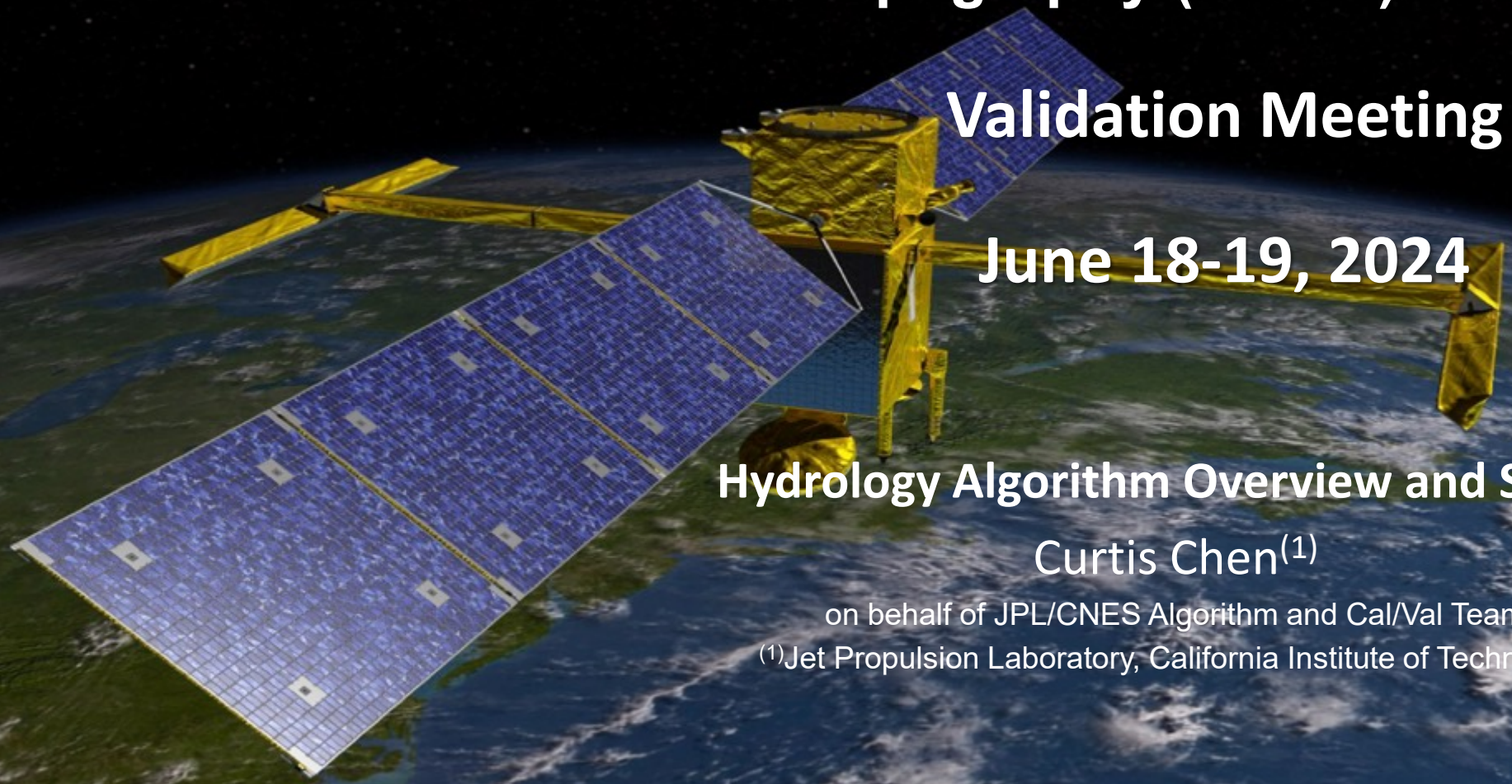
National Aeronautics and Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

Surface Water and Ocean Topography (SWOT) Mission

Validation Meeting

June 18-19, 2024



Hydrology Algorithm Overview and Status

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on behalf of JPL/CNES Algorithm and Cal/Val Team

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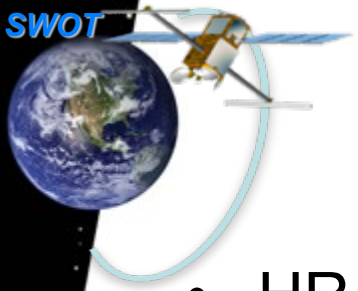
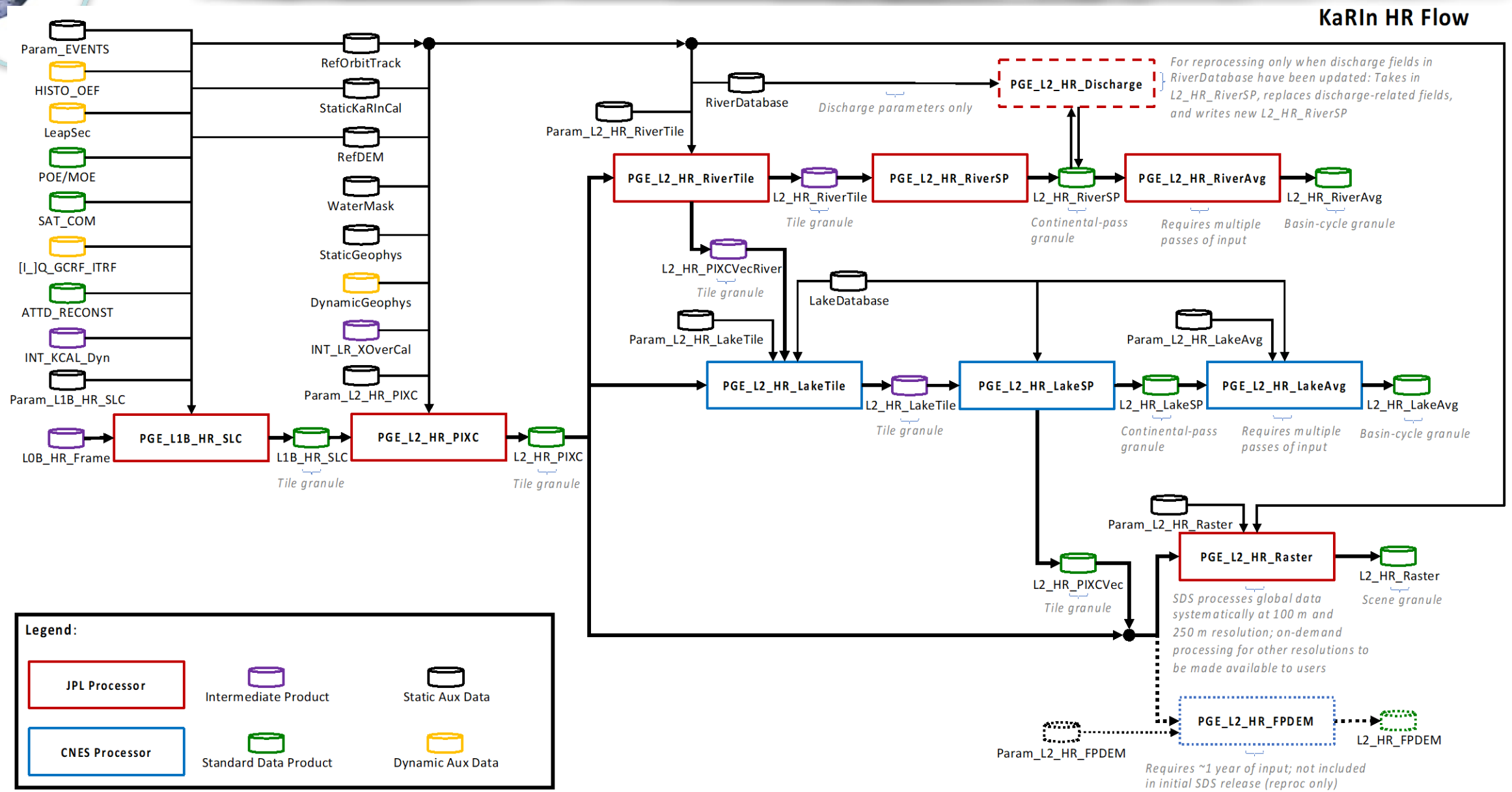


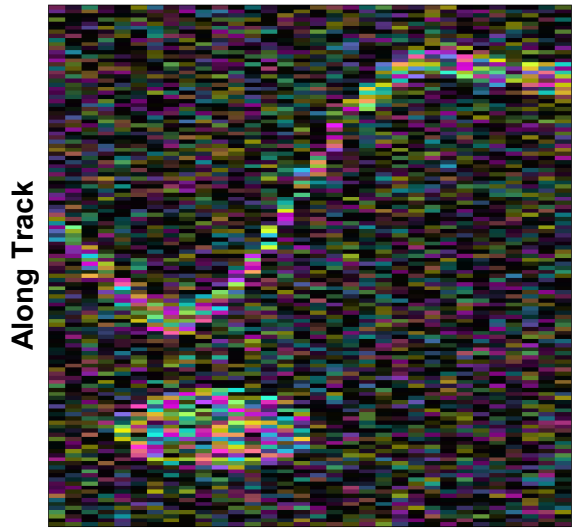
Outline

- HR products and algorithm flow
- High-level status

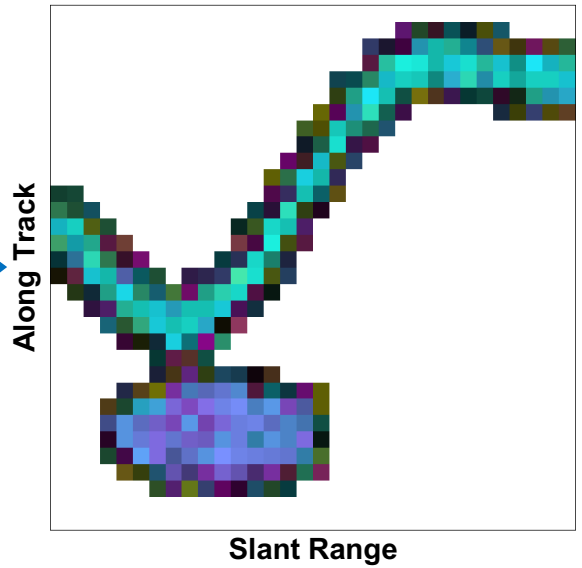
HR Algorithm Flow



Data Product Illustration

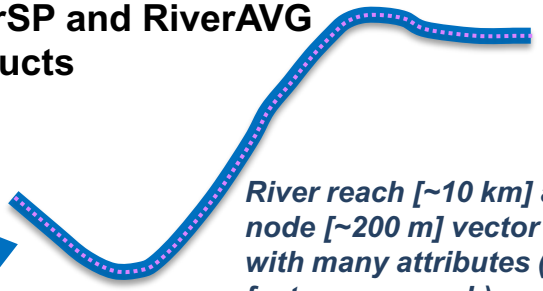


Pair of complex radar images; water is brighter than land



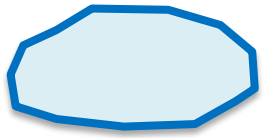
Sparse array or cloud of geolocated points in 3-D space with many pieces of information per point; most land pixels are discarded

RiverSP and RiverAVG Products

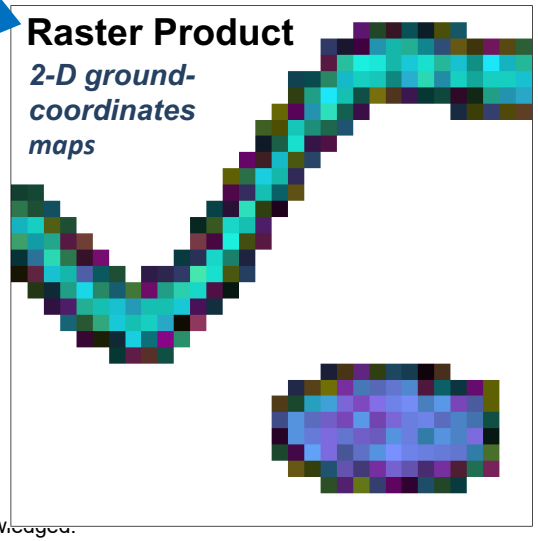


River reach [~10 km] and node [~200 m] vector objects with many attributes (line feature per reach)

LakeSP and LakeAVG Products



Lake vector object with many attributes (polygon feature per lake)

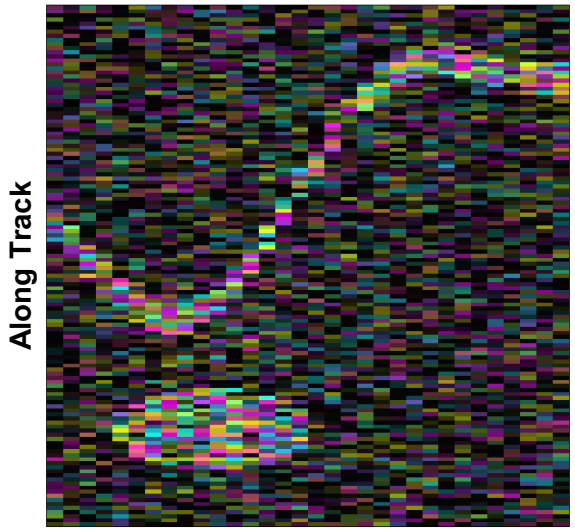


Raster product best for water that is not well captured by river or lake products (wetlands, floods, coasts, etc.)

Caution: This cartoon is highly simplified and omits many details; for conceptual purposes only

Data Product Illustration

SLC Product

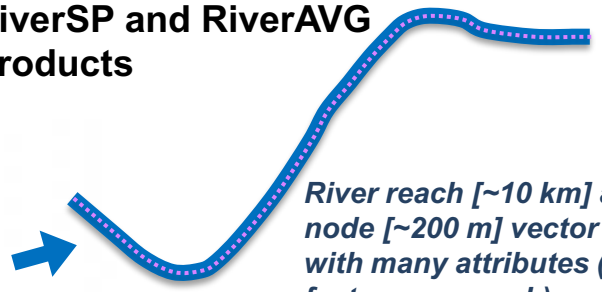


Pair of complex radar images; water is brighter than land

PIXC Product

Sparse array or cloud of geolocated points in 3-D space with many pieces of information per point; most land pixels are discarded

RiverSP and RiverAVG Products



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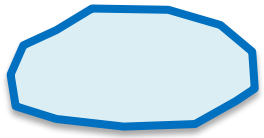
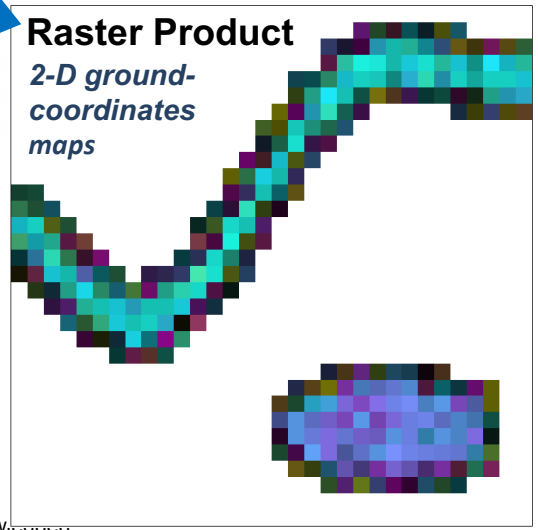
LakeSP and LakeAVG Products



Lake vector object with many attributes (polygon feature per lake)

Raster Product

2-D ground-coordinates maps



Raster product best for water that is not well captured by river or lake products (wetlands, floods, coasts, etc.)

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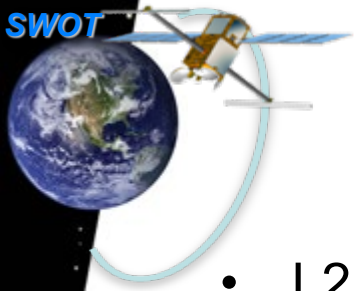
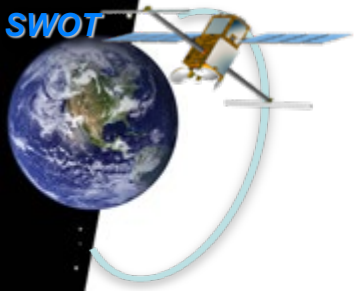
HR Algorithm Status

- Single-look complex (SLC) processing is mature
- Pixel cloud (PIXC) algorithms are mostly stable but will be updated based on continuing validation work
  - PIXC processing is complicated and affects river, lake, raster, and FPDEM processing (which are complicated, too)
  - Validation and tuning must address coupling of end-to-end processing flow
- River and lake algorithms are working reasonably well but may still benefit significantly from additional development work
  - Algorithms were developed before launch based on limited simulations that could not capture complexities of real data and unknown phenomenology
  - Real rivers and lakes are varied and phenomenology adds more dimensions, so characterization and tuning must examine large data sets with sufficient external data (difficult!)
- Raster processing is relatively mature, but not without its own challenges
- Floodplain DEM (FPDEM) algorithms are being evaluated, but FPDEM production is not planned for near term



HR Algorithm Development Approach

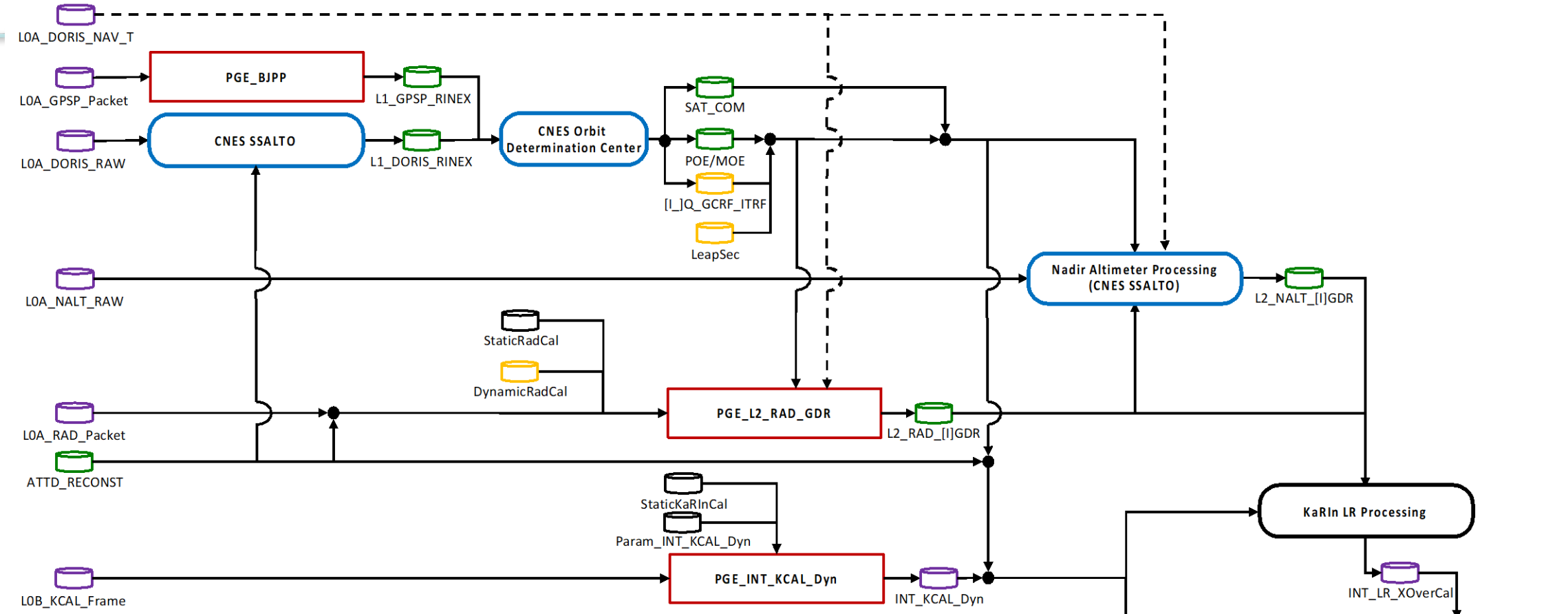
- L2 HR algorithms are still evolving (much more so than LR)
  - HR ground processing is much more complicated than LR processing
  - Inland surfaces have greater phenomenological variability than ocean
- Validation for HR is iterative:
  - Process:
    - Compare SWOT data to field data and assess differences
    - Adjust HR algorithms in order to improve SWOT performance
    - Repeat
  - Team is mindful not to over tune algorithms based on available field data
    - Algorithm changes should not be completely empirical; design algorithm enhancements with physical basis that should apply generally/globally
    - Assess algorithm updates on field data that did not influence algorithm changes
- Upcoming presentations on HR validation include results from both public Version C data products and offline-processed products using developmental software and parameters
  - Covers both what to expect from data available now and what to expect from future versions of data
  - Source of data will be identified in context



Backup

Top-Levewl Algorithm Flow

Radiometer, POE/MOE, KaRIn Calibration Flow



LR Algorithm Flow