Destriping Linears – A new approach to an old problem

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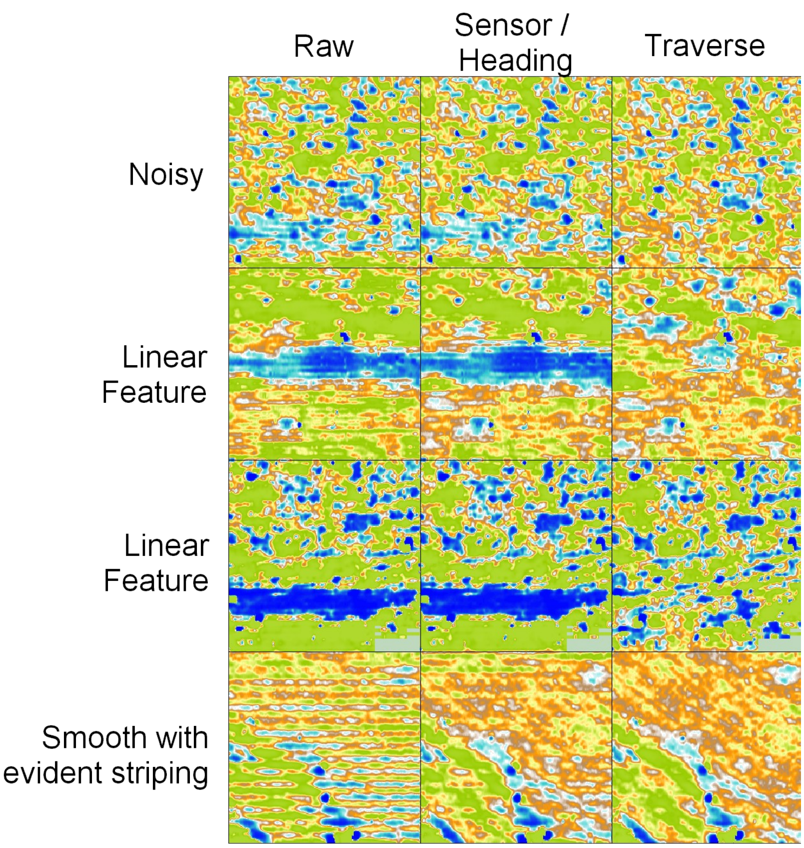
Destriping magnetometer data is frequently one of the most basic functions of any processing strategy. It often provides the biggest enhancement to a dataset for the smallest level of change to the data. However, it can also have a huge negative effect when a linear feature runs parallel to the direction of survey. Because each traverse is considered in isolation from all other data in the grid, there is no way to tell if the average of the traverse is due to the instrument or to real features. The result is that all deviation from the average, including any resulting from an anomaly that is constant along that traverse, is removed. This article presents a new variation on the Destripe method that handles this situation far better than the existing methods.

At the ISAP conference in Paris this year, Tim Horsley presented a poster on a magnetometer survey carried out in Maryland, USA. One of the problems encountered with this survey was a terrace that ran almost parallel to the direction of survey. Though the terrace response was clearly visible in the raw data, basic destriping – which was essential for the majority of the survey – almost completely removed portions of this anomaly. While pondering the problem, Tim considered the root cause of the stripes: sensor mismatch (when using a dual magnetometer) and heading errors. It occurred to him that a grid could in fact be considered as four separate but interlaced grids, one for each combination of sensor and direction. If these grids were separated out, the application of a grid matching function, (such as zero median grid), might better remove the heading and sensor error and match the component grids. The application of a sensor & heading based destripe process should therefore eliminate the striping without perceptibly affecting responses due to real linear features.

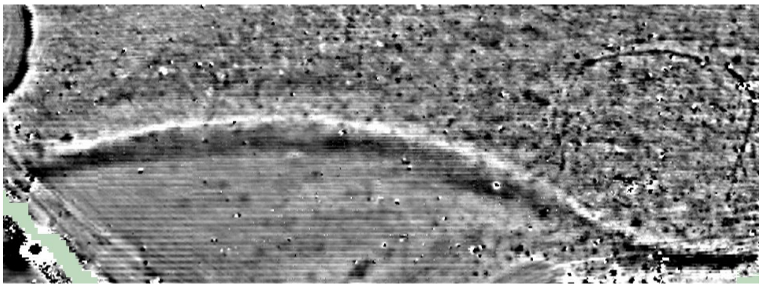
Tim produced an Excel file to manually create the four sub-grids for the worst affected grids of his dataset. These were then processed and recombined in Excel and used in the final dataset. The results were promising, but obviously very time consuming and not practical for general use.

During the Paris conference Tim spoke to David Wilbourn, the creator of ArcheoSurveyor, about the problem and the new solution. David considered it an interesting idea and worth investigating. Tim therefore supplied David with a copy of the survey data for testing and the necessary code was implemented.

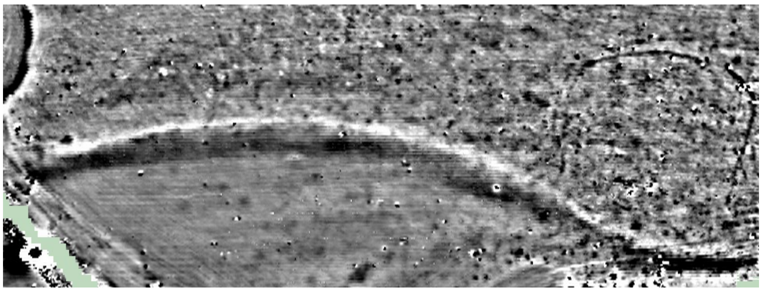
Illustration 1 shows the raw data and the results of applying the two methods to 4 different grids. These grids were selected from the Maryland survey to illustrate a range of data 'types'. They include two linear features, a noisy and a quiet grid. The data has been band weight equalised and a garish colour scheme applied purely to highlight the features and effect of the processes. Each grid square is 30m and data were collected using a Bartington Grad601-2 dual fluxgate gradiometer at 0.125m intervals along traverses spaced 0.5m apart.



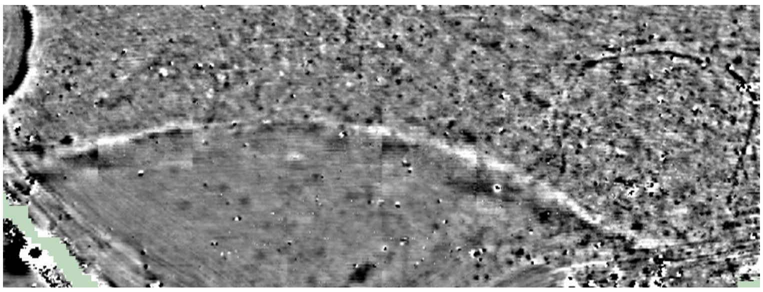
The following illustrations show a larger section of the same survey in basic greyscale. Grid lines have been turned off as these tend to mask edge problems. The two grids used for the example linear features can be seen left of centre and bottom right. The area shown is 240m x 90m, and the top of the survey faces northwest.



Processing is just clip at +/- 1SD. The long curving anomaly due to the terrace edge is clearly visible across the centre of the survey. However striping, especially in the relatively quiet area below the terrace feature, is severe.



Sensor Destriping & clip at +/- 3SD. Now the linear anomaly remains intact and is almost identical to the raw version. There are only the slightest hints of grid edges and yet almost as much detail of the ploughmarks is visible in the quiet area.



Traverse Destriping & clip at +/- 3SD. Destriping improves the appearance of the quiet area, allowing ploughmarks to show through. However, it has almost entirely removed the linear response where it runs parallel to the direction of survey. It also produces distinct disjunctions at grid edges.

In conclusion, Tim and David consider this new method to be successful and a significant addition to the set of processes available to users of magnetometers. Preliminary testing indicates that, in many instances, the basic traverse destripe functions may be more effective at removing striping since the mismatch between traverses is not always consistent and simply due to heading error and sensor mismatch. However, in data grids with both striping and anomalies due to features running parallel to the survey direction, the new sensor destripe function is a far more appropriate since it allows the unwanted striping to be reduced while preserving archaeological or natural responses.

The new destripe mode will be made available in the next major release of ArcheoSurveyor. Due to the complexity of line interlacing patterns, it currently only supports Bartington & Geoscan magnetometers but other instruments will be added as requested.