Incorporating Changes in Multi-scale Databases

Dan Lee, Nobbir Ahmed, Iffat Chowdhury
dlee@esri.com
nahmed@esri.com
ichowdhury@esri.com
Analysis and Geoprocessing, Esri Inc.
Redlands, California, USA

Abstract

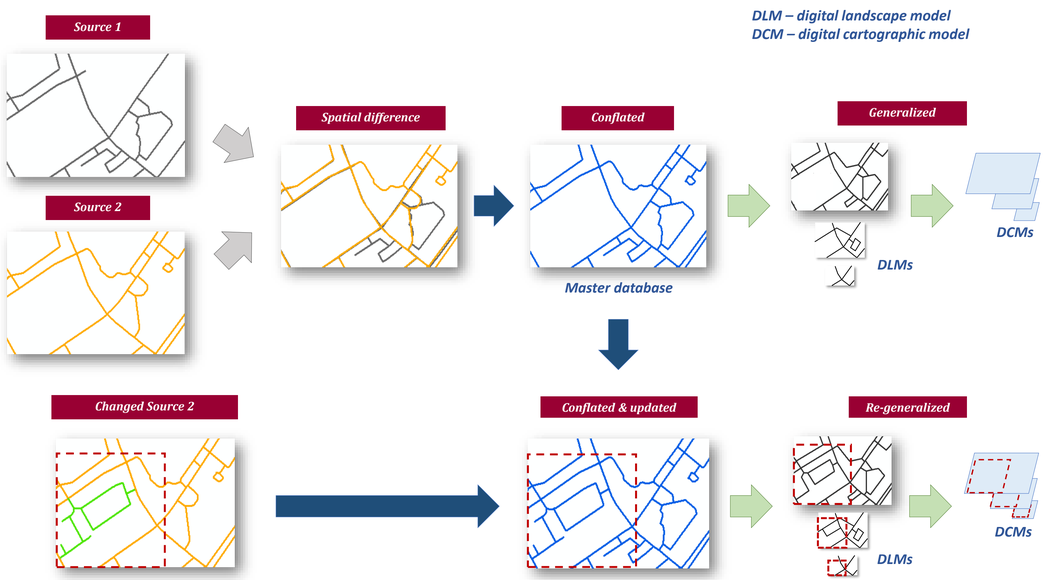
Many GIS and mapping agencies build and maintain multi-scale databases to support spatial analysis and mapping purposes. Often it's necessary to incorporate changes into the large scale master database and propagate the changes to smaller scale databases and maps. The challenges are: (1) update data don't always line up with existing data; (2) lack of linkages among corresponding features across multiple scales, which makes the propagation of changes difficult. The increasing needs for change detection, data harmonization, and linkages among multi-scale databases for incremental updating remain.

Solving the above problems requires feature matching techniques and tools to reconcile data differences for the optimal accuracy, completeness, and consistency. This process is known as conflation. A set of conflation tools has been developed based on common use cases and requirements and released in ArcGIS Desktop. Given the wide range of data varieties and complexities, the automated tools can produce highly accurate results and evaluations, while interactive inspections and corrections are also part of the workflow.

This presentation identifies the role of conflation in typical workflows of building and updating multi-scale databases and highlights the activities in national mapping agencies. A brief overview of the key conflation tools is given, followed by example workflows, including attribute transfer between correspondent features for the purposes of enriching information and establishing linkages for multi-scale databases and spatial adjustment to improve spatial quality.

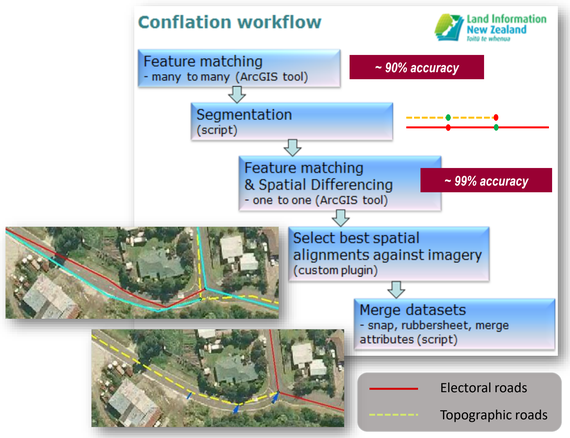
Conflation in multi-scale data and map updating

Conceptual workflow

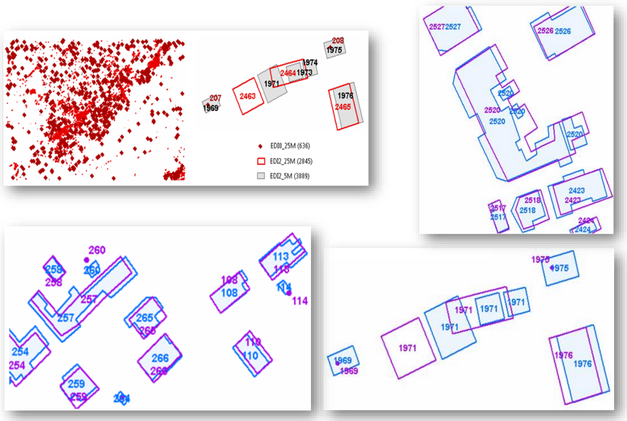


Activities at national mapping agencies

Merging multi-source roads for better spatial quality (LINZ)



Testing ideas on linking 1:5k and 1:25k buildings (ICGC)

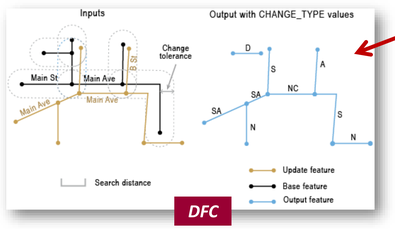


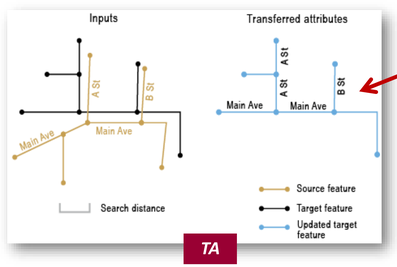
Acknowledgements: Thanks to the following NMAs for providing data and information:

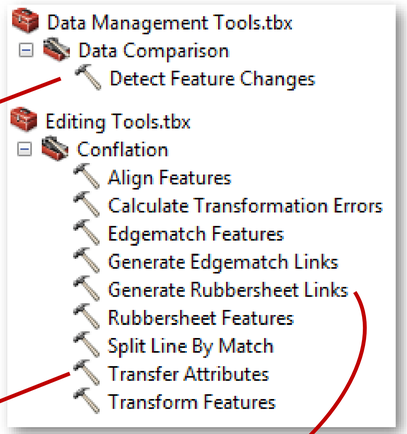
- Land Information New Zealand
- Institut Cartogràfic i Geològic de Catalunya (ICGC), Barcelona, Spain.

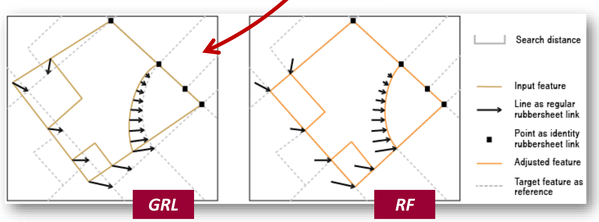
Reconciling spatial & attribute differences

System tools









Task based workflow

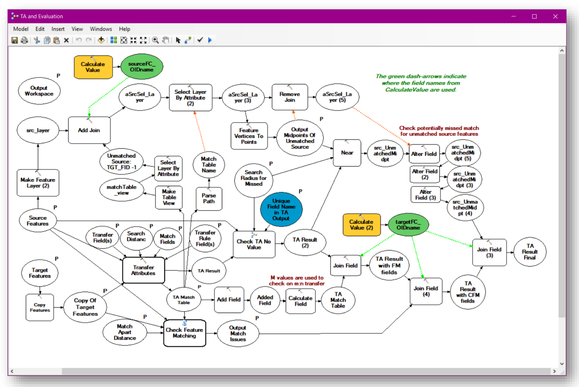
- In same projection
- Standard data validation
- Selection of relevant features

- Conflation tools
- Workflow tools

- Queued review
- Interactive editing

Example 1: attribute transfer *

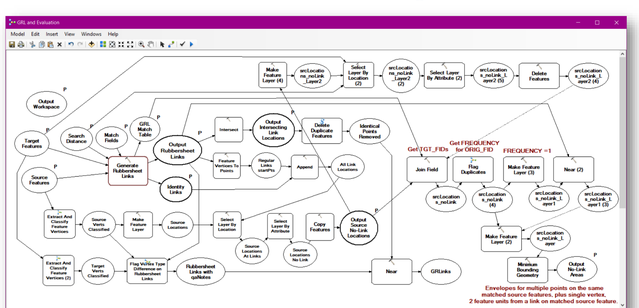
Automatic attribute transfer and evaluation



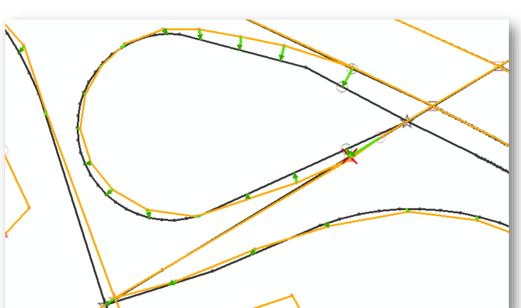
Interactive review and corrections

Example 2: rubbersheet links generation *

Automatic rubbersheet links generation



Interactive review and corrections



* **Public data sources:**
- San Diego GIS
- Open Street Map

Conclusions

Conflation plays indispensable roles in data reconciliation, change detection, and multi-scale, incremental database and map updating. Changes in newly updated master databases can be propagated to smaller scales through linkages and re-generalization of the affected areas. Conflation can be done more efficiently with workflows:

- Use the best practice in pre-processing.
- Run automated tools to obtain highly accurate results and evaluation information.
- Interactively review and edit the results. The time is worth-investing.

Our future efforts will continue aiming at further automation, formalization of workflows and increasing productivity to meet the growing demands for conflation.

- Fully integrated conflation management.
- New tools and improved feature matching.
- Efficient processing of large datasets.
- Contextual conflation.
- Incorporation of other data sources (imagery, lidar, GPS)