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Alaska National Hydrography Dataset Positional Accuracy Assessment Study

Initial Results

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Introduction

- In July 2011, the National Geospatial Program (NGP) embarked on a new large-scale Alaska Topographic Mapping Initiative
- The Alaska National Hydrography Dataset (NHD) originally was derived from 1:63,360-scale topographical maps
  - suitable for 1:25,000-scale US Topo production?
- Concerns
  - spatial accuracy of data
  - density of stream network

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Introduction

- Causes of accuracy problems
  - inadequacy of 1:63,360-scale mapping for meeting the positional requirements of 1:25,000 scale mapping
  - insufficient or poor horizontal control of the original topographic production effort
  - temporal changes in water features
  - any combination of these factors

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Introduction

- Initial visual assessments
  - wide range in the quality of fit between features in NHD and these new image sources
  - no statistical analysis has been performed to actually quantify accuracy
  - Determining *absolute accuracy* is cost prohibitive (must collect independent, well defined test points)
  - Quantitative analysis of relative positional error is feasible

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Data Sources

- Two sources of Interferometric synthetic aperture radar (IfSAR)
  - Intermap (X band collection)
  - Fugro Earth Data (X and P band collection)
- **Hydro flattening** done on different standards and with different methods between the two contractors.
  - FEDI (Fugro Earth Data):
    - water bodies 150 meters in length and 50 meters in width or greater are flattened
    - double line drains 150 meters or more in length and 50 meters in width are flattened
  - Intermap: NextMap USA Standards
    - similar to FEDI

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Methods

- NHD features are restricted to particular features of NHDFlowline, NHDArea, and NHDWaterbody
- Area and waterbody features are represented in the IfSAR files of breaklines
- Flowlines, not a normal delivery of IfSAR project data, are extracted directly from the bare-earth data
- Buffered overlap areas assessed, as well as analyses to identify trends with slope, elevation, land use type, and land use cover

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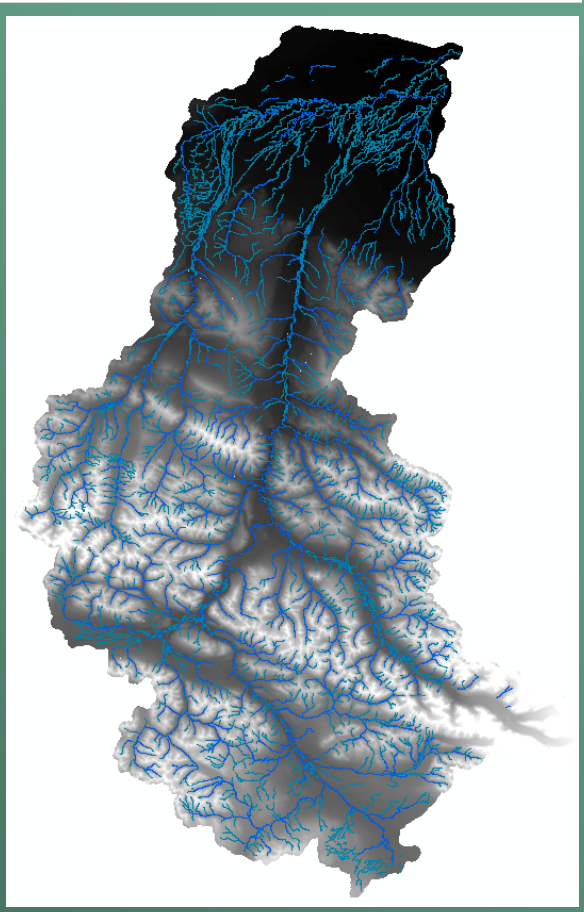
NHD Flowlines

- Flowlines needed to be extracted directly from the bare-earth data
- Use of Larry Stanislawski's tool of U.S. Geological Survey (USGS) -- extracts stream networks and compares to existing NHD



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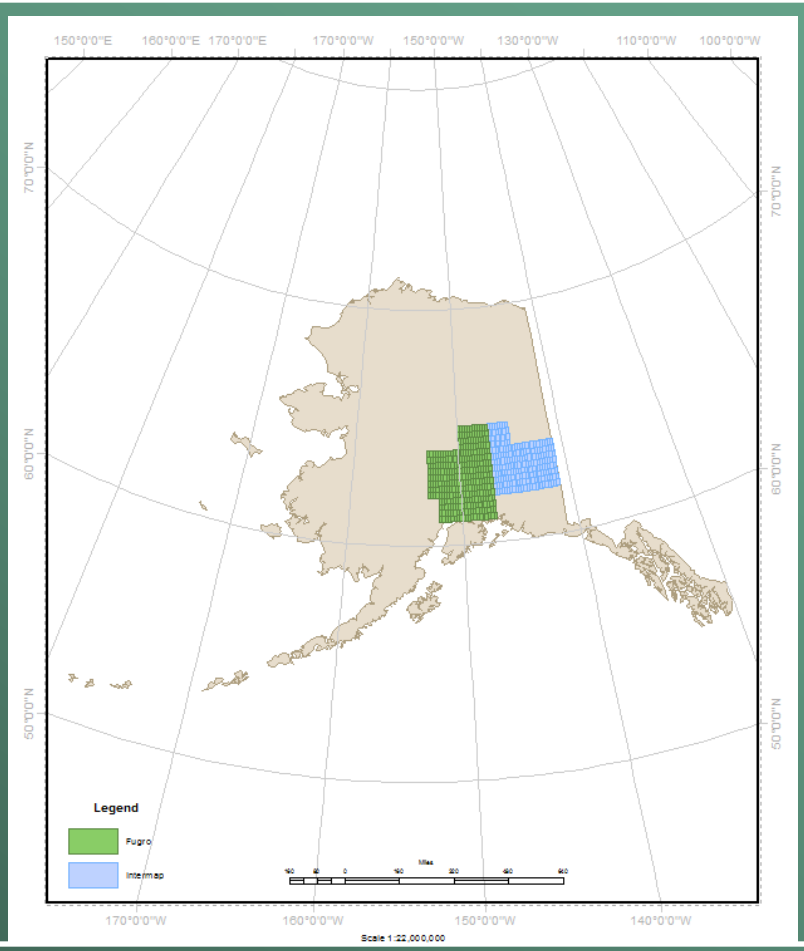
Study Area

- Entire project: A total of 416 tiles make up the entire study area
  - Intermap site measuring ~26,000 square miles, or an area the size of West Virginia
  - Fugro site measuring ~32,000 square miles, or an area the size of South Carolina
- Flowlines: 3,000 square miles, or the size of Delaware



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Issues Found in Initial Assessment

1. The NHD and the reference source features have portions that do not overlap.
2. The boundaries of many NHD features have changed.
3. Some features of each type are missing from the NHD dataset.

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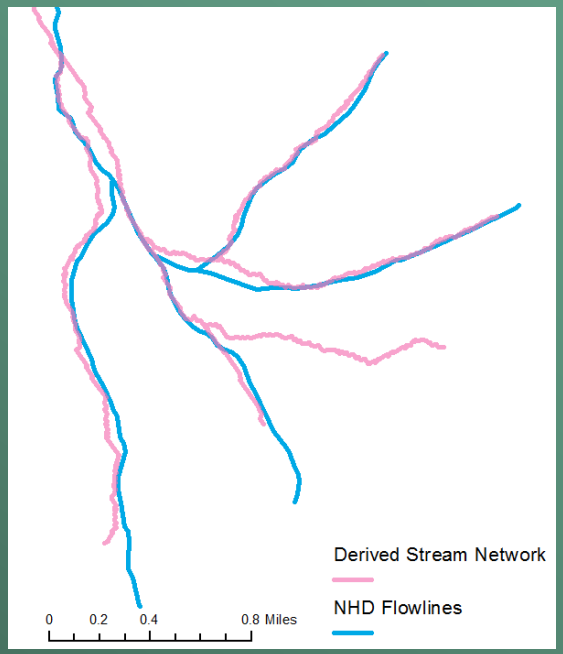
Issue 1: Overlap

- **All features**



Boundary changes vary -- for this feature, the change is roughly 40 percent with a 12.7-meter (m) buffer

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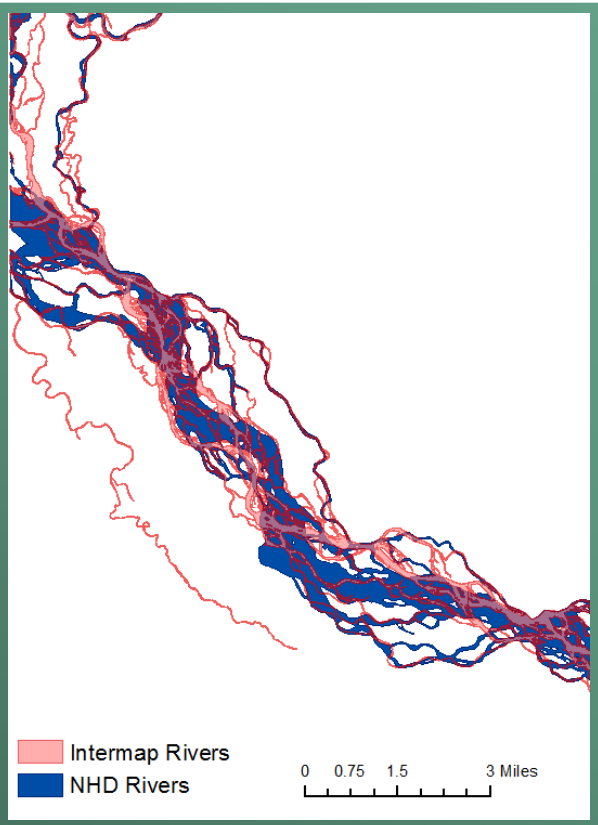
Issue 2: Boundary Change

- **Areas and waterbodies**



The change is roughly 50 percent with a 12.7-m buffer

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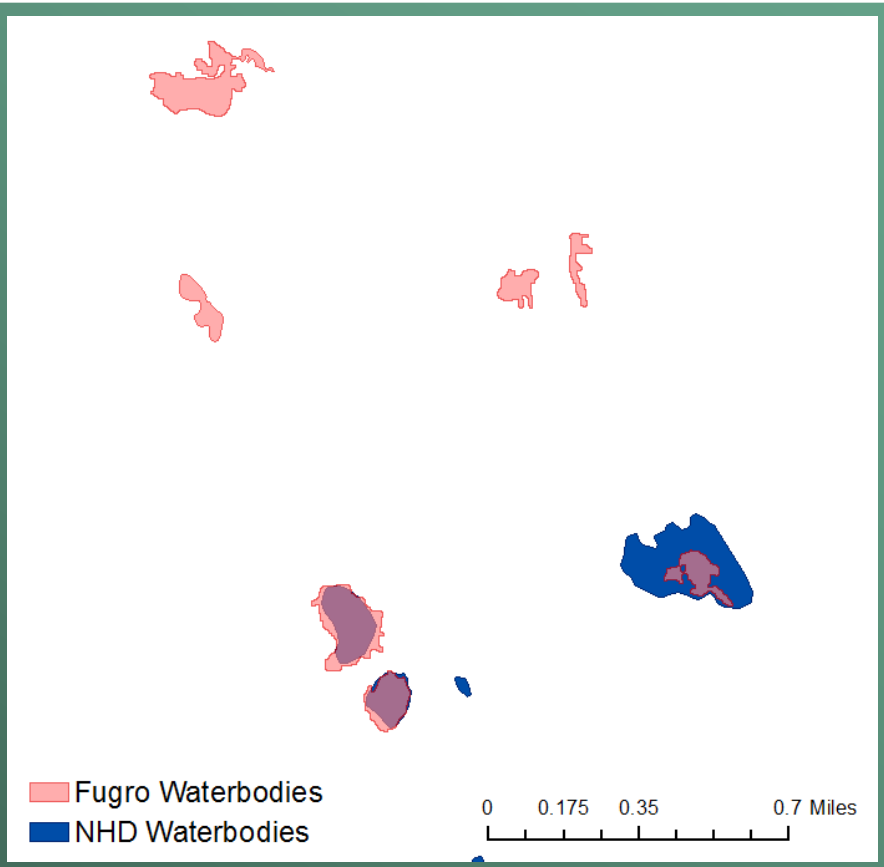
Issue 3: Missing features

- Areas and waterbodies



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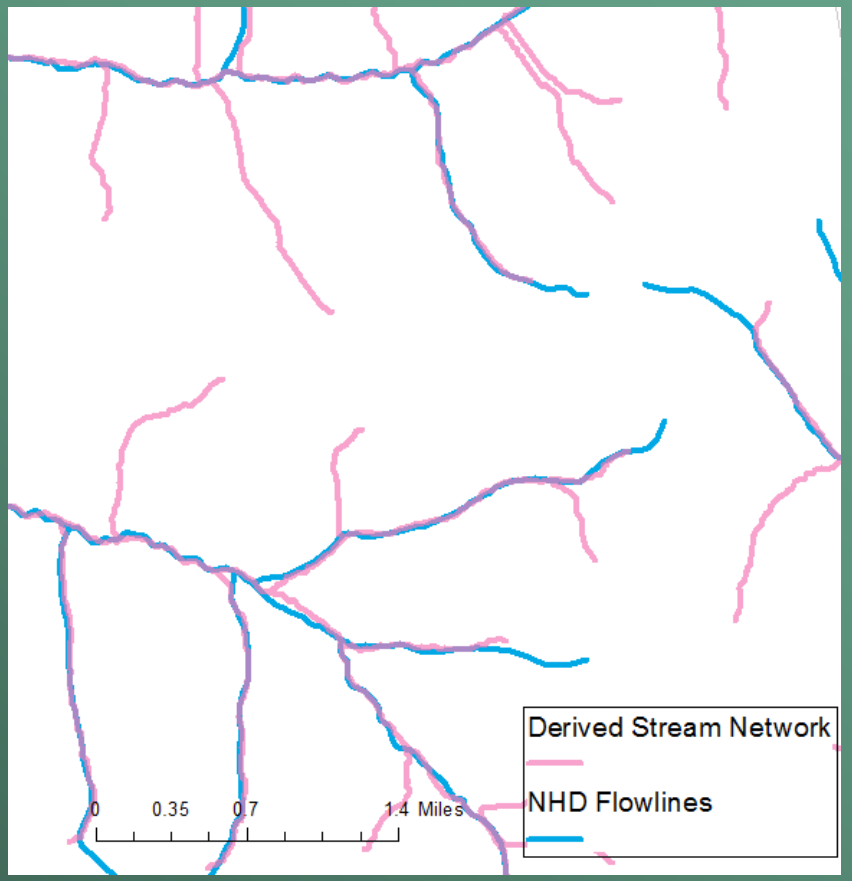
Issue 3: Missing Features

- Flowlines
  - Based on the confluence to confluence (c2c) analysis
  - Includes both full and partial matches



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Results

- Although some of the 1:63,360 NHD has features that do not need updates [based on the update criteria used for the contiguous United States (CONUS)], many features may need updating
- Using the CONUS edit criteria; NHD Areas are updated if 1000 feet or more of change observed, and NHD Waterbodies 500 feet or more of change observed)
  - NHD Areas in Intermap area:
    - FType (feature type) 460: 57/109 features need updates (52%)
    - FType 537: 25/114 need updates (22%)
  - NHD Waterbodies in Intermap area:
    - 1640/6357 need updates (26%)

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Results

- The successfully derived network from the IfSAR data allowed for comparisons between the 1:63,360 NHD and the streams derived for a 1:25,000 map
- The use of the breakline dataset as a reference set for Areas and Waterbodies allowed for faster processing time than manually digitizing or feature extraction from the IfSAR or Système Pour l'Observation de la Terre (SPOT) satellite data

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Results: Missing Features

- **The NHD was buffered by 25 and 500 m to select any breakline features that fell outside these buffers.**
- Waterbodies:
  - Intermap: 5,251 features missing from the NHD when using a 25-m buffer (5% of all reference source features) and 866 when using a 500-m (less than 1% of all reference source features). However, 175 of the 5,251 and 49 of the 866 are greater than 2 acres, and none are larger than 400,000 square meters (m^2)
  - Fugro: 348 features missing when using a 25-m buffer (17% of all reference source features) and 150 when using a 500-m (7%). 315 of the 348 and 140 of the 150 are greater than 2 acres, and 5 from the 25-m and 3 from the 500-m are greater than 400,000 m^2
- Flowlines:
  - Intermap only: with a 25-m buffer, 26% of the reference source streams were missing from the NHD (1398 features) and 8% at 500-m (418 features)
- Areas:
  - Intermap: 129 features missing when using a 25-m buffer (32% of all reference source features) and 91 when using the 500-m (23%)
  - Fugro: 13 features missing when using a 25-m buffer (14% of all reference source features) and 9 when using the 500-m (9%)

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Recommendations

- The methods for calculating changes to feature extent and overlap could be used to automate identification of segments that need updating
- Use the test-case methodology mentioned above to
  - Identify missing features in the NHD that are present in the breakline/derived stream network datasets from the IfSAR and add the identified features, if they meet the NHD requirements
  - Identify and edit features overlapping beyond a chosen buffer area
  - Identify and edit features with boundary changes beyond a chosen buffer area/length
  - Add missing Area/Waterbody features of desired size

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Recommendations

- The above analyses could be conducted before any updates of the NHD
  - Although this will add processing time, it may ultimately decrease the amount of time needed to edit the dataset
  - Once the suspect features are flagged, the normal processes to update the NHD, such as using orthoimagery and the NHD Edit tool, can be utilized

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Next Steps

- NGTOC is running four test quads with SPOT and IfSAR coverage as a test case to compare automated methods with manual updates
- Feasibility of the use of this methodology will be determined for the operational environment
  - Time, cost, interoperability concerns
- Alterations/improvements will be incorporated if needed/identified
  - So far, the automated methods shown in this presentation have caught the same manual update errors, with time comparisons yet to be run

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