

National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California



Surface Water and Ocean Topography (SWOT) Science Team Meeting

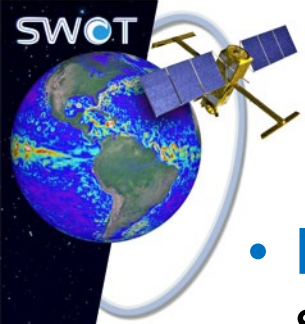
October 15, 2025

Filtering of River Products

Alexander Corben⁽¹⁾

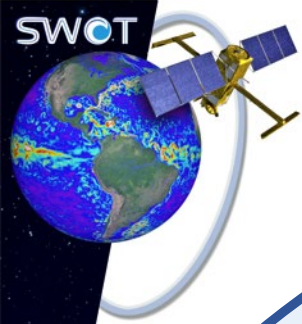
on behalf of JPL/CNES Algorithm and Cal/Val Team

⁽¹⁾Jet Propulsion Laboratory, California Institute of Technology



River Data Filtering

- **Filtering criteria for SWOT data should be application specific**; users should apply some filtering of data, but should consider filter parameters for themselves
- **Filter settings may need to depend on product version**
 - Filter settings that worked well for Version C0 and/or C2 may or may not work well for Version D
 - ideal filters for any given application are likely to change with future product versions
- Additional variables are likely to be included in future product versions to provide more filtering options
- **Filters used for algorithm development and calval are not necessarily optimized for either performance or sufficient data retention**
- ADT has developed a set of outer and inner envelope filters for assessing SWOT performance against field data for calval



Filtering Envelopes

Excludes features where SWOT (or truth/reference data) are expected to not perform well independent of SWOT algorithms and quality indicators

Outer:

- Swath edges
- Narrow/short rivers and small lakes
- Ice
- Poor quality truth/reference data (e.g., unstable or poorly referenced gauge/PT data, and cloudy image masks, etc.)



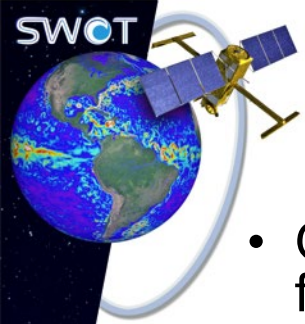
We care about the fraction of data removed going from the Outer to the Inner envelope

Additional filtering from the SWOT data quality-related variables for specific applications

Inner:

- Quality flags
- Dark water fraction
- Observed fraction

We care about error statistics of data in the Inner envelope

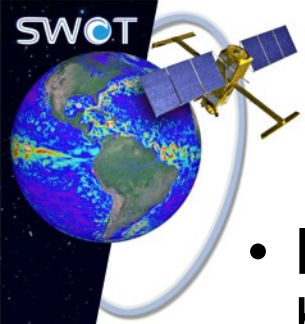


Example River Cal/Val Filtering Envelopes

- Outer: where SWOT might reasonably be expected to make a useful measurement; not filtered based on SWOT-derived variables
- Inner: ultimate filtering criteria for validation against field data
- Outer and Inner stages used to characterize how much data are lost at each stage
- **Users should tune inner filtering for specific needs to trade-off quality for fraction of preserved data**

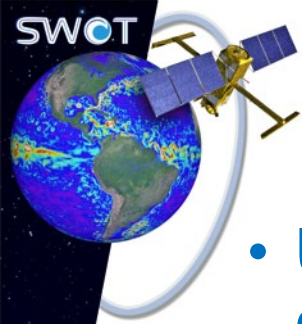
Example Outer Filter	
Product Variable	Filtering Criteria
xtrk_dist (cross-track distance)	10 – 60 km
p_width (prior width from SWORD)	>= 80m
p_length (prior reach length from SWORD)	>= 7km
ice_clim_f (climatological ice flag)	Likely not ice covered

Example Inner Filter	
Product Variable	Filtering Criteria
dark_frac (dark water fraction)	<= 0.4 (40%)
obs_frac_n (fraction of nodes with valid WSE)	>= 0.5 (50%)
node_q (summary node quality indicator)	Good, Suspect, [and Degraded]
reach_q (summary reach quality indicator)	Good, Suspect, [and Degraded]
node_q_b (bitwise node quality indicator)	<= 2097152
reach_q_b (bitwise reach quality indicator)	<= 2097152
xovr_cal_q (crossover calibration quality indicator)	<= 1
area_total (total water surface area)	>= 0



River Data Filtering Suggestions

- Between 10-60 km cross-track distance is a good starting place, but there can be valid/useful data outside of that range
- Summary quality flags give general assessments of good, suspect or degraded quality, but **more useful information is given in bitwise quality flags** for filtering data for specific applications
- **Surface areas and widths for features with high dark water fraction are less reliable** and are determined more from prior information than the SWOT measurement itself, WSEs for these features may have higher error but may still be useful depending on the application
- While SWOT estimated uncertainties for WSE tend to track with errors, the **surface area/width uncertainties are less reliable and using them for filtering is not recommended**



Conclusions

- **Users should apply their own application-specific filtering to the SWOT data, tuned to trade-off quality for fraction of preserved data**
- **Filter settings may need to be revised with changes in product version**
- See Product Description Documents (PDD) for more information about variables in SWOT products which may be useful for filtering:
 - <https://podaac.jpl.nasa.gov/SWOT?tab=datasets-information§ions=about>