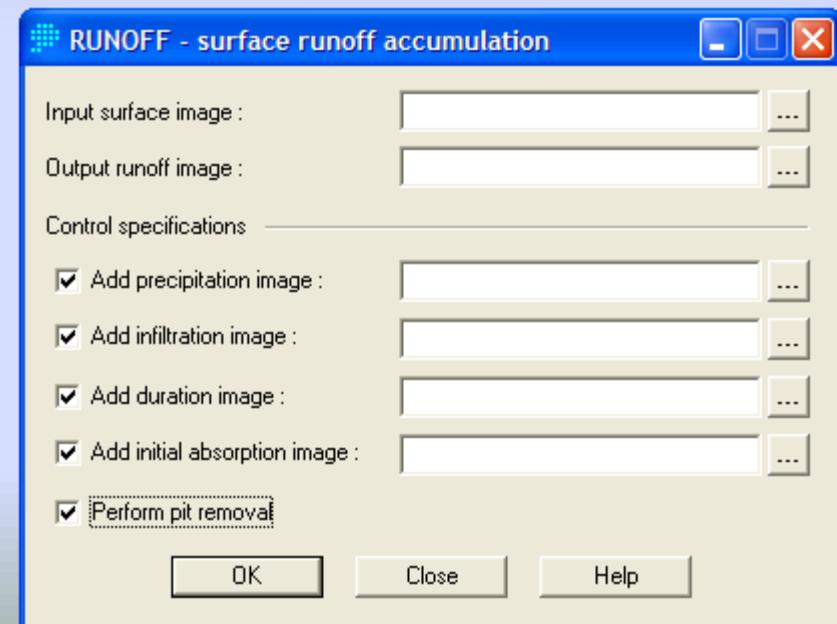
- Cost
- Varcost
- Disperse

Friction/Force Modeling

- Resultant
- Decomp

Optimal Paths

- Pathway
- Runoff



Surface Processes

Distance

- Distance

Cost Distance

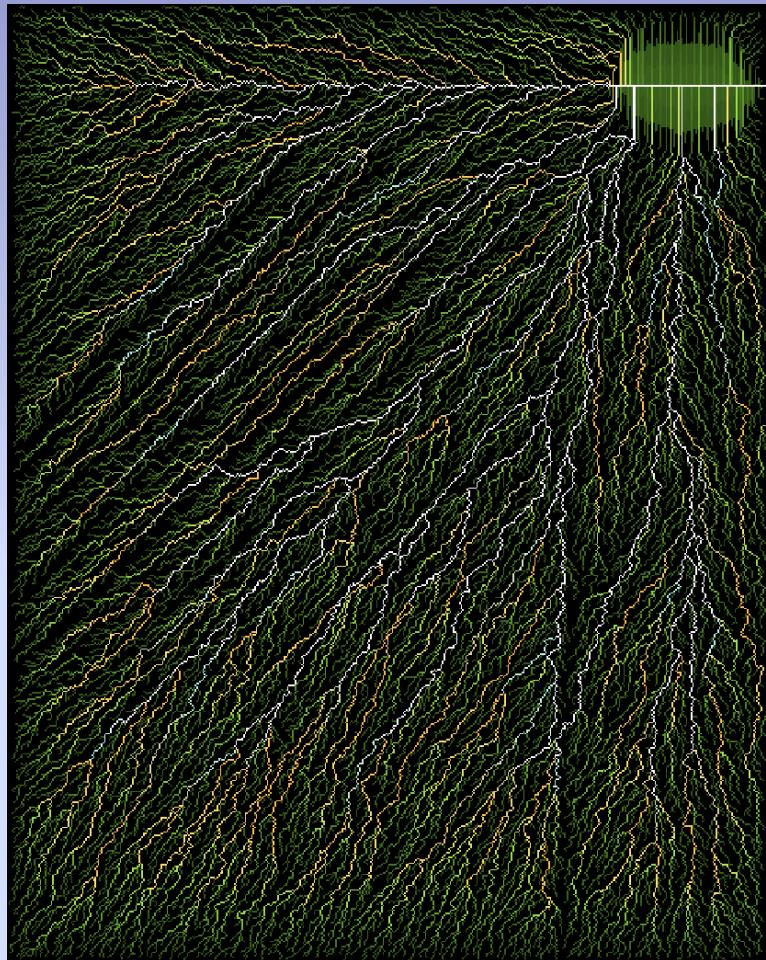
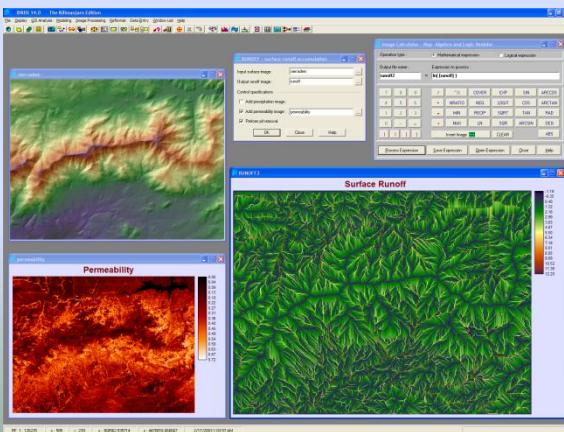
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- Varcost
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Friction/Force Modeling

- Resultant
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Optimal Paths

- Pathway
- Runoff



Surface Processes

Distance

- Distance

Cost Distance

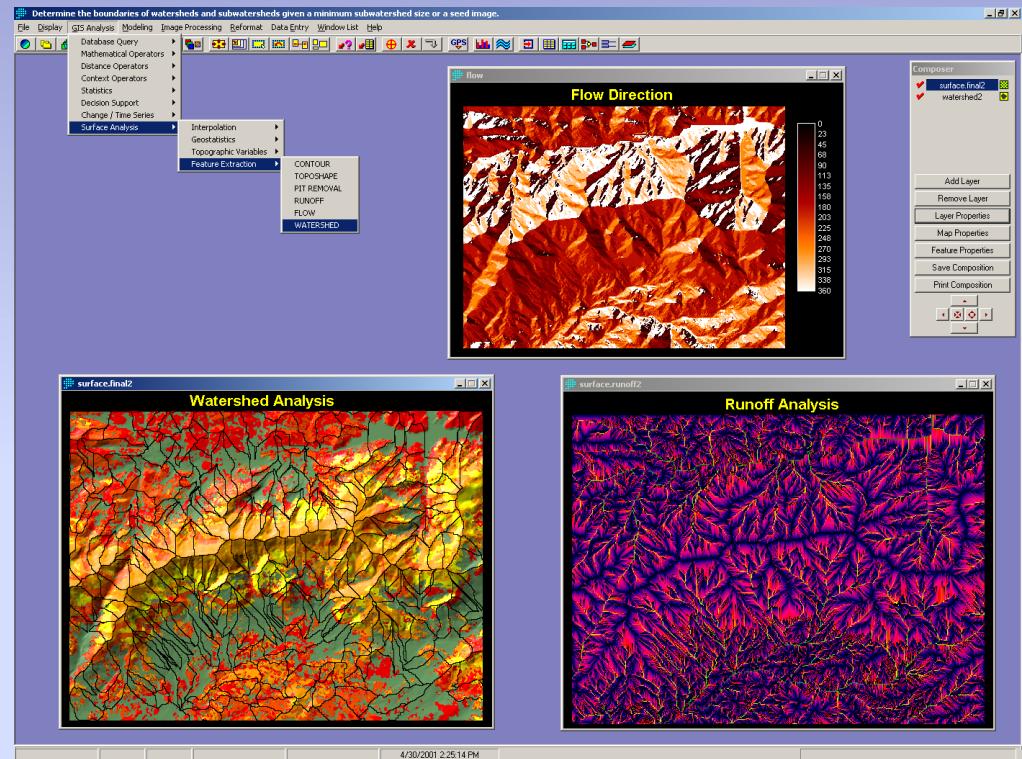
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Friction/Force Modeling

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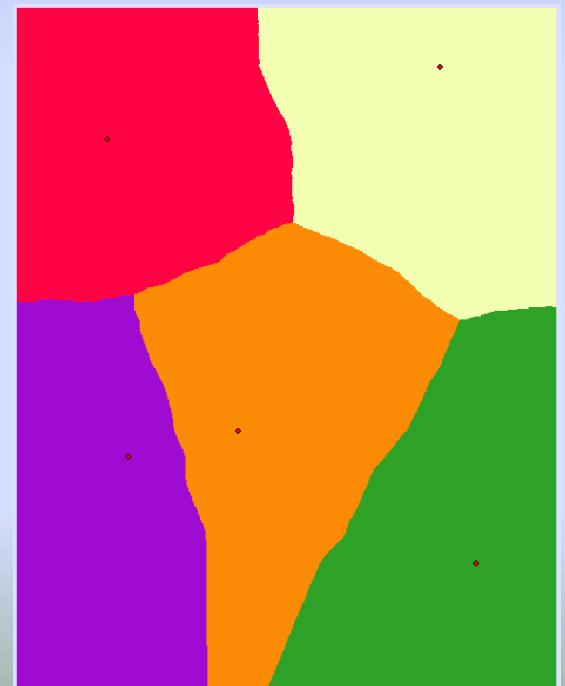
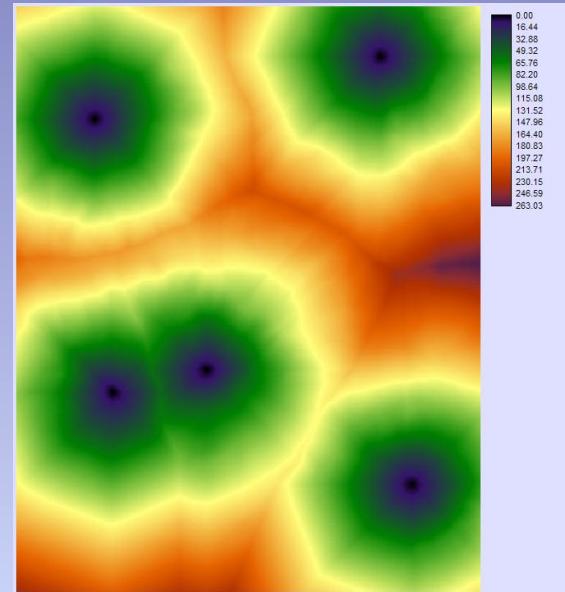
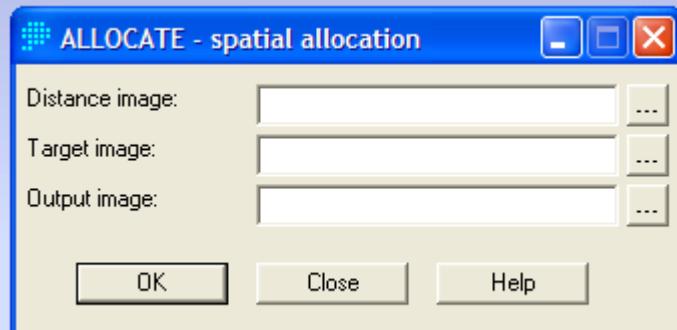
Optimal Paths

- Pathway
- Runoff
- Flow



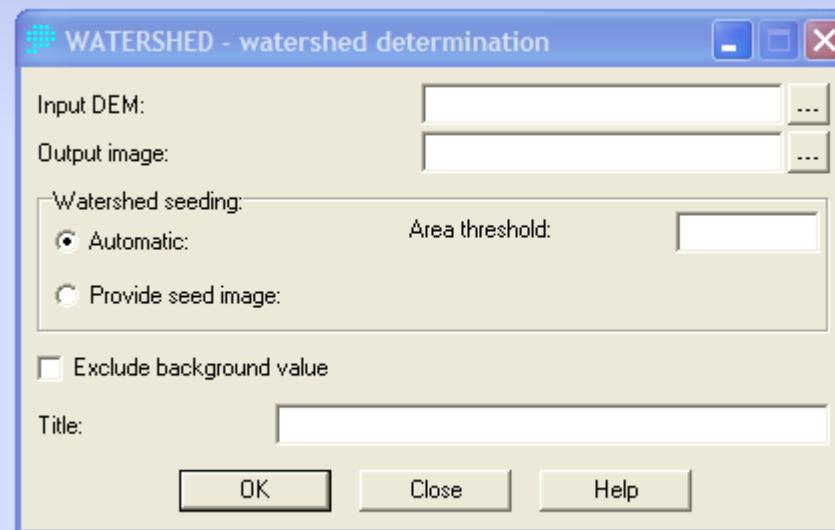
Surface Regions

- Allocate



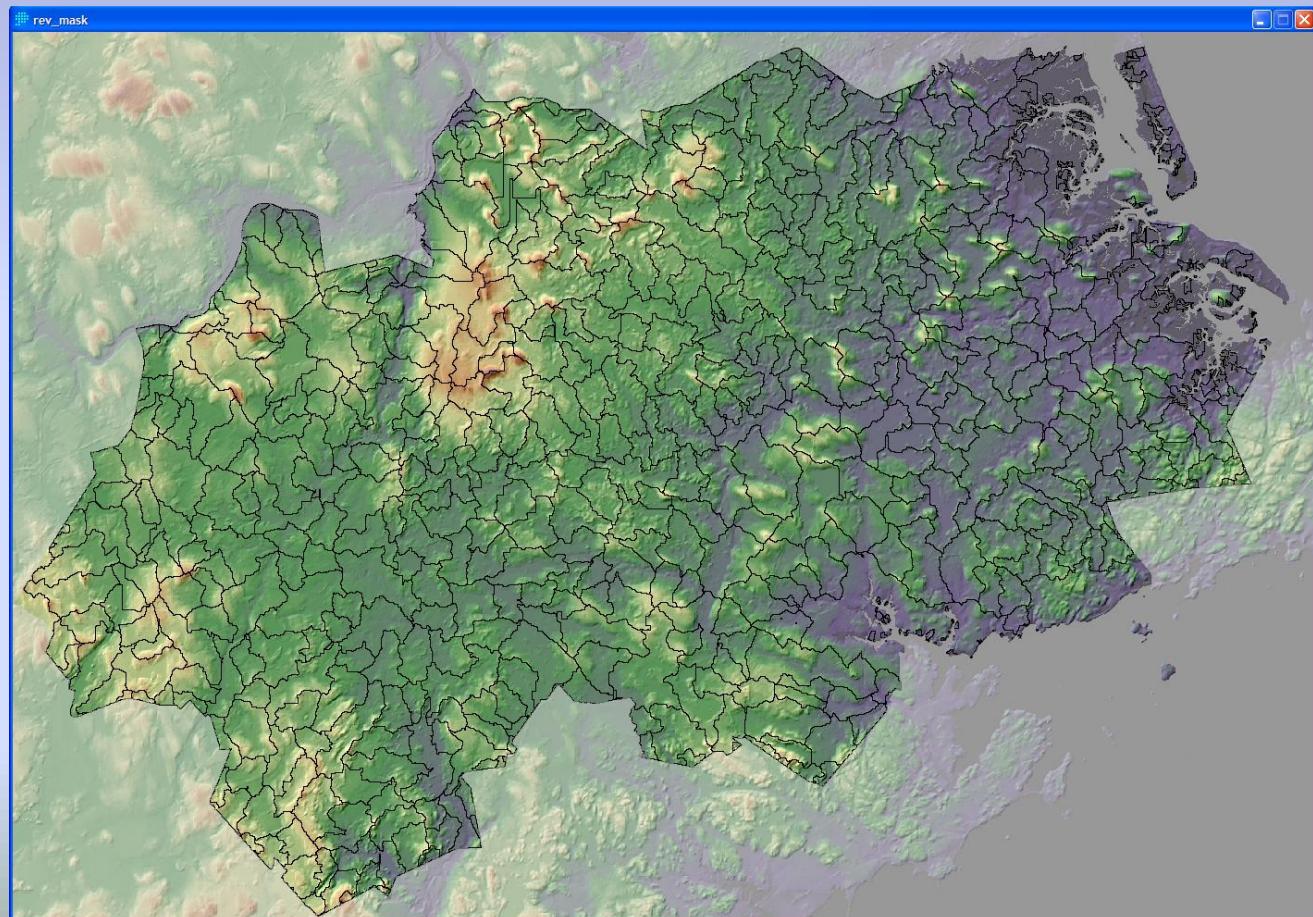
Surface Regions

- Allocate
- Watershed



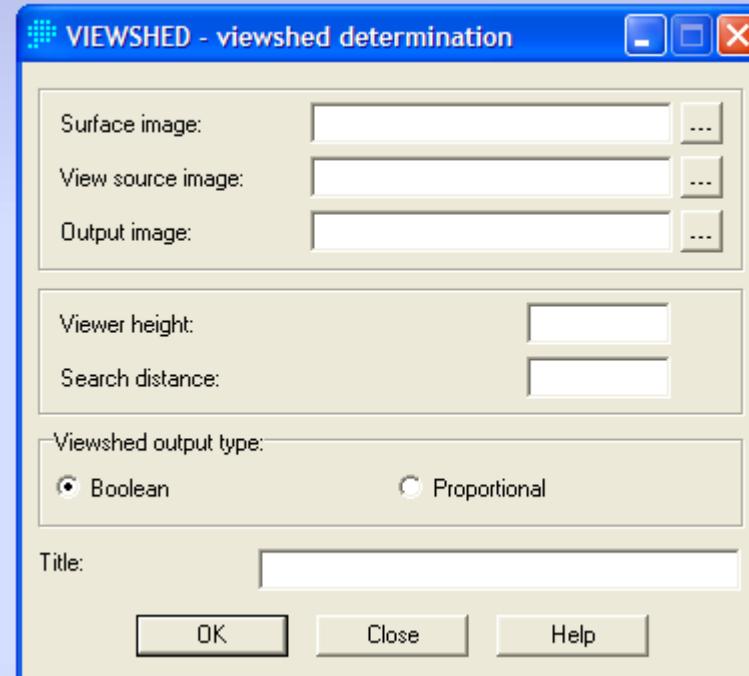
Surface Regions

- Allocate
- Watershed



Surface Regions

- Allocate
- Watershed
- Viewshed



Surface Regions

- Allocate
- Watershed
- Viewshed

