National Aeronautics and Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

Surface Water and Ocean Topography (SWOT) Mission

Validation Meeting

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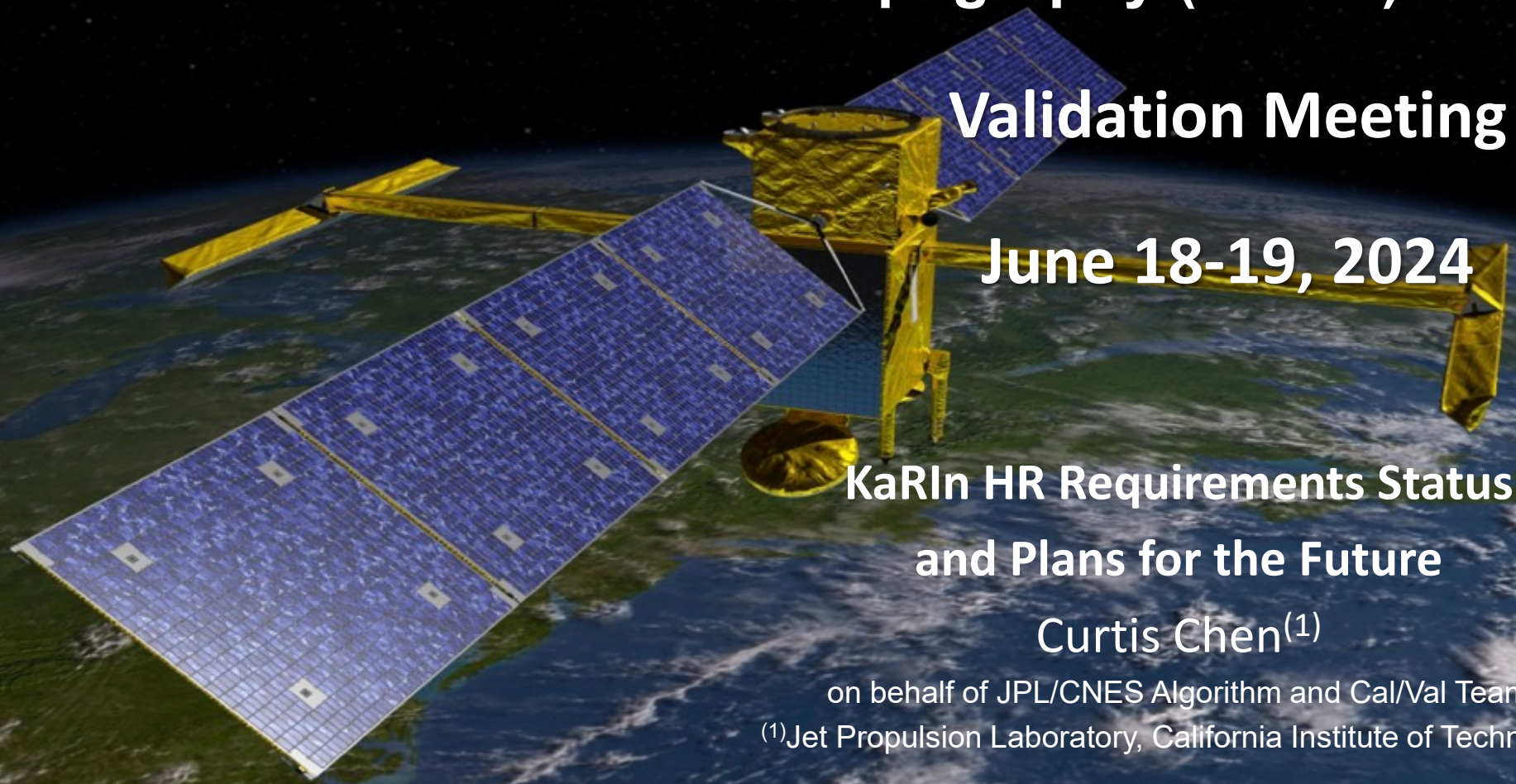

KaRIn HR Requirements Status and Plans for the Future

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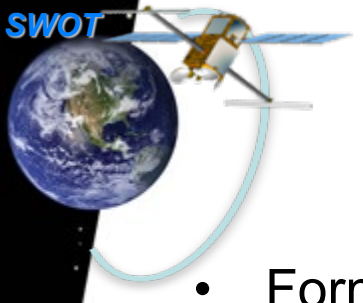
Outline

- Key KaRIn HR L2 requirements
- Recap of important upcoming HR product changes
- Areas for future validation and algorithm development work



Interpretation of KaRIn HR Requirements

- Formal KaRIn HR requirements are subject to interpretation
  - Exclusion in Requirement 2.5.4.a for when "*the KaRIN measurement is not physically feasible, including… surface water in regions of extreme topographic layover…*"
    - Just about everything over land is in geometric layover, but layover often has little impact
    - Dark water can be interpreted to be a case where measurement is "not physically feasible"
  - Comments on Requirement 2.8.5 in Science Requirements Document on reach slope:
    - "*It does not include the influence of water/land classification errors along the river margin*."
    - "*Slope accuracy for rivers only imaged in the near swath (within 20 km of nadir) have lower accuracy and will not be used to evaluate this requirement*."
  - Precise definition of reach-level quantities (how exactly is averaging done?) is not clear
- Therefore, Cal/Val team has prioritized characterization and improvement of SWOT performance from overall science perspective, not just requirements perspective
  - Requirements still guide large-scale project priorities
  - But focus on spirit of requirements rather than letter of requirements

Key KaRIn HR L2 Requirements

Requirement	Status
WSE accuracy (rivers and lakes): 10 cm @ $(1\ km)^2$, 25 cm @ $(250\ m)^2$	See Topics D2_02, D2_04, D2_06, D2_08. Random noise performance is excellent. SWOT usually captures relative WSE variations over time. Cannot always independently measure reach-scale absolute WSE as defined and observed by SWOT with sufficient accuracy.
Reach slope accuracy: 17 urad = 1.7 cm/km	See Topic D2_04. Slope accuracy is quite good.
Water body relative area accuracy: 15%	See Topics D2_05 and D2_06. Measurement is fundamentally sound. Dark-water-projection issue limits performance for Version C data, but significant improvement is expected in next product version. Classification and pixel assignment are challenging but will continue to improve.

- KaRIn HR performance is generally consistent with formal requirements
  - SWOT measurement is already complicated, and variability of rivers/lakes adds additional complexity, so performance naturally varies with site and observation
  - Quality flags (especially related to dark water) help indicate where performance is best
  - Difficult to collect field data that is sufficient for definitive validation of formal requirements—shows just how good KaRIn is
- In context, fundamental KaRIn performance is phenomenal and gives huge leap ahead from state of the art
  - Performance will continue to improve as algorithms mature with planned work
  - Many improvements are already implemented

Notable Upcoming HR Product Changes

Fall 2024:

- Dark water projection fix
- Fix PIXC handling of crossover correction flag
- Fix to PIXC heights of non-unwrapped pixels
- River area improvements
- Lake quality flag enhancements
- Height correction for range-Doppler coupling
- Height-constrained geolocation update for Raster
- Bug fixes
- RiverAvg and LakeAvg production

Next bulk reprocessing:

- Calibration updates
  - 2.5 dB radiometric calibration adjustment
  - Minor changes to phase screen (around +/-4 mm)
  - Fix HR ~1.5 cm bias relative to LR
  - Fix cross-track geolocation error in H swath (~0.3 HR pixel)
- SWORD v17
  - Improved topology
  - Altered Reach IDs
- Lake processing
  - Improved handling of specular ringing and dark water
  - PLD updates for additional lakes, improved polygons, more bathymetry

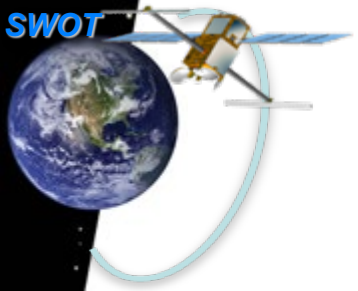
Beyond:

- Continued improvement and refinement
- Discharge and storage change
- L2_HR_FPDEM

Areas for Future Validation and Algorithm Development

- Additional validation of WSE and area over greater diversity of rivers and lakes because SWOT performance depends on many specifics of particular sites
- Refinements to PIXC classification
- Improved pixel assignment during river and lake processing (including both algorithm and SWORD/PLD updates)
- Improvement of quality flagging (multiple products)
- Additional characterization of and possible partial mitigations to impacts of specular ringing and dark water
- Characterization and estimation of systematic uncertainties
- FPDEM algorithm development and testing

Project welcomes HR product validation results and data sets from users



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