National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

Surface Water and Ocean Topography (SWOT) Mission

SWOT Science Team Meeting

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Bordeaux, France

Ocean Cal/Val Plan and Global Statistical Cal/Val

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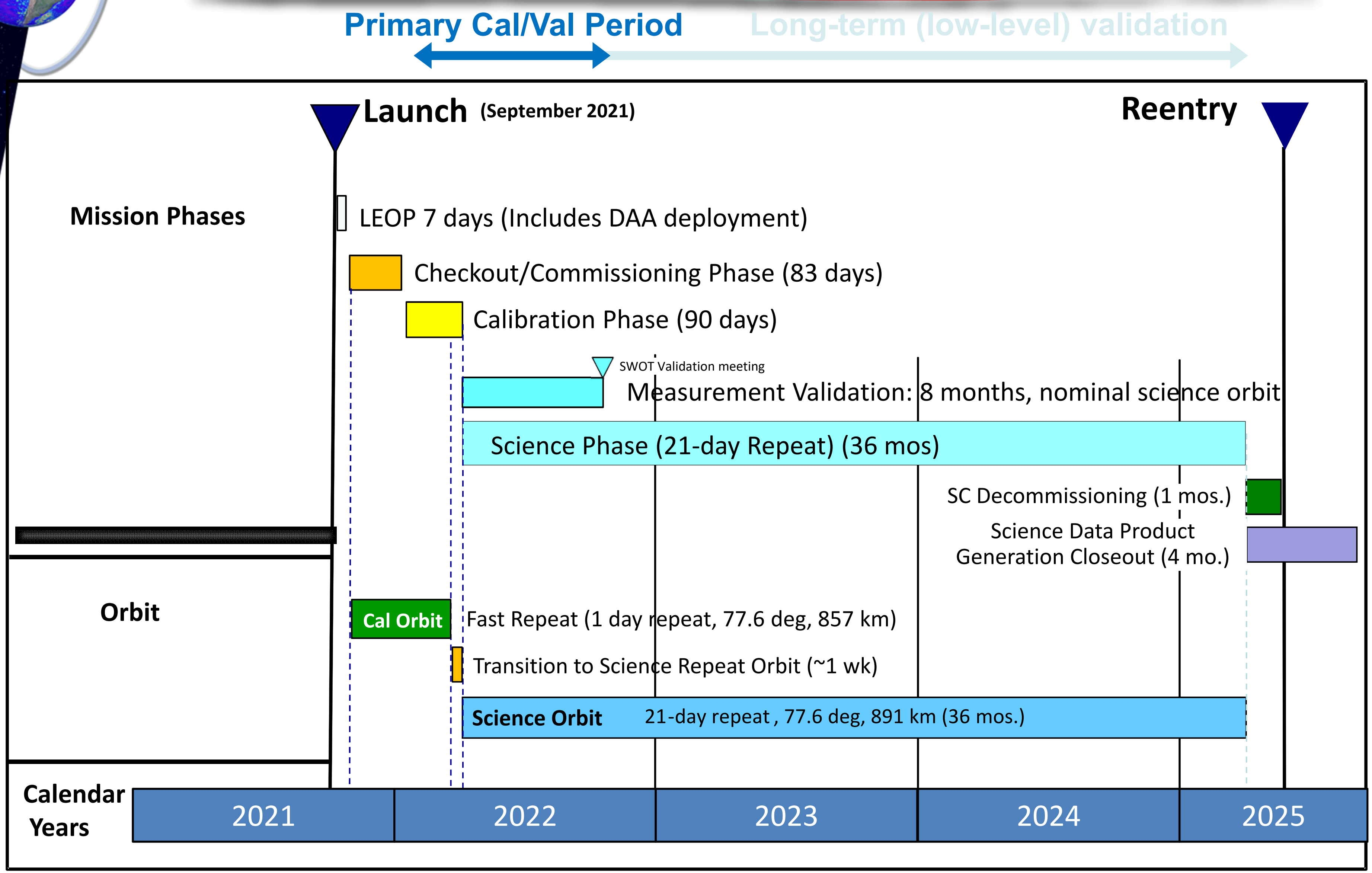
Cal/Val Objectives

- Basic objectives of Cal/Val[1]:
  - Calibration: Estimate calibration parameters for ground processing based on flight data
  - Error budget validation: Validate measurement performance ("*Does system behave as expected, and if not, what can/should we do?*")
  - Data product validation: Validate measurement with respect to high-level requirements ("*Does performance meet mission success criteria?*")
- Different sources of data may be useful for different Cal/Val objectives
  - Direct measurements of quantities related to SWOT measurement physics may best demonstrate that measurement performance is as expected—or enable diagnosis of problems if measurement performance is not as expected
  - Direct measurements of quantities of oceanographic science interest may best establish link between SWOT measurements and science objectives underlying SWOT requirements

[1] SWOT Cal/Val Plan, Sects. 1.2-1.3

Mission Phases/Timeline



Status as of 2018 Montreal Cal/Val Meeting

- Airborne lidar and hydrographic and geodetic in situ concepts were being pursued but needed to be matured and fully validated via pre-launch ocean experiments
  - Airborne lidar instrument was looking for faster, longer-range aircraft
  - in situ experiment design was being developed, including moorings, gliders, and wirewalker
  - GPS buoys were being considered in the context of other in situ measurements
- Global statistical approaches could likely validate wavelengths as short as 50-70 km, though validation to 150 km by local (in situ or airborne) approaches would still be preferred
- California Cal/Val site would be primary US project site
- Development of Mediterranean activities was continuing
- Follow-on validation and science activities were being coordinated external to SWOT project organization

Meeting Objectives

- Discuss big picture of how different Cal/Val approaches fit together in order to guide and prioritize future efforts:
  - Provide status on major ocean Cal/Val activities:
    - Global statistical approaches **(very brief summary)**
    - US in situ activities (hydrographic and GPS)
    - US lidar activities
    - Bass Strait in-situ activities
    - French/European in situ activities & French lidar activities
  - Discuss additional approaches and sources of data (“adopt a crossover”)
- Discuss technical feasibility and risks associated with individual approaches and identify risk mitigations
  - Ability of proposed approaches to collect data of sufficient accuracy
  - Ability to interpret and inter-compare SWOT and other data sets
  - Robustness of approaches to launch date changes, logistical challenges, etc.
- Coordinate planning of additional activities that might benefit SWOT

Timeline of US Cal/Val Plans

- Mid 2017: Monterey Bay experiment (in situ hydrographic, GPS collection)
- Mid 2018: Peer review of plans for pre-launch in situ campaign
- Early 2019: Execute pre-launch in situ campaign at California Cal/Val site
  - Deferred; plans to be discussed in meeting
- Mid 2019: Execute pre-launch lidar campaign on Gulfstream V aircraft
  - (Data analysis will continue beyond Bordeaux meeting)
- Late 2019: Refine post-launch Cal/Val plans based on experience from pre-launch campaigns

- Early 2022 (L+3 months to L+6 months): Post launch Cal/Val at California crossover site

Timeline of French/European Cal/Val Plans

- May 2018 - Pre-SWOT Western Mediterranean cruise (F. d'Ovidio & al)
- Fall 2018 - Lidar ocean flights along altimeter groundtracks (L. Froideval) – campaign was postponed due to weather conditions. Still not completed over open ocean - some flights were performed over Gironde Estuary.
- Fall 2018 – SKIM campaign performed, providing interesting inputs related to current and SWH variability.

Ongoing activities :

- Pre-launch preparation of global statistical CalVal activities
- Assessment of SWH, Tropo, MSS, … variability within the swath globally.
- Satellite product support for international « Adopt-a-crossover sites »

Future plans :

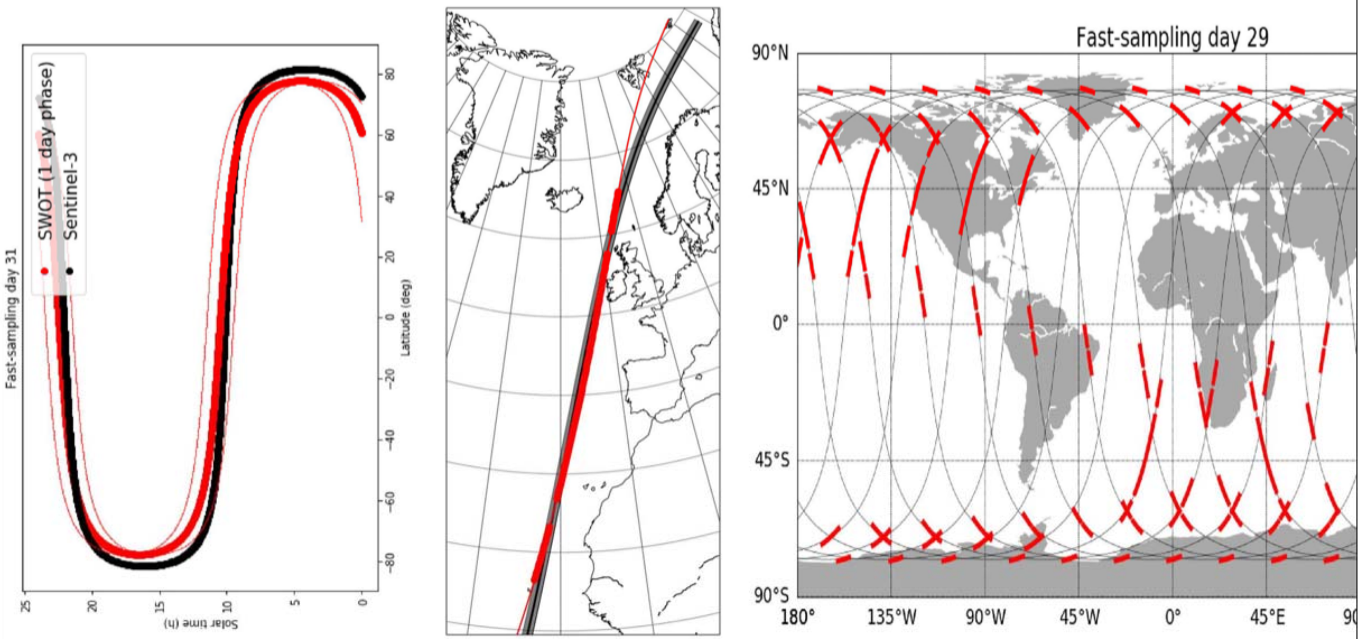
- Potential synergy with other satellite campaigns or Calval projects : e.g. CFOSAT in 2020 (bay of Biscay), potential future SKIM campaigns.
- 1day Xovers : assess SSH variability, SWH & Sigma0 mean values and variability, MSS/Tides/DAC quality, internal tides amplitudes; … continue the analysis with more recent inputs or models
- Continue working on LRM and SAR processing methods improvement to contribute to SWOT validation
- Early 2022 (L+3 months to L+6 months): Post launch Cal/Val at chosen crossover sites (Mediterranean Sea, SW Pacific, ...)

Preparation of global statistical CalVal activities

- Refer to G. Dibarboure presentation during Montreal meeting : https://spark.adobe.com/page/31dB2ZaWuvSnZ/ : identify SWOT / JCS or S3A/B Xover with a short time gap

Case 1: good alignment of solar times

- Where a XOVER can exist, the time difference is always less than 1h
- Valid segments at all latitudes + some extremely long segments



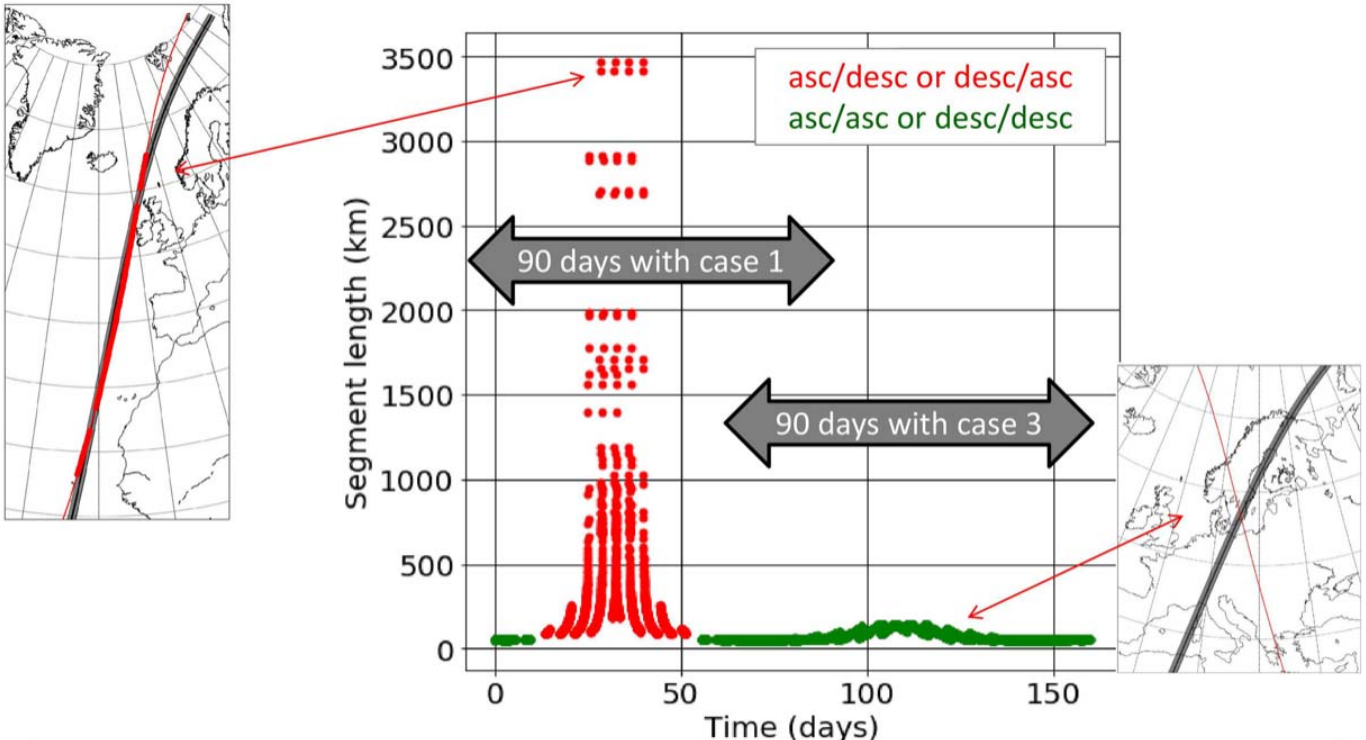
Longest XOVER found

One random day's worth of S3A XOVERs when solar times are aligned (S3B: same quantity, different regions)

Preparation of global statistical CalVal activities

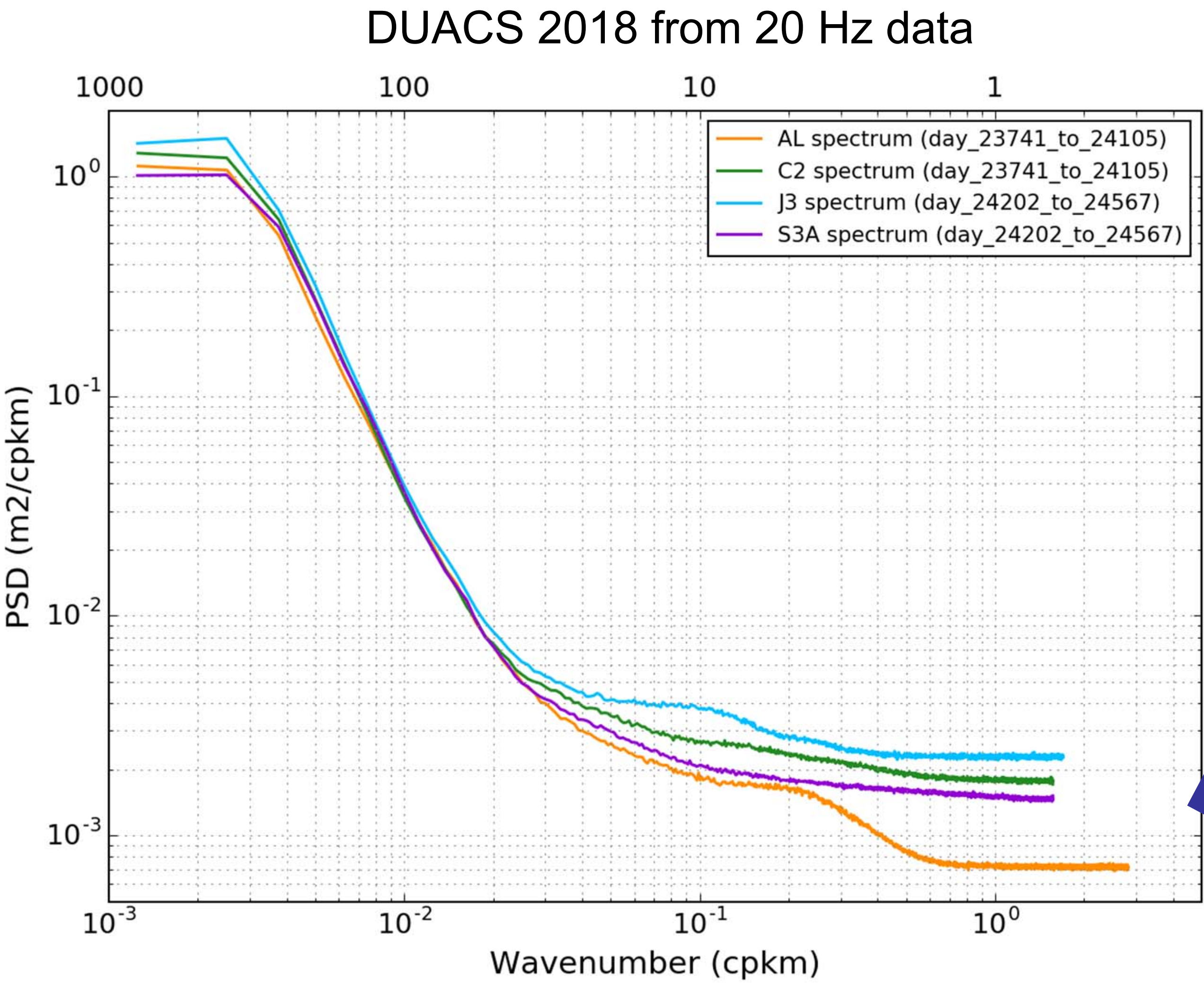
- Refer to G. Dibarboure presentation during Montreal meeting : https://spark.adobe.com/page/31dB2ZaWuvSnZ/

Length of XOVERs: when should be the sampling phase ?

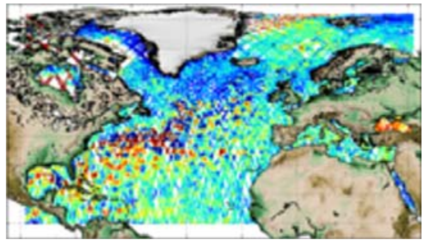


Sentinel-3 provides many 1h XOVERs during <u>any</u> 90-day period
Better if we align solar times (λ extended from 150 to 1000 km)

Ongoing validation: R&D DUACS 2018 (better LRM) : V1 demonstrative data set

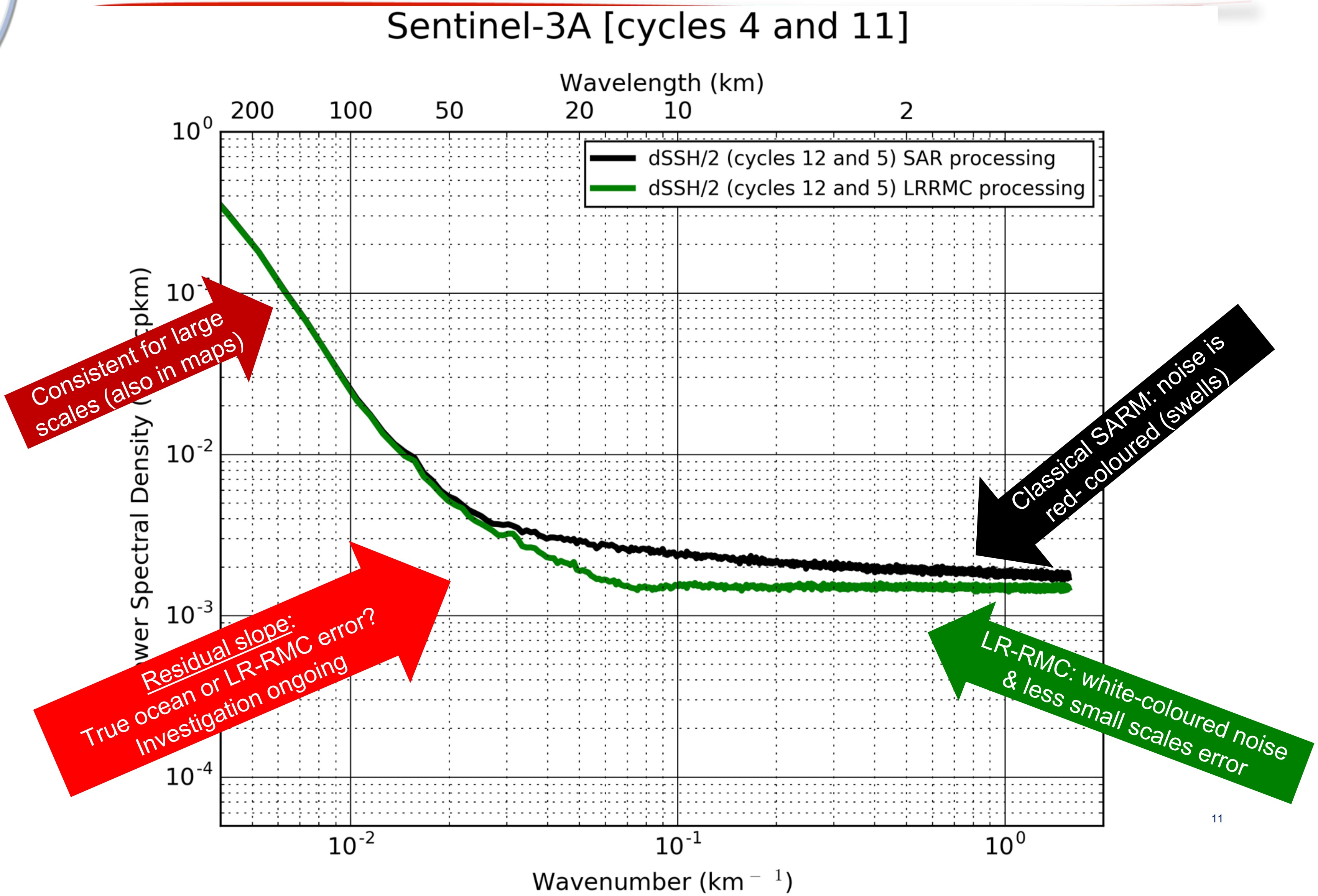


Usable up to	Europe	Agulhas
SARAL	30 km	40 km
Sentinel-3	30 km	45 km
Jason-3	35 km	50 km
CryoSat-2	35 km	50 km
Jason-2	35 km	50 km



SARAL slightly better than Sentinel-3 in v1

Ongoing development: R&D DUACS 2019 (better SARM)



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