UNIVERSITY OF TWENTE.

POINT DATA TRANSFORMATION (INTERPOLATION)

GABRIEL PARODI

STUDY MATERIAL: PRINCIPLES OF GEOGRAPHIC INFORMATION SYSTEMS

AN INTRODUCTORY TEXTBOOK

(SECTION 5.3, PAGES 137-144).

ILWIS USER GUIDE CHAPTER 11 (PAGES 417-457)

FACULTY OF GEO-INFORMATION SCIENCE AND EARTH OBSERVATION

A geographic field representation obtained from two measurements:

(a) Qualitative or Categorical (discrete)

(b) Quantitative interpolation (continuous)

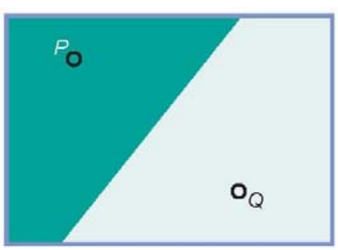
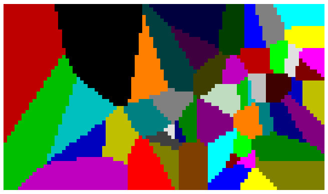


Fig. 5.8 (a)

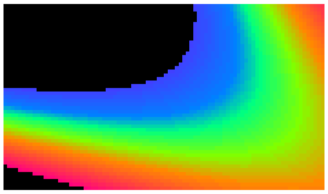
Fig. 5.8 (b)

UNIVERSITY OF TWENTE.

Discrete fields



Continuous fields



UNIVERSITY OF TWENTE.

UNIVERSITY OF TWENTE.

GENERATING FIELD REPRESENTATIONS FROM POINT DATA

FACULTY OF GEO-INFORMATION SCIENCE AND EARTH OBSERVATION

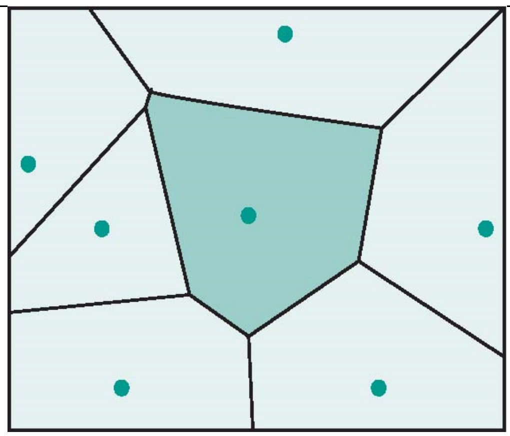
Generating field representations from point data

- Discrete
- Thiessen Polygon (nearest neighbour)

- Continuous : interpolation techniques
  - trend surface fitting (linear, quadratic)
  - moving window averages
  - inverse distance weighing
  - triangulation
  - geostatistics

UNIVERSITY OF TWENTE.

Discrete – Thiessen polygons



Any location is assigned the value of the closest measured point

UNIVERSITY OF TWENTE.

Continuous - trend surface fitting

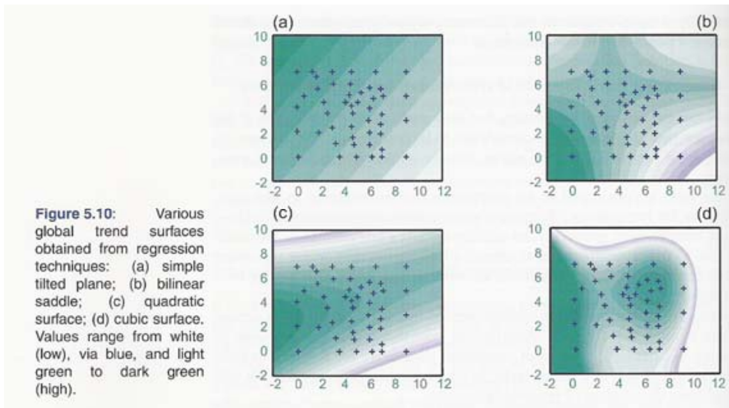
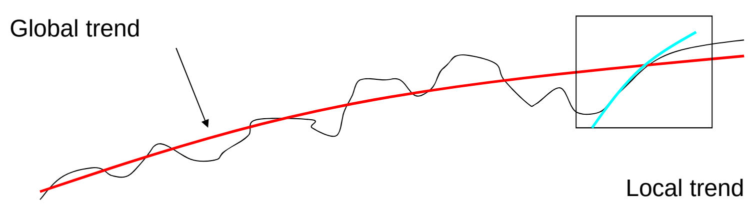


Figure 5.10: Various global trend surfaces obtained from regression techniques: (a) simple tilted plane; (b) bilinear saddle; (c) quadratic surface; (d) cubic surface. Values range from white (low), via blue, and light green to dark green (high).

Entire field can be represented by a formula

UNIVERSITY OF TWENTE.

Global trend – local trend



- Trend surface fitting method more suitable for global trend
- Global trend sensitive to edge effects
- Moving surface technique better for local trends

UNIVERSITY OF TWENTE.

Continuous - Moving window averaging

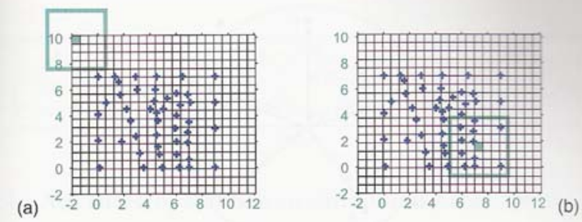


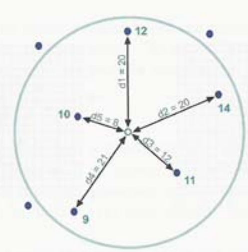
Figure 5.11: The principle of moving window averaging. In blue, the measurement points. A virtual window is moved over the raster cells one by one, and some averaging function computes a field value for the cell, using measurements within the window.

- Most important parameter settings:
  - Raster resolution
  - Shape/size of the window
  - Selection criteria
  - Averaging function

UNIVERSITY OF TWENTE.

Continuous - Moving window averaging
Inverse distance weighing

Figure 5.12: Inverse distance weighting as an averaging technique. In green, the (circular) moving window and its centre. In blue, the measurement points with their values, and distances to the centre; some are inside, some are outside of the window.



feels—again, domain expertise is needed in this assessment—that measurements further away from the cell centre should have less impact than those nearby, a distance factor must be brought into the averaging function.

Functions that do this are called *inverse distance weighting functions*. Let us assume that the distance from measurement point i to the cell centre is denoted by d_i. Commonly, the weight factor applied in inverse distance weighting is the distance squared, and then the averaging formula becomes:

$$\sum_{i=1}^{n} \frac{m_i}{d_i^2} / \sum_{i=1}^{n} \frac{1}{d_i^2}.$$

Continuous - Inverse distance weighing

$$(12/20^2+14/20^2+11/12^2+9/21^2+10/8^2)$$

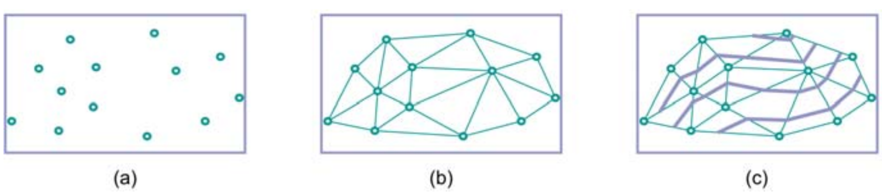
$$/$$

$$(1/20^2+1/20^2+1/12^2+1/21^2+1/8^2)$$

$$= 10.27$$

UNIVERSITY OF TWENTE.

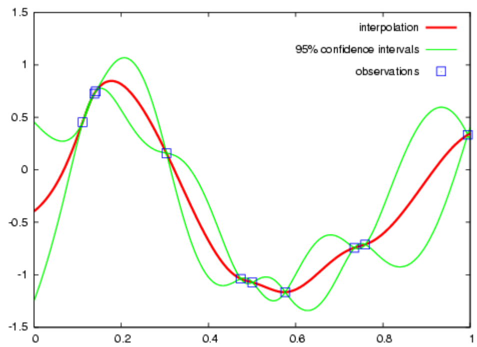
Continuous - Interpolation by triangulation



- Interpolation by triangulation
- (Preferably Delaunay triangulation)
- Construction of isolines

UNIVERSITY OF TWENTE.

Kriging



- Kriging belongs to the family of linear least squares estimation algorithms. The aim of kriging is to estimate the value of an unknown real-valued function, f, at a point, x * , given the values of the function at some other points.

UNIVERSITY OF TWENTE.

Source: http://en.wikipedia.org/wiki/Image:Example_krig.png

What method is best?

- There is no general answer to this question. It sounds as a stereotype, but true: all methods have advantages and disadvantages. The following aspects are to be considered in selecting the interpolation method:

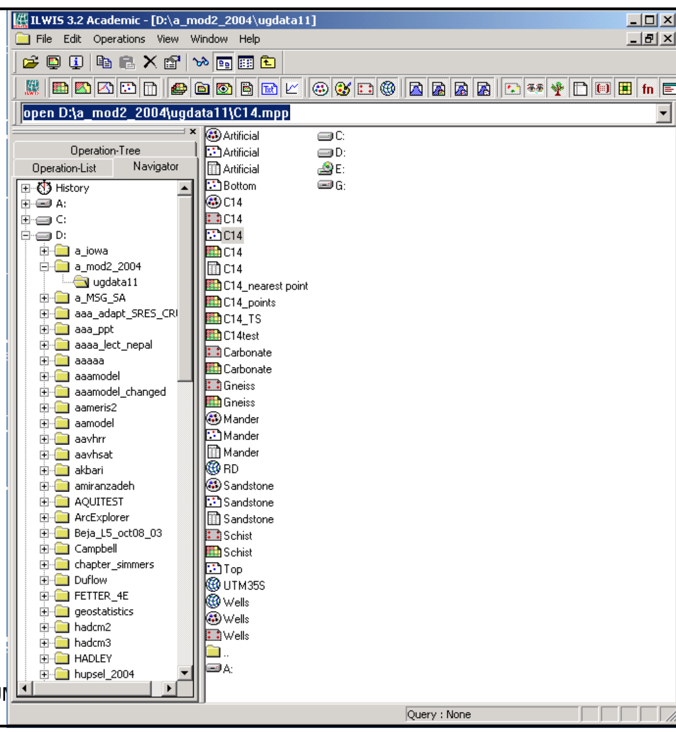
- Availability of data
- Type of variable to interpolate
- Nature of the surface (antecedent information)
- Scale and resolution
- Further application of the interpolated map

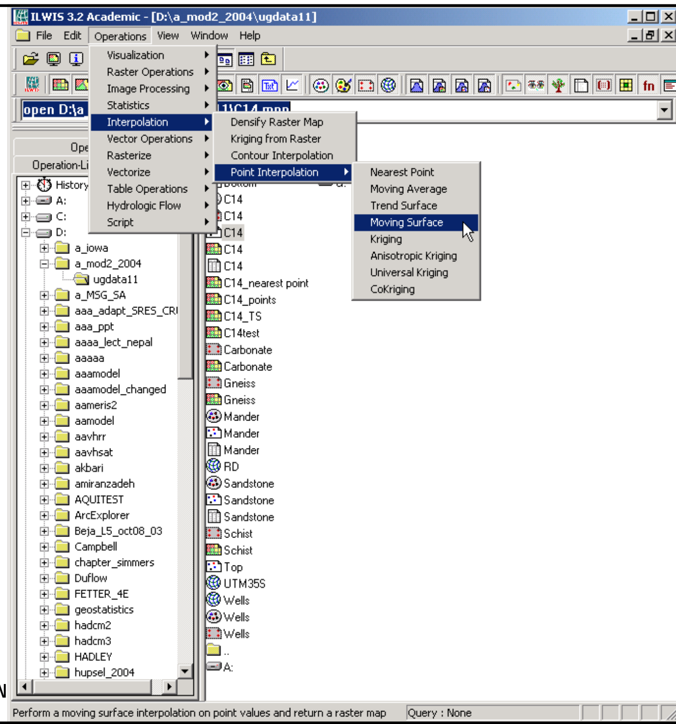
UNIVERSITY OF TWENTE.

Steps for interpolation

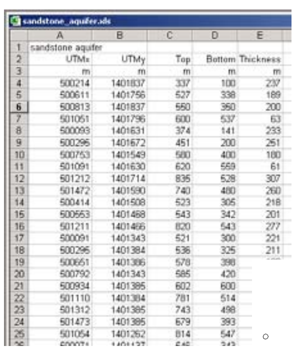
- *.txt or excel file
- import into ILWIS/ArcGIS as table
- create point map (needs coordinate system)
- select interpolation method
  - (needs georeference, pixel size)

UNIVERSITY OF TWENTE.





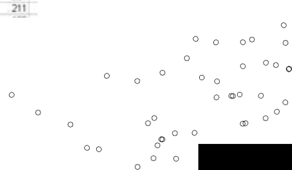
UN



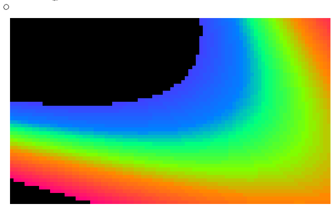
	A	B	C	D	E
1	sandstone aquifer				
2	UTMx	UTMy	Top	Bottom	Thickness
3	m	m	m	m	m
4	500214	1401837	337	100	237
5	500611	1401756	527	338	189
6	500813	1401837	560	360	200
7	501051	1401796	600	537	63
8	500093	1401631	374	141	233
9	500296	1401672	451	200	251
10	500753	1401549	580	400	180
11	501091	1401630	620	559	61
12	501212	1401714	835	528	307
13	501472	1401590	740	480	260
14	500414	1401508	523	305	218
15	500553	1401468	543	342	201
16	501211	1401466	820	543	277
17	500091	1401343	521	300	221
18	500296	1401384	536	325	211
19	500651	1401386	578	398	
20	500792	1401343	585	420	
21	500934	1401385	602	600	
22	501110	1401384	781	514	
23	501312	1401385	743	498	
24	501473	1401385	679	393	
25	501054	1401262	814	547	

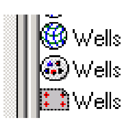
datafile

pointmap



rastermap





coordinate system
and georef (georeference)

UNIVERSITY OF TWENTE.

Lecture End