SWOT Raster Product

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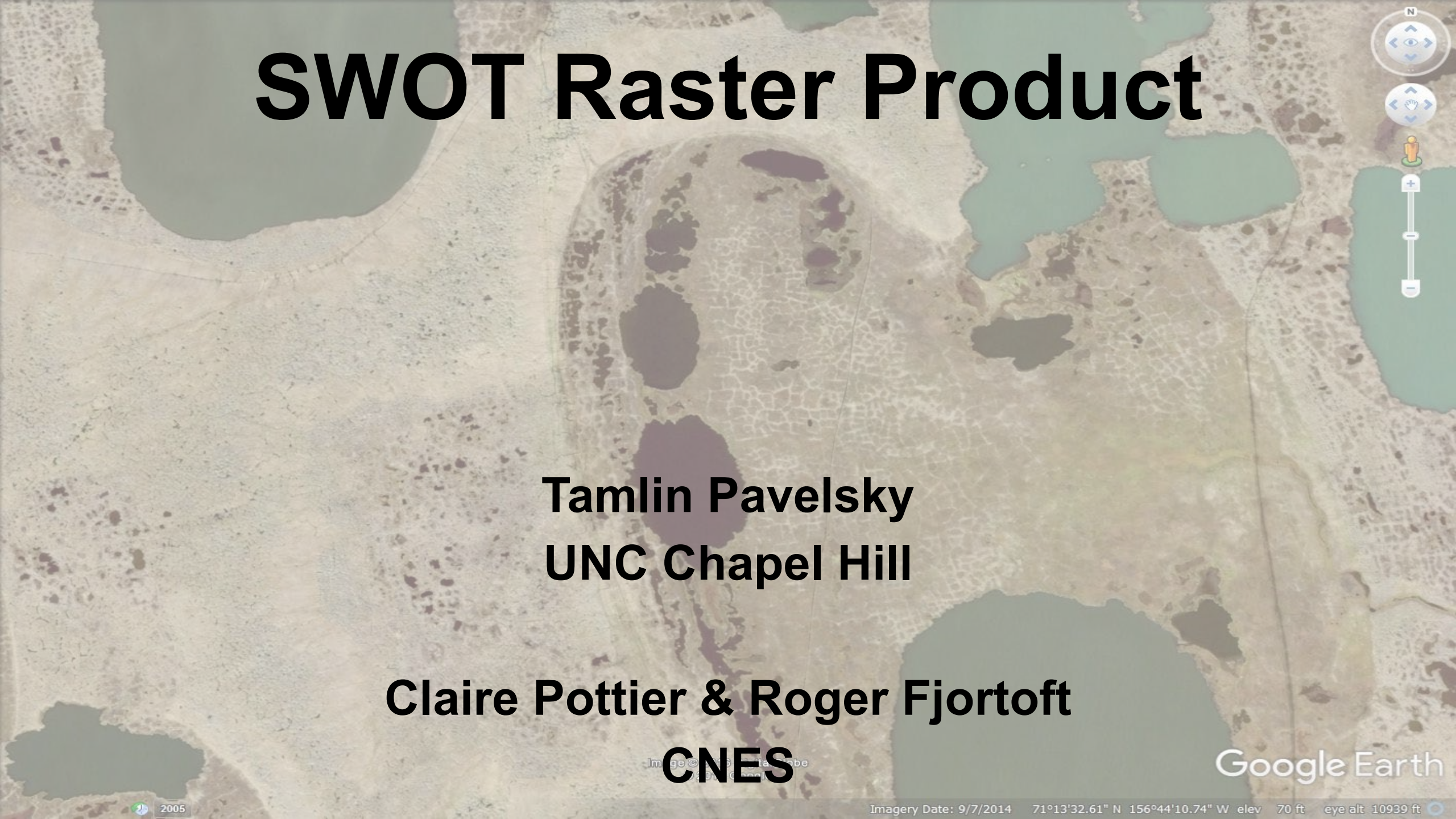
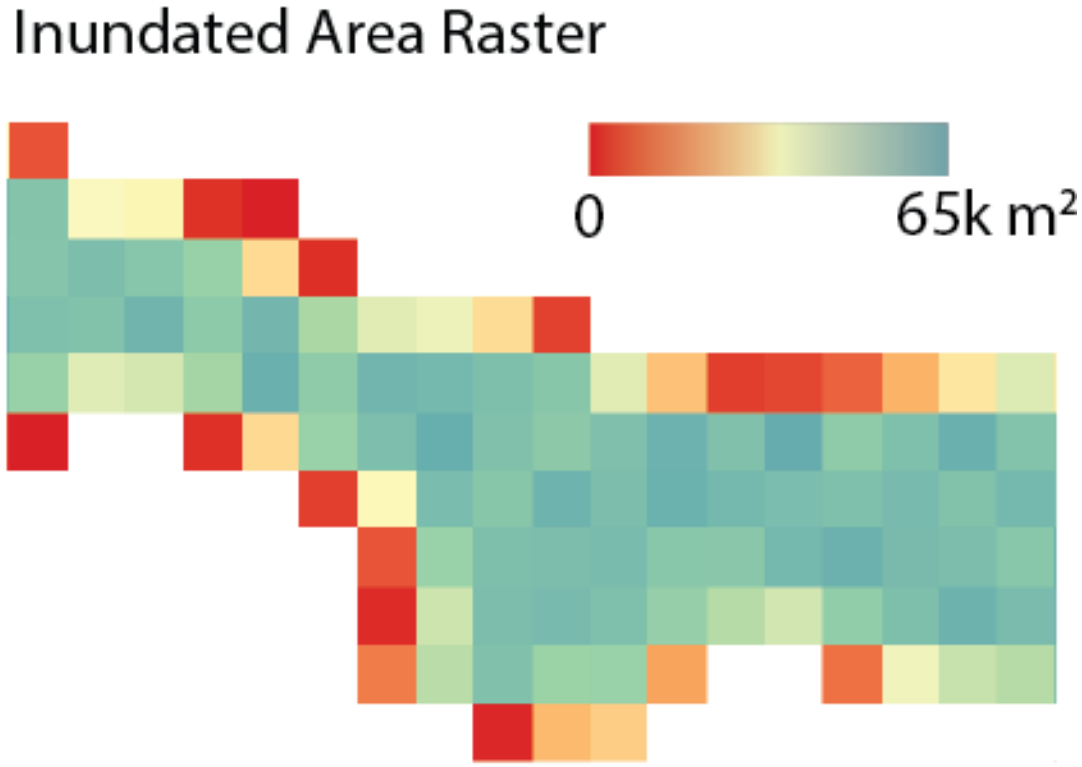


Outline

1. Raster Product Goals
2. Geographic Extent
3. Systematic vs. On Demand
4. Variable vs. Fixed Grid
5. Spatial Resolution
6. Raster Variables
7. Calculation Method(s)



Raster Product Goals

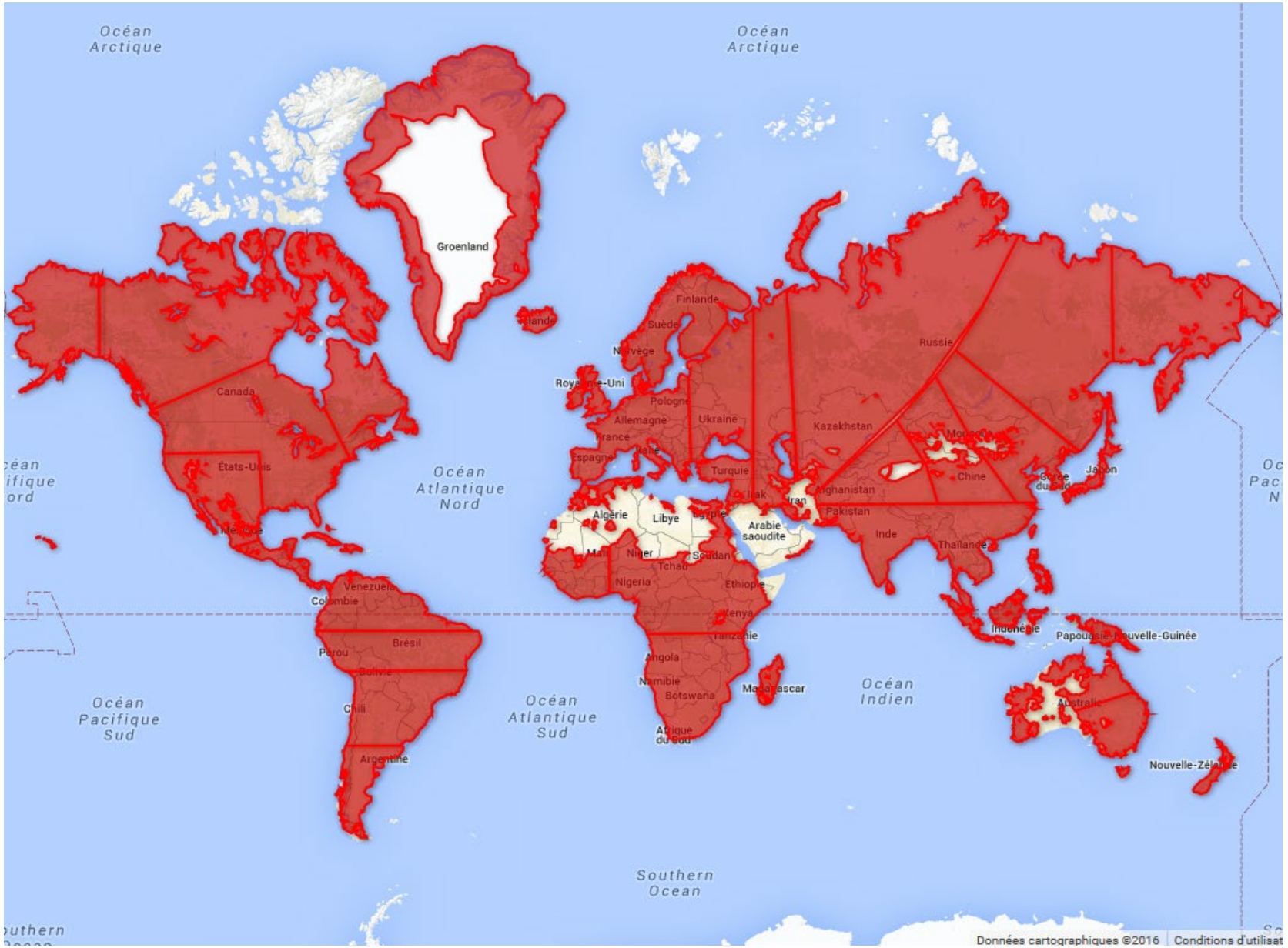
1. Provide SWOT height and inundation extent data, along with appropriate errors and flags, resampled onto a uniform grid

2. Provide a means to study complex flow environments not effectively captured by other SWOT data products (e.g. wetlands, estuaries)

3. Measure internal variability in river reaches and lakes not captured by the vector products.

4. Encode data in a format (i.e. a uniform grid) familiar to the hydrology community, making it an attractive product for many potential users.

Geographic Extent of Raster Product



The raster product will be produced or producible everywhere the pixel cloud is produced.

Tile size: the proposed tile size is ~120 x ~120 km, matching the extent of the 2-swath raster.

Proposal: data will be produced for any tile that contains detected water. If no water is detected, no data granule will be produced.

Fixed Grid vs. Variable Grid Processing

Advantages of Variable Grid

- Requires no a priori input
- Automatically adjusts to orbit variations

Advantages of Fixed Grid

- **Facilitates time series analysis**
- Ensures spatial grid continuity
- Doesn't require unique spatial reference information to be stored for individual tiles

Recommendation: fixed grid processing to facilitate time series analysis

Systematic and On-demand Raster Processing

- Systematic production in mission centers
  - ✚ Global coverage, archived, systematic/global...
  - - Fixed and relatively low resolution(s)

- On-demand production in distribution centers*
  - ✚ Flexible in terms of coverage, resolution/sampling, selection of data layers...
  - − Not archived, more limited coverage (<< global)

- What applications are supported by systematic and on-demand rasters?

Solution: both systematic and on-demand processing.

Spatial Resolution

Note: very high-resolution would converge to pixel cloud without smoothing

Advantages of Higher Resolution (e.g. 100 m)

Greater ability to resolve water feature boundaries
Fewer mixed pixels

Advantages of Lower Resolution (e.g. 250 m or 1km)

Substantially lower pixelwise height errors, especially in mixed pixels
Smaller data volumes

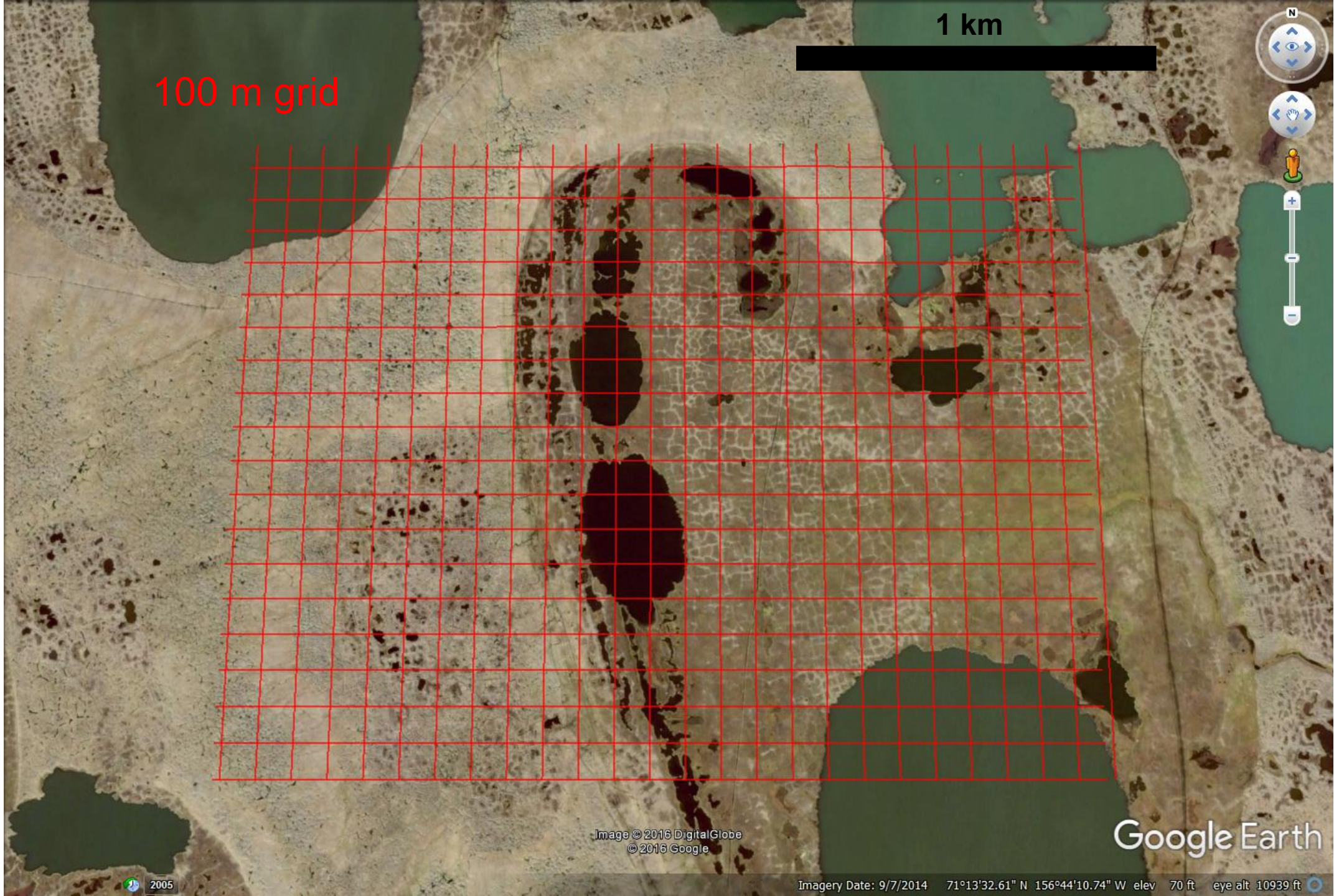
Solution: produce both high resolution (100 m) and lower resolution (250 m) options. Other resolutions available on demand.

Choice of file formats

Data format: netCDF, GeoTIFF, and JPG2000

- Two (somewhat) separate considerations: backend operability, user friendliness
- Recommendation: Store as NetCDF, make available as GeoTIFF, JPG2000, etc.


1 km
Image © 2016 DigitalGlobe
© 2015 Google
Google Earth
2005
Imagery Date: 9/7/2014 71°13'32.61" N 156°44'10.74" W elev 70 ft eye alt 10939 ft


1 km
100 m grid
Image © 2016 DigitalGlobe
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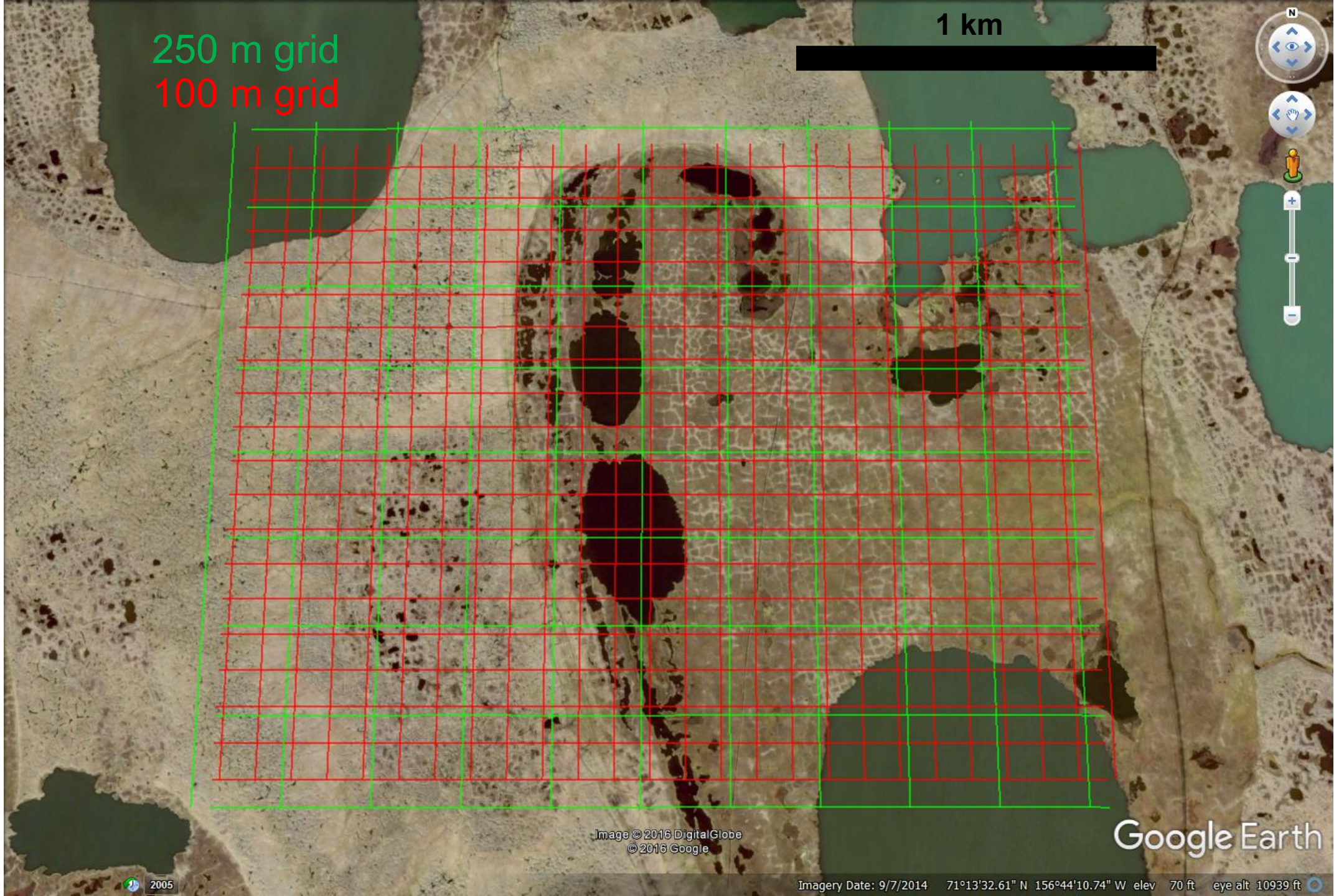
250 m grid
100 m grid
1 km
Image © 2016 DigitalGlobe
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2005
Imagery Date: 9/7/2014 71°13'32.61" N 156°44'10.74" W elev 70 ft eye alt 10939 ft

Proposed Fields for SWOT Raster Data Product

Data Fields

- Height & uncertainty (m)
- Inundated Area & uncertainty (m^2 or %)
- Average sigma0 & uncertainty (dB)
- Number of pixel cloud pixels contributing to raster cell (m^2)
- Cross-track distance of raster pixel center (m)

Are there any important fields we are currently missing?

Quality Fields

- Low SNR Area (m^2 or %)
- Ice Cover Area (m^2 or %)
- Layover Area (m^2 or %)
- General data quality flag (TBD)

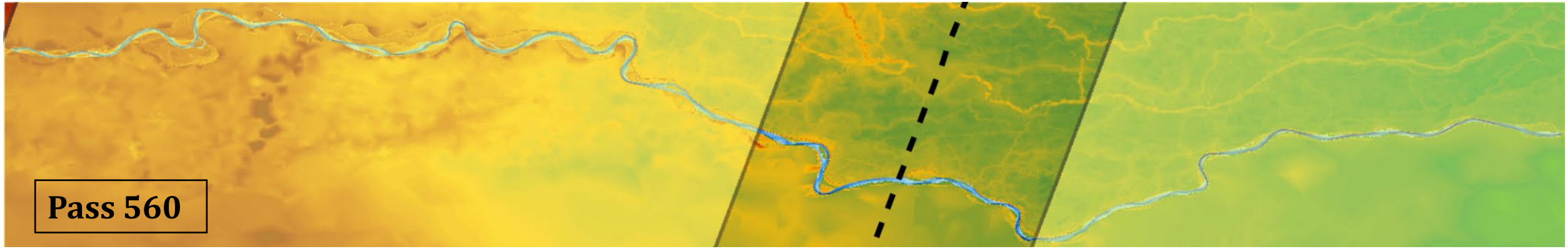
Correction Fields

- Geoid: geoid height above reference ellipsoid
- Solid Earth tide model
- Pole tide & water tide models
- Orbit quality flag
- Instrument flags
- Dry, wet tropospheric and ionospheric corrections
- Cross-over correction

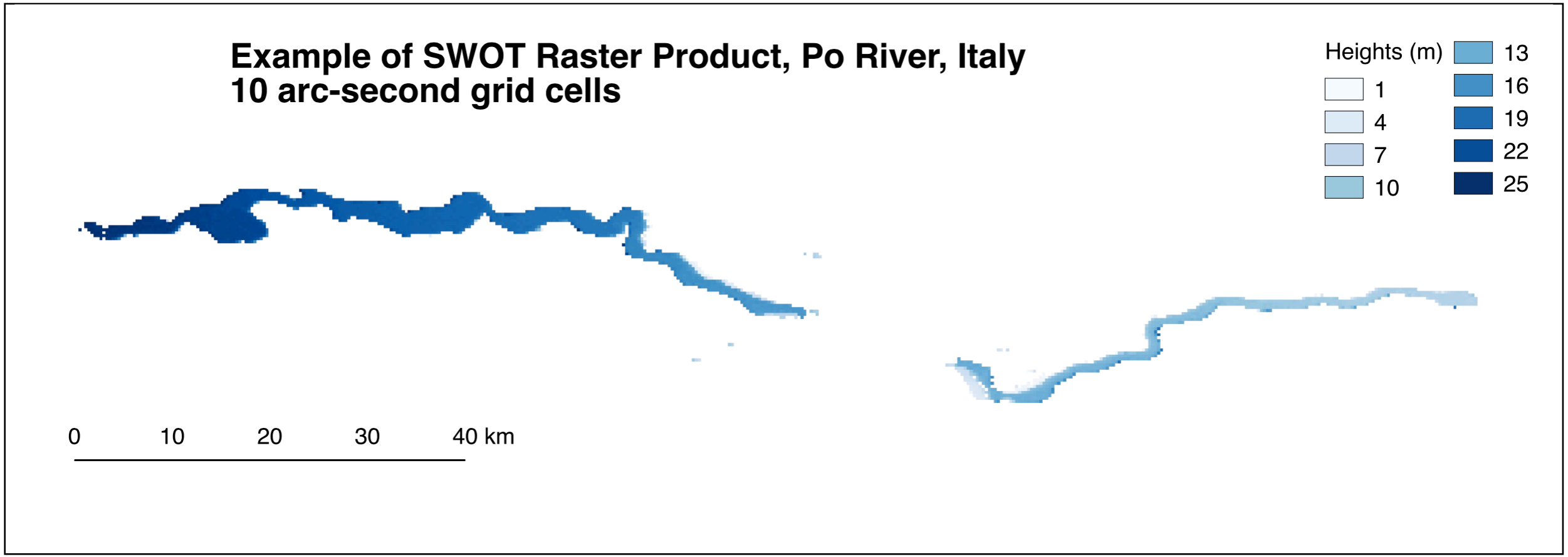
Preliminary Example of Raster Data Product

To illustrate the key variables in a raster product, we have produced a rough prototype at 10 arcsecond resolution based on the raw pixel cloud output over the Po River during a flood event.

The raster will be produced from the medium pixel cloud product, but the Po was originally run using the raw pixel cloud.

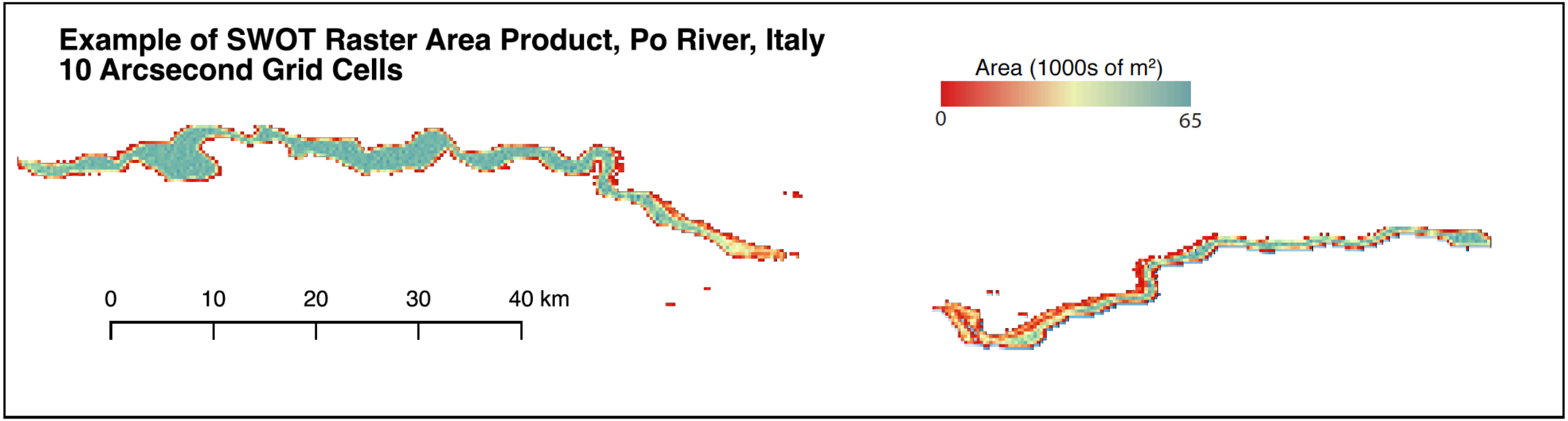


Height Raster Map



Calculated from *Height*

Area Raster Map



Calculated from *No_Layover_Ground_Resolution*

Pathway Forward

- Develop more robust raster algorithms and example data products over a range of different environments.
  - Requires simulations of rivers, lakes, wetlands
  - We welcome submission of existing simulations to test algorithms
- Lead in France: C. Pottier
- Lead in the U.S.: T. Pavelsky