River vector product status

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The river vector products

- Spatial aggregation:
  - Nodes: Equally spaced nodes every ~ 200m
  - Reaches: Collection of nodes ~ 10km long
- Temporal representation:
  - Single pass: Nodes and reaches observed in either side of the swath for a single pass. Likely distributed as one shapefile file per continent.
  - Cycle average: aggregation of all passes in a cycle. Possibly distributed as one shapefile per continent.
  - Kostas Andreadis will discuss cycle averages on Day 3 at 11 am
- Basic and expert versions

Basic versus expert products

- Basic version:
  - Shorter version of the products including best estimates of values such as area, discharge, diagnostics flags, etc.
- Expert version
  - Extensive version with extra fields containing measurement diagnostics, instrument calibration, geophysical corrections, discharge algorithm parameters, etc.

River nodes - Basic vs Expert

Attributes are divided into 8 categories:

1. Time and location:
   - Node id, reach id, time stamp, centroid of detected pixels (latitude and longitude) and associated uncertainties.
2. Hydro parameters:
   - Water surface height with respect to geoid and ellipsoid and associated uncertainties,
   - Width and estimated uncertainty,
   - Planform area (more to come) of water and uncertainties,
   - Cross-track distance, node distance, node length,
   - Metric of layover effect.
3. Geophysical flags:
   - Number of pixels per node,
   - Flags: dark water, layover, frozen surface, measurement quality, partial/fully observed, quality of cross-over calibrations.

River nodes - Basic vs Expert continued

4. KaRin σ_0 information:
   - Radar σ_0 and uncertainty, Radar σ_0 calibration, Radar σ_0 atmospheric correction from model data.
5. Geophysical references:
   - Geoid model height,
   - Tides: Earth, pole, water, and load.
6. Geophysical range corrections:
   - Dry and wet tropospheric and ionospheric correction to heights.
7. Instrument corrections:
   - Cross-over calibration, KaRin orientation (attitude), overall instrument height bias, internal calibration.
8. Items from the prior river database:
   - Prior height and historical variability,
   - Width and historical variability, distance from outlet, planform type, dam id.

River reaches – Basic vs Expert

1. Time and location:
   - Reach id, time stamp, coordinates of the center of the reach (latitude and longitude).
2. Hydro parameters:
   - Water surface height and slope and their uncertainties
   - Width and uncertainty,
   - "Enhanced" slope: water surface slope computed from smoothed node heights,
   - Cross-sectional area change and uncertainty,
   - Planform total area (+ other areas) of water pixels and uncertainty,
   - Layover metric,
   - Average deviation from a priori and detected node locations,
   - Cross-track distance,
   - Consensus discharge and uncertainty,
   - Discharge from individual algorithms.

River reaches – Basic vs Expert

3. Flags:
   - Number of good nodes,
   - Dark water, frozen surface, layover effect, quality summary, partial observation, quality of cross-over calibrations.
4. Geophysical references:
   - Geoid height and slope with respect to the ellipsoid,
   - Tides: Earth, pole, water, and load.
5. Geophysical range corrections:
   - Dry and wet troposphere and ionospheric corrections to surface height.

River reaches – Basic vs Expert

6. Instrument corrections:
   - Cross-over calibration,
   - KaRin orientation (attitude),
   - Overall instrument height bias,
   - Internal calibration.
7. Copy of Prior river database:
   - Number or up and downstream reaches and their ids,
   - Prior height and width and their historic variability,
   - Planform class,
   - Number of nodes per reach, distance from outlet, reach length,
   - Mean annual flow, dam id, discharge parameters.

Planform Areas

- We currently envision the following elements describing areas:
  - area_total: Total estimated planform area. Includes corrections for dark water. That's our best estimate of the planform area,
  - area_detct: Area of detected water pixels,
  - area_ht: Area of pixels used to compute height.

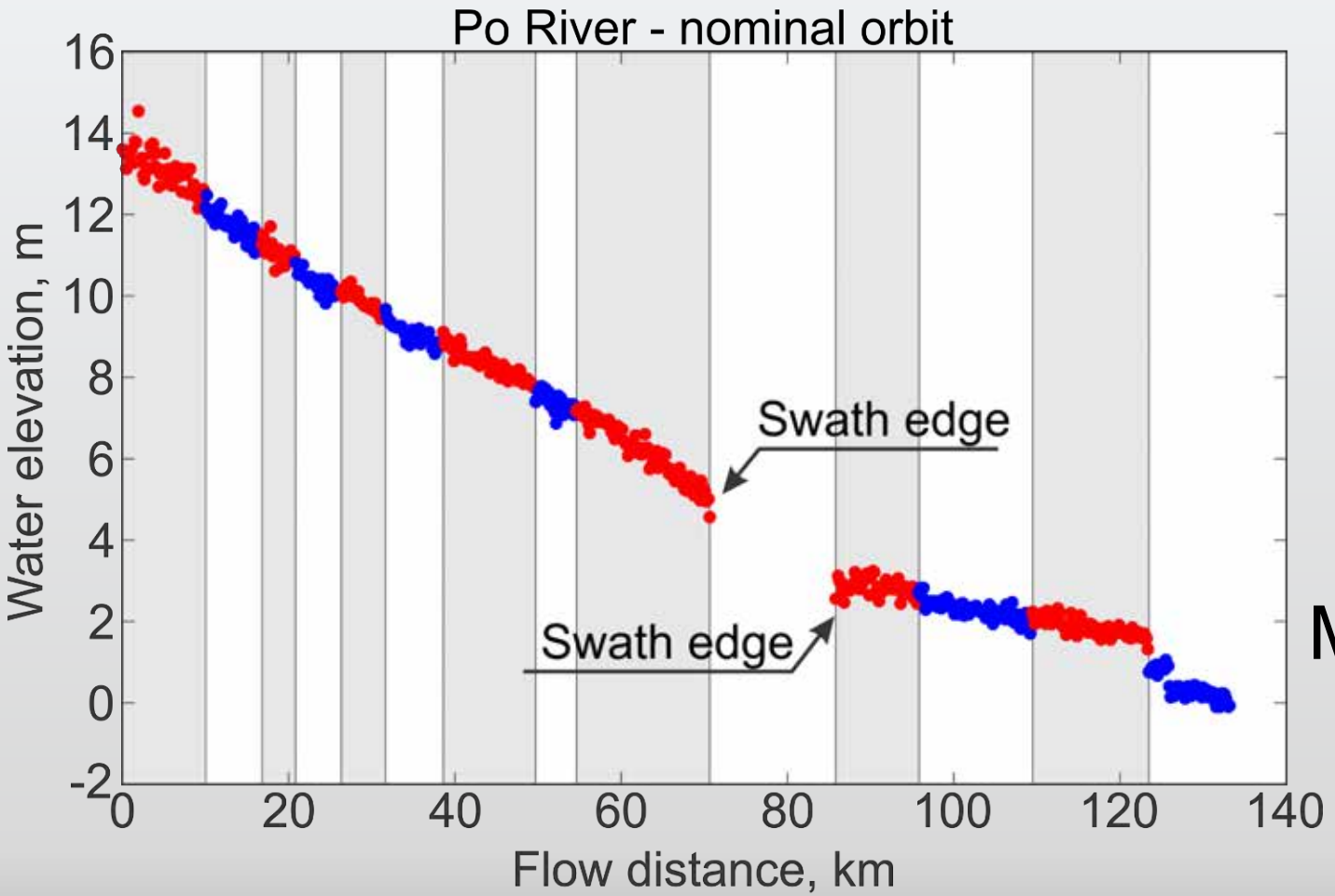
Discharge

- To avoid confusion, the ADT plans on including only the consensus discharge in the basic product.
- The method to compute a consensus discharge from the ensemble of individual algorithms is under investigation (more on this on Friday).

Height and slope uncertainties

- Node height and slope uncertainty formulations:
  - Simple height uncertainty derived from pixel height variability and number of pixels in a node is not a good predictor of node height uncertainty!
  - Due to ⇨ spatial correlation of pixel height error.
- Reach height and slope uncertainties:
  - Node height errors also present spatial correlation, so methods based on linear regression error estimation do not work.
- Methods to estimate node height uncertainty are in advanced stage.

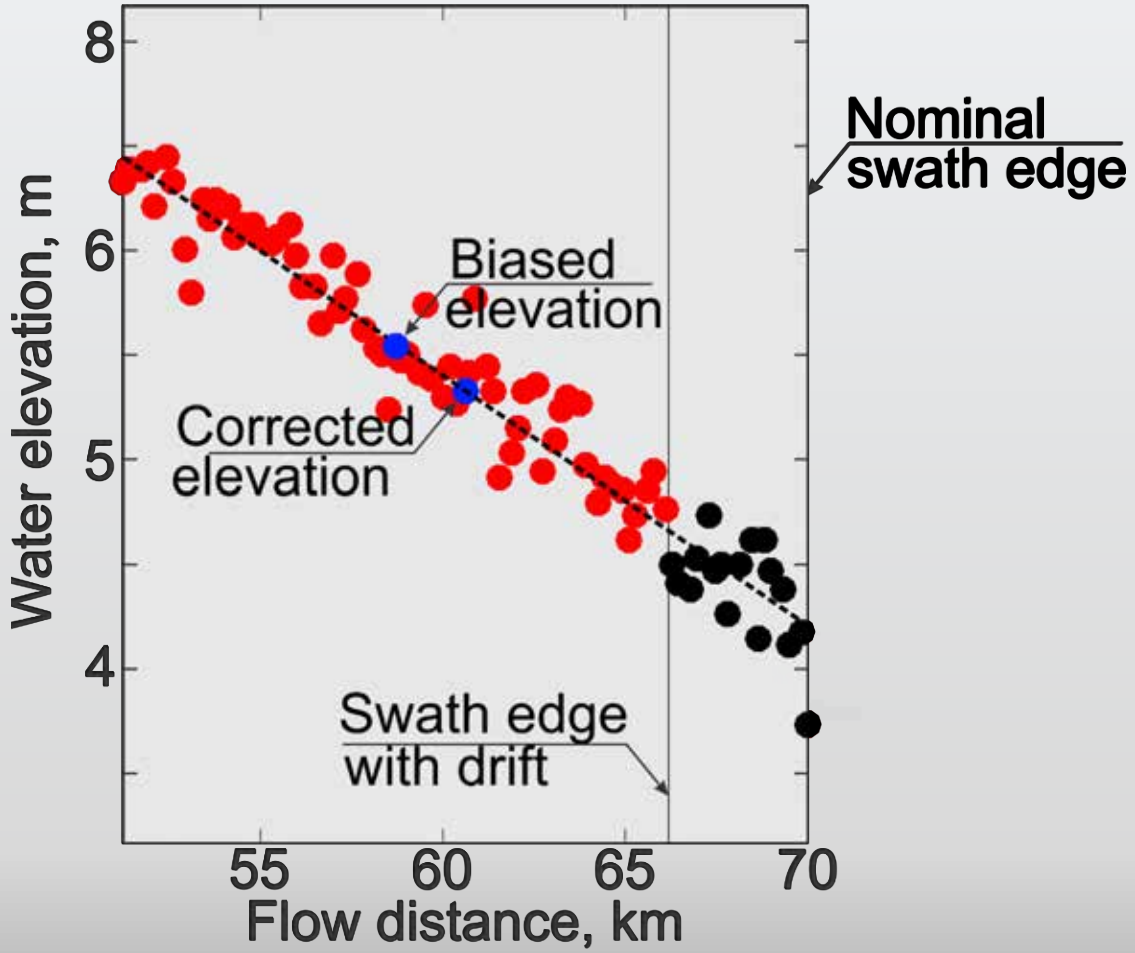
Partially observed reaches



Orbit drifts and dark water

Missing nodes

Partially observed reaches



- Limits on the fraction of missing nodes are under evaluation.
- Partial observation flag could assume 3 values:
  - Totally observed
  - Partially observed
  - Severely impacted

Investigation of special cases

- Unresolvable multi-channel reaches:
  - Could be processed in the same way as single channel reaches:
    - Pixels are mapped into the combined centerline,
    - $\text{Width} = \frac{Inundated\ area}{Reach\ length}$

- If channels are resolvable, e.g. wider than 100 m and longer than 10 km, they could be treated separately. Methods are currently under development

Special cases - continued

- Flat reaches:
  - Reach slope < slope uncertainty.
  - Discharge will not be computed by Manning's based algorithms.
  - More appropriate methods are under investigation.
- Reservoirs:
  - Short reach surrounding a dam will be defined.
  - Discharge will not be computed by Manning's based algorithms.
  - Storage change can be used to constrain up and downstream discharge.
  - Treated in more detail in Lake products.
- Waterfalls:
  - As with man-made dams.

Summary

- The ADT is converging towards the product attributes and their names:
  - Renewed effort to harmonize lake and river product to improve user experience.
- Methods for computation of water surface elevation uncertainty are forthcoming. Width and slope are under development.
- The definition of special cases and how they will be handled is advancing.

Thank you for your attention!!

Questions?