SAGA

The Soil Science & Archaeo-Geophysics Alliance

Training School 1

Introduction to Data Processing

for Archaeological Prospection

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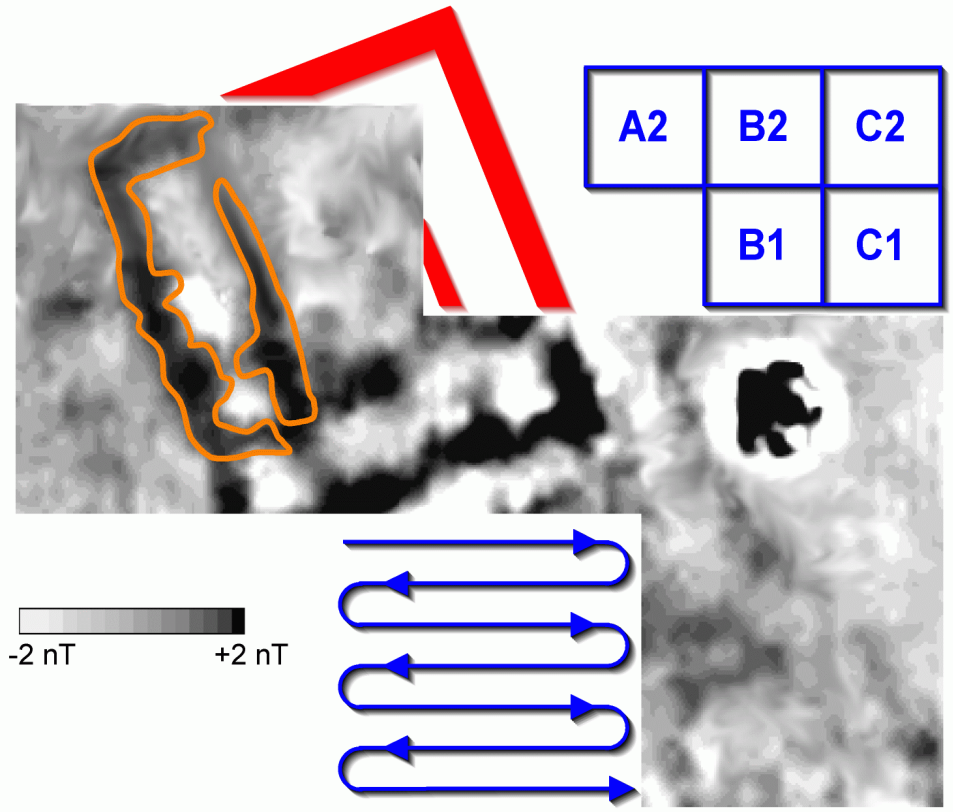
ISAP

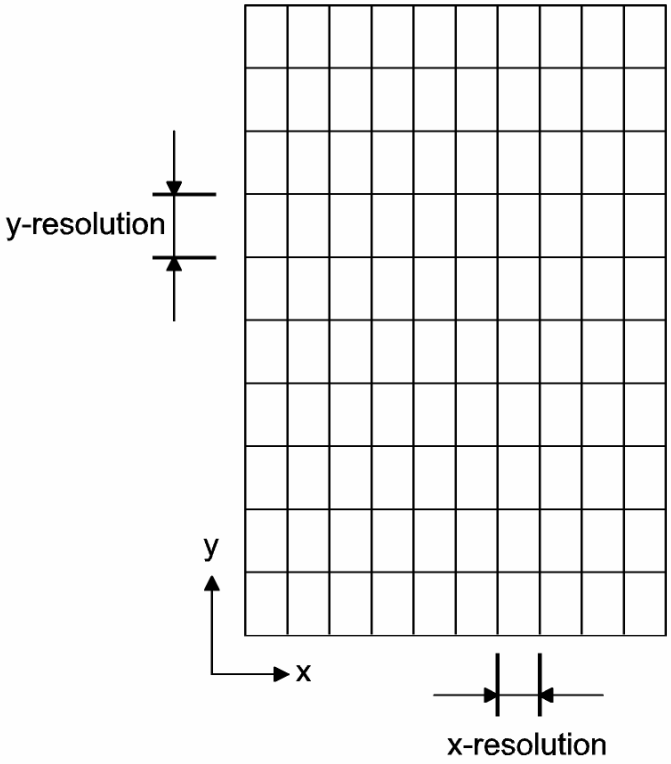
The Life of Geophysical Data

1. Data acquisition
2. Storage in instrument
3. Download to and storage on computer
4. Conversion to other formats
5. Assembling data into composites
6. Processing
7. Georeferencing and data combination
8. Interpretation
9. Reporting
10. Archiving



1. Data Acquisition

- Measurements in the field
  - Gridded survey:
    use lines and points



1. Data Acquisition

- Measurements in the field
  - Un-gridded survey: record position from RTK-GPS or tracking TS

2. Storage in Instrument

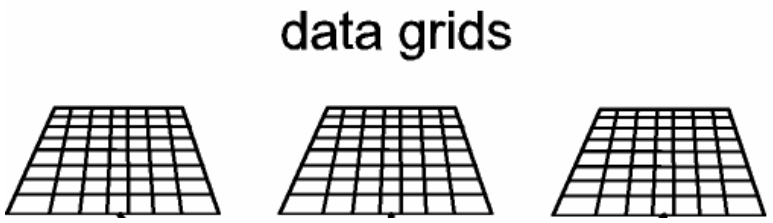
- Gridded survey: record a sequential stream of data values and derive position by counting

- Un-gridded survey: record data values together with some positions

3. Download to and Storage on Computer

- Data (measurements)
- Metadata (description of survey: grid size …)

- Gridded survey:
  break stream into smaller entities (Data Grids)
  using the metadata (e.g. grid size, zigzag)



- Un-gridded survey:
  create data files with measurement and location information for all data

4. Conversion to other Formats

- Proprietary data format of each manufacturer, but exchange with other software is required
- No common standard that maintains all metadata
- Lowest common denominator
  - XYZ data (XY position + value)
  - Spreadsheet in text format (csv files)

```
  4.7,  13.9,   1.4,  -2.5,
 -6.0,   5.1,   5.4,  -0.6,
  0.2,   0.6,   1.1,  -0.6,
 -3.2,   0.5,   0.8,  -2.6,
 -1.4,   2.4,  -1.5,  -1.4,
 -5.5,  -4.0,  -2.5,  15.5,
 -6.4,  -8.5,  -5.5,  -2.4,
 -4.4,  -5.9,  -4.0,  -2.1,
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 -4.4,  -4.8,  -5.8,  -8.6,
 -3.8,  -3.9,  -8.6, -10.5,
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-14.9,  -9.5,  -5.7,  -2.0,
-18.2, -17.5, -19.2, -13.1,
 -9.6, -31.5, -34.2, -18.1,
  7.0,  25.0,  17.7,   3.9,
  1.8,  22.3,  21.7,   1.6,
 22.0,  20.4,  13.3,   0.7,
```
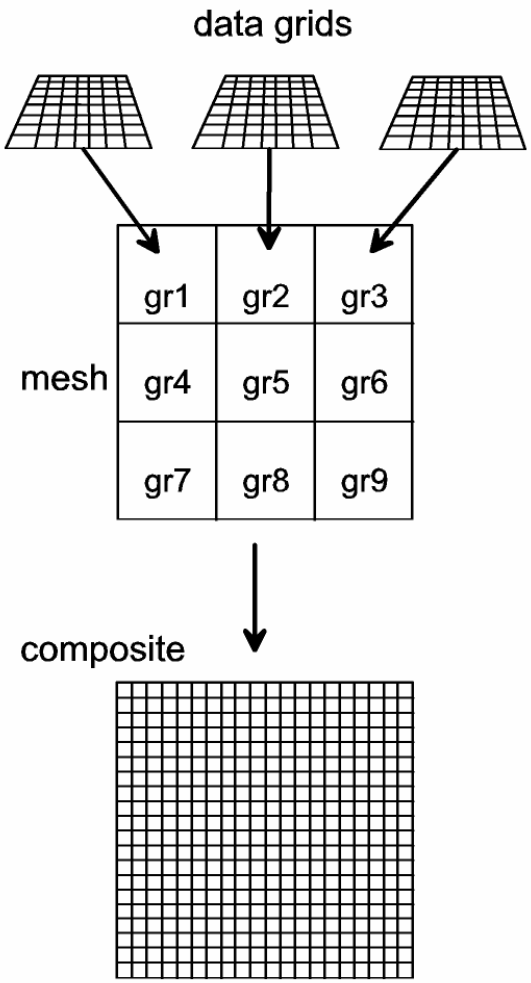

5. Assembling Data into Raster

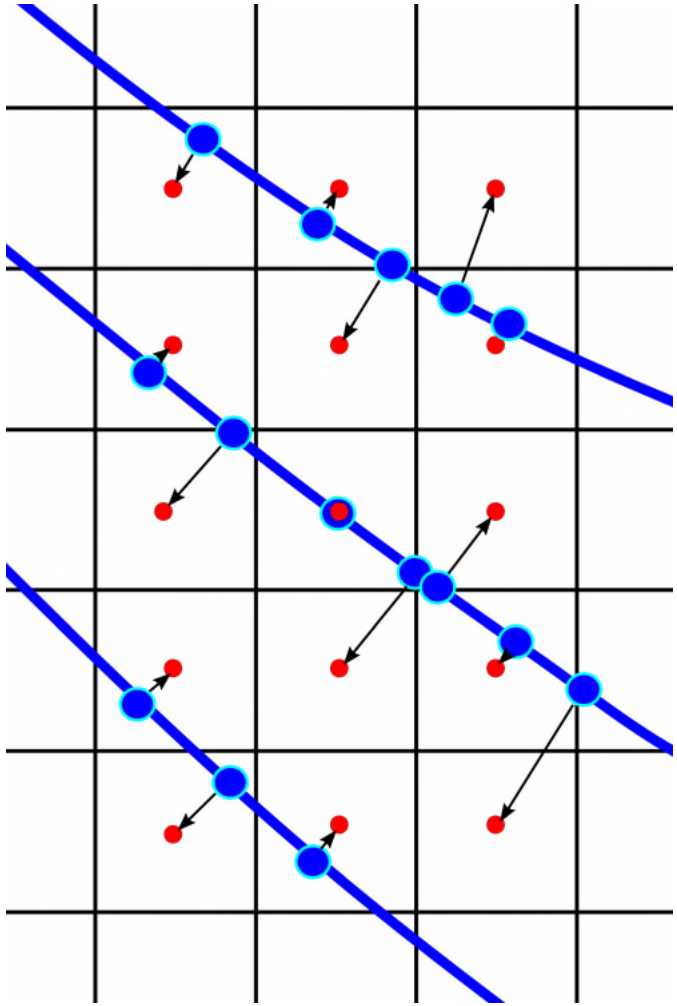
- Combining the collected data into one large raster unit for further processing ('Composite')

- Gridded survey: Data Grids to Composite using a map ('Mesh', 'Master Grid') to place the Data Grids



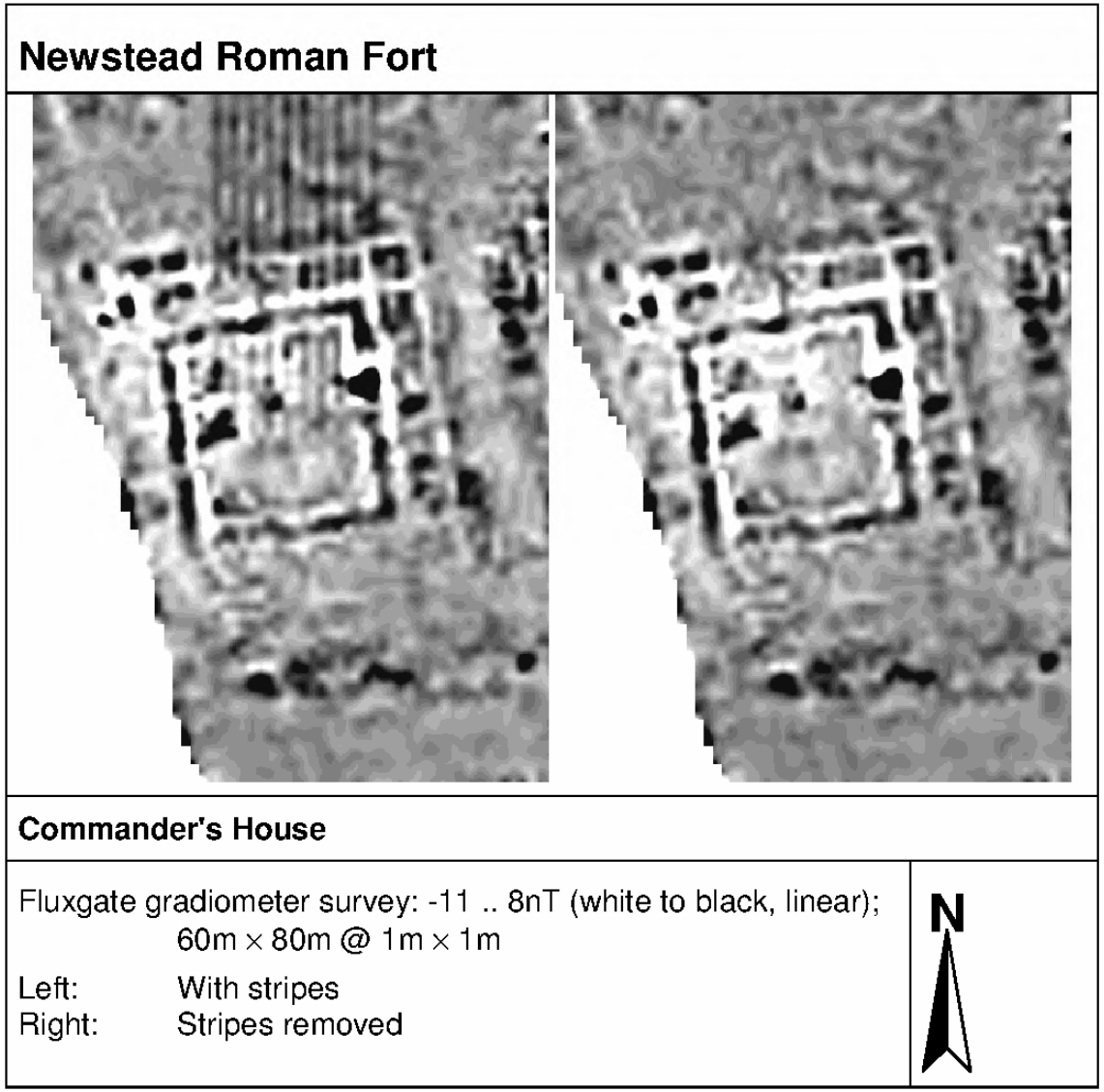
5. Assembling Data into Raster

- Combining the collected data into one large raster unit for further processing (‘Composite’)
- Gridded survey: Data Grids to Composite using a map (‘Mesh’, ‘Master Grid’) to place the Data Grids
- Un-gridded survey: interpolate data so that they fit onto a raster



6. Processing

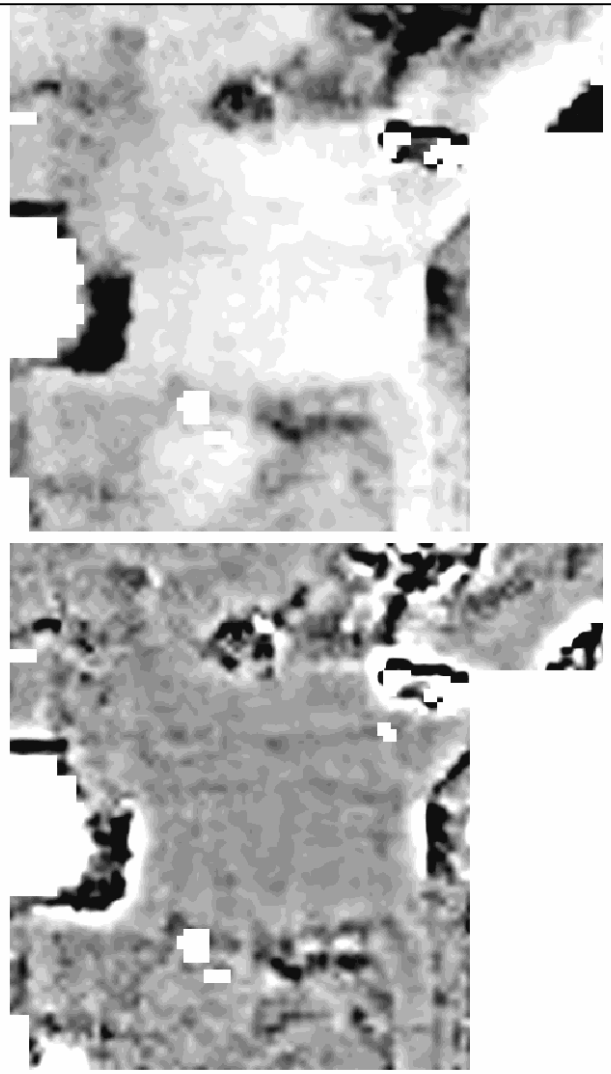
- **Data Improvement**
  - Knowing data acquisition parameters (e.g. grid size, zizgzag) “remove instrument errors”



6. Processing

- **Data Processing**
  - Use the improved raster data
  - Geophysical properties know no grid boundaries

Courtyard, Paharpur, Bangladesh



Earth Resistance Survey

Earth resistance survey: 30 ... 110 Ω (white to black, linear);
80m × 80m @ 1m × 1m

Top: Improved data
Bottom: High-pass filtered data

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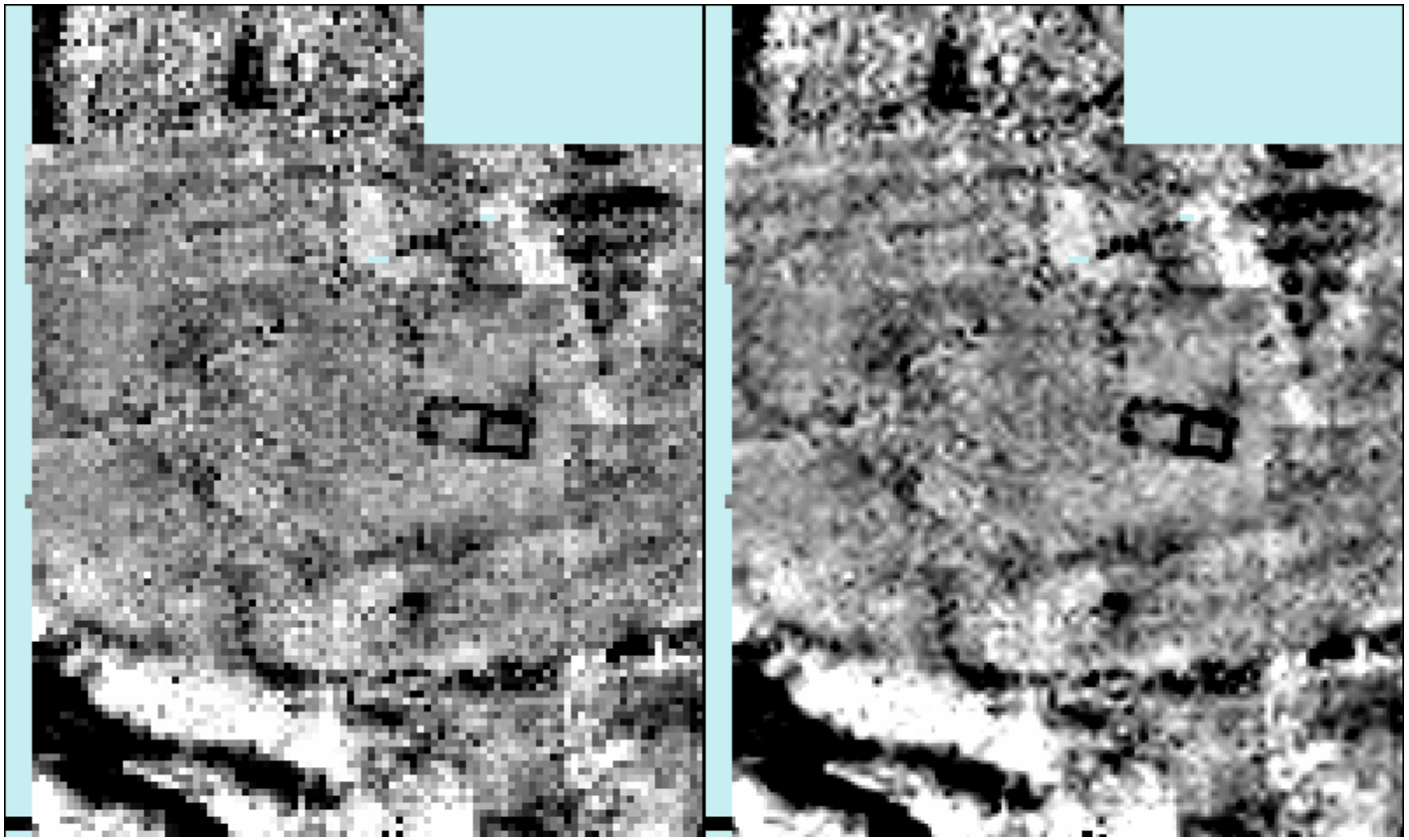
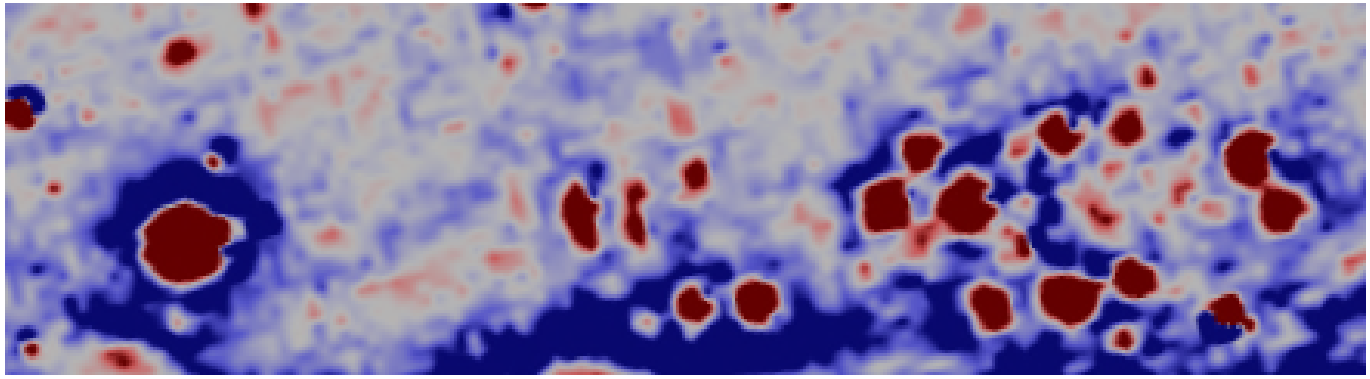
6. Processing

- **Image Processing**
  - Interpolation with additional raster points “to look better”



6. Processing

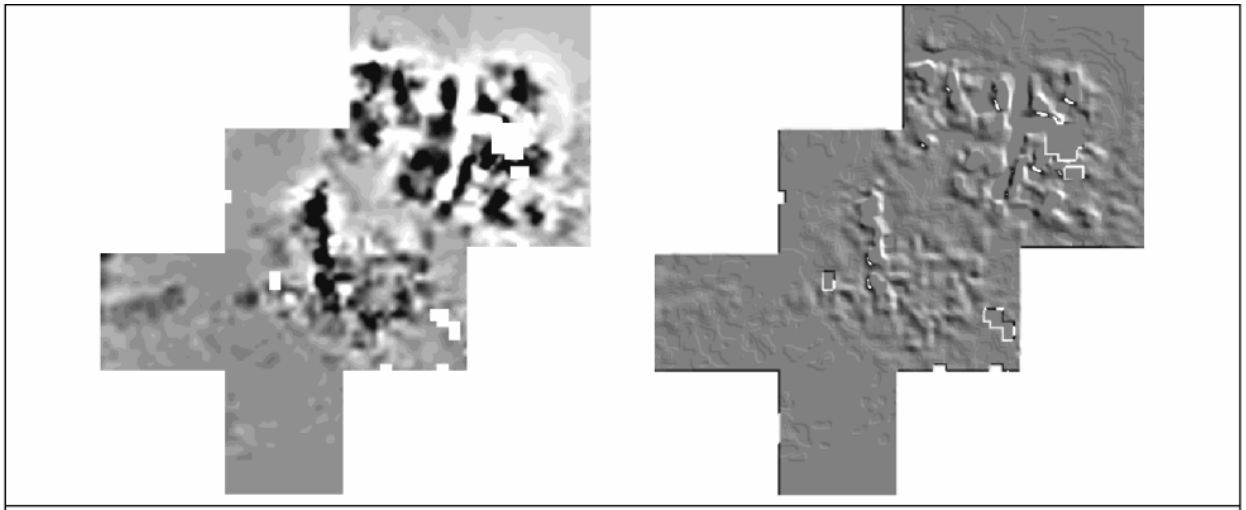
- **Image Processing**
  - Convert data to image, reducing the range (e.g. 256 grey levels, arbitrary colour levels)



6. Processing

Image Processing

- Convert data to image, reducing the range (e.g. 256 grey levels, arbitrary colour levels)
- Not much meaningful processing possible



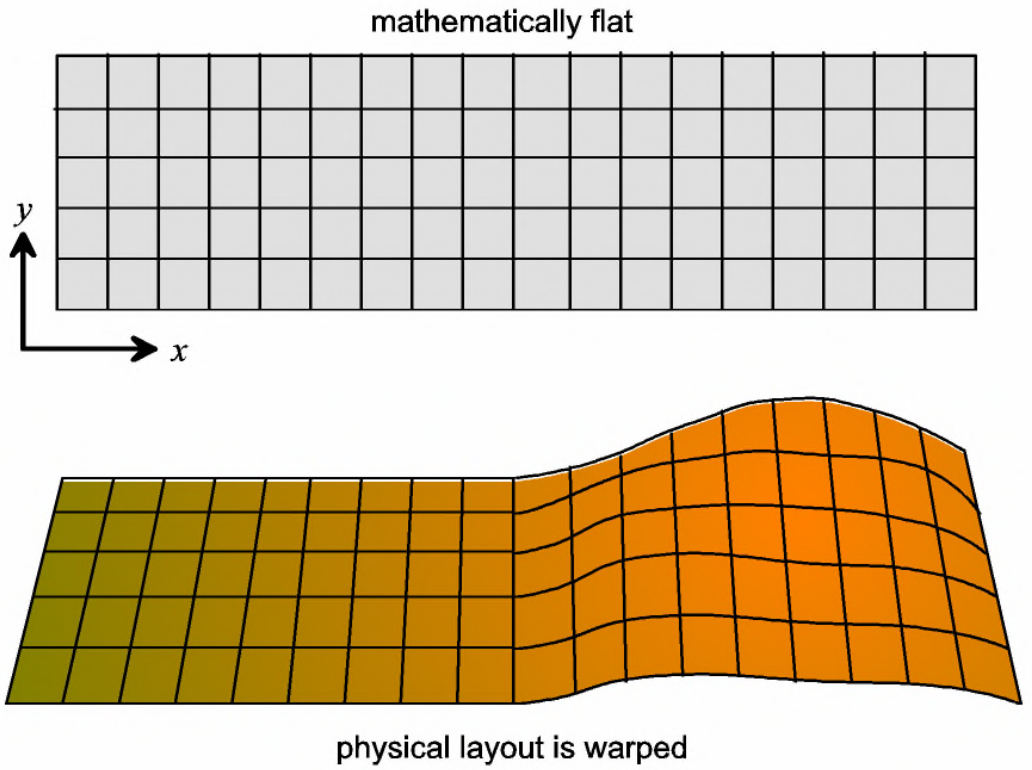
Kiln

Fluxgate gradiometer survey: -27 .. 34nT (white to black, linear)
40m × 40m @ 0.5m × 0.5m

Left: Image of data after improvement
Right: Embossed image

7. Georeferencing and Data Combination

- Geophysics coordinates (lines/points) are mathematically a perfect raster but are warped over topography
- Projection to horizontal image
- All data for a project need to have same coordinate system
- Combine data from different techniques

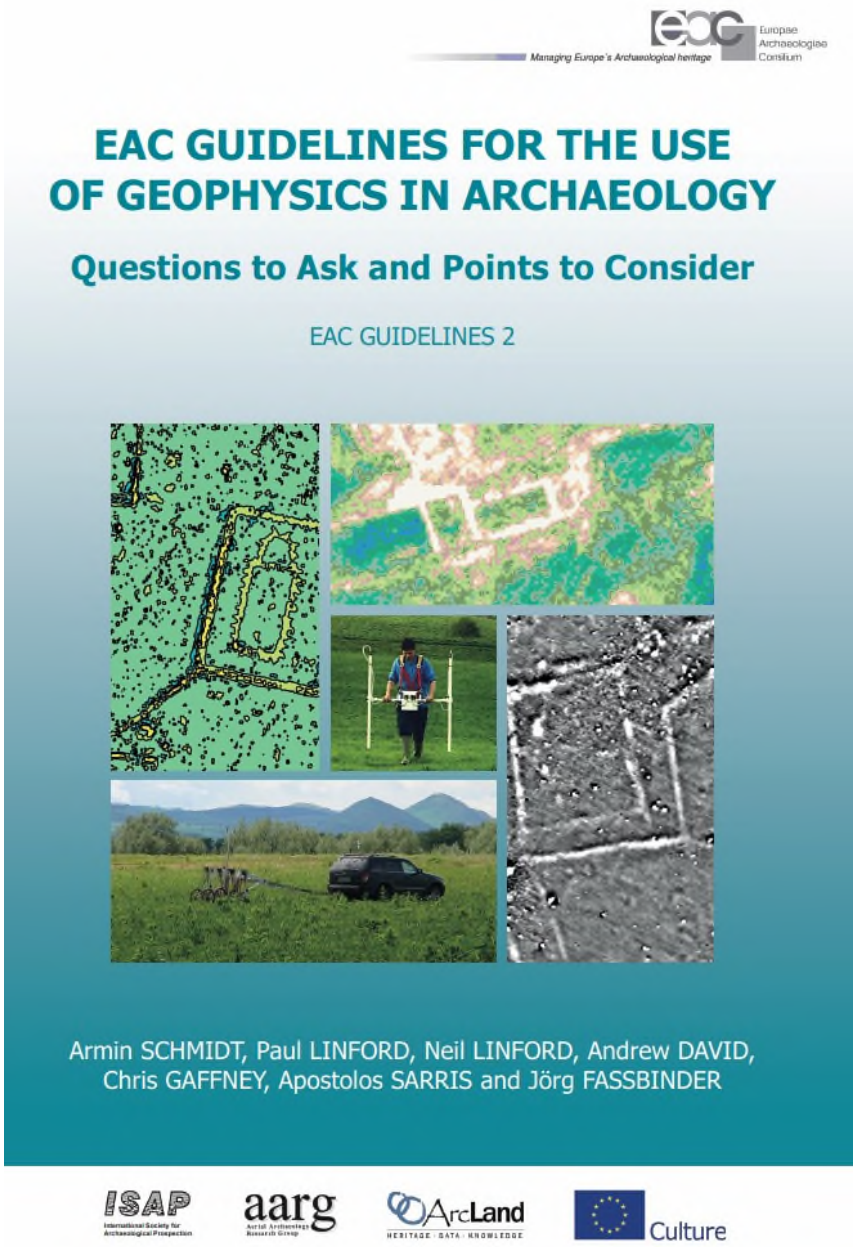


8. Interpretation

- Assign meaning to a million data points
- Not just delineation of anomalies but subjective explanation
- Use archaeological contextual knowledge and geophysical insight to assign archaeological statements to the data
- Difficult, but necessary
- Avoid over-interpretation

9. Reporting

- Each geophysical survey should lead to a report
- Summarising methodology, results and interpretation
- Not always feasible, but desirable
- EAC Guidelines for content



10. Archiving

- Compile all data and other relevant files (e.g. GIS) into a logical folder structure
- Provide preservation files in formats that are understood (e.g. XYZ)
- Complement this with project information and metadata
- This is ‘The Archive’
- Deposit it with an ‘Archiving Body’
- **G2GP: Geophysical Data in Archaeology**
- **downloads.geodatawiz.com/saga/**