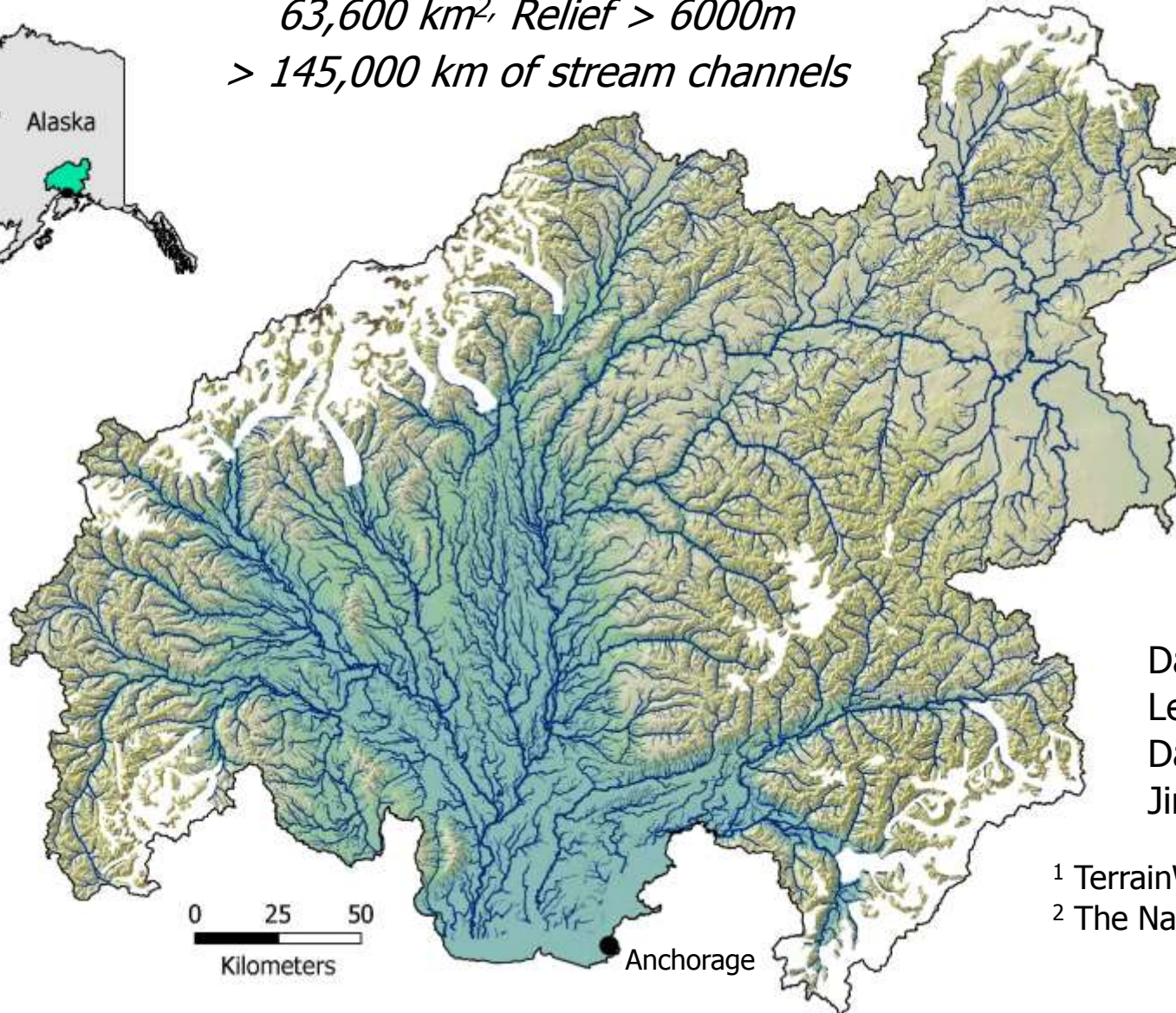# Creation of a complete, accurate, and versatile GIS-based stream layer and Hydroscape for the Matanuska-Susitna Basins

63,600 km², Relief > 6000m
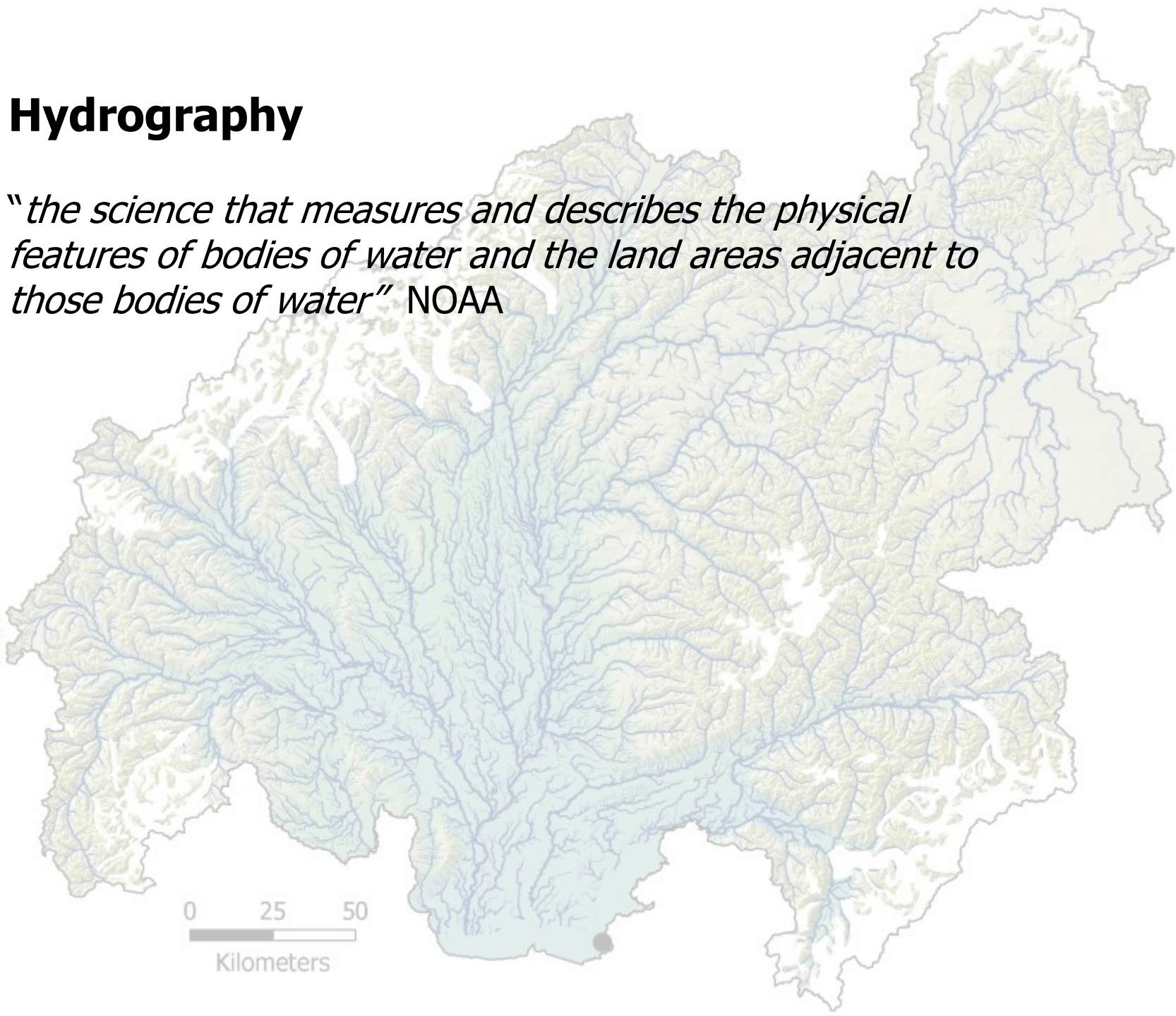*> 145,000 km of stream channels*

Alaska

Dan Miller[1]
Lee Benda[1]
Dave Albert[2]
Jim DePasquale[2]

[1] TerrainWorks, Inc.
[2] The Nature Conservancy

0   25   50
Kilometers

Anchorage

Hydrography

"*the science that measures and describes the physical features of bodies of water and the land areas adjacent to those bodies of water*" NOAA

Hydrography

"the science that measures and describes the physical features of bodies of water and the land areas adjacent to those bodies of water" NOAA

Landscape

"features of an area of land, including the

<u>*physical elements*</u> *of landforms such as mountains, hills,*

<u>*water bodies*</u> *such as rivers, lakes, ponds and the sea,*

<u>*living elements*</u> *of land cover including indigenous vegetation,*

<u>*human elements*</u> *including land use, buildings and structures, and*

<u>*transitory elements*</u> *such as lighting and weather conditions"*

Wikipedia

Hydrography in a Landscape context: Hydroscape
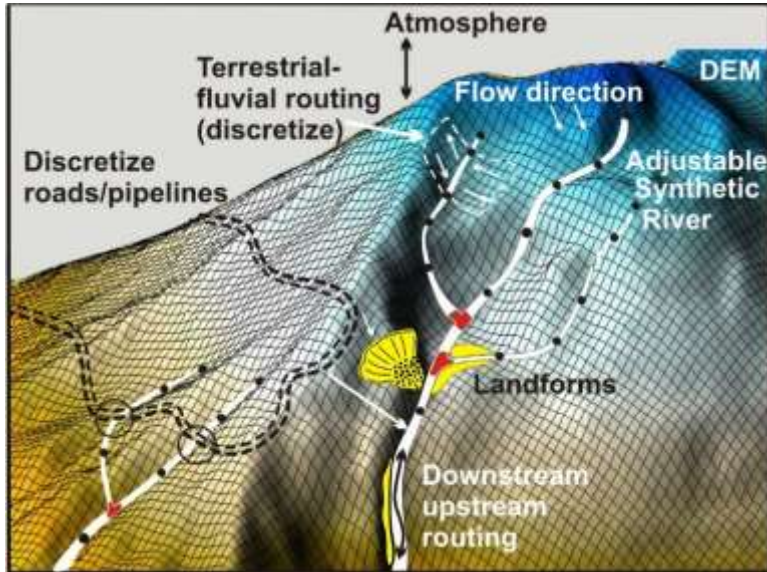
0   25   50

Kilometers

Digital Hydroscape: Data structures, Computer programs
Spatial Template, Interactions, Linkages
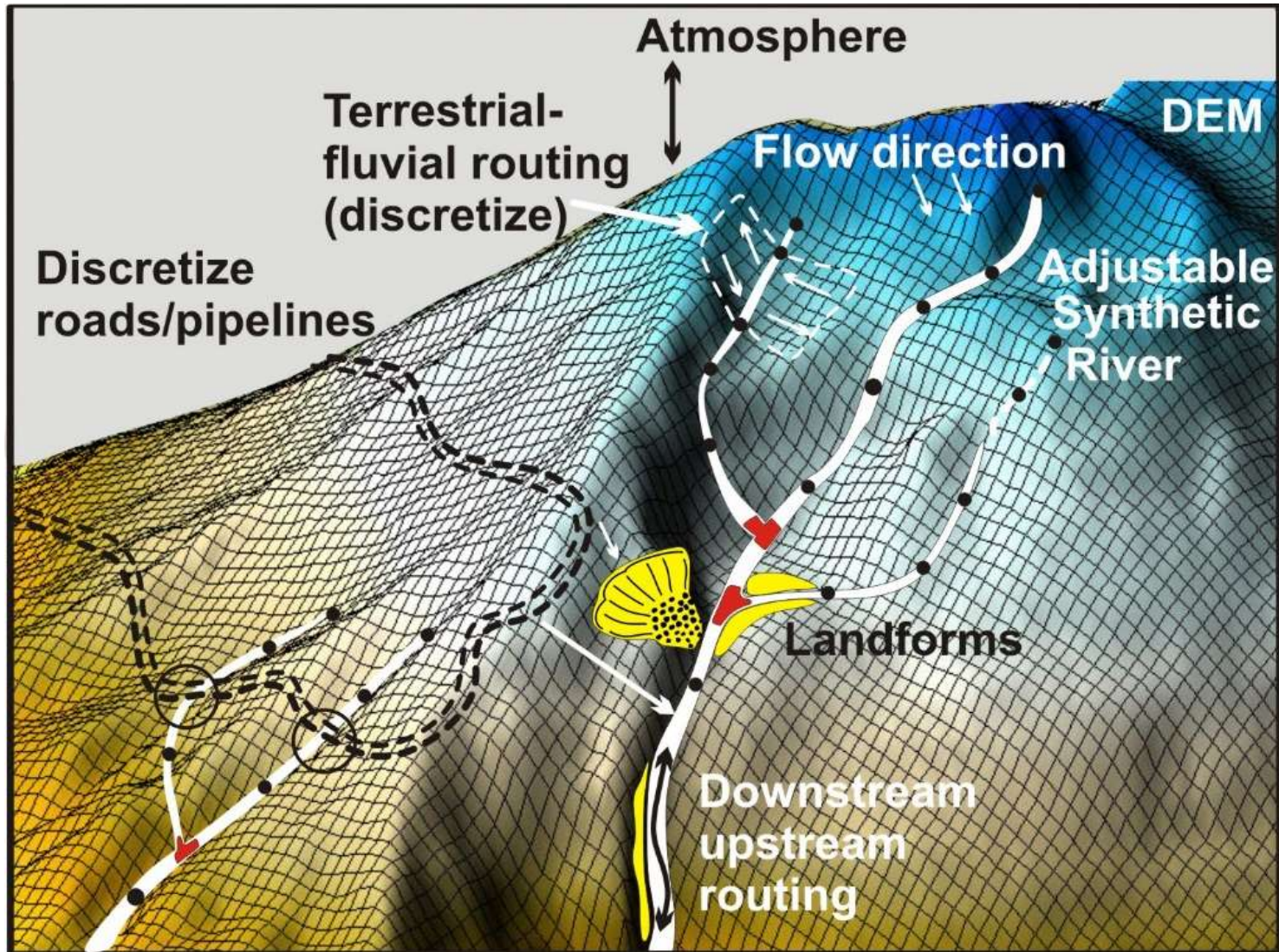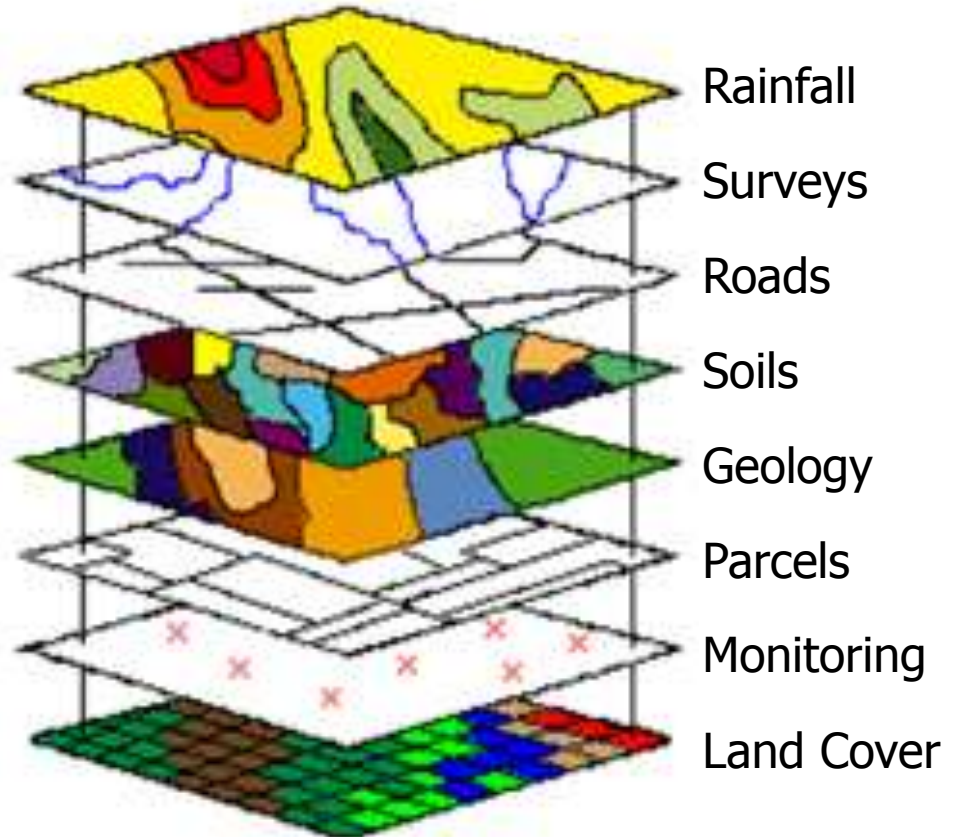
Digital Hydroscape
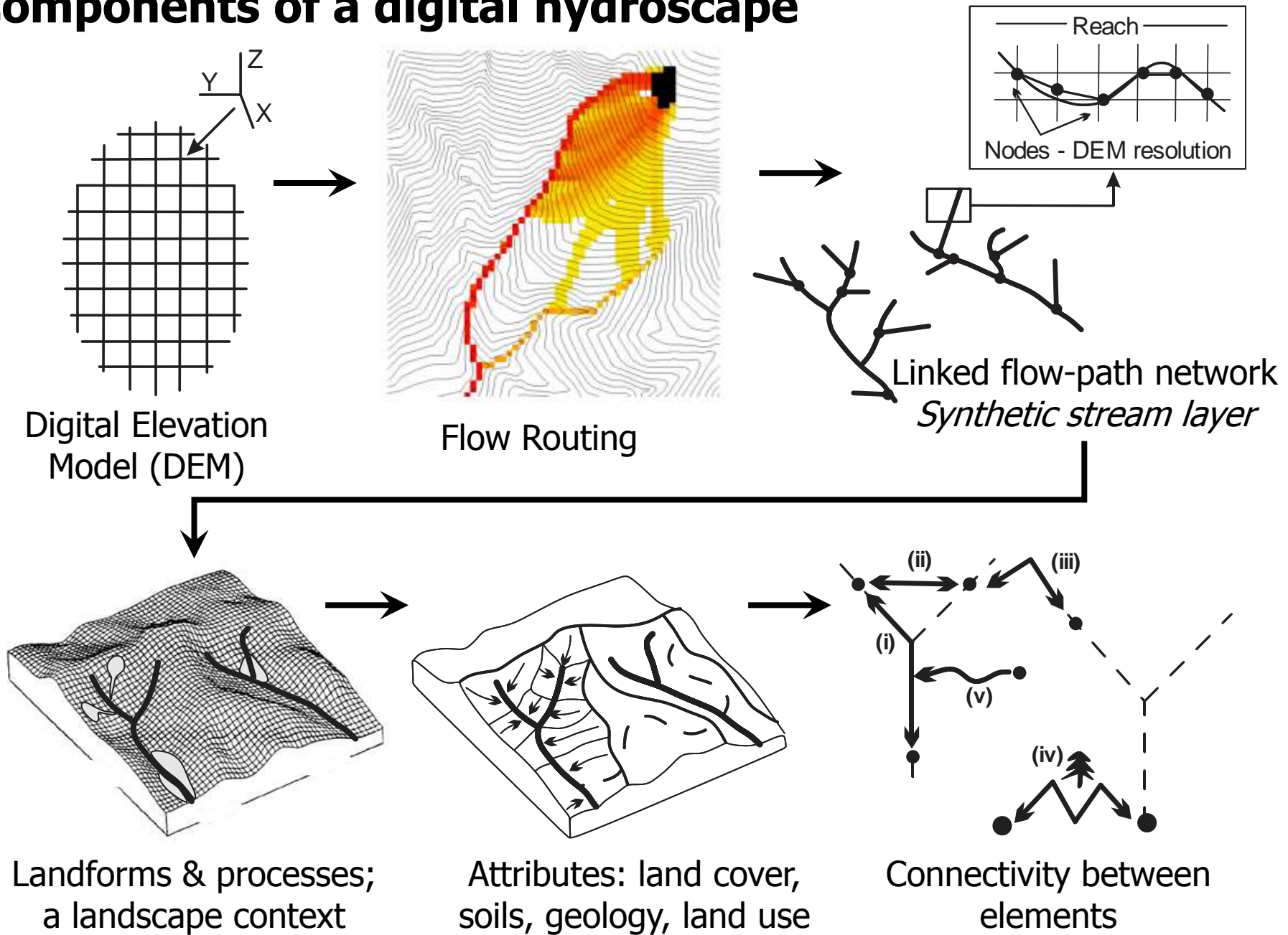Data structures, computer programs

NetMap
⟷ User Interface
## ArcGIS
Data, Maps, Documentation

Rainfall

Surveys

Roads

Soils

Geology

Parcels

Monitoring

Land Cover

Components of a digital hydroscape

Digital Elevation Model (DEM)

Flow Routing

Linked flow-path network
Synthetic stream layer

Reach

Nodes - DEM resolution

Landforms & processes; a landscape context

Attributes: land cover, soils, geology, land use
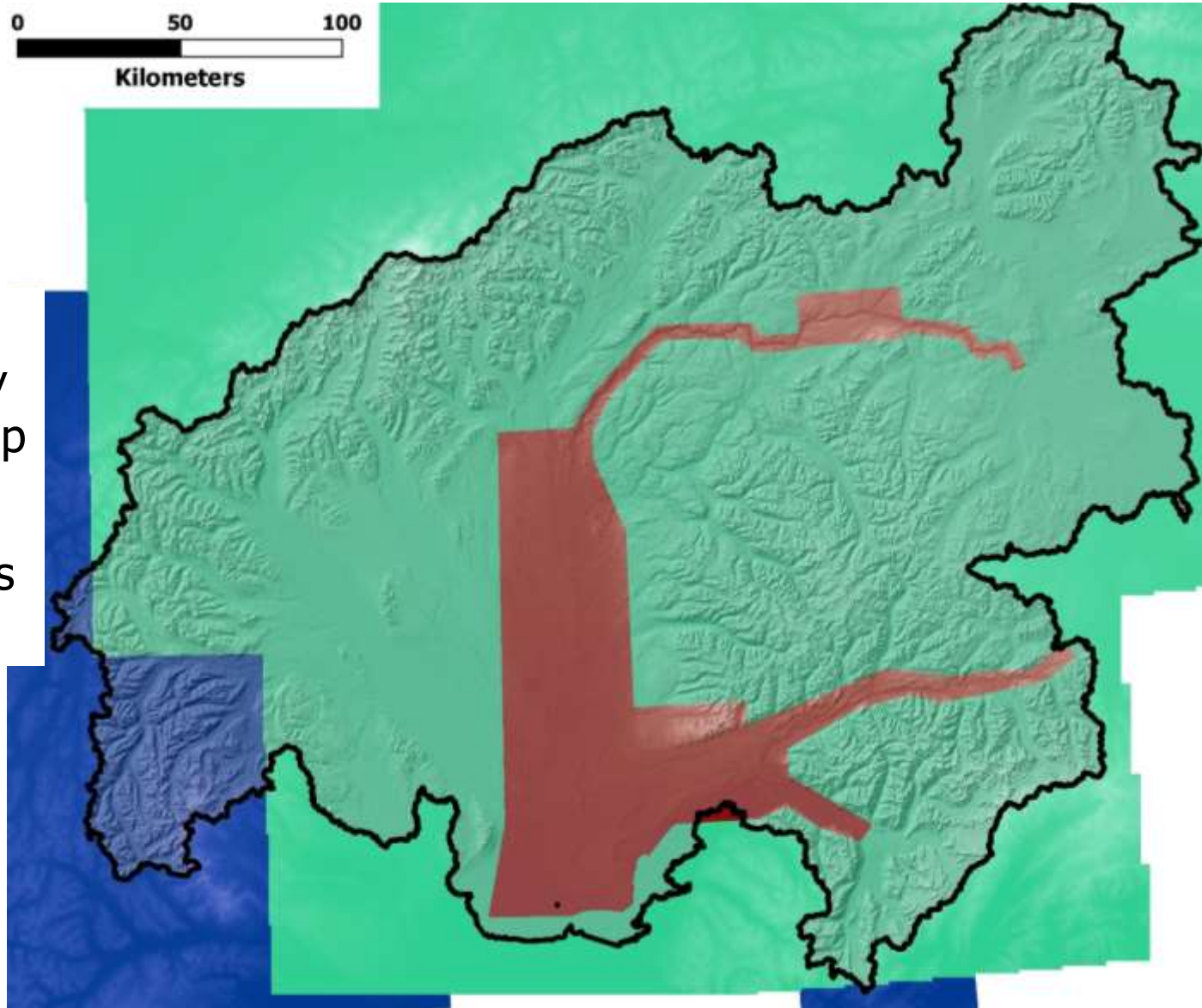
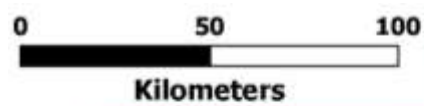Connectivity between elements

To build a flow-path network.

1. Contiguous DEM over entire watershed

2. Calibrate channel extent

3. Hydrologic conditioning

4. Build linked channel-node dataset

5. Build GIS output files

6. Verify, fix, repeat

Reach

Nodes - DEM resolution

Linked flow-path network
Synthetic stream layer
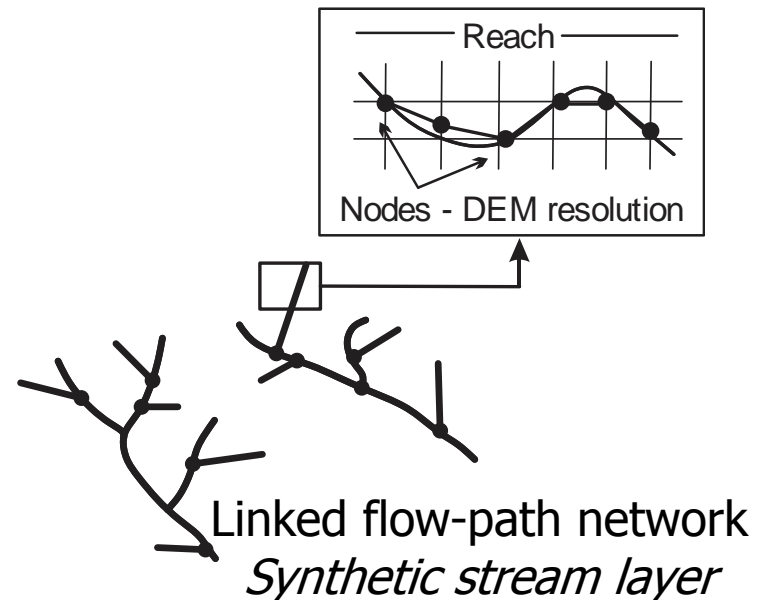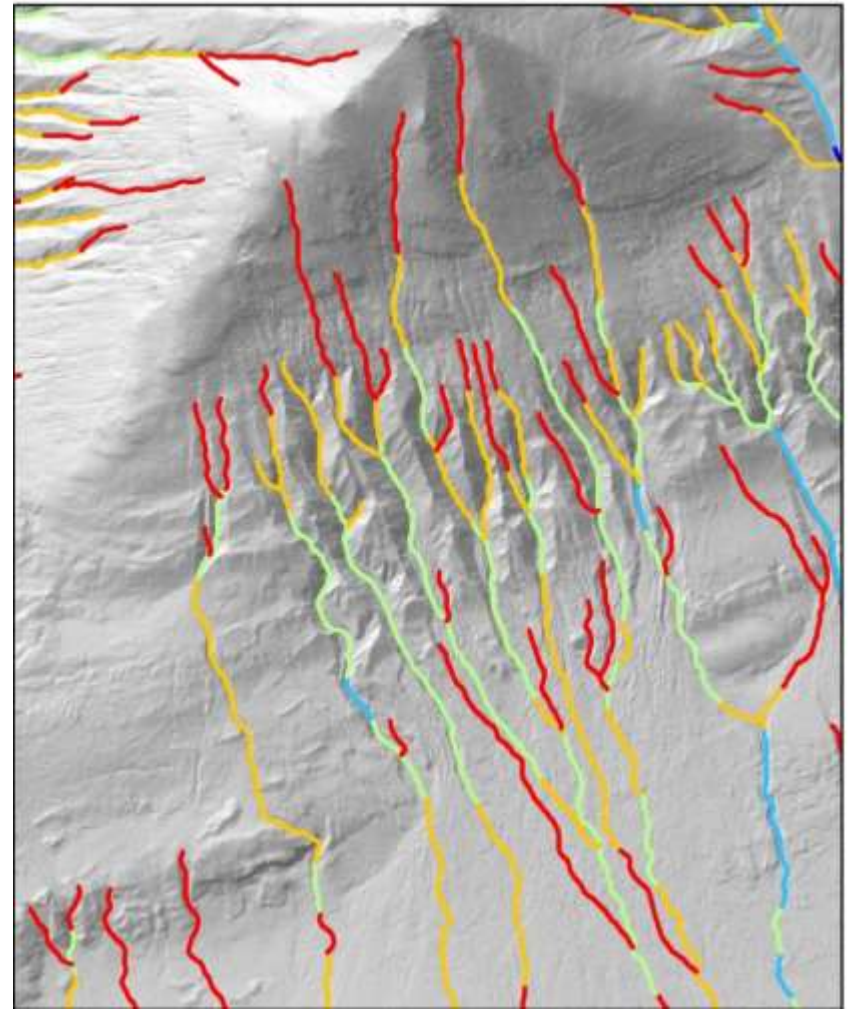
Elevation data sources
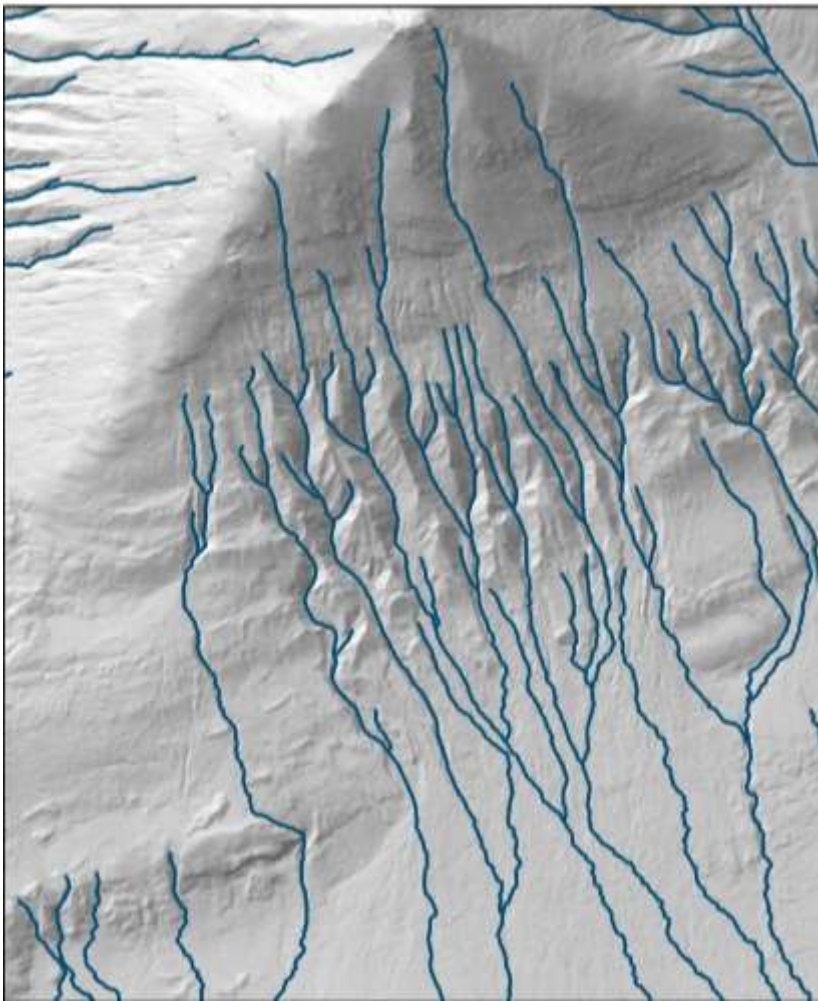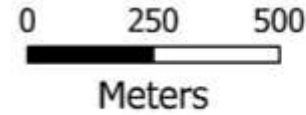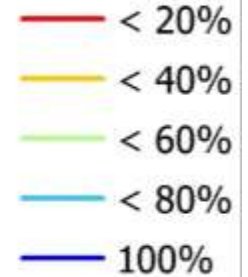

1-m LiDAR
5-m IfSAR
~90m NED

1. Warp - to match elevations exactly in areas of overlap

2. Sample to a single, contiguous DEM

Calibration – flow-path extent.
We want to include all potential channels.

You can delete channel segments, but you cannot subsequently add channels.

Probability of Perennial Flow

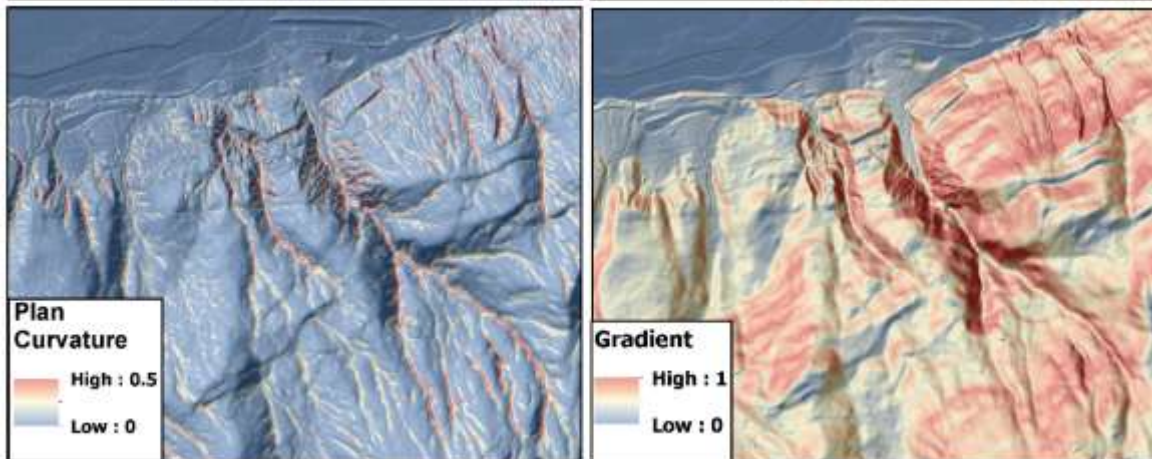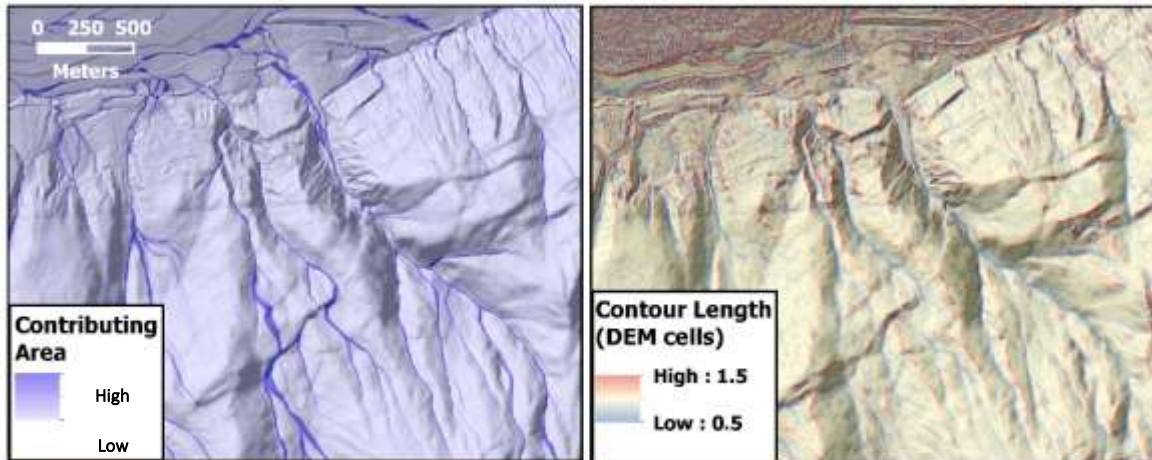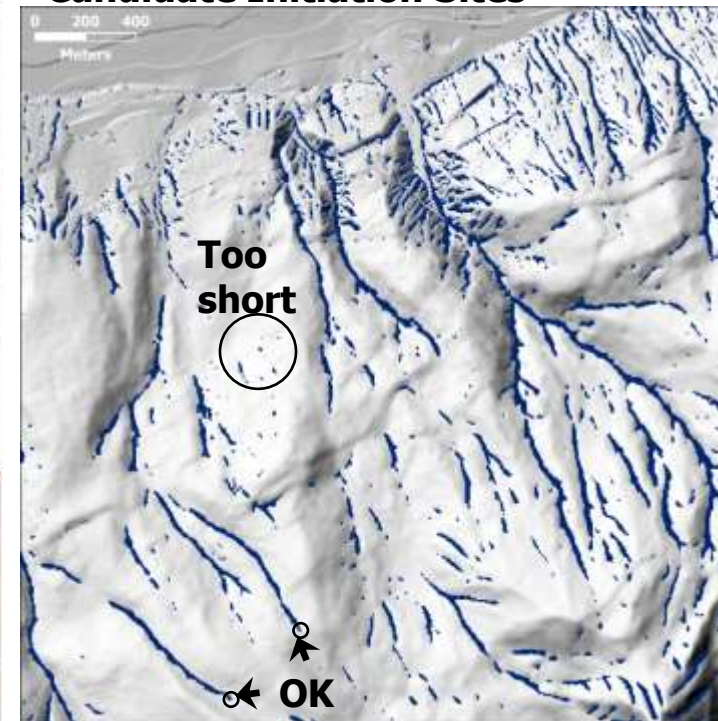|	
——	< 20%
——	< 40%
——	< 60%
——	< 80%
——	100%

Calibrate channel-network extent.

Channel-initiation threshold calibrated to DEM.

<u>Three thresholds</u>:

1) Specific contributing area * slope squared; measure of erosive potential.
2) Plan curvature; measure of flow convergence.
3) Minimum flow length over which above two threshold musts be met.

Candidate Initiation Sites

Enforcement by:
- Point (identified channel initiation points)
- Line (surveyed channels)
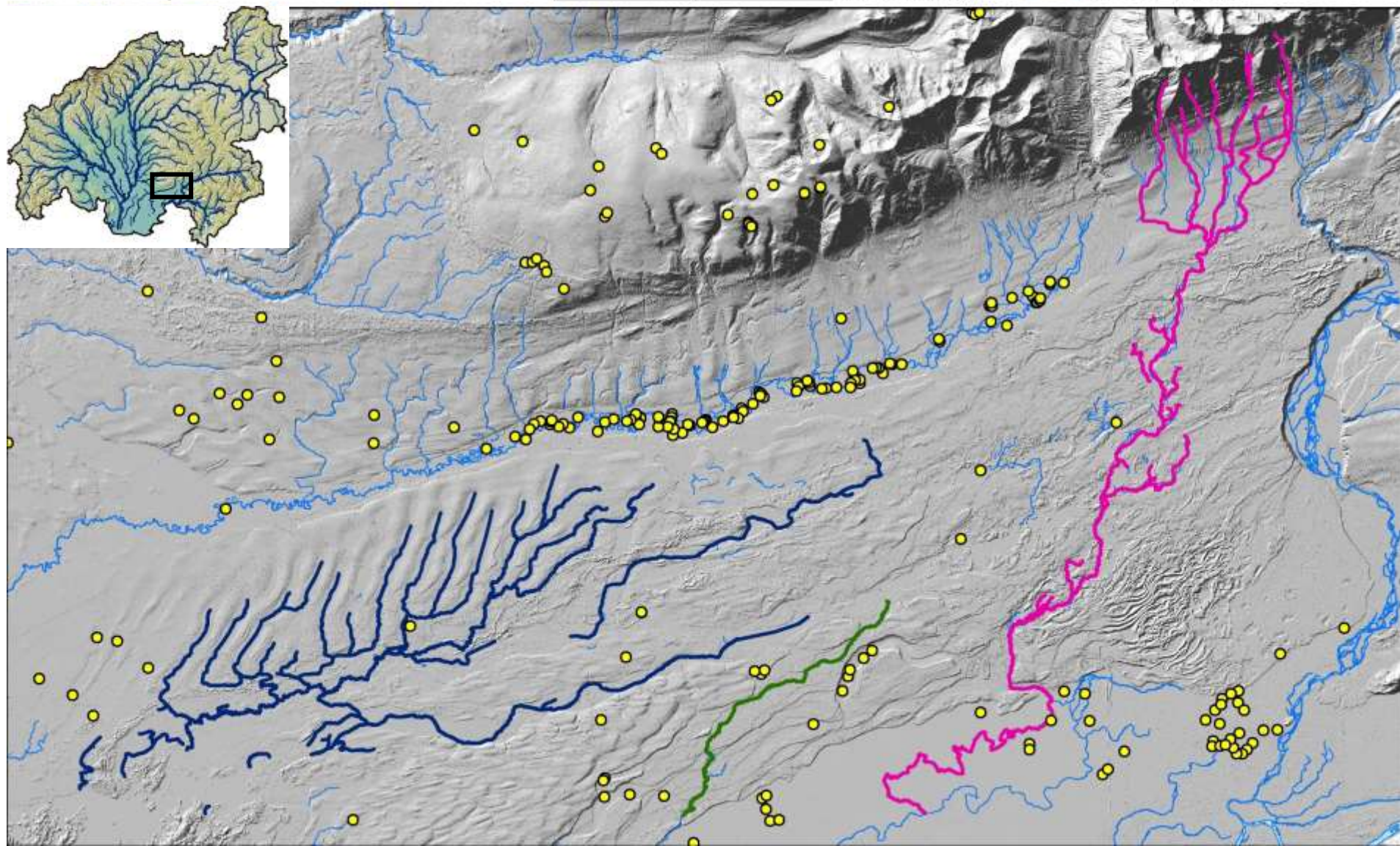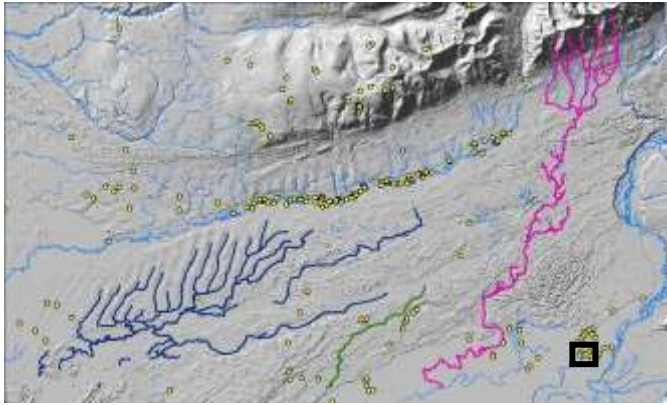- Polygon (water mask)

Enforced Initiation Points
Big Lake Streams
Lower Cottonwood
Wassilla Creek
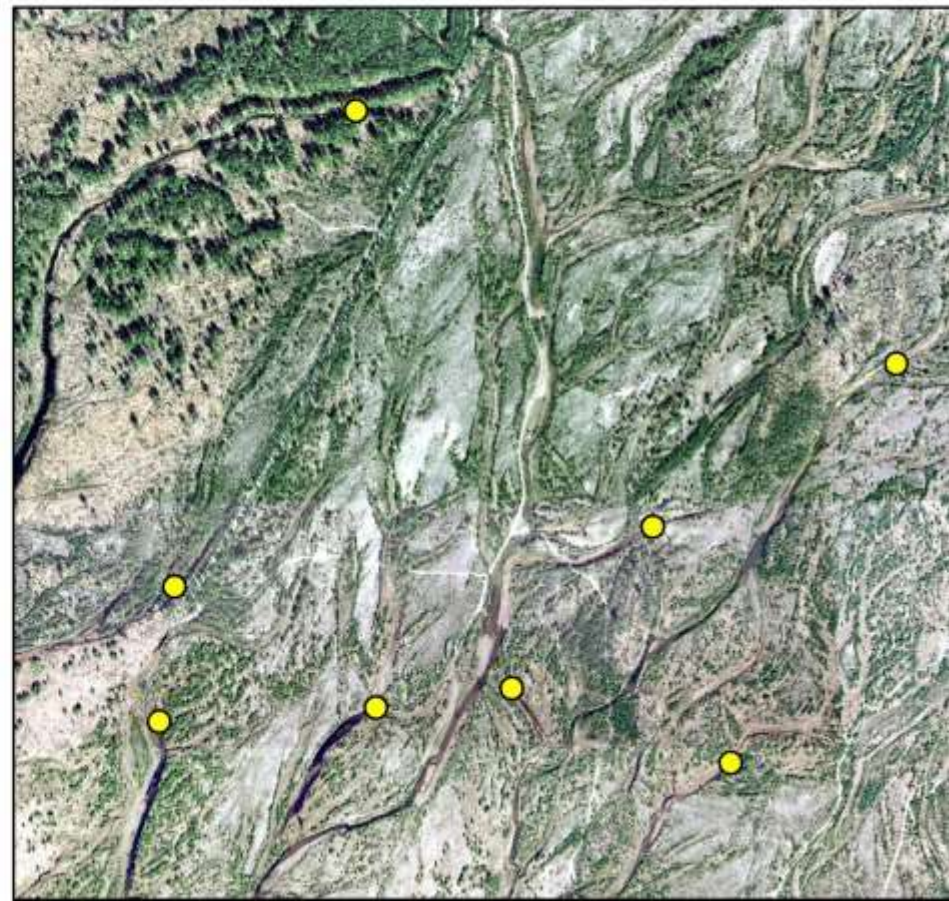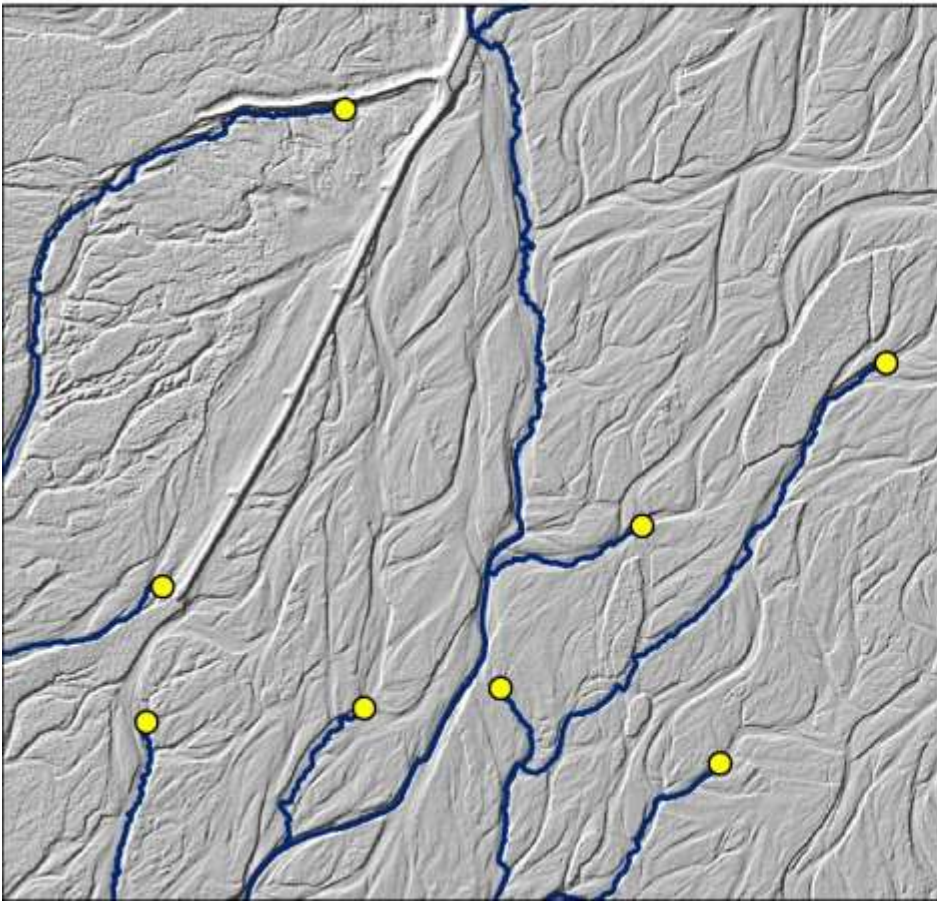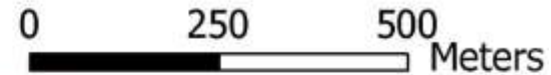Water Mask

0   5   10
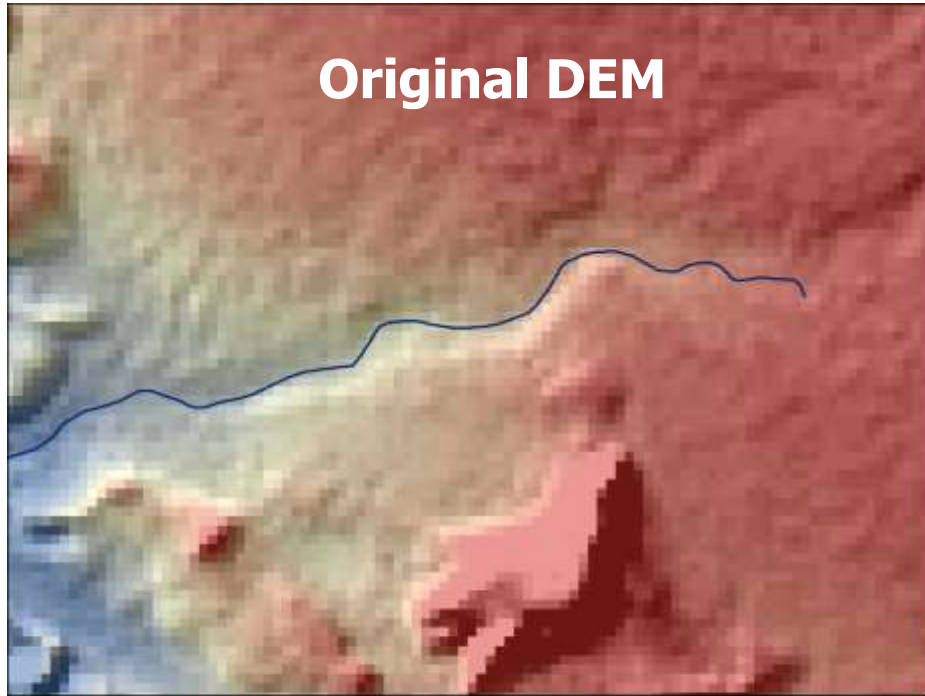Kilometers

Enforced channel initiation

Initiation points identified from high-resolution areal photographs or ground-surveyed GPS points
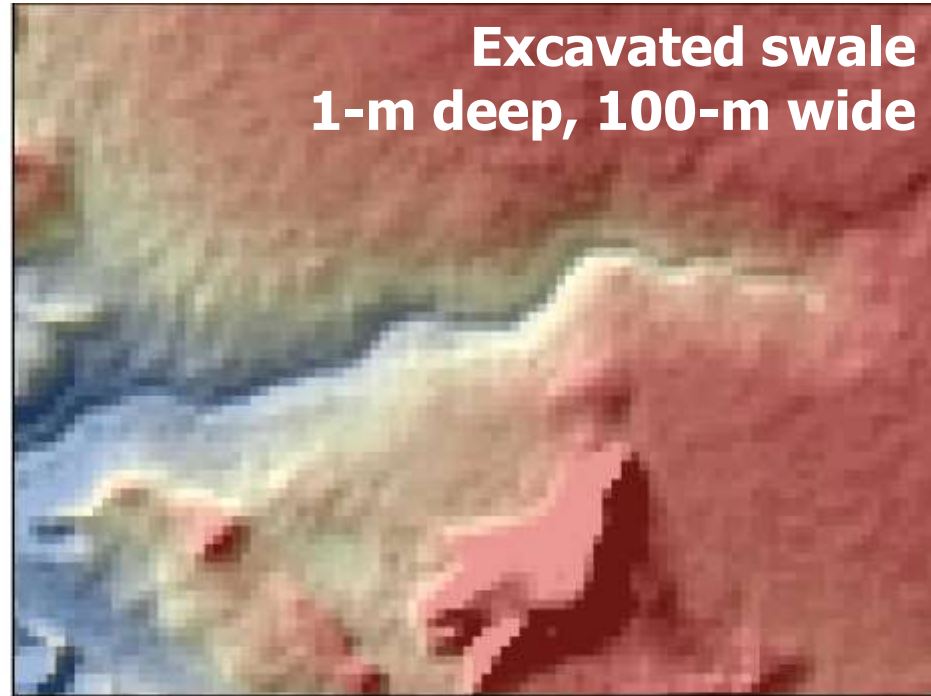
○ Enforced Initiation Points
— DEM-traced channels

0   250   500
Meters

Original DEM

**Excavated swale
1-m deep, 100-m wide**

**Excavated swale
2-m deep, 100-m wide**

Elevation (m)

High : 424

Low : 419
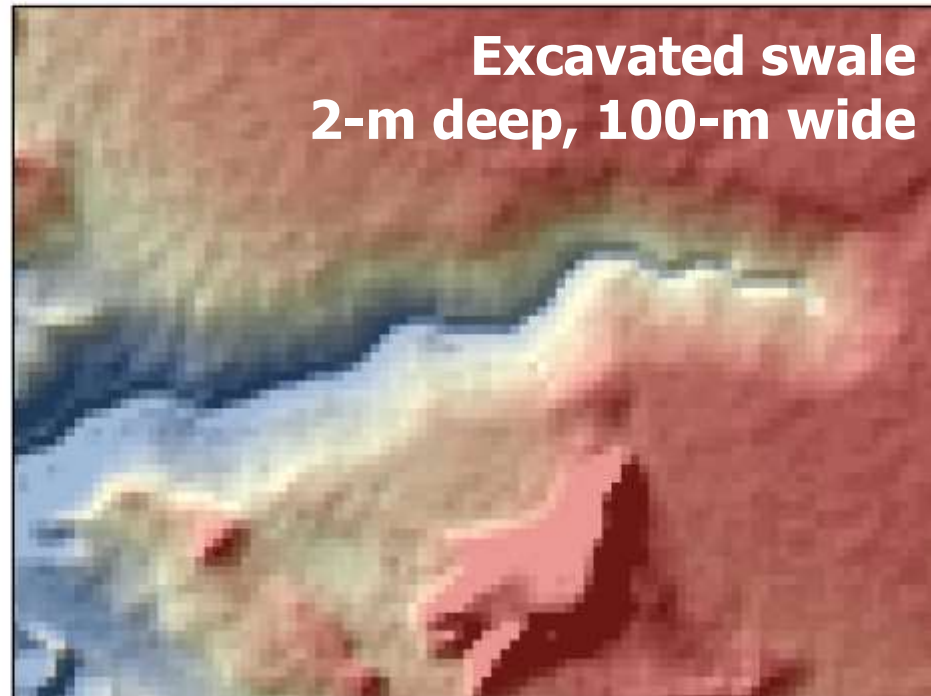
Meters

0   100   200
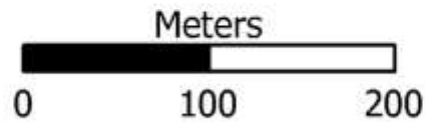
—— Single-line hydrography

Drainage enforcement:

- Encourage flow toward preferred courses
- Degree of encouragement determined by depth and width of excavated swale
- Once flow directions set, swale is removed and all analyses done on original DEM

Water mask: Delineates surface water
Derived from remotely sensed imagery
- Hydrologic enforcement – guides flow lines
- Provides channel and habitat attributes

Radar Intensity

0   250   500
Meters
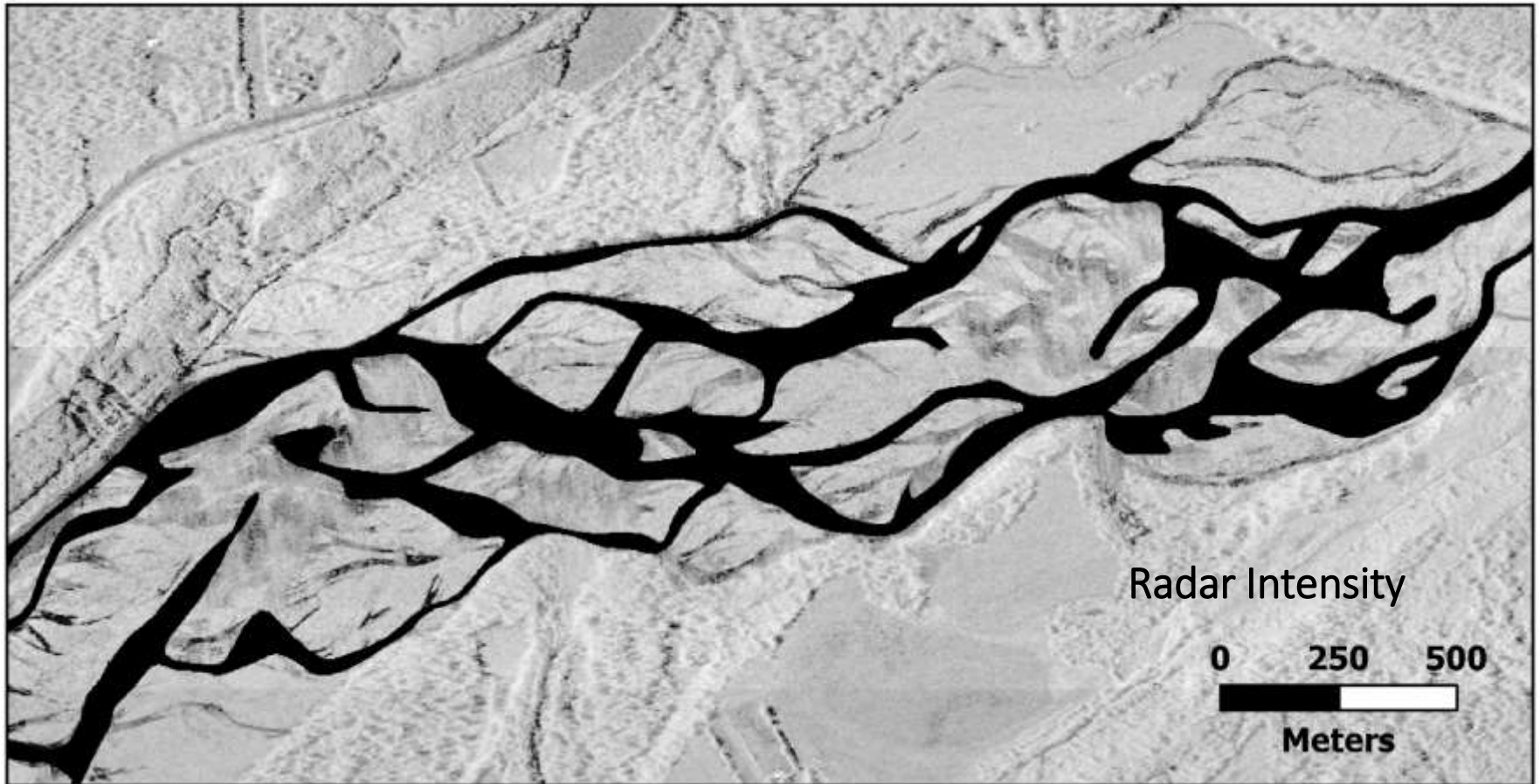
NetMap: hydroscape in ArcGIS

Synthetic stream layer
- Attributed
- Validated
- Linked to a variety of models
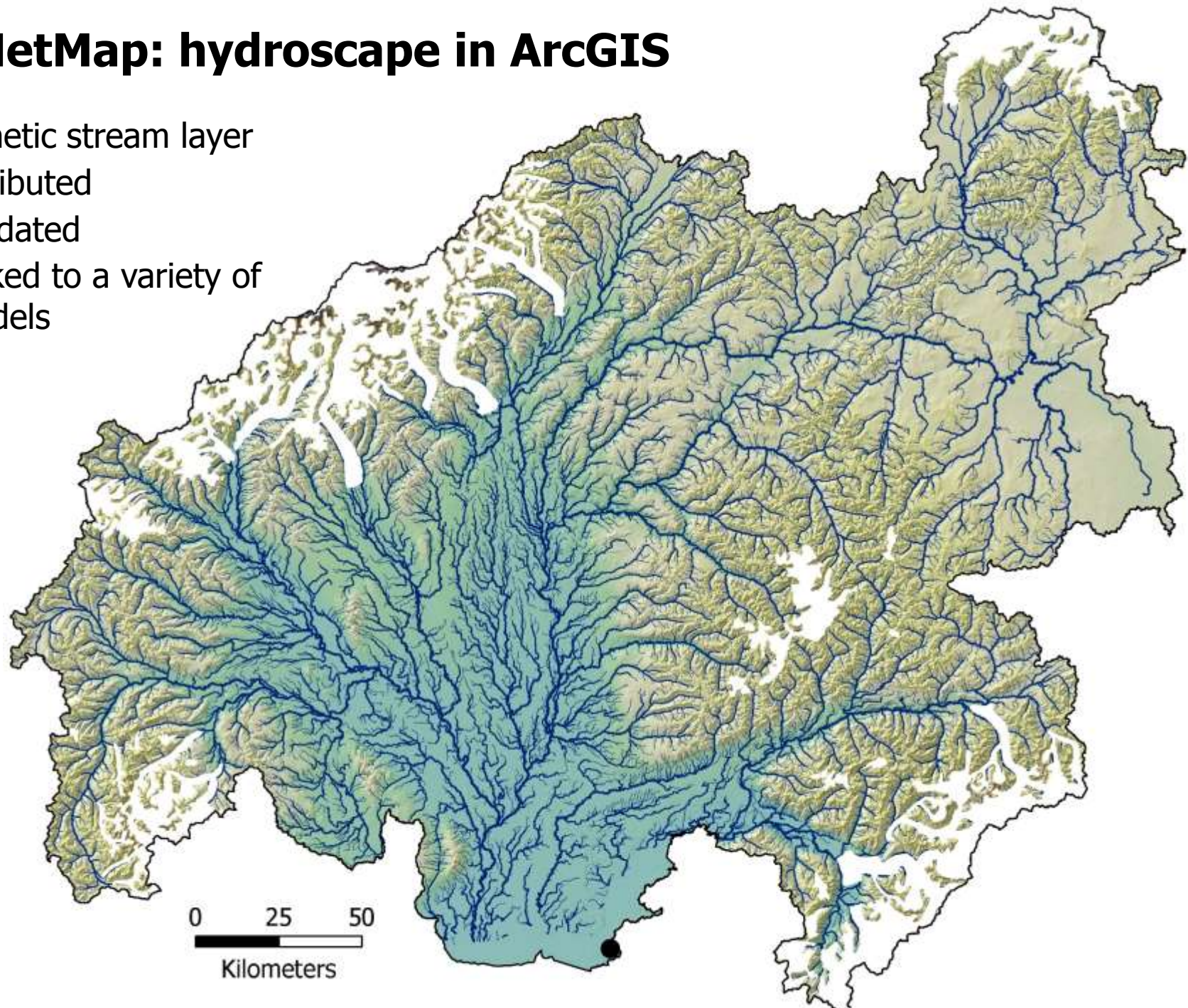
An Introduction to Integrated Hydrography
with NetMap Digital Hydroscape

A mapping and analysis platform for stream and watershed assessment

1:30 – 4:30 Thursday, Nov. 20, Alaska Pacific University GIS Lab.

Agenda

1:30 – 2:00pm, Introduction:
What is NetMap?
Under the hood: how does NetMap work?
How is NetMap used?

2 – 2:30pm Demonstration exercise in the Goose Bay / Big Lake watershed
Culverts and Habitat Connectivity

2:30 - 4:00pm Hands-on exercises for the Goose Bay / Big Lake watershed.

Impervious surfaces and water quality

Proximity of parcels to active river flood plain

Parcels near spawning streams

4:00 – 4:30pm Open Discussion

Road Crossings

LiDAR reflections don't see pipes and culverts, so drainage through road prisms and other areas drained by pipes need to be enforced.

Elevation (m)

High : 11

Low : 6

——— Culverts

0   20   40 Meters