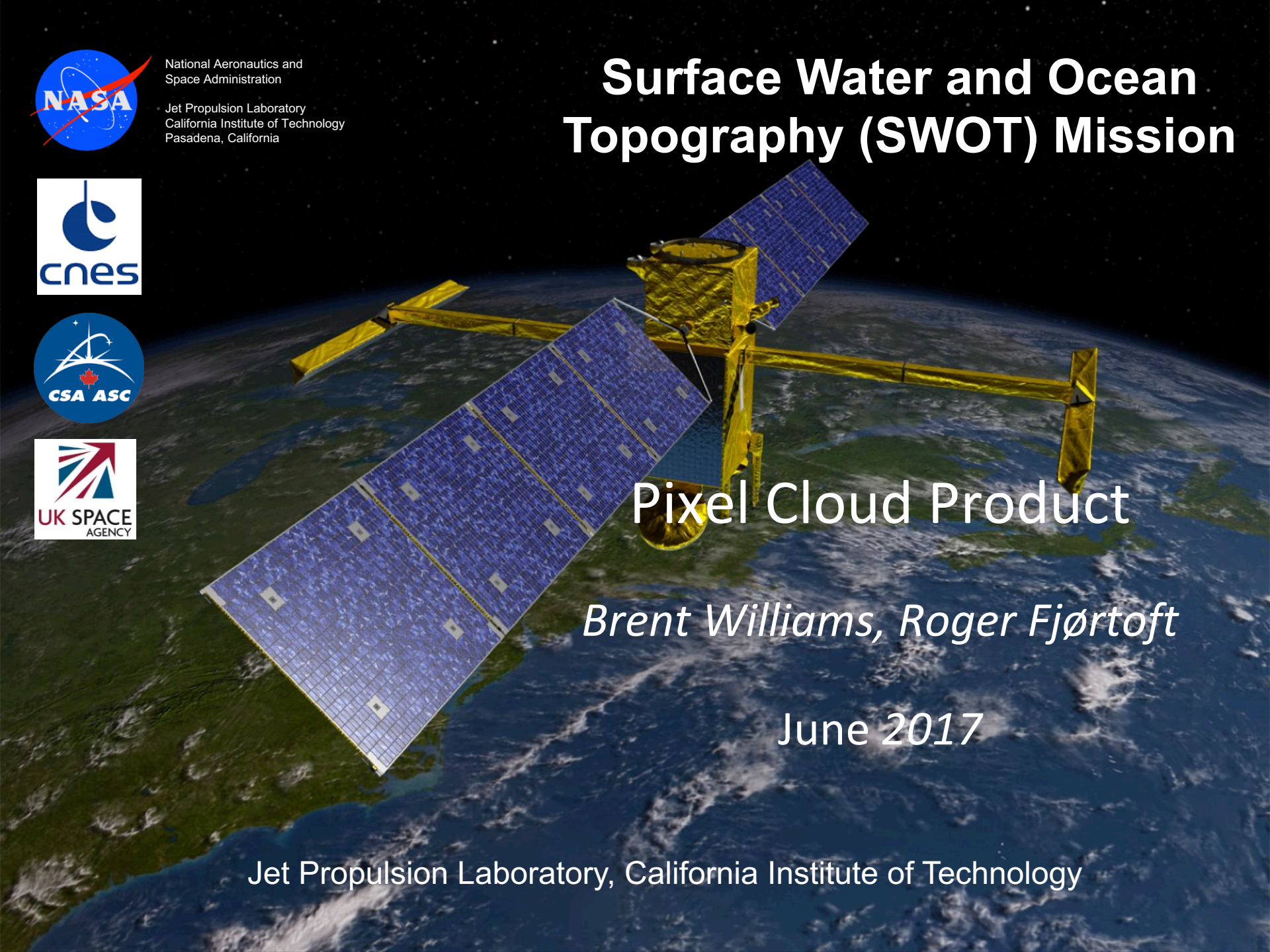
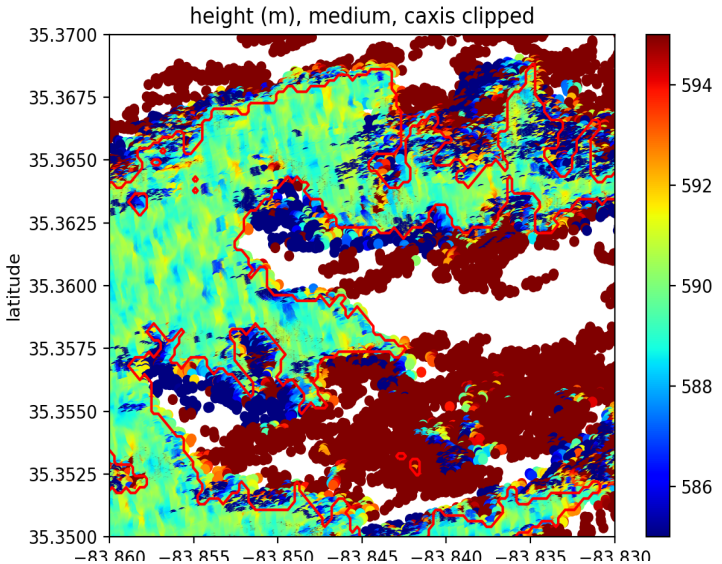

National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California
Surface Water and Ocean Topography (SWOT) Mission
Pixel Cloud Product
Brent Williams, Roger Fjørtoft
June 2017
Jet Propulsion Laboratory, California Institute of Technology

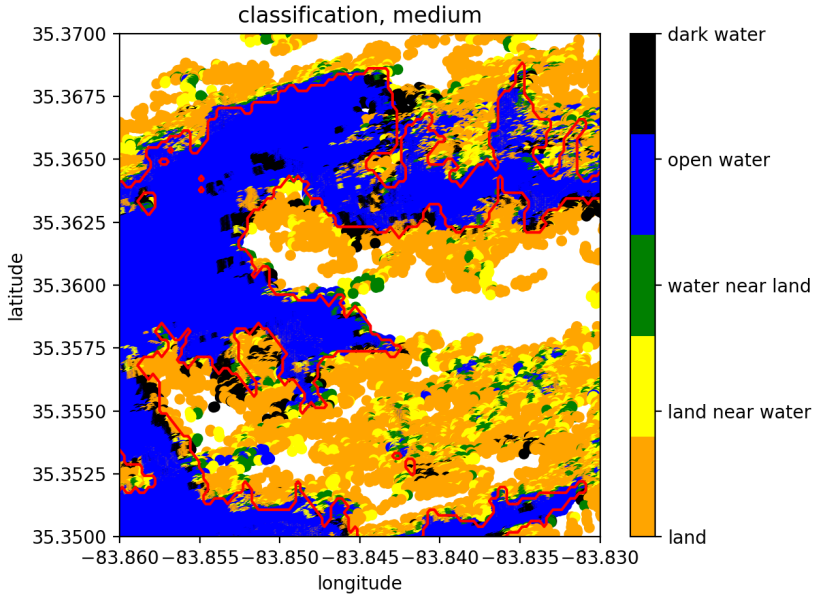
Level 2 High Rate Pixel Cloud Product (L2_HR_PIXC)

What is it?

- Unstructured list of geolocated interferogram pixels (lat/lon/height)
- Primarily for water pixels, but has some land-classified pixels (e.g., pixels in the pruning mask representing inclusion zones)
- Classification/flags
- Satisfies main purpose of the “water mask” in Science Requirements Document (SRD)

- There are many other useful fields as well
  - Sensor position and attitude
  - Estimates of geolocation errors
  - Radar image pixel indices
  - Interferogram: magnitude/power, phase, coherence
  - Geophysical corrections and reference heights/tides
  - Satisfies the purpose to provide low level information that may be useful to expert users

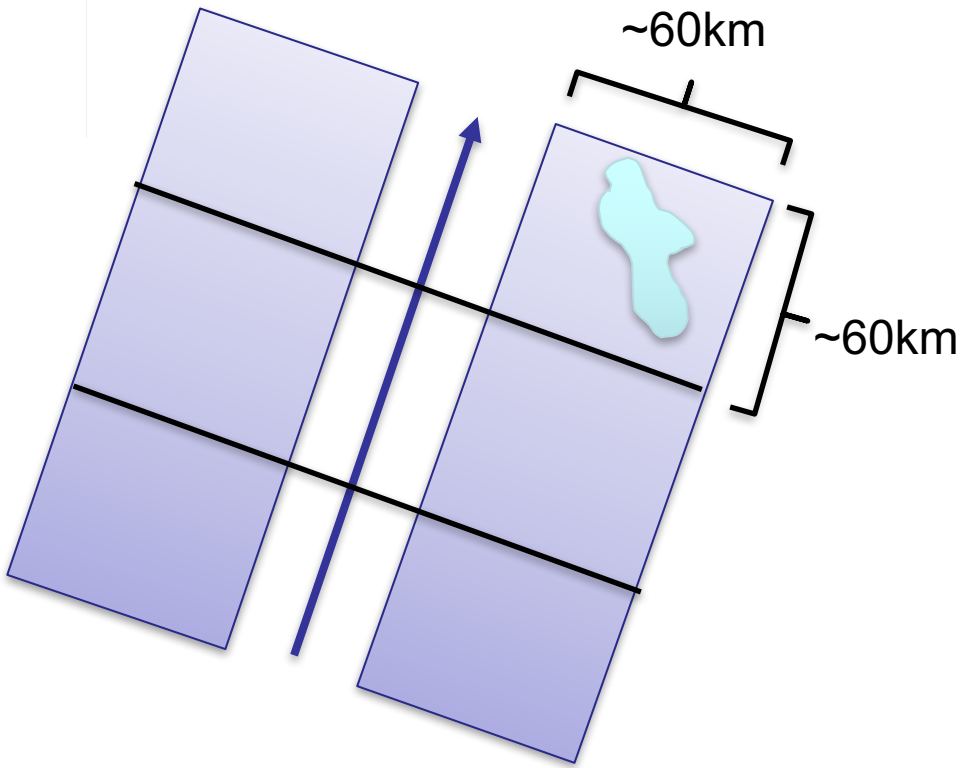




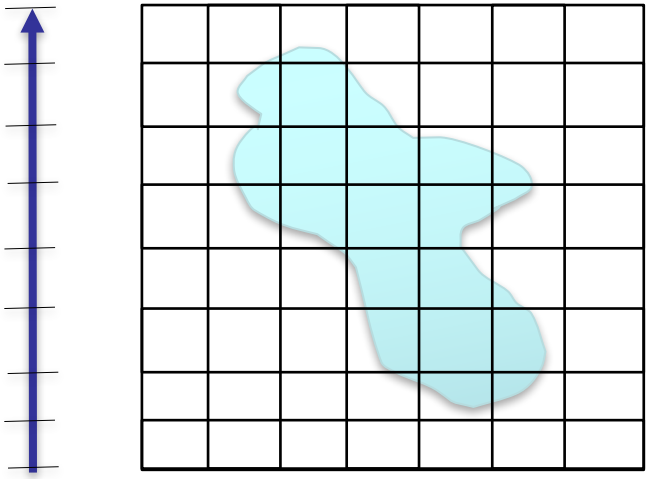
Red line is truth mask boundary

Tile Granules

- The unstructured pixel cloud list is a NetCDF 1-D array organized into pass/swath-side tiles about 60kmx60km
- Sensor position and attitude included in a separate 1-D array (and separate file)
- Tile boundaries are cut along orbit, but will generally fall in the same place on ground for the same pass/side for every cycle

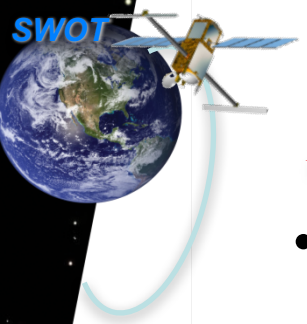


~10% of Interferogram pixels expected to have water and are kept in pixel cloud



Sensor 1-D array

Pixel cloud: radar image is pruned, geolocated and reshaped into 1-D array



Smoothing Layers

- 3 levels of smoothing (all same posting, ~20m in azimuth):
  - Rare (~4-looks in azimuth direction)
    - ♦ Needed for water detection
    - ♦ Not geolocated
  - Medium (~50 looks, adaptive multilooking of interferogram)
    - ♦ Minimal smoothing needed before geolocation
  - Well-done (>>100 looks, smoothing of geolocated heights)
    - ♦ Aggressive smoothing of heights/locations to regularize topology and preserve 2-D shapes of features

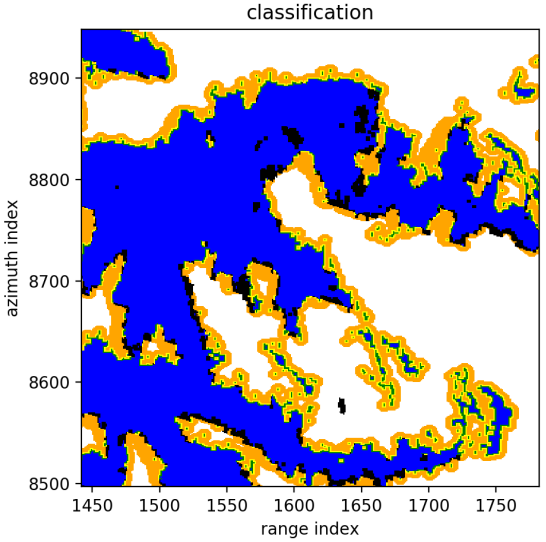
Moved from L2_HR_PIXC to new standard product PIXC_VEC

- There is a new PIXC_VEC product that provides more smoothed heights/locations (same shape as PIXC)
  - This level of smoothing occurs in generating river and lake vector products
  - Methodology/philosophy described in more detail later in this session (see Damiens talk)
  - Add on product giving additional variables at the pixel level without duplicating fields in the L2_HR_PIXC product
    - ♦ E.g., river reach/node IDs, lake ID, and possibly other vector level flags or attributes

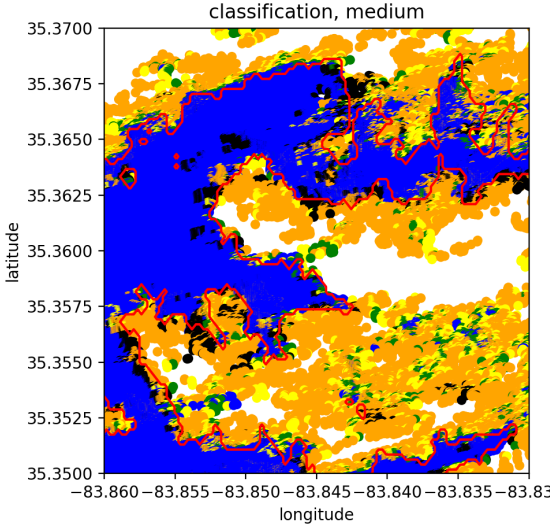
Example

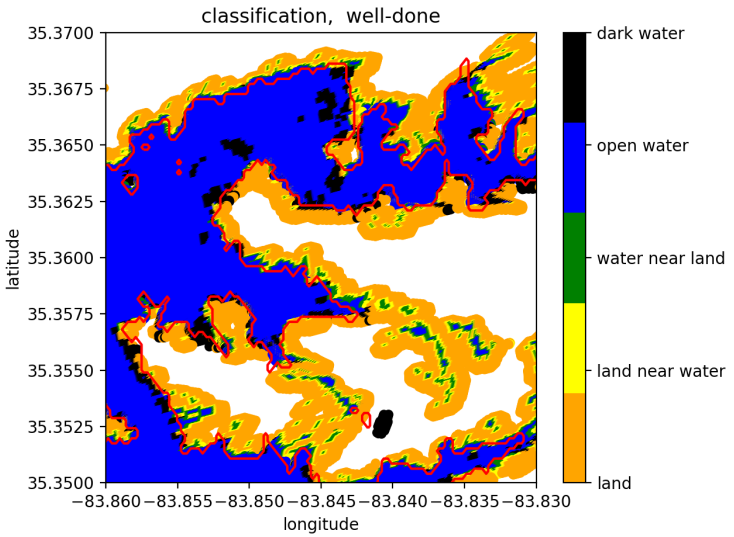
- All fields of all layers correspond to same radar image pixels
  - Radar image indices reported enabling representation as raster image in radar geometry with pixels common for all layers
  - Pixels can be mapped 1-1 to the medium (or well-done) layer locations
- Medium pixel cloud
  - Heights preserve the most information but are noisy
  - Geolocations also noisy—radar image pixel connectedness not preserved
- Well-done (PIXC_VEC)
  - Additional height smoothing
  - More suitable for polygonization and floodplain DEM studies

Reshaped as Radar Image



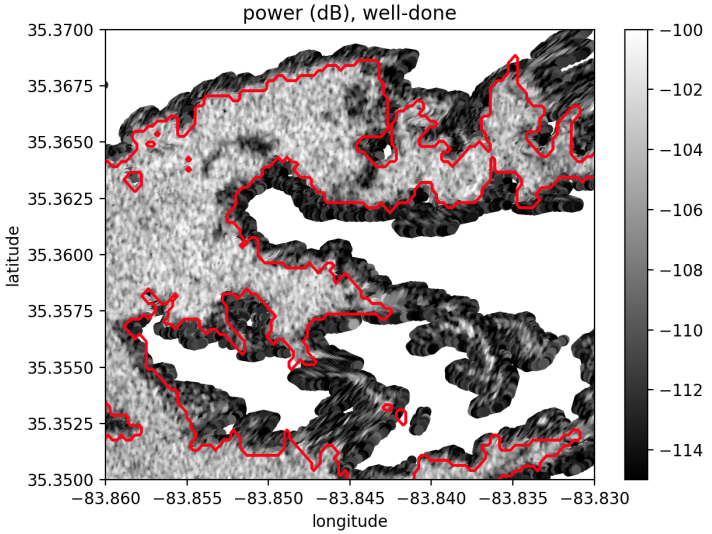
Projected on ground. Red line is truth mask boundary

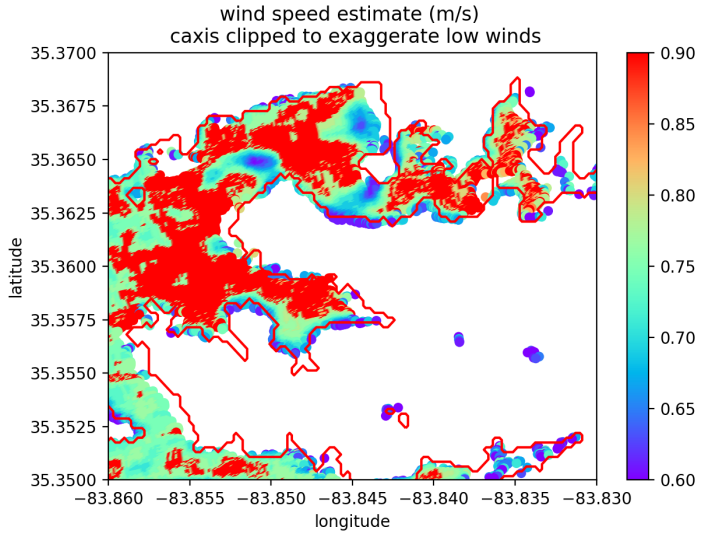




Rare Pixel Cloud Layer

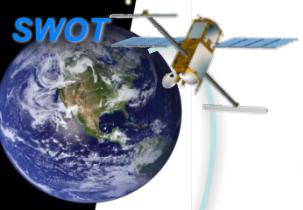
- Preserves information
  - Interferogram quantities for unpruned pixels preserved with minimal smoothing (~4 effective looks)
  - Classification and other flags derived at fine resolution and posting
- Geolocated heights not provided for rare smoothing (suboptimal)
  - Can still map pixels to ground with medium, or well-done locations
- Potential uses:
  - Special processing/reprocessing for special applications
    - ♦ Ambitious users can do their own smoothing and geolocation (no information is lost)
  - Deriving quantities from brightness (sigma0, wind, alternative surface classification…)
  - Deriving quantities related to the coherence (sub-cell height variability, wave height, alternative surface classification…)





Red line is truth mask boundary
Wind estimation not part of standard processing

Backup



Backup

- Comments on Standard Products vs how Podaac may distribute
  - L2_HR_PIXC and PIXC_VEC are two different standard products
    - ♦ SDS implementation considerations
    - ♦ SDS will archive these products
    - ♦ L2_HR_PIXC is a collection of multiple files (sensor file, and pixel cloud pixels…)
  - May be transparent to users
    - ♦ Podaac and CNES distributions may enable the users to customize how they receive data products
      - ○ Various fields in L2_HR_PIXC can be combined on distribution
      - ○ Ability to select fields to include/exclude is envisioned
      - ○ Not archived like this

KaRIn HR Flow