Yukon DEM Project Technical Overview

Objective

The goal of this project was to generate a seamless 30 meter digital elevation model for the Yukon Territory based on 1:50,000 scale digital topographic maps.

Data Sources

1:50,000 scale National Topographic Data Base files (NTDB) are digital versions of Canada's National Topographic System (NTS) maps. Each 1:50,000 map spans 30 minutes east-west, and 15 minutes north-south. The Yukon contains over 750 NTDB files. The NTDB contains many entities, however, only contours, hydrographic lines, and hydrographic polygons were used as input to the DEMs.

1:50,000 scale NTDB does not exist for adjacent Alaska or British Columbia. In order to eliminate edge effect caused by a lack of elevation data in areas adjacent to Yukon, elevation datasets native to Alaska and BC were acquired to supplement the NTDB.

Alaska 7.5 Minute DEM (US Geological Survey)
· converted to elevation points
· projected to Yukon Albers
· elevation points used to create 30m DEM

BC 10m DEM (BC Ministry of Environment, Land, and Parks TRIM)
· converted to elevation points
· projected to Yukon Albers
· elevation points used to create 30m DEM

Source Data Quality

Although the quality of the NTDB is adequate for most cartographic applications, structural limitations and coding errors make the creation of a seamless DEM a challenge.

The Process

The DEM generation process (as depicted in the posters) was developed iteratively. It was not possible to anticipate all problems at the outset of the project, therefore, methodology and AML code was refined throughout the process. Data was fed into the AMLs, errors were discovered, corrected, and data was re-fed into the AMLs until a satisfactory DEM was created.

NTDB Data Structure Limitations

Problem	Why this is a problem	Corrective Measure
spatial edge mismatches	produces edge-effect or seams between adjacent maps	include data from adjacent maps when generating DEM; interpolater "smooths" DEM making edge effect less noticeable
streams lack directionality (they "flow" in random directions)	interpolator sets streams into DEM, giving them the appearance of depth. If flow direction is incorrect, canyon anomalies are created in the DEM	a rough DEM is created as input to an AML which "flips" stream segments based on the relative elevation of pixels underlying their endpoints
lakes lack elevations (although lake elevations exist in the hardcopy source NTS maps, these data was not captured for the NTDB)	lakes elevations are required to flatten the surface of lakes in the DEM, otherwise lakes appear as valley bottoms. Automated lake flattening yields unacceptable anomalies.	lake elevations were added to lake features based on hardcopy topographic maps and field surveys. Lakeshore vectors were used as contours in the DEM generation stage after which lake polygon elevations were integrated into the model to "flatten" them.

NTDB Data Errors

Problem	Why this is a problem	Corrective Measure
contours coded with incorrect elevations	results in invalid topography	contour elevation codes were manually corrected
spurious streams	results in invalid stream courses	such streams were manually deleted from source data

Tools

ESRI

Arc/Info 7.2 - 8.0 formed the core toolset. Most used modules of ArcInfo were:

AML : *automation, task repitition*
Arc : *creating buffers, merging/appending data*
Librarian : *corporate data management*
Topogrid : *quick & dirty DEM generation*
ArcPlot : *check plots*
ArcView : *visual error checking*
ArcEdit : *data editing/correction, stream flipping*

Other

ANUDEM : *Final DEM generation (Topogrid is based on an earlier version of ANUDEM.)*

"Duct-tape"

TextPad, vim *: script editors*
Cygwin *: MS-Windows port of the most essential Unix tools: grep, sed, tar, gzip, wget, ftp, etc.*
Internet Explorer, Mozilla *: web research*
Outlook *: mailing list research and support*
NT CMD shell *: scripting*

Documentation

MS-Word, TextPad, vim *: word processing*
Dreamweaver *: website*
Illustrator *: posters*
PhotoShop, The GIMP *: image editing*
ACDSee , XNView *: image viewing/conversion*

DEM Testing

Arc::hillshade, GRID, LandSerf, MicroDEM *: DEM statistics & visualization*
ArcMap, ArcView, ArcPlot *: Cartographic derivatives*
Virtual Terrain Project, World Construction Set : *Terrain Modelling*