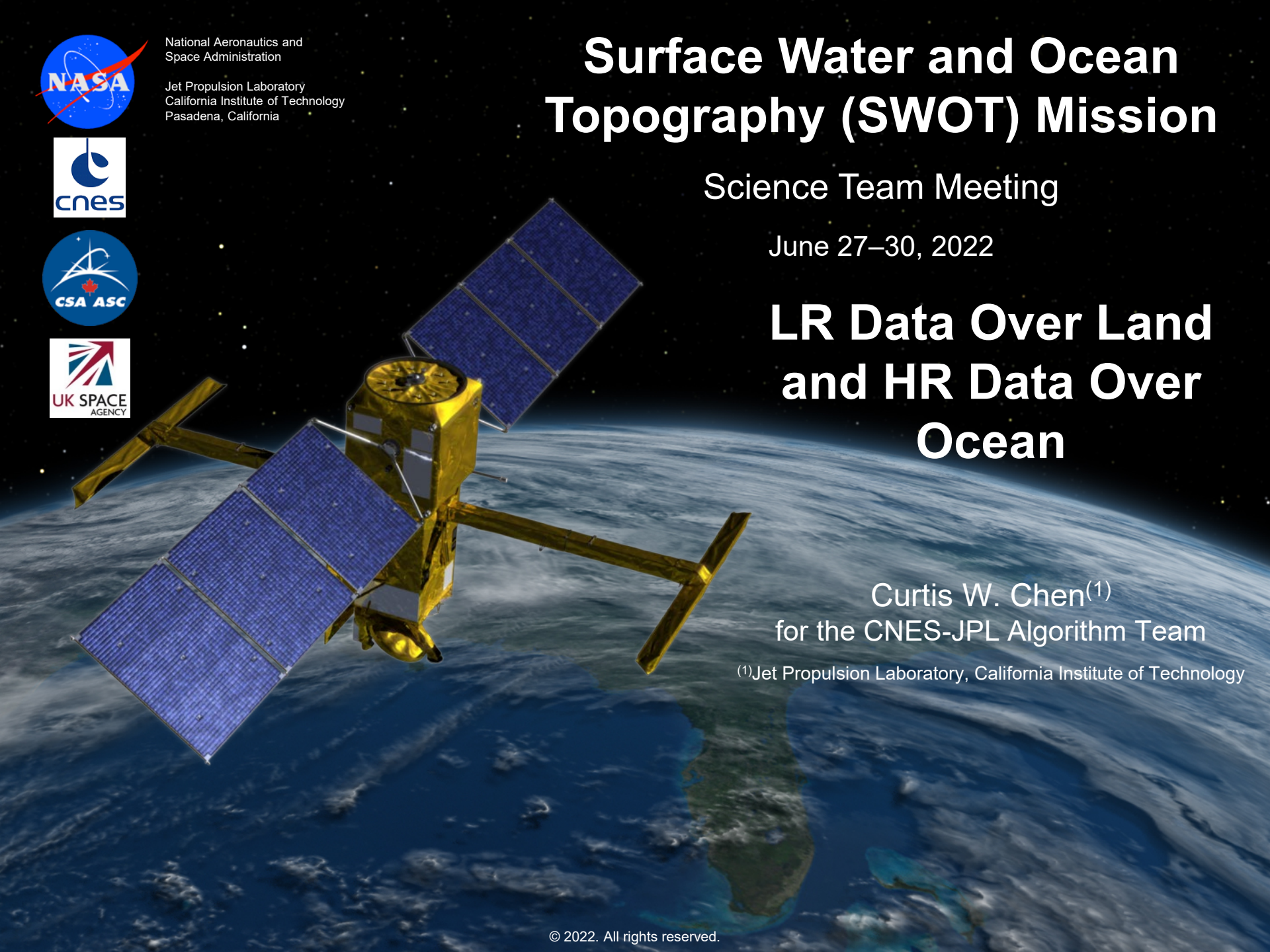

National Aeronautics and Space Administration

Jet Propulsion Laboratory
California Institute of Technology
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Surface Water and Ocean Topography (SWOT) Mission

Science Team Meeting

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LR Data Over Land and HR Data Over Ocean

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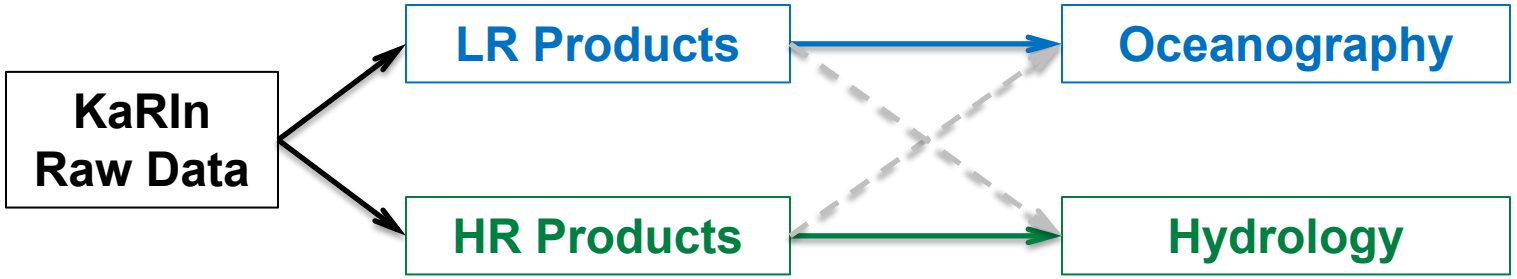
LR and HR Data Streams



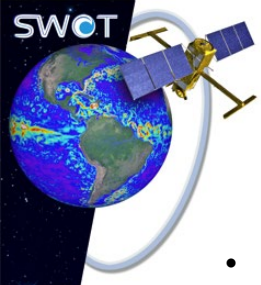
- KaRIn LR and HR data streams are split on board spacecraft in instrument firmware processing
  - Nine-beam LR interferograms are formed on board and spatially averaged before being downlinked
  - HR pulse data are pre-summed (low-pass filtered in along-track) on board before being downlinked
- Ground algorithms and data products are designed around using LR data over ocean and HR data over land, not vice versa
  - LR data for hydrology and HR data for oceanography *may* still be useful
  - But prospective users should gain familiarity with data products and algorithms to determine whether LR data for land and HR data for ocean meet their needs/desires

Users should *not* assume that LR and HR data differ only in horizontal resolution and height accuracy

LR Data Over Land

- KaRIn on-board processor (OBP) uses flat reference surface per swath side
  - Design of on-board reference surface was based on hydro input
  - May still give increased error where there are rapid spatial variations in elevation
- Phase-bias correction in ground processing is sensitive to spatial variations in backscatter and topography at 1–10 km length scales
- LR ground processing does not include many steps that are done in HR processing:
  - Classification (water detection and dark water flagging)
  - Phase unwrapping with respect to HR reference DEM
  - River and lake vector processing
- Crossover-calibration corrections are not applied to LR products, so LR products will contain spatially varying cross-track tilts
  - But crossover-calibration correction terms are reported in product so users can apply themselves
- LR quality flags are designed for ocean and may not be trustworthy

LR data products are *not* simply less-noisy, coarser-resolution versions of HR products



HR Data Over Ocean

- Pre-summing in OBP implies loss of information in downlink
- HR ground processing does not do very much spatial averaging
  - HR data may be sensitive to wave-bunching effects observed on AirSWOT unless specialized post-processing is applied
- HR data products do not include ocean tide or sea-state bias (SSB) corrections
- Prior-based river and lake outputs may exist but be empty over ocean where there are no database features
- HR quality flags are designed for inland water and may not be trustworthy

- Note: Cal/Val team will use some HR data over ocean, but only for specific calibration purposes and only after customized offline processing

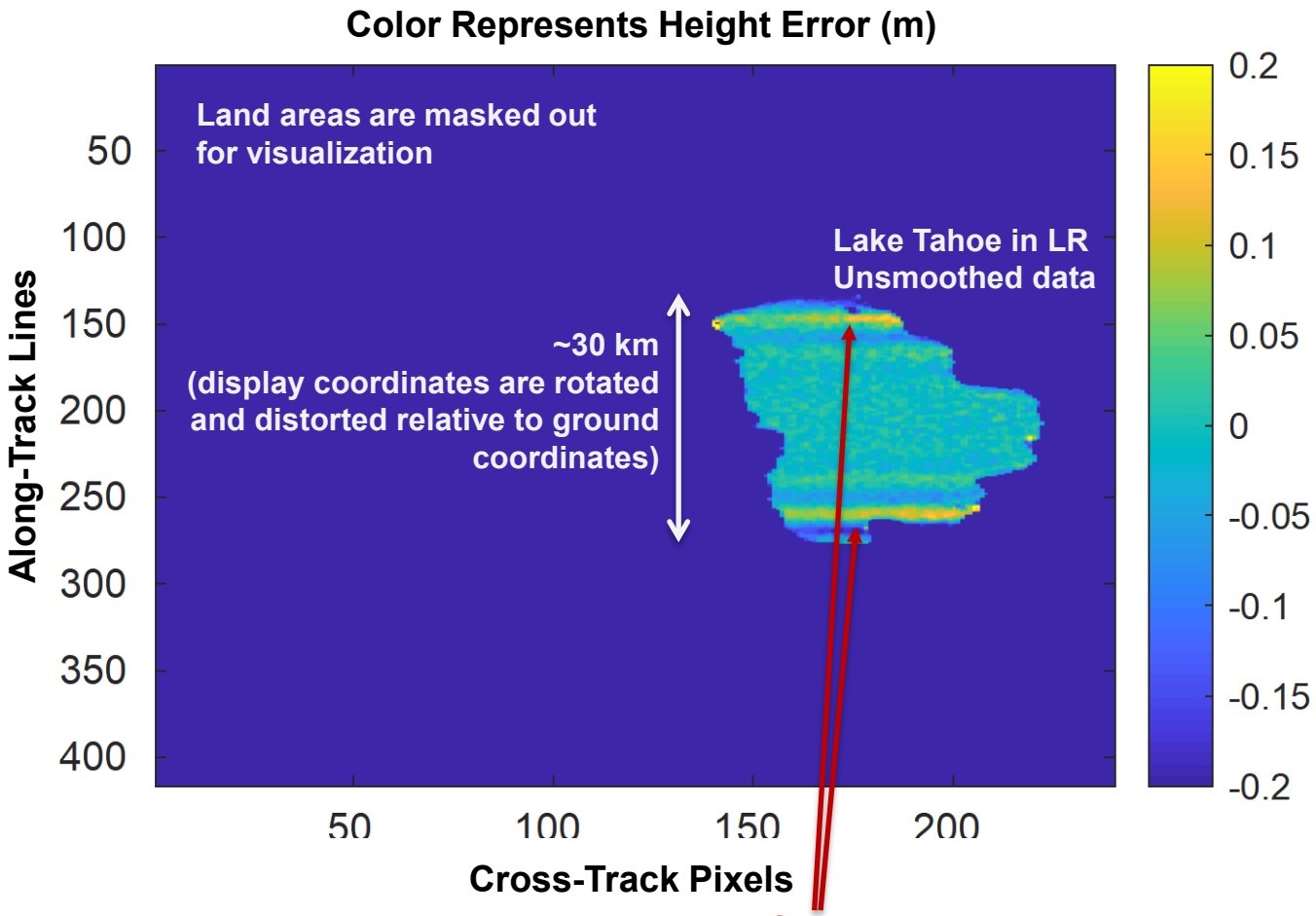
HR data products are *not* simply noisier, finer-resolution versions of LR products

Conclusions

- Expert users are welcome to try to exploit LR data for inland water and/or HR data for ocean, but such users should:
  - Plan to become familiar with details of KaRIn measurement principles, algorithms, and data products before making interpretations of data
  - Temper their expectations of data quality
  - Expect to have to resolve unexpected features and quirks of data
- Priority for remaining time before launch and Cal/Val is LR data for ocean and HR data for inland water, not vice versa
- Future improvements in operational data products may be possible but would probably not be available until some future reprocessing (not yet determined)

Backup

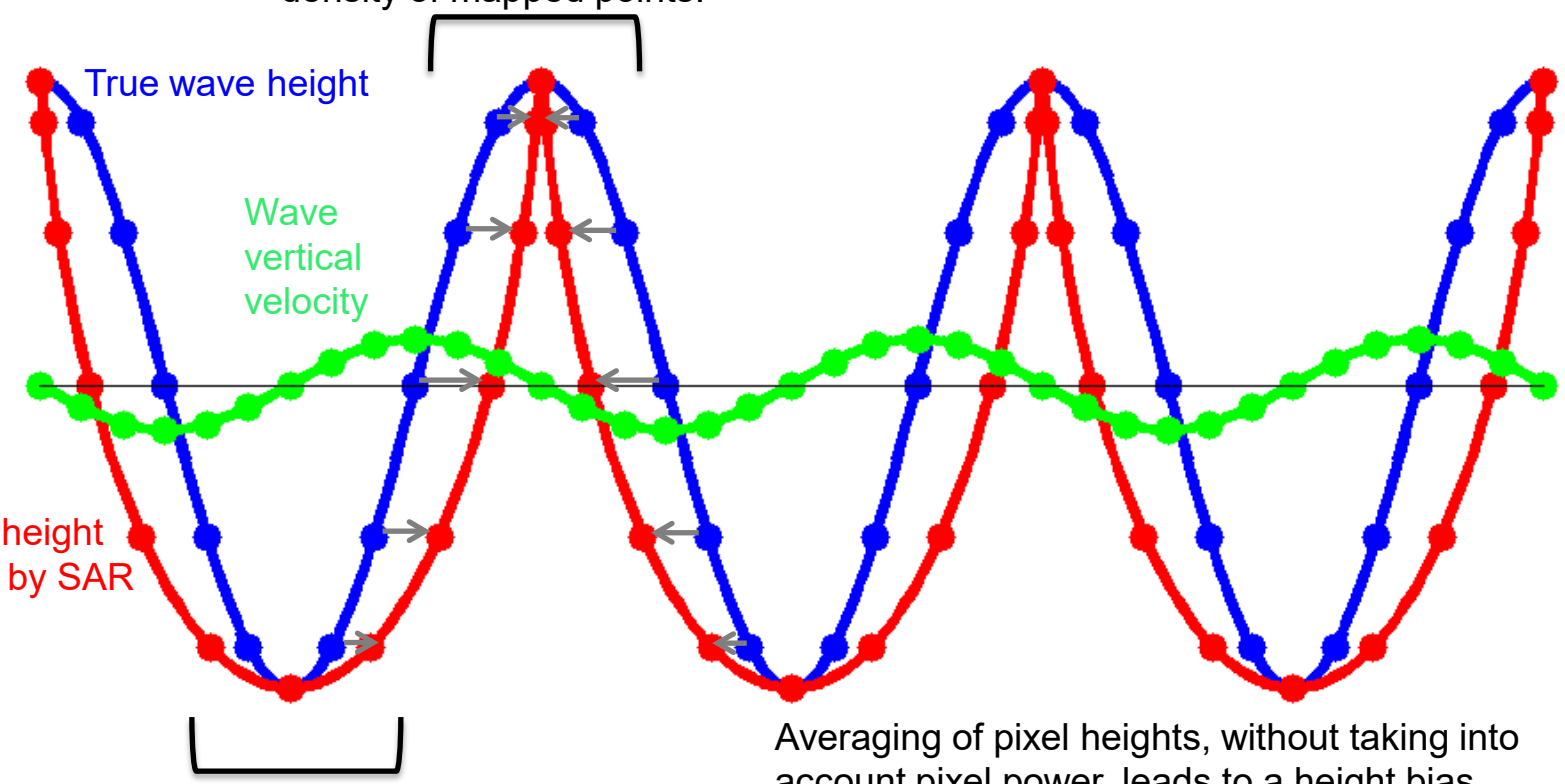
Simulated LR Data Over Lake Tahoe



+/-0.2 m height errors due to processing artifacts (interpolator ringing) are evident

A possible mitigation has been identified but has not yet been baselined because it increases computation resource needs

Height Distortion From Wave Bunching



Azimuth shift is proportional to line-of-sight target velocity, which is mainly due to wave vertical velocity for near-nadir viewing geometry

Averaging of pixel heights, without taking into account pixel power, leads to a height bias. In the simple sinusoid case shown, heights would be biased low.

Wave bunching is non-linear distortion, so spectrum of observed heights can exhibit energy at spatial frequencies that are not present in the true wave field