Recent Applications of GIS at the Alaska Satellite Facility

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ASF/GI/UAF

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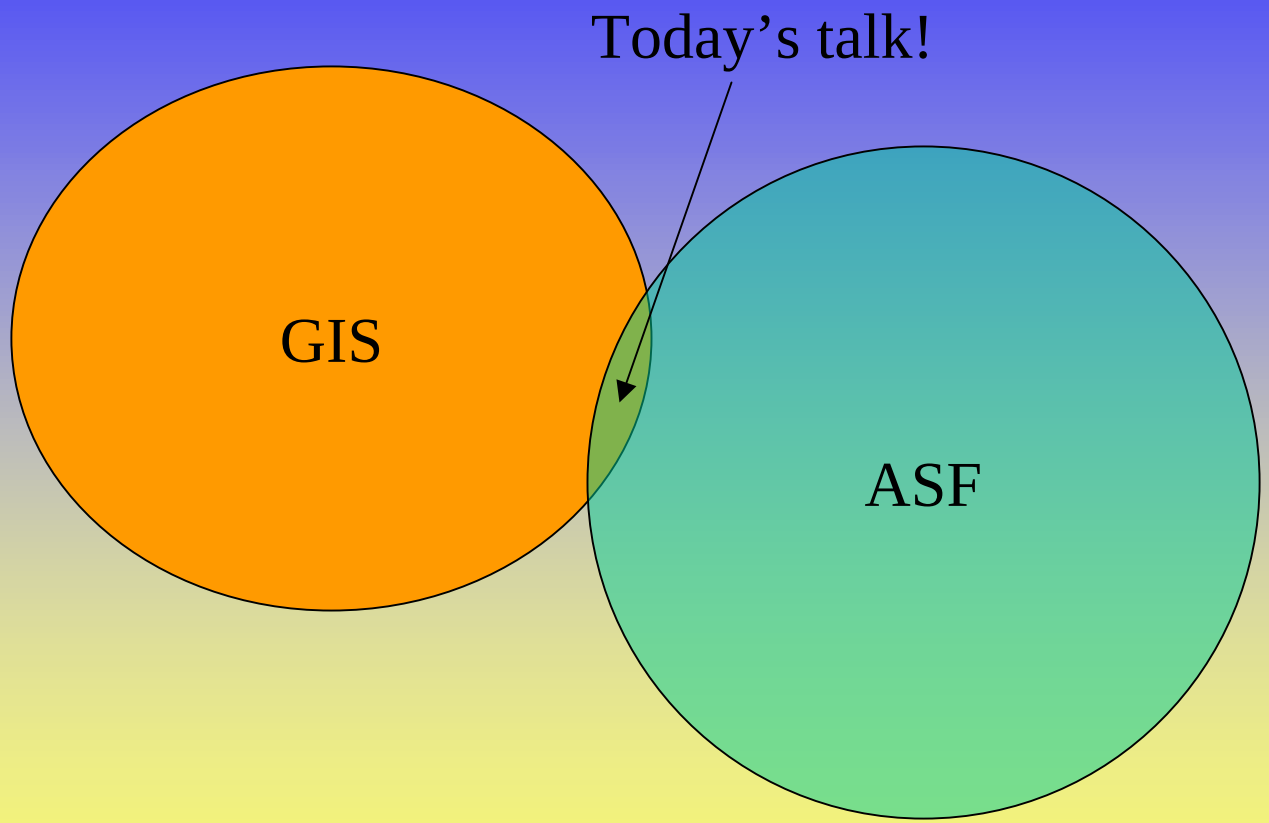
MOVING SALE!

- 1995 Toyota 4Runner
- 1994 Toyota Pickup
- Nice black shelves
- Futon sofa
- Recliner
- Skis
- Doghouses
- Household stuff– ask!
- Large terrarium
- Washer & dryer
- Dining table & chairs
- Misc. garage chemicals
- Tire chains!

Summary

- GIS defined
- Lessons learned
- Examples of problems addressed using GIS
- What’s next?


Today’s talk!
GIS
ASF

GIS: Definition

Geographic Information System(s) –

A computer system for capturing, storing, checking, integrating, manipulating, analyzing and displaying **data related to positions on the Earth's surface**. Typically, a GIS is used for **handling maps** of one kind or another.

(from thefreedictionary.com)

Map layers

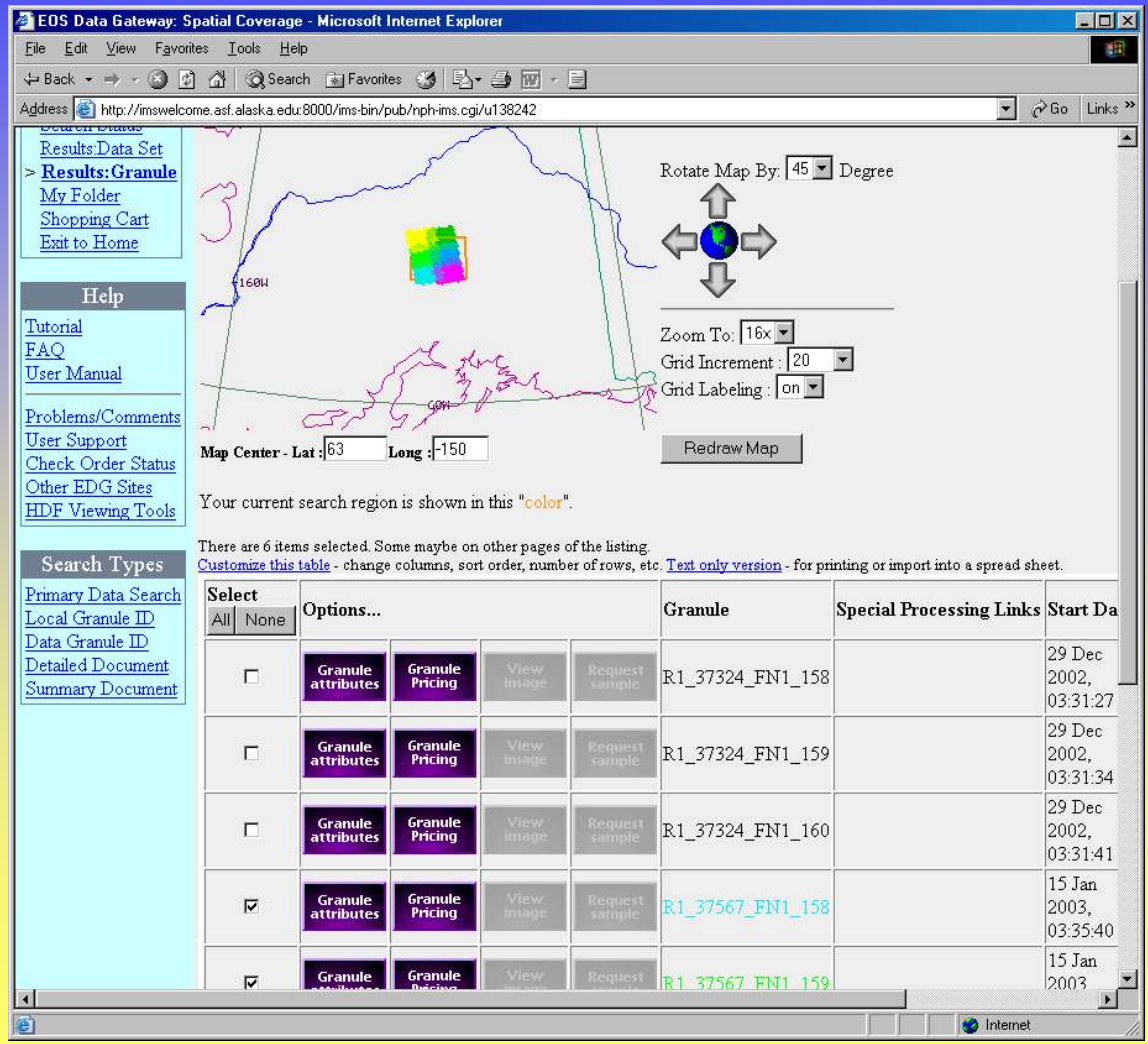
Raster data: images

- rows and columns of pixels
- SAR data, DEMs, scanned maps
- “continuous” change, spatially
- GeoTIFF, JPEG, binary, etc.

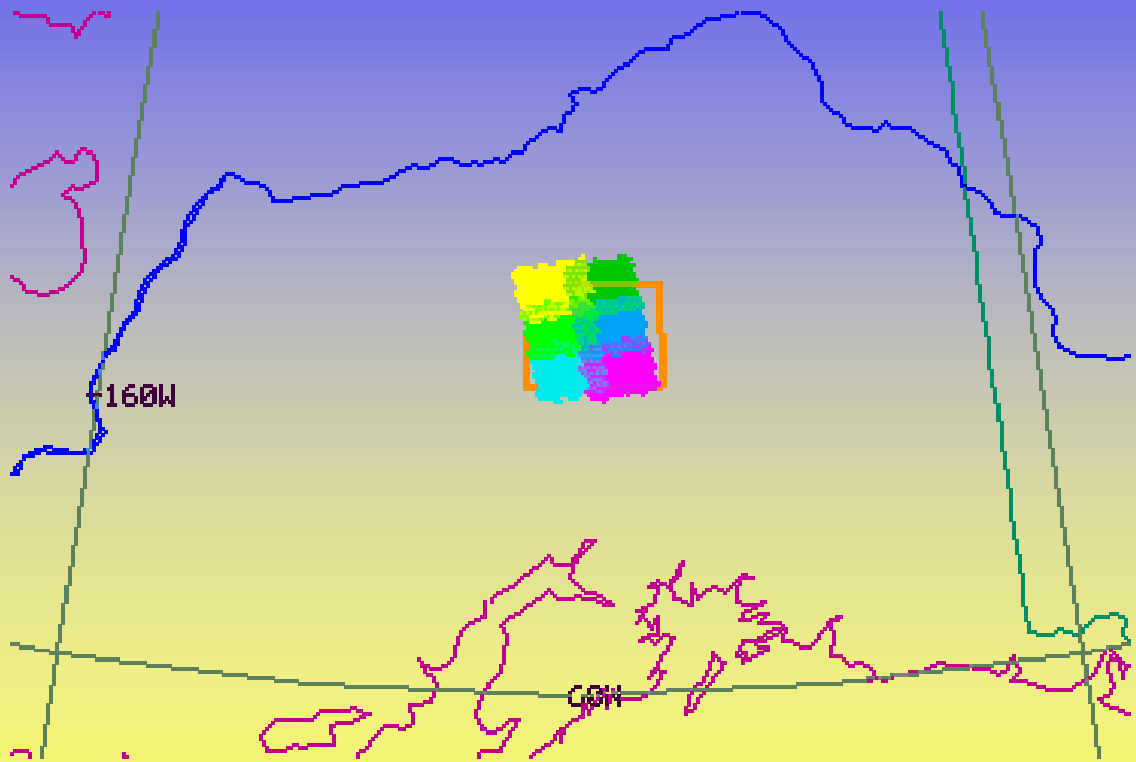
Vector data: points, lines, & polygons

- GPS points, satellite swath outline, lat/long grid
- “discrete” change
- shapefiles, coverages

EOS Data Gateway (EDG) = GIS



EOS Data Gateway (EDG) = GIS



(also SPA, DESCW, etc.)

Lessons learned

- Get to know your data!
  - File format: geotiff, binary+header, etc.
  - Byte order: moving between Unix and Windows
  - Data type: float, integer, byte…
  - Projection, datum, ellipsoid

Lessons learned

- Get to know your software!
  - ESRI: ArcInfo, ArcView, ArcGIS
  - (Other vendors for GIS, too)
  - Multiple solutions
  - Image processing software, where Arc comes up short (filtering, format conversions, etc.), incl. ENVI, IMAGINE, LAS, PCI
- Get to know your System Administrator!

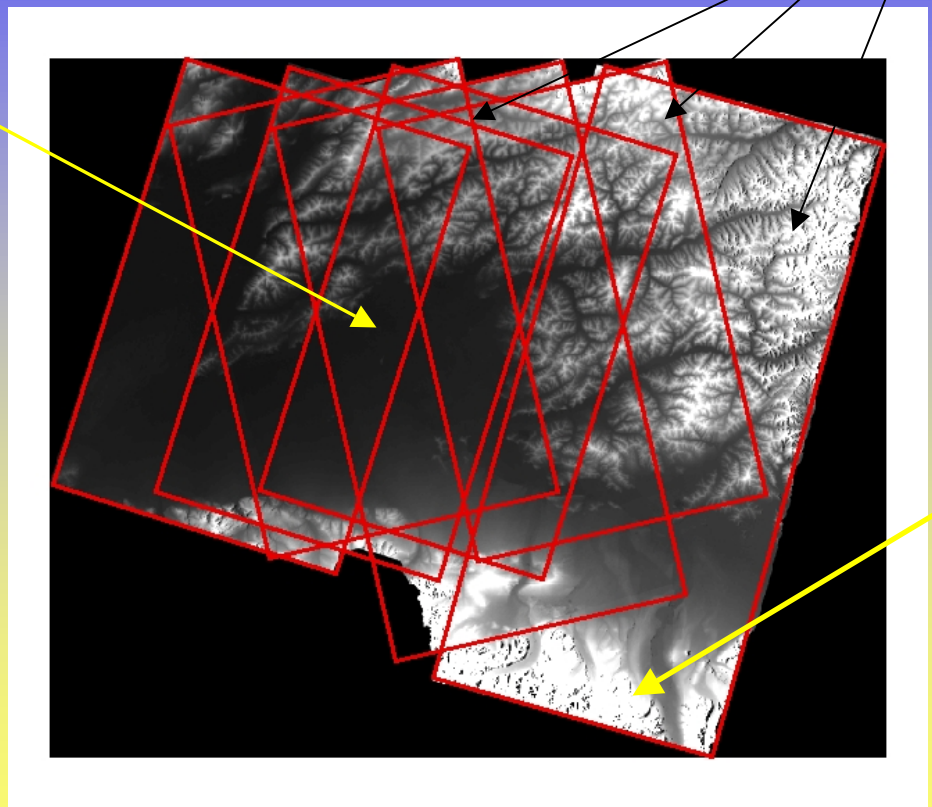
GIS at ASF: a tool for addressing spatial data challenges

- Fairbanks DEM
- Tanana Crossing
- MatSu DEM
- Various user questions
- N60 Tandem coverage
- IceSAT
- Texas corner reflectors

Fairbanks DEM input coverage

ERS orbit swaths

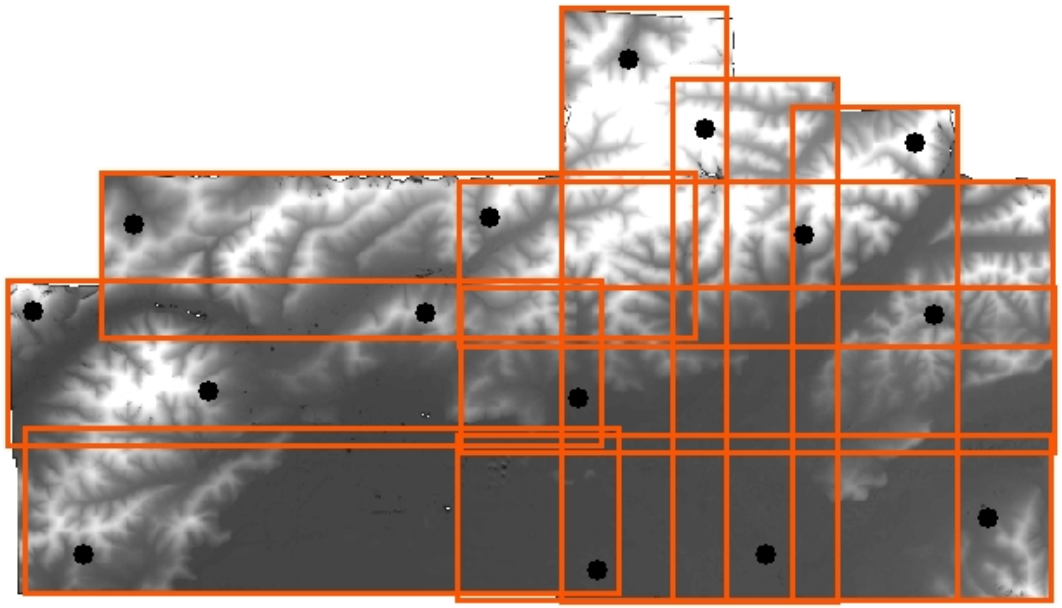
"deeper" input coverage improves results



Fewer input layers, more noise in results

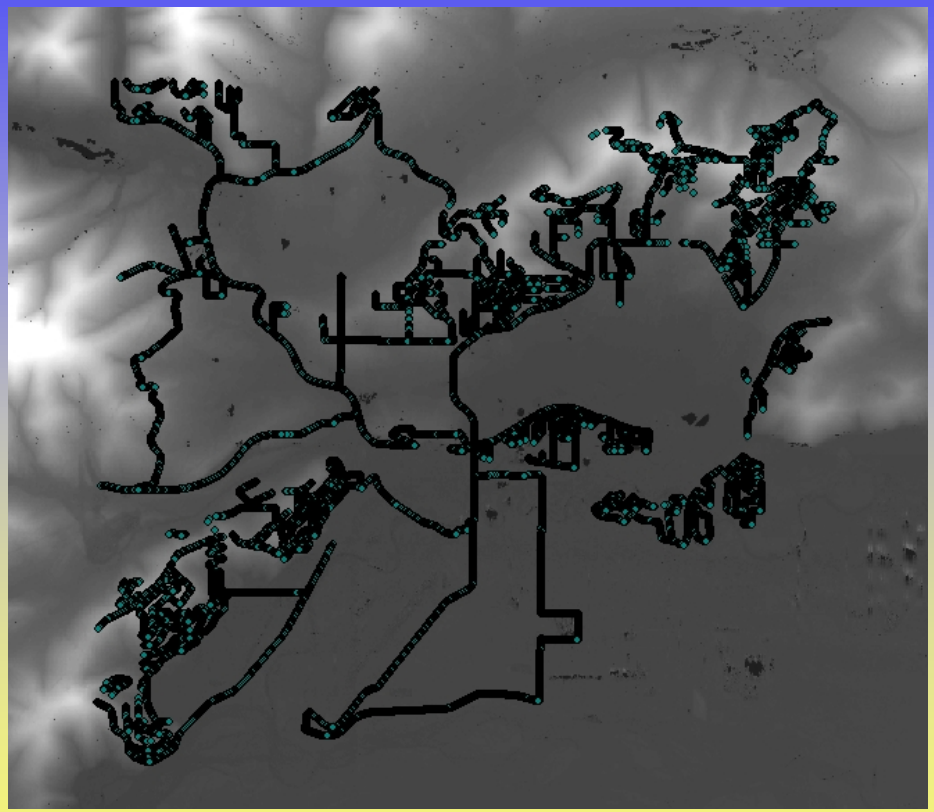
GIS allows multiple layers, in any combination, to be viewed at once

AIRSAR with GCPs



- 13 AIRSAR strips combined as DEM/AMP mosaic of Fairbanks area
- Ground control points chosen for distribution, dual use, and accessibility
- GIS allows scrutiny of individual raster inputs, potential GCP locations, and “big picture” coverage

DEM & GPS height comparison



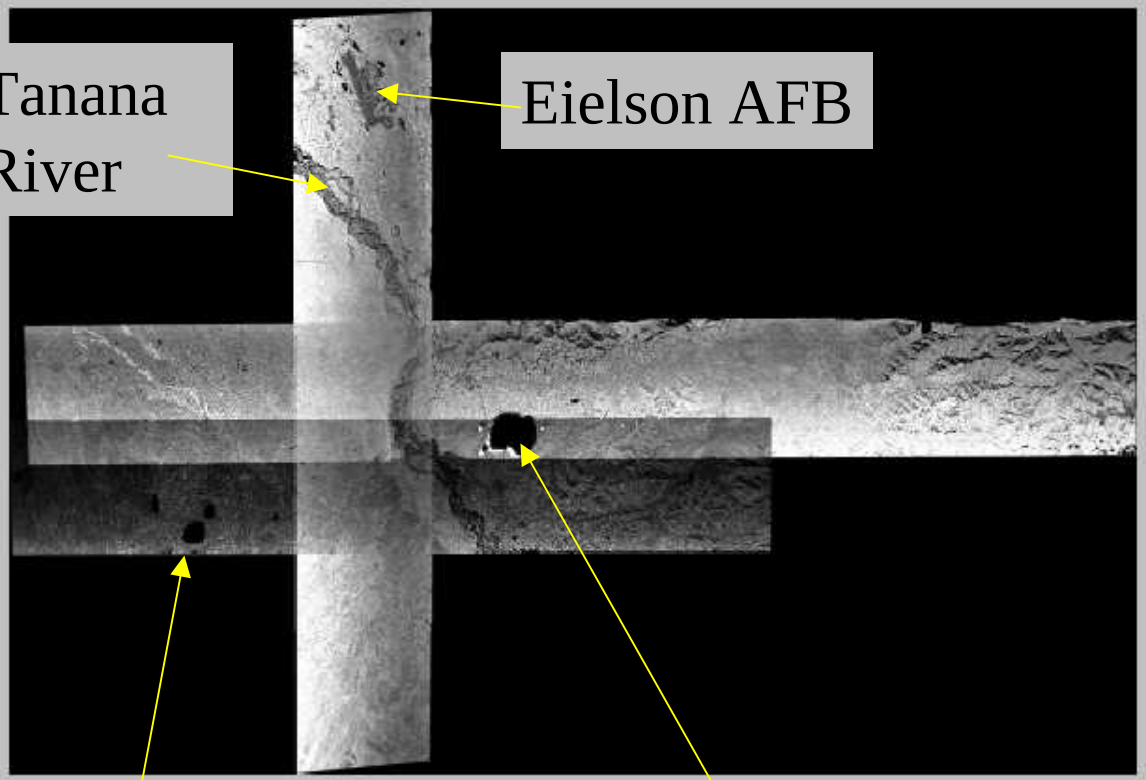
- 30,000+ GPS points collected by DNR
- Diff. Corrected
- Compared to DEM height using ArcInfo

1. .tif → GRID
2. real → integer
3. GRID → polygon
4. Arc: identity point poly outcov

*Recent improvement: “Pixel Value to Point” ArcMap extension

Tanana Crossing Project

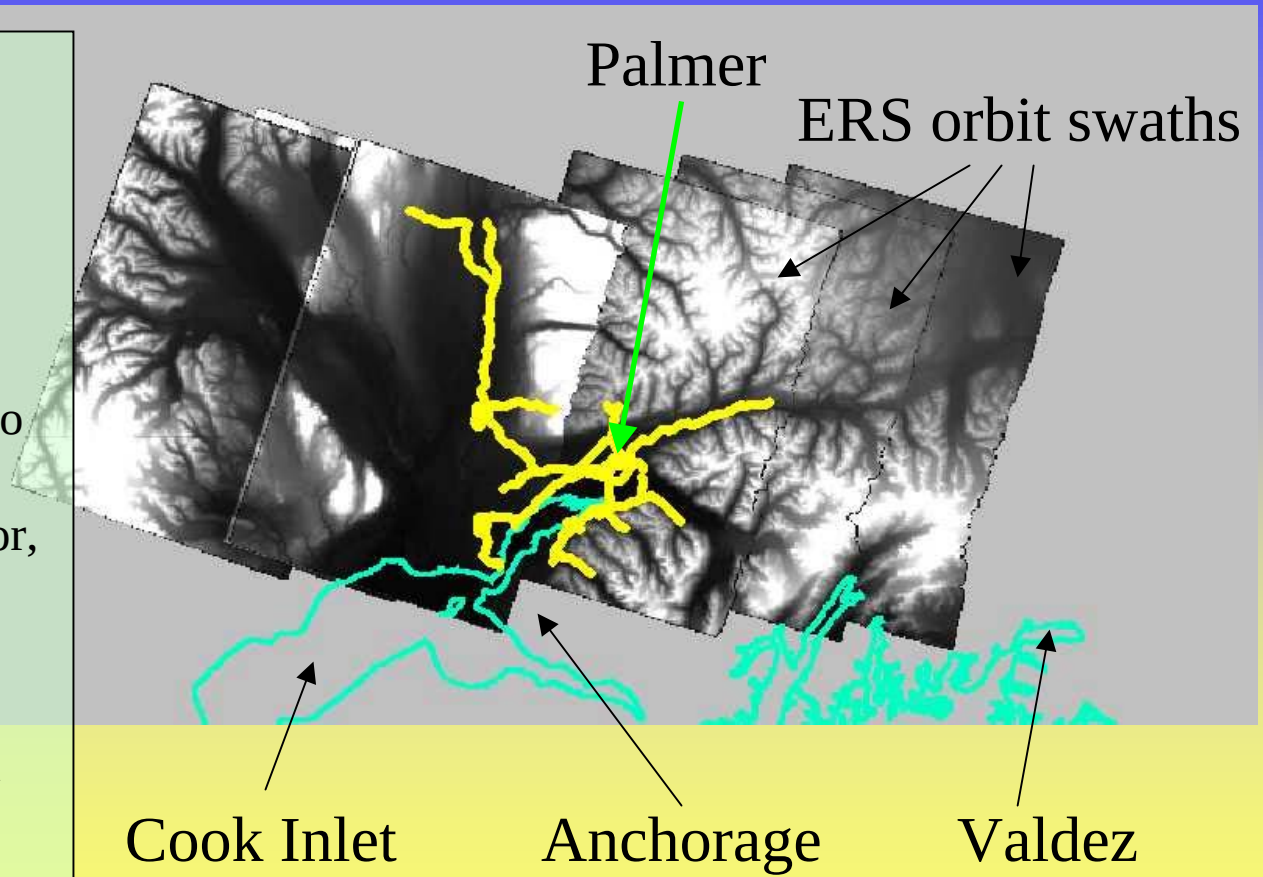
(a.k.a. "THE BLAIR LAKES PROJECT")



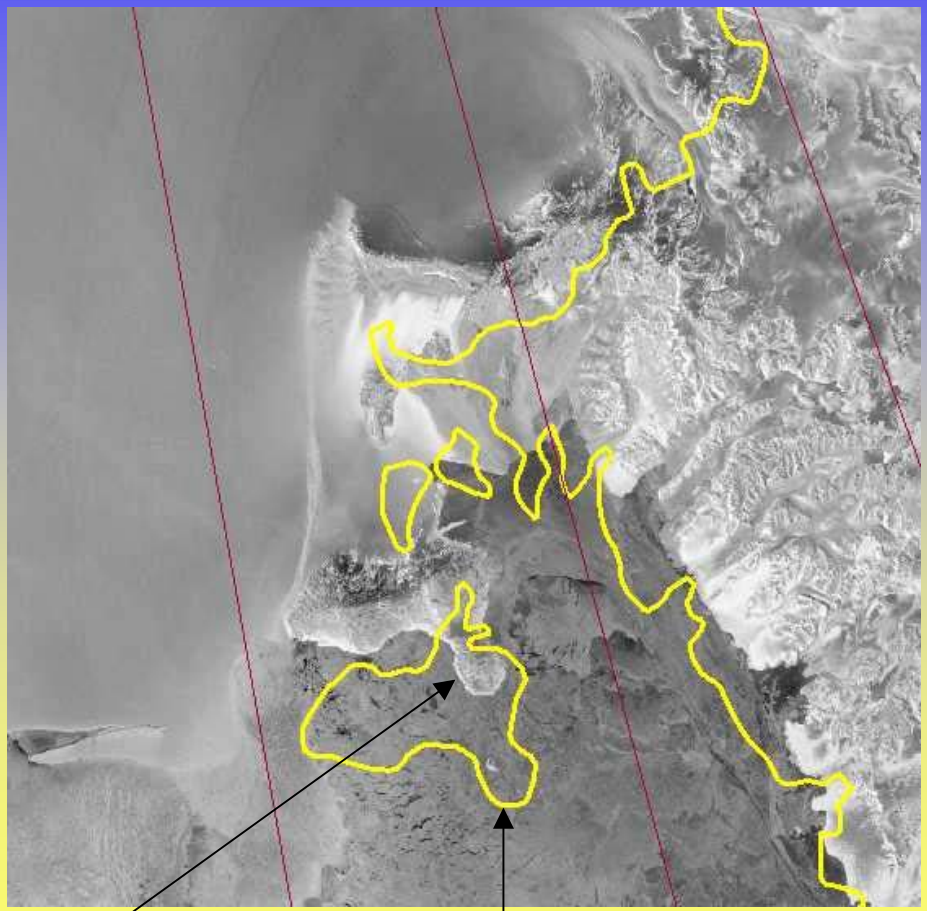
- Support of UAF Geol. Eng. Dept.
- DoD plan to cross the Tanana River at Flag Hill by Harding Lake, to reach Blair Lakes training area
- Four AIRSAR DEM/AMP strips
- DEM "voids" were problematic for customer; filled with ArcView script
- GPS collected by customer

MatSu DEM Project

- ERS Tandem Mission DEM mosaic generated for the Matanuska-Susitna Borough
- 11 input DEMs
- 60,000+ DGPS points used to evaluate the output DEM (DEM raster to polygon vector, identity with GPS heights)
- ArcGIS enabled easy transformation of layers from various sources to a common map projection



User Questions

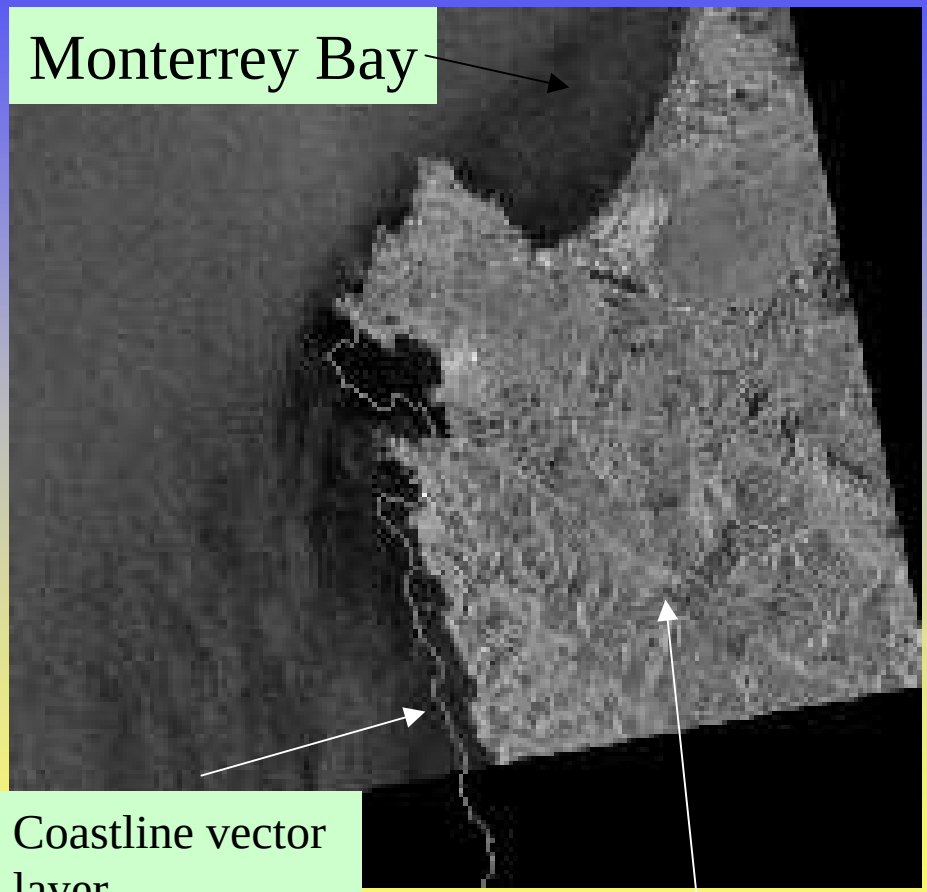


- ASF User reported misalignment between the RADARSAT Antarctic Mapping Project data and other GIS layers

- ArcGIS allowed comparison of the data with stock vector layers (lat/lon, coastline), reproducing User experience

- Error probably lies in polarstereographic projection definition, (latitude of true scale = 90?)

User Questions



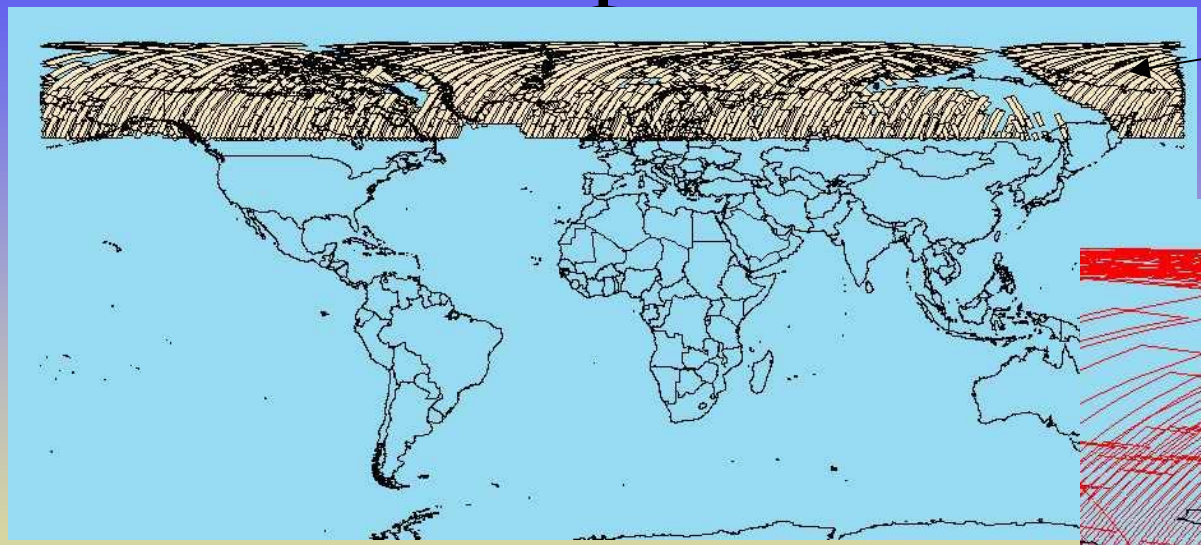
- ASF User reported geocoding problem with ASF RADARSAT data, misalignment with vector coastline file
- Discussed post-processing of SAR by User; ASF tool versions
- SAR data and coastline file (.asc) sent to ASF
- MATLAB coastline converted to ESRI point vectors, then to lines
- Observed agreement between SAR data and coastline when compared at ASF

User Questions

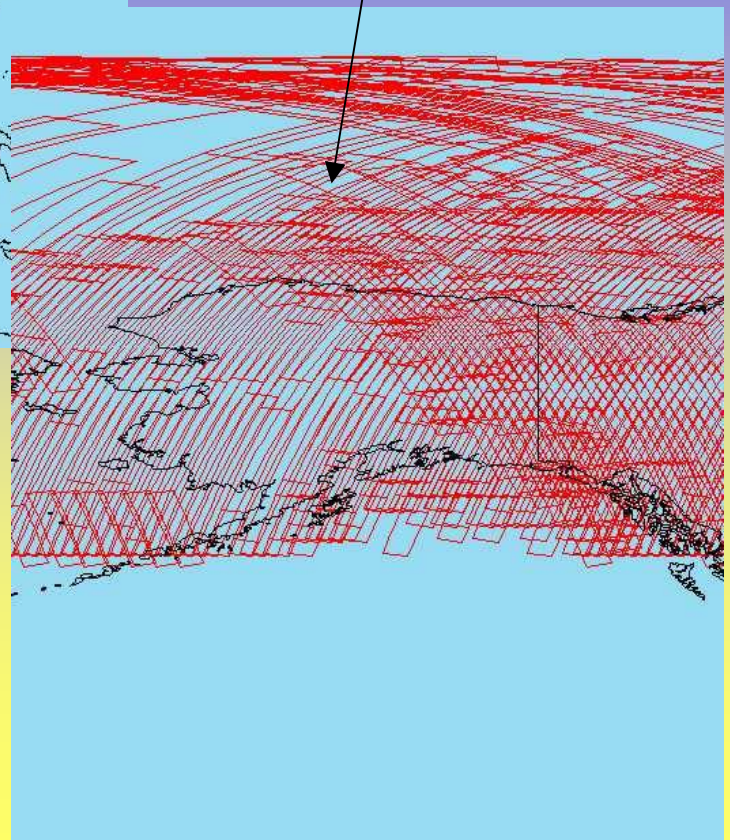
- Observed agreement between SAR data and coastline when compared at ASF (within SAR geolocation spec)

- Error probably in User's generation of coastline file from ASCII data (State Plane?)

N60 Project: ERS DEM coverage to complement SRTM data

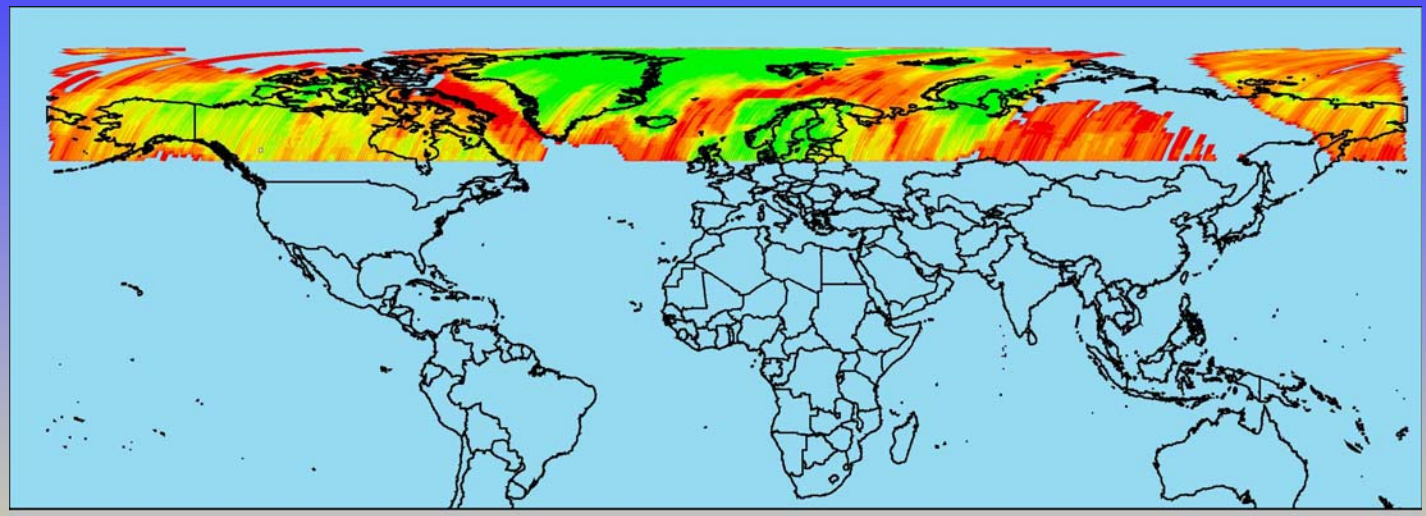


ERS Tandem Mission swaths above 55N



Challenge: How many ERS tandem pairs at a given point?

N60 Project: Tandem coverage

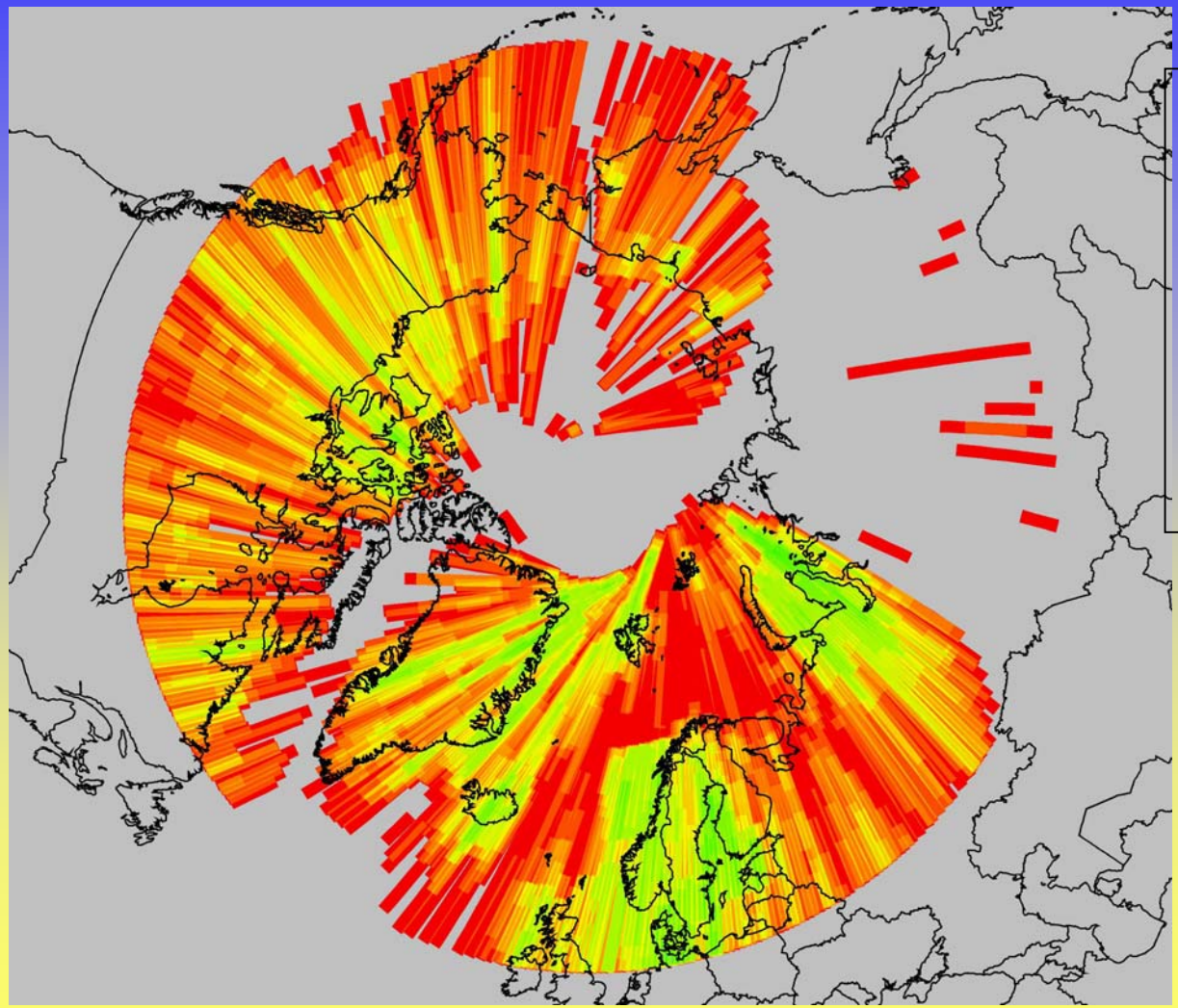


Tandem Pair Depth
Bperp < 350m

1	9 - 10
2	11 - 12
3 - 4	13 - 14
5 - 6	15 - 16
7 - 8	17 - 18
	19 - 71

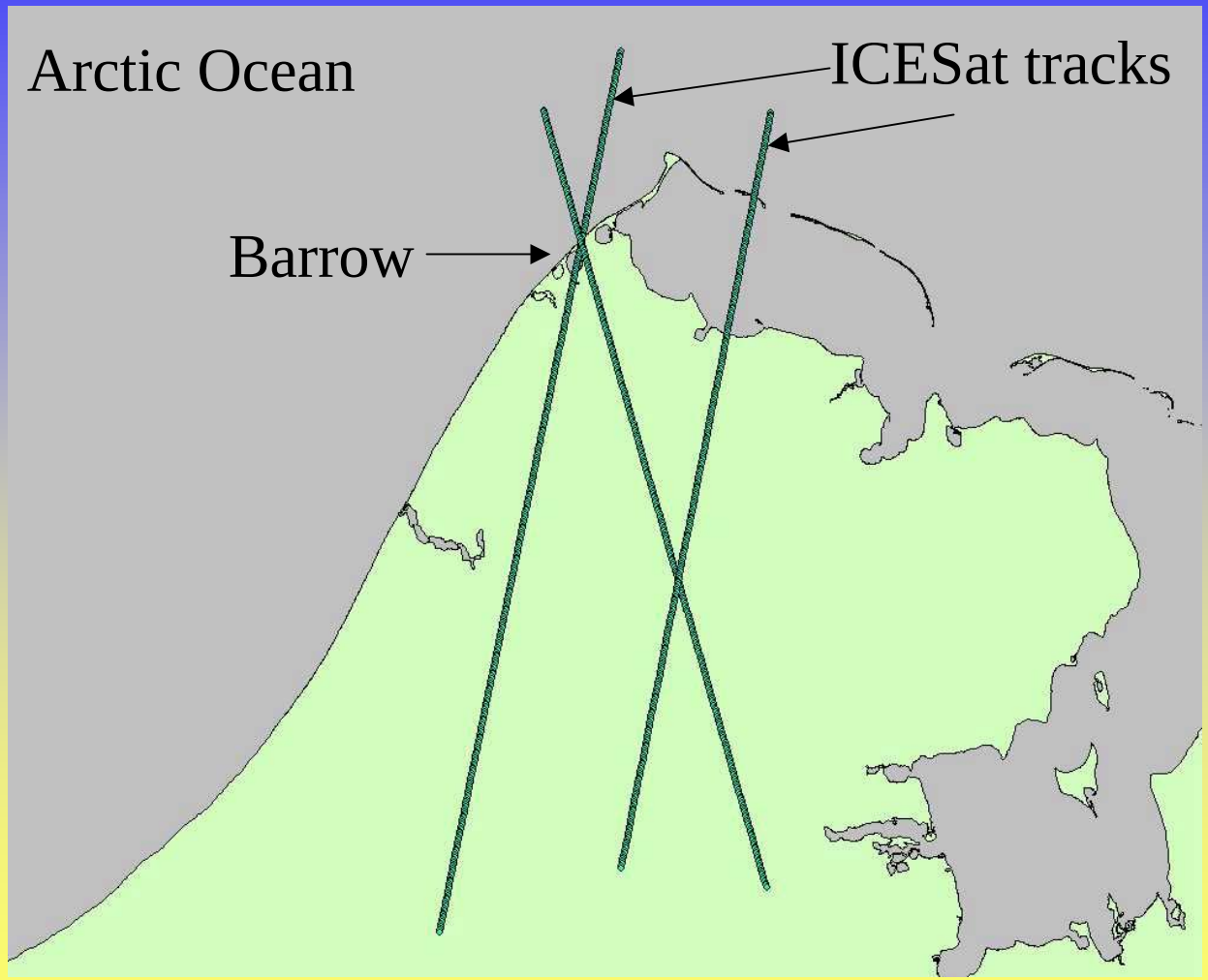
- ArcInfo “regionpolycount” demonstrated by Dave Verbyla (UAF SALRM)
- Bona fide GIS analysis to reveal new info.

N60 Project: Tandem coverage

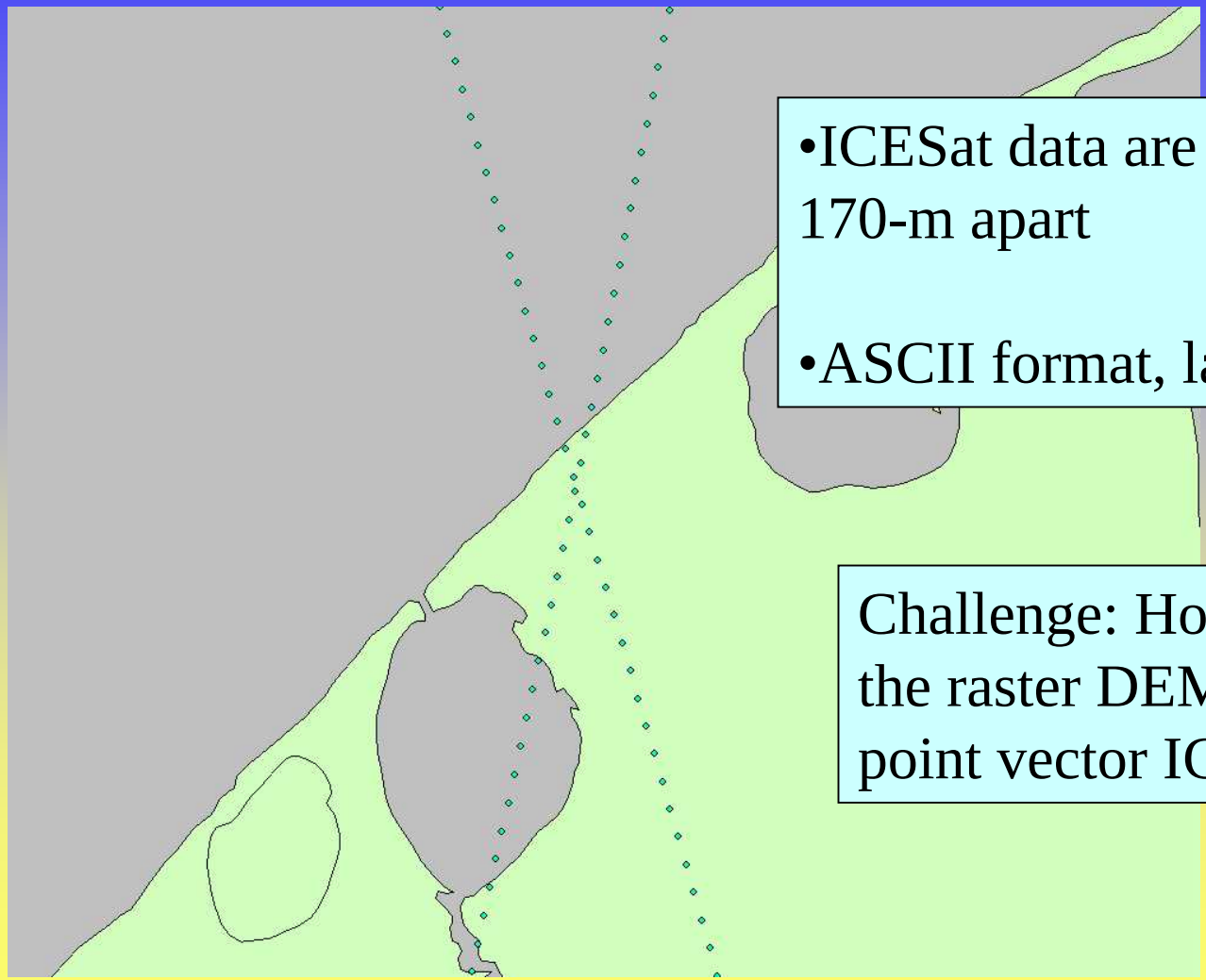


- Polarstereo view is preferable, in progress
- Reveals gap over Siberia

ICESat: vector to raster



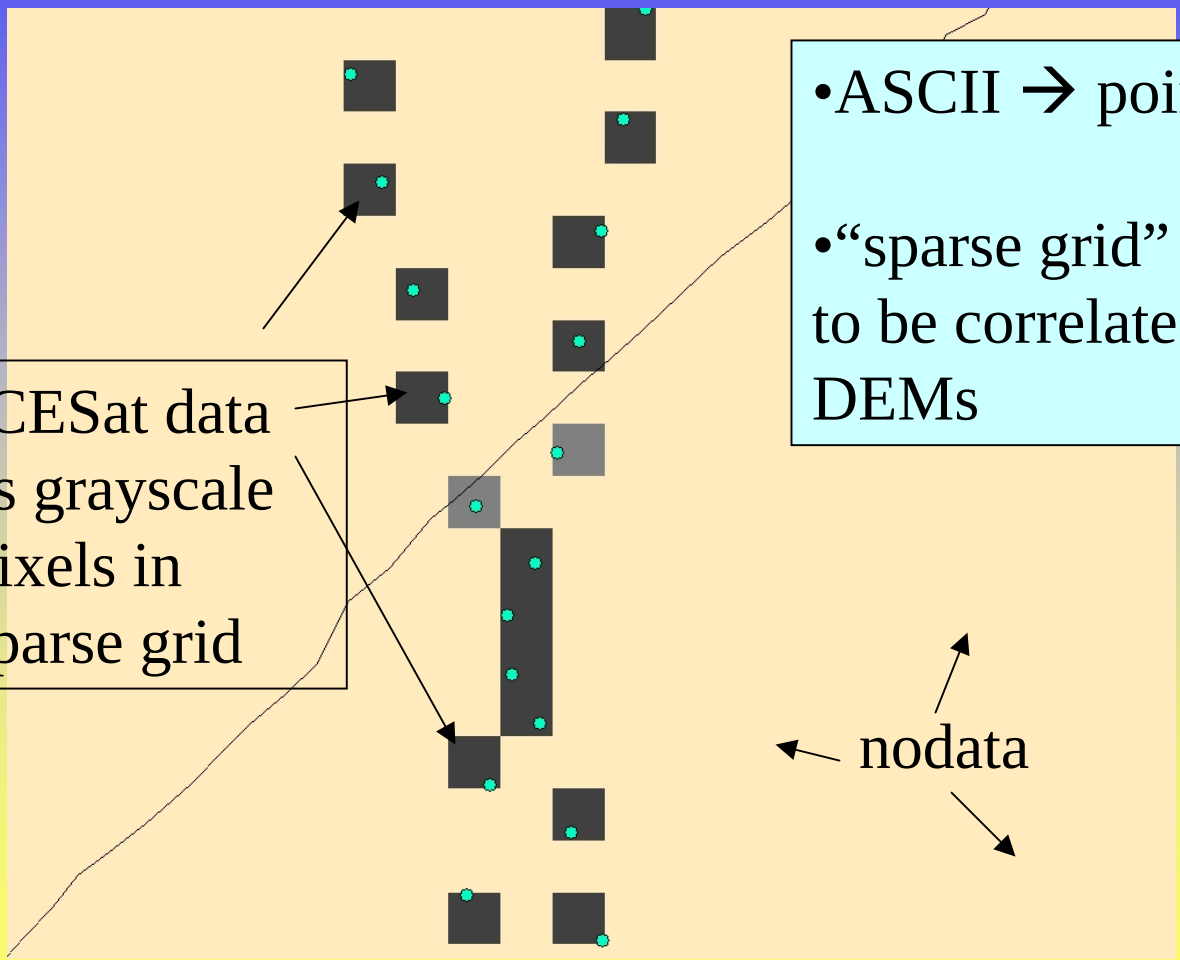
ICESat: vector to raster



- ICESat data are points about 170-m apart
- ASCII format, lat/lon/elev

Challenge: How to coregister the raster DEMs with the point vector ICESat data?

ICESat: vector to raster

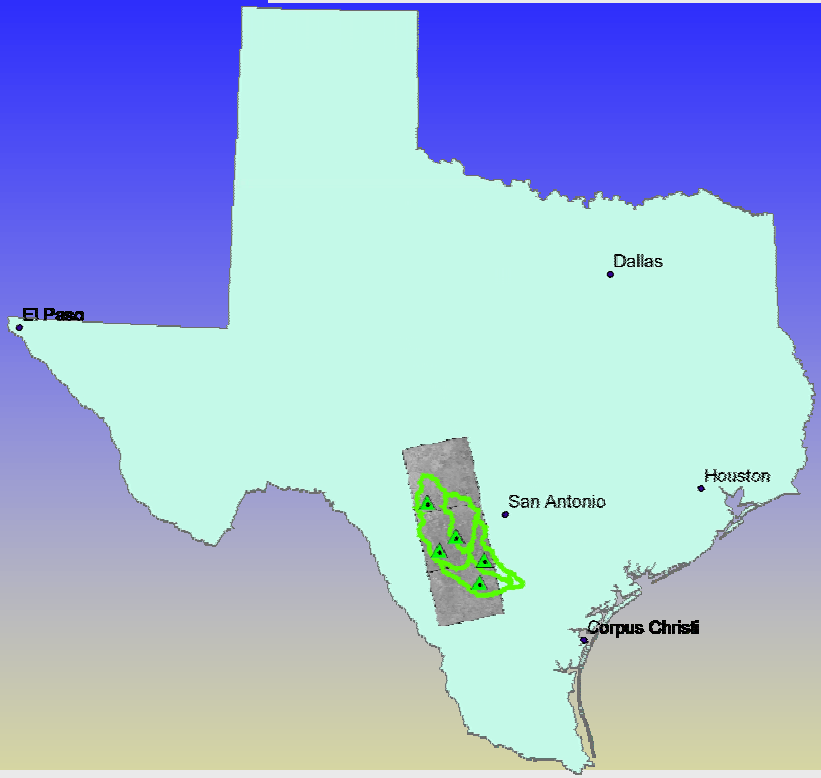


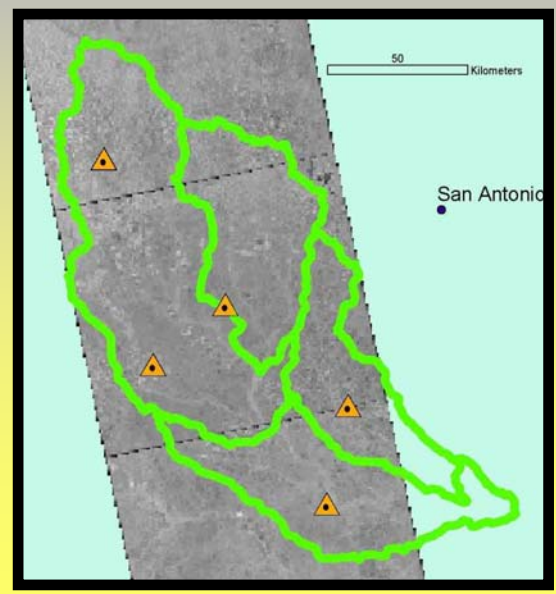
ICESat data as grayscale pixels in sparse grid

nodata

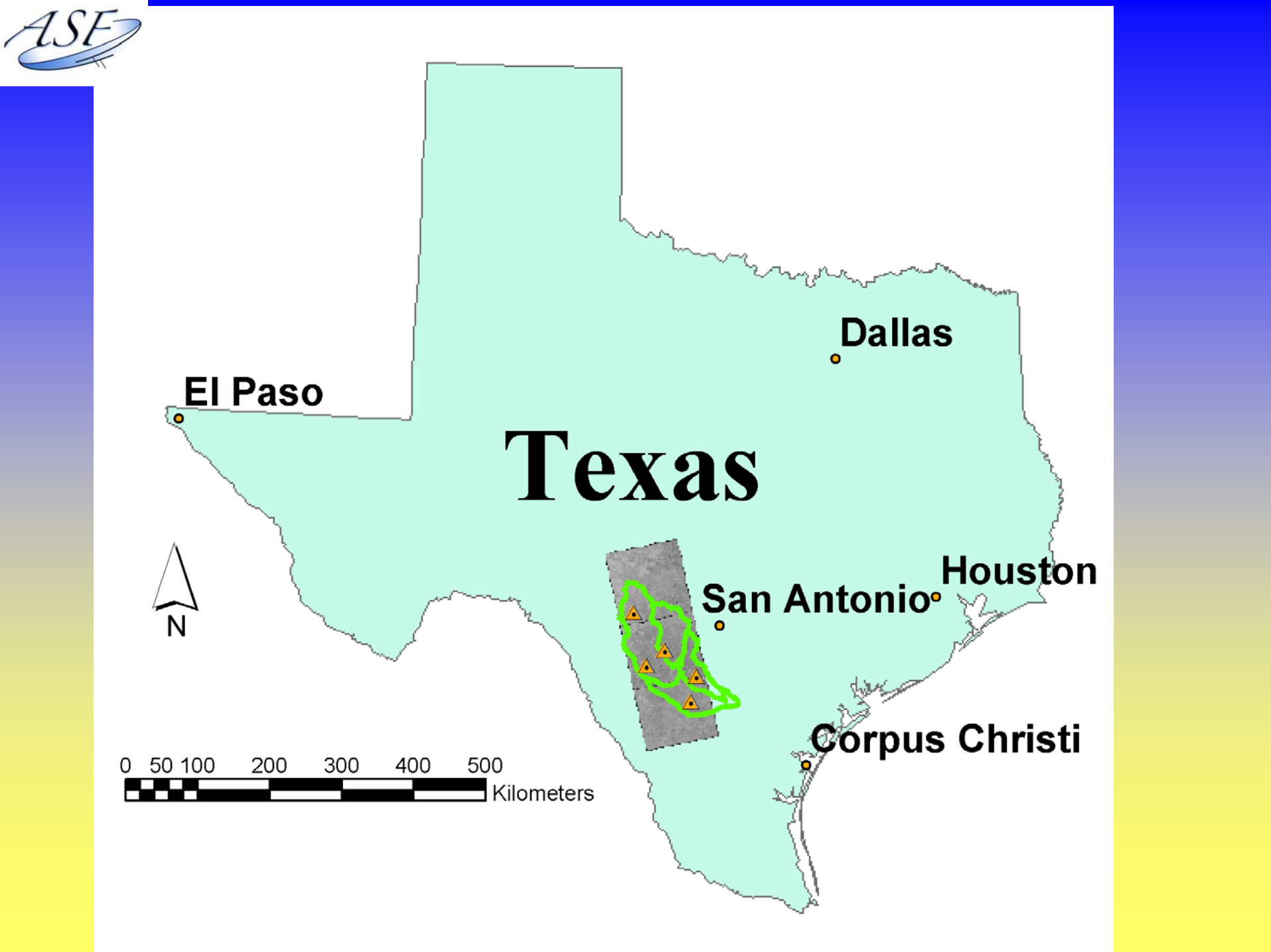
- ASCII → points.shp → raster
- "sparse grid" of ICESat elevations to be correlated with raster InSAR DEMs

Texas Corner Reflector Array

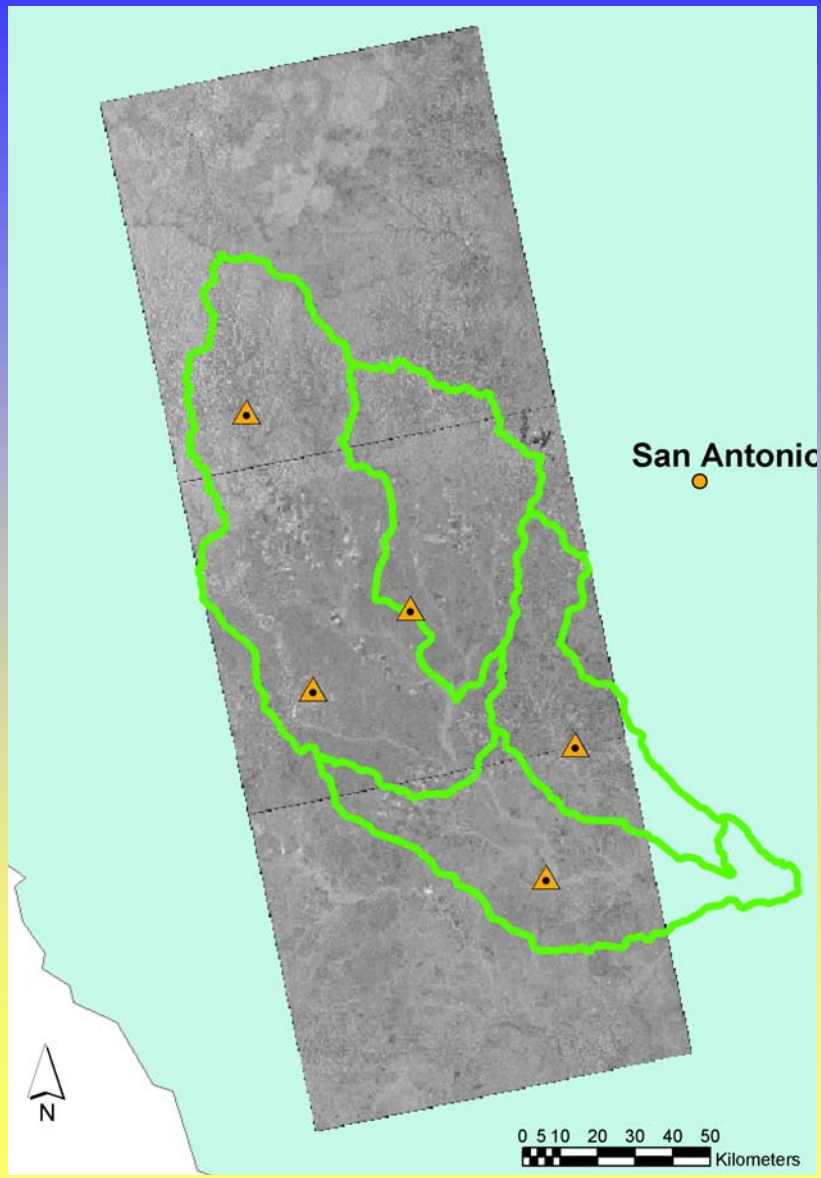


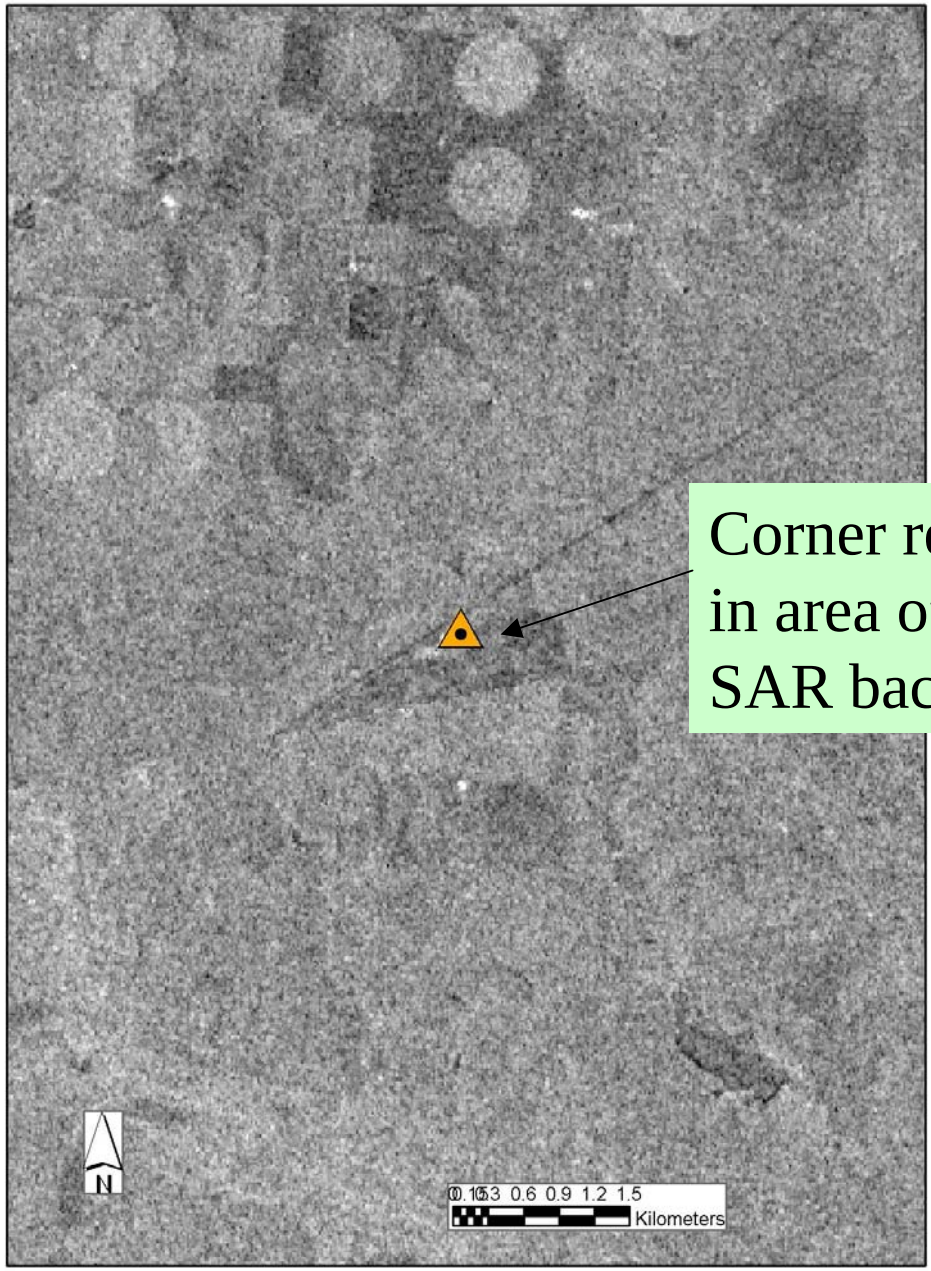


- Five ASF trihedral reflectors installed April 2004
- Dr. Ni-Bin Chang, Texas A&M Univ.- Kingsville
- RADARSAT ST1, Apr04 - May05
- Soil moisture modeling in watershed above Choke Canyon reservoir
- Array provides absolute and relative geolocation accuracy


Dallas
El Paso
Texas
Houston
San Antonio
N
Corpus Christi
0 50 100 200 300 400 500
Kilometers

Choke Canyon Reservoir Watershed





Corner reflector placed in area of relative dark SAR background

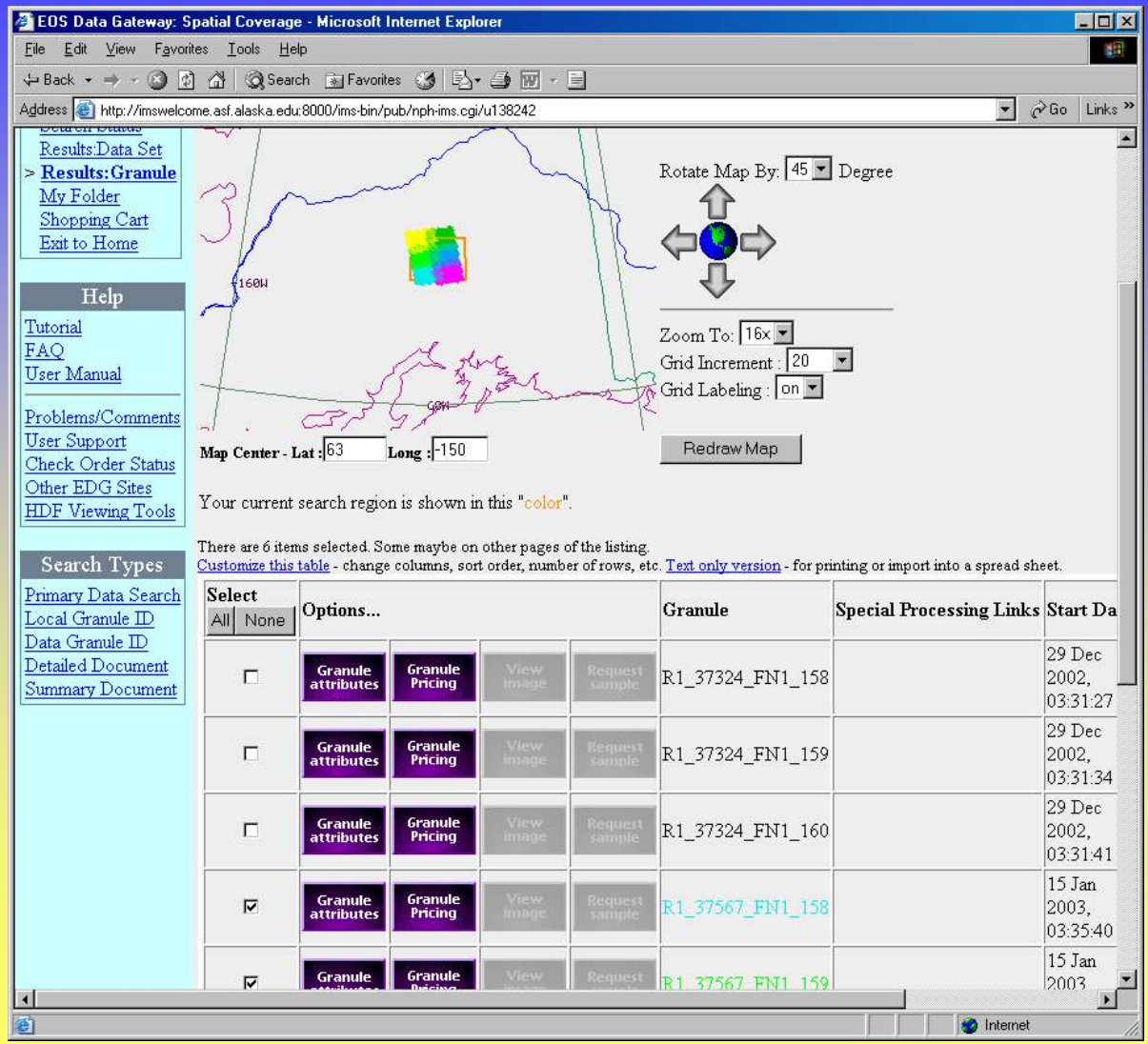
CCRW - North

CCRW - South

GIS at ASF: What's next?

- Operations QC– coastline overlay to reveal product anomalies
- Geotiffs from ASF, via tools or as image product format
- EDG2SHP

EDG2SHP



- ASF User Working Group recommendation to "improve users' ability to see what SAR data is available"; EDG "deemed not suitable"
- ASF Forum suggestion for shapefiles of frames

Customize EDG results

edg_frame_corners.txt - Notepad

File Edit Format Help

Granule	Start Date	Area Coverage
R1_39654_ST5_152	10 Jun 2003, 04:16:42	61.20 Lat, -160.58 Lon; 61.34 Lat, -158.69 Lon; 60.37 Lat, -158.34 Lon; 60.23 Lat, -160.18 Lon;
R1_39654_ST5_153	10 Jun 2003, 04:16:49	61.59 Lat, -160.75 Lon; 61.73 Lat, -158.83 Lon; 60.76 Lat, -158.48 Lon; 60.62 Lat, -160.34 Lon;
R1_39754_ST4_152	17 Jun 2003, 04:12:32	61.19 Lat, -160.46 Lon; 61.34 Lat, -158.57 Lon; 60.38 Lat, -158.20 Lon; 60.23 Lat, -160.03 Lon;
R1_39754_ST4_153	17 Jun 2003, 04:12:38	61.58 Lat, -160.64 Lon; 61.73 Lat, -158.73 Lon; 60.77 Lat, -158.35 Lon; 60.62 Lat, -160.20 Lon;
R1_39854_ST3_153	24 Jun 2003, 04:08:27	61.57 Lat, -160.42 Lon; 61.74 Lat, -158.51 Lon; 60.77 Lat, -158.11 Lon; 60.61 Lat, -159.96 Lon;
R1_39976_ST1_296	02 Jul 2003, 17:16:48	62.11 Lat, -159.92 Lon; 61.90 Lat, -158.04 Lon; 60.95 Lat, -158.60 Lon; 61.15 Lat, -160.42 Lon;
R1_39976_ST1_297	02 Jul 2003, 17:16:55	61.72 Lat, -160.13 Lon; 61.51 Lat, -158.27 Lon; 60.56 Lat, -158.82 Lon; 60.76 Lat, -160.62 Lon;
R1_39976_ST1_298	02 Jul 2003, 17:17:02	61.34 Lat, -160.33 Lon; 61.13 Lat, -158.50 Lon; 60.19 Lat, -159.04 Lon; 60.38 Lat, -160.82 Lon;
R1_40197_ST3_153	18 Jul 2003, 04:08:22	61.57 Lat, -160.41 Lon; 61.74 Lat, -158.50 Lon; 60.77 Lat, -158.10 Lon; 60.61 Lat, -159.95 Lon;
R1_40233_ST7_297	20 Jul 2003, 16:51:52	61.73 Lat, -161.89 Lon; 61.63 Lat, -159.98 Lon; 60.66 Lat, -160.29 Lon; 60.76 Lat, -162.15 Lon;
R1_40233_ST7_298	20 Jul 2003, 16:51:58	61.33 Lat, -162.00 Lon; 61.23 Lat, -160.11 Lon; 60.26 Lat, -160.42 Lon; 60.36 Lat, -162.25 Lon;
R1_40276_ST5_297	23 Jul 2003, 17:04:25	61.73 Lat, -162.00 Lon; 61.59 Lat, -160.09 Lon; 60.62 Lat, -160.50 Lon; 60.76 Lat, -162.34 Lon;
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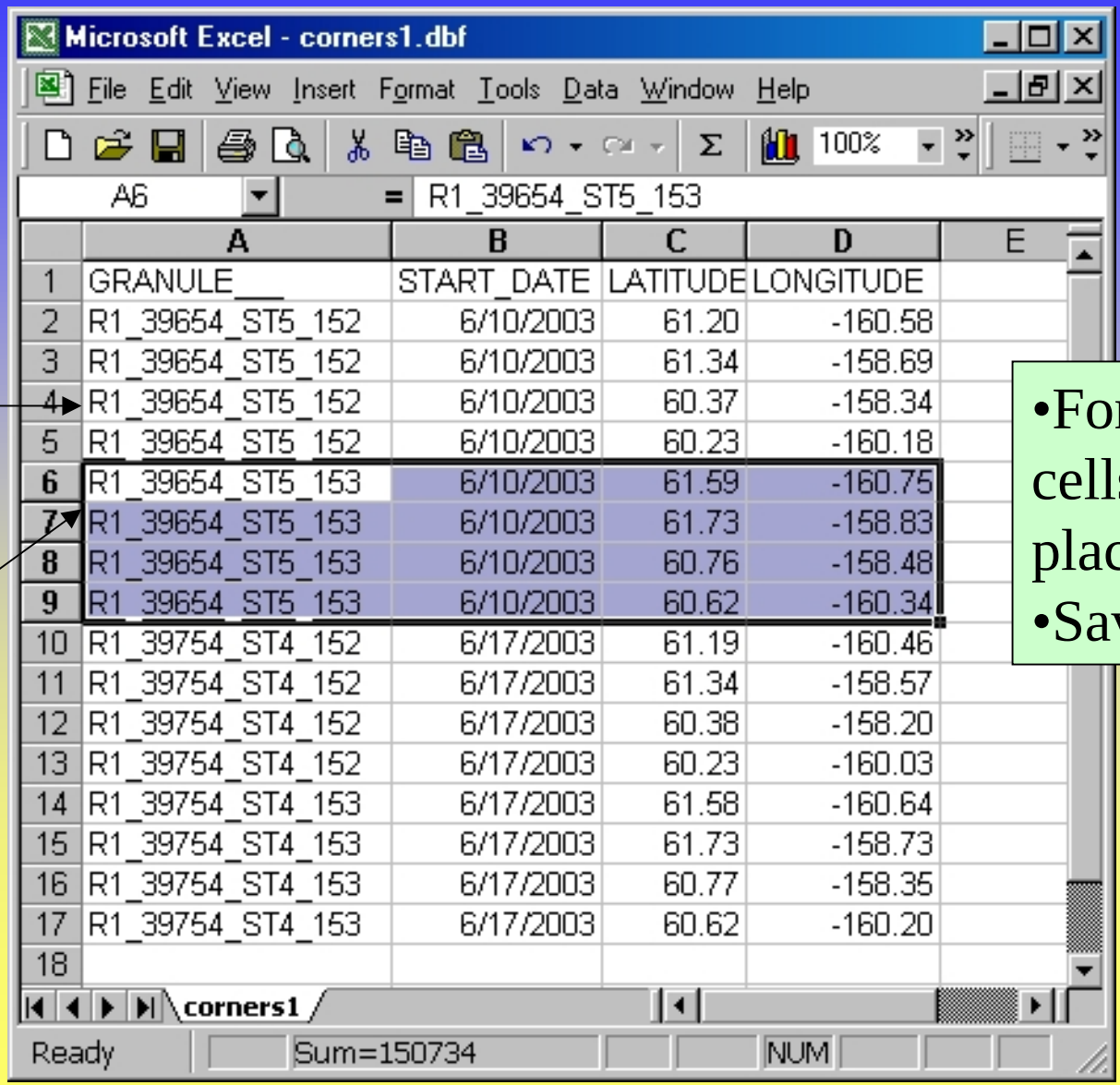
R1_40340_ST3_152	28 Jul 2003, 04:16:39	61.17 Lat, -162.29 Lon; 61.34 Lat, -160.40 Lon; 60.37 Lat, -160.01 Lon; 60.21 Lat, -161.83 Lon;
R1_40340_ST3_153	28 Jul 2003, 04:16:46	61.57 Lat, -162.48 Lon; 61.74 Lat, -160.57 Lon; 60.77 Lat, -160.17 Lon; 60.61 Lat, -162.02 Lon;
R1_40419_ST2_296	02 Aug 2003, 17:12:36	62.11 Lat, -160.17 Lon; 61.92 Lat, -158.28 Lon; 60.97 Lat, -158.81 Lon; 61.16 Lat, -160.64 Lon;
R1_40419_ST2_297	02 Aug 2003, 17:12:42	61.72 Lat, -160.36 Lon; 61.54 Lat, -158.50 Lon; 60.58 Lat, -159.02 Lon; 60.77 Lat, -160.82 Lon;
R1_40419_ST2_298	02 Aug 2003, 17:12:49	61.33 Lat, -160.55 Lon; 61.15 Lat, -158.71 Lon; 60.19 Lat, -159.22 Lon; 60.37 Lat, -161.00 Lon;
R1_40476_ST5_298	06 Aug 2003, 16:56:05	61.34 Lat, -160.03 Lon; 61.20 Lat, -158.15 Lon; 60.23 Lat, -158.55 Lon; 60.37 Lat, -160.37 Lon;
R1_40562_ST1_296	12 Aug 2003, 17:20:55	62.11 Lat, -160.99 Lon; 61.90 Lat, -159.12 Lon; 60.95 Lat, -159.69 Lon; 61.15 Lat, -161.50 Lon;
R1_40562_ST1_297	12 Aug 2003, 17:21:02	61.72 Lat, -161.20 Lon; 61.51 Lat, -159.36 Lon; 60.57 Lat, -159.91 Lon; 60.76 Lat, -161.70 Lon;
R1_40562_ST1_298	12 Aug 2003, 17:21:09	61.34 Lat, -161.40 Lon; 61.14 Lat, -159.58 Lon; 60.19 Lat, -160.12 Lon; 60.38 Lat, -161.89 Lon;
R1_40683_ST4_152	21 Aug 2003, 04:16:36	61.19 Lat, -161.49 Lon; 61.34 Lat, -159.61 Lon; 60.38 Lat, -159.24 Lon; 60.23 Lat, -161.07 Lon;
R1_40683_ST4_153	21 Aug 2003, 04:16:43	61.58 Lat, -161.67 Lon; 61.73 Lat, -159.76 Lon; 60.77 Lat, -159.39 Lon; 60.62 Lat, -161.24 Lon;
R1_40819_ST5_298	30 Aug 2003, 16:56:05	61.34 Lat, -160.04 Lon; 61.20 Lat, -158.16 Lon; 60.23 Lat, -158.56 Lon; 60.37 Lat, -160.38 Lon;

Table not GIS ready: At least 4 delimiters; corners in one row

Format table in Excel



	A	B	C	D	E
1	GRANULE___	START_DATE	LATITUDE	LONGITUDE	
2	R1_39654_ST5_152	6/10/2003	61.20	-160.58	
3	R1_39654_ST5_152	6/10/2003	61.34	-158.69	
4	R1_39654_ST5_152	6/10/2003	60.37	-158.34	
5	R1_39654_ST5_152	6/10/2003	60.23	-160.18	
6	R1_39654_ST5_153	6/10/2003	61.59	-160.75	
7	R1_39654_ST5_153	6/10/2003	61.73	-158.83	
8	R1_39654_ST5_153	6/10/2003	60.76	-158.48	
9	R1_39654_ST5_153	6/10/2003	60.62	-160.34	
10	R1_39754_ST4_152	6/17/2003	61.19	-160.46	
11	R1_39754_ST4_152	6/17/2003	61.34	-158.57	
12	R1_39754_ST4_152	6/17/2003	60.38	-158.20	
13	R1_39754_ST4_152	6/17/2003	60.23	-160.03	
14	R1_39754_ST4_153	6/17/2003	61.58	-160.64	
15	R1_39754_ST4_153	6/17/2003	61.73	-158.73	
16	R1_39754_ST4_153	6/17/2003	60.77	-158.35	
17	R1_39754_ST4_153	6/17/2003	60.62	-160.20	
18					

One corner per row

Common identifier for frame corners

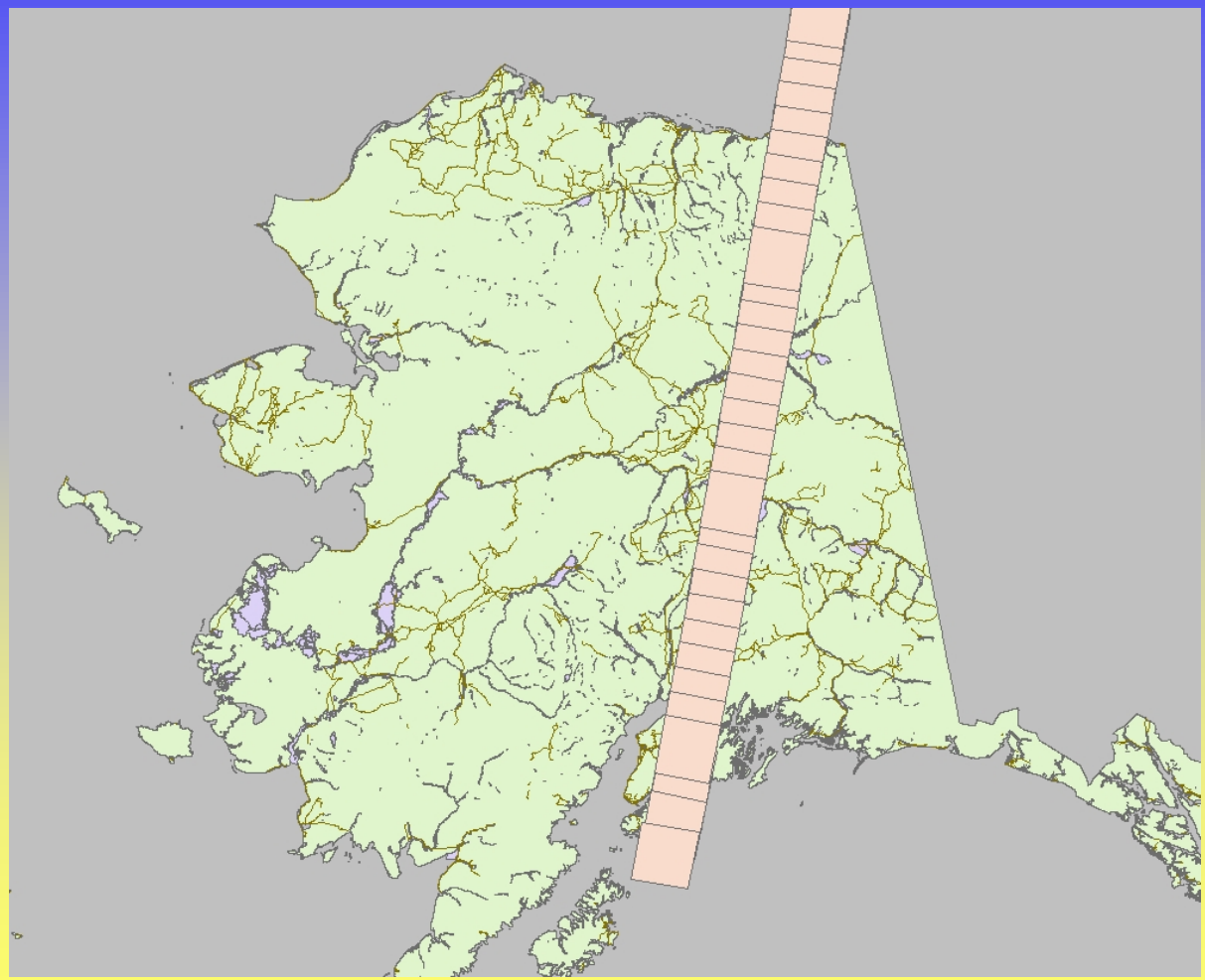
- Format lat/lon cells to 2 decimal places
- Save as .dbf

EDG2SHP

- Bring .dbf table into ArcView
- Add points as event theme
- Convert event theme to point shapefile
- Convert points to polylines
- Convert polylines to polygons
- Link to original table to recover attributes

A GIS-ready representation of your ASF frames!

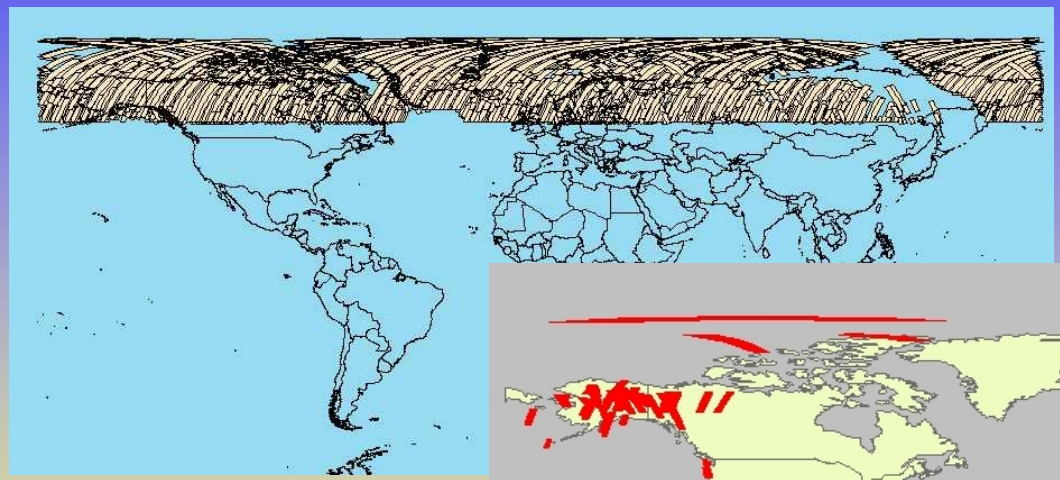
EDG2SHP

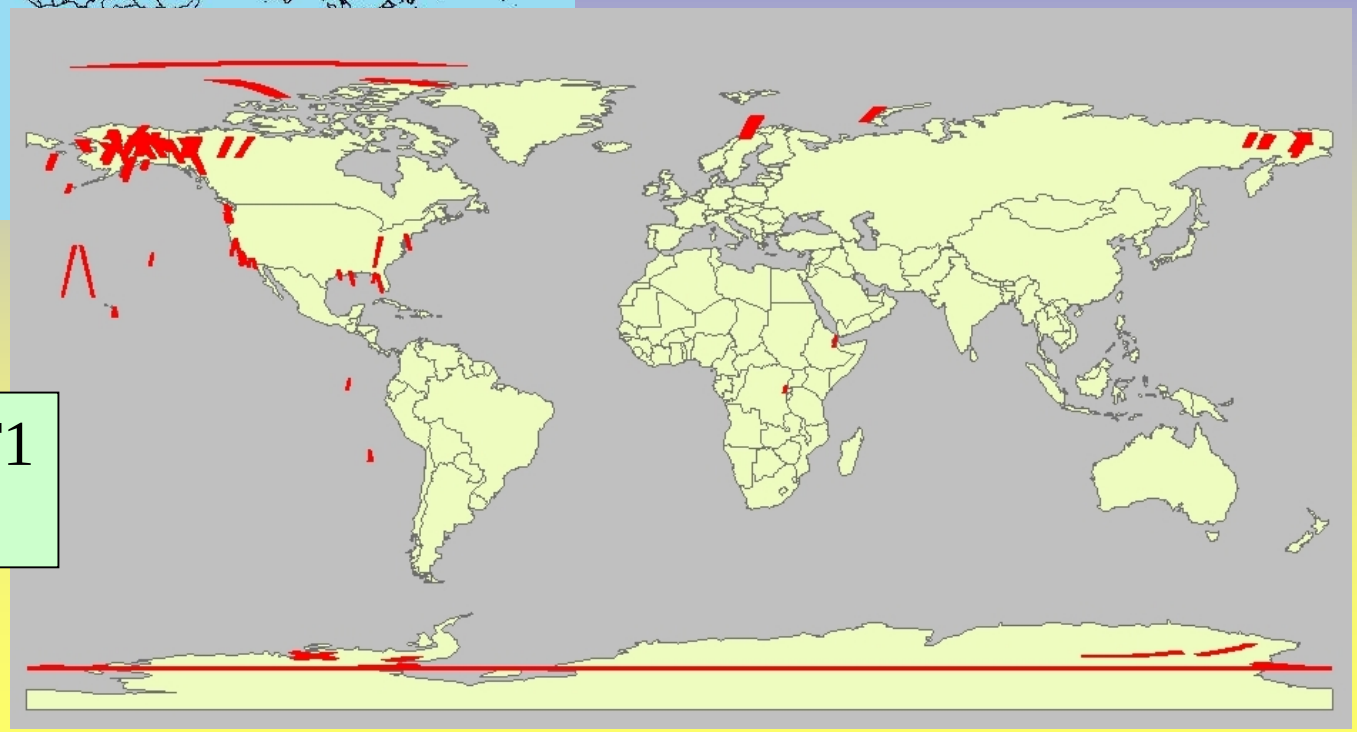


EDG2SHP

- Very manual solution, useful for short list of frames
- Excel macro or shell script to format table to .dbf is helpful
- Better solution needed to serve all users, all data, all searches
- Use techniques developed for N60 swaths to create shapefiles for all ASF holdings

Polygon shapefiles for all ASF archive frames





RADARSAT ST1
from Jan-01

Thanks!