Identifying Data Errors Using Shaded Relief

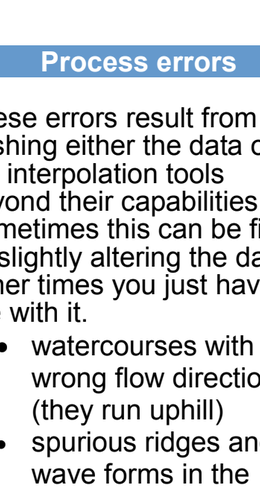
Process errors

These errors result from pushing either the data or the interpolation tools beyond their capabilities. Sometimes this can be fixed by slightly altering the data. Other times you just have to live with it.

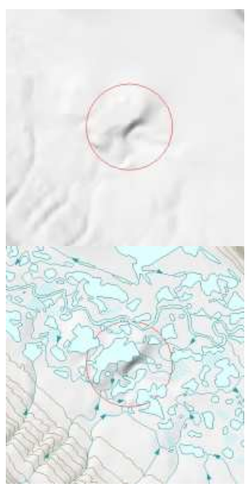
- watercourses with the wrong flow direction (they run uphill)
- spurious ridges and wave forms in the surface. These usually occur in broad flat areas where there are not enough data points

Examples

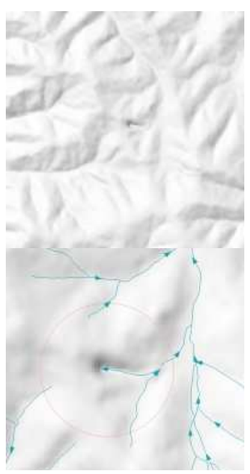
These are errors resulting from the way DEM generation works. The software simply cannot deal effectively with certain arrangements of data and there is nothing which can be done about it without creating fake data to guide the interpolation.



A second example of interpolated artifacting. There is simply not enough nearby elevation data.



Box canyon anomaly. This very common error is created from streams which are pointing in the wrong direction (uphill) and drainage enforcement is being used in the DEM creation process. This can not be considered an error in the base data since flow direction is not part of the NTDB specification for watercourses.



Source Data Errors

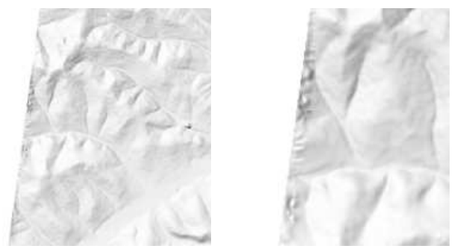
These are errors in the actual base data itself. The most common forms are:

- edge mismatch along tile borders
- watercourses draining into more than one watershed
- features on the wrong data layer, for example a treeline vector is coded as a watercourse.
- contours with wrong elevation values

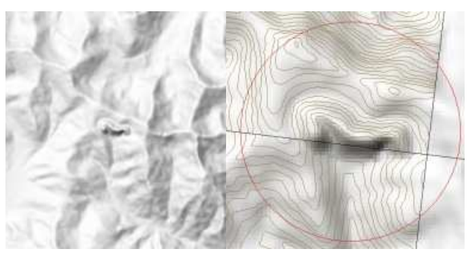
Examples

Uncorrectable edge effect
Each tile is internally consistant so there is nothing to change. The source data for these two tiles were captured at slightly different scales. Short of going back to the original photos for a reinterpretation there is nothing to be done.

Edge effect due to lack of data
If we desire a 'perfect' DEM our only option would be to make the area of interest smaller. The image on the left also shows a second source data error.

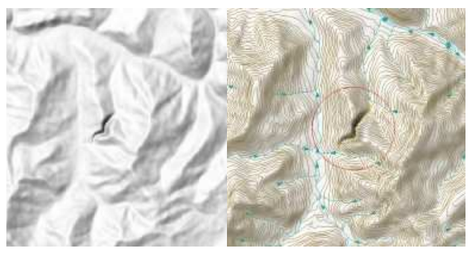


Elevation miscoding
In the northern-most tile, halfway down the slope the elevations start to rise again. When compared with the adjacent tile to the south it is obvious the elevations should just continue smoothly downward.



This time it is the southern tile whose elevation values switch direction mid-slope. The image on the right shows two contours selected in yellow and the database attributes of those selected contours at the bottom where it is apparent these two contours diverge by almost 200 meters.

Feature class miscoding
At first glance this appears to be similar to the double watershed examples above.

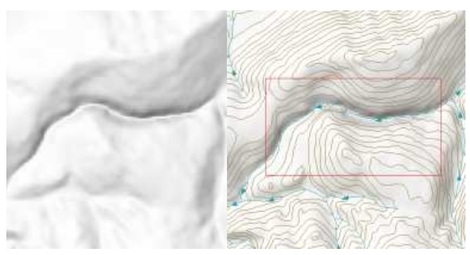


With a closer look it is apparent this watercourse does not conform to the topography at all.

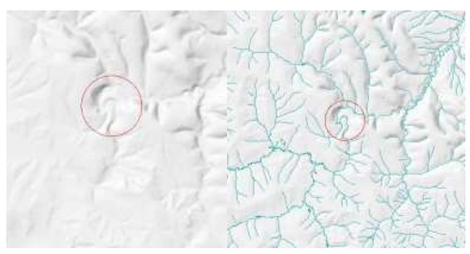
It's hard to figure out what's going on here until we turn on the forest cover layer. Obviously this watercourse is an imposter and now we know it's true identity.

Double watershed streams
These errors can be a little tricky, for in nature it is possible for two watersheds to be joined by single stream which in effect flows both ways. However most of the double watershed streams we found in the Repository are data topological errors and not likely to be the real thing.

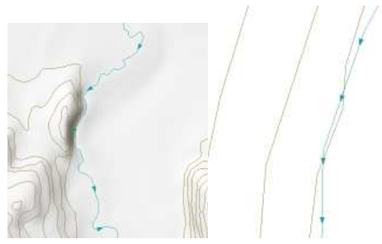
This double watershed stream stands a pretty good chance of being the real thing. There is probably a marshy area in the middle of the saddle but only higher resolution photos or a ground truth expedition will let us know for sure. The simple fix is to break the vector into two so the flow direction can be correct for each watershed.



Another double watershed stream. This is one of the few shaded relief anomalies where zooming out rather than in is necessary to understand what is happening.

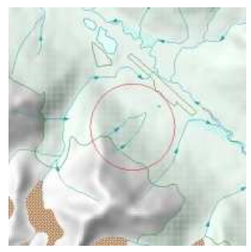


Photogrammetry errors
The contour and watercourse lines cross each other. This kind of error is rare with this example being the only one of this type discovered in the base data, so far.

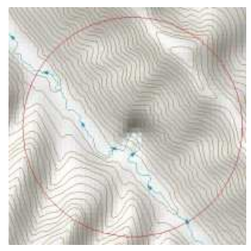


Elevation miscoding
There is an elevation line grossly out of step with it's neighbours. In this case it was a lake shoreline more than 200 meters higher than it should have been.

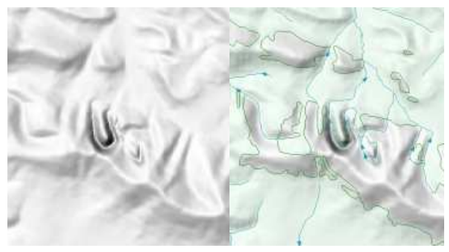
Missing data
These two streams just stop in the middle of nowhere. Either they should be coded as 'disappearing stream' or there is a marsh or waterbody missing from the dataset. The shaded relief images only played an incidental role in discovering this error, I just happened to see it while looking for problems with the relief.



'What the …?' errors
A watercourse which does not obey the constraints of gravity.



Even with the forest cover layer turned on it's hard to figure out what is supposed to be happening here.

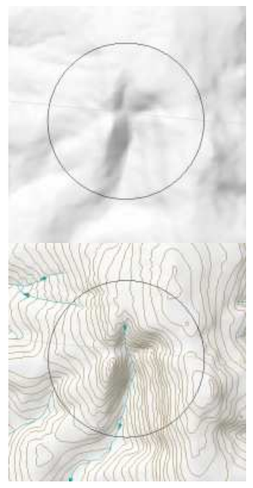


Anti-Errors

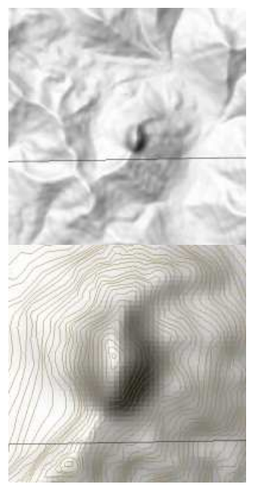
These are anomalies which appear to reflect a problem with the data or the software but turn out to be faithful representations of the source data. Please keep in mind that a feature can be an accurate reflection of the source data and still be very wrong since there is no guarantee the source data itself is correct.

Examples

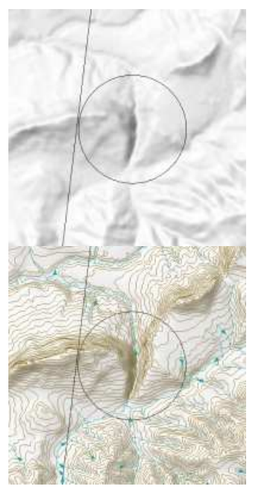
Looking at the shaded relief and the tile border line it looks like there is some edge effect, however a closer look reveals that the shaded relief accurately reflects the source data.



This pimple turns out to be supported by the source data, it is simply a very sharp peak.



A canyon anomaly which has the potential of being an imposter watercourse. The anomaly turns out to be supported by the base data.



This poster shows examples of the types of errors in the *RRGIS Spatial Data Repository* discovered with the aid of shaded relief images generated from 1:50,000 Canadian National Topographic Database contours and watercourses. See the *Errata 50k* package downloadable from the RRGIS website for explicit point by point references to specific problems. The images shown here are screen shots taken from the Errata_50k ArcView project before the errors were corrected. We regret not beginning this example document earlier because the most egregious and visually interesting errors are already fixed.

More information on this poster and the data mentioned above can be found on the Yukon Renewable Resources website at http://renres.gov.yk.ca/pubs/rrgis/

Yukon Renewable Resources Geographic Information Section