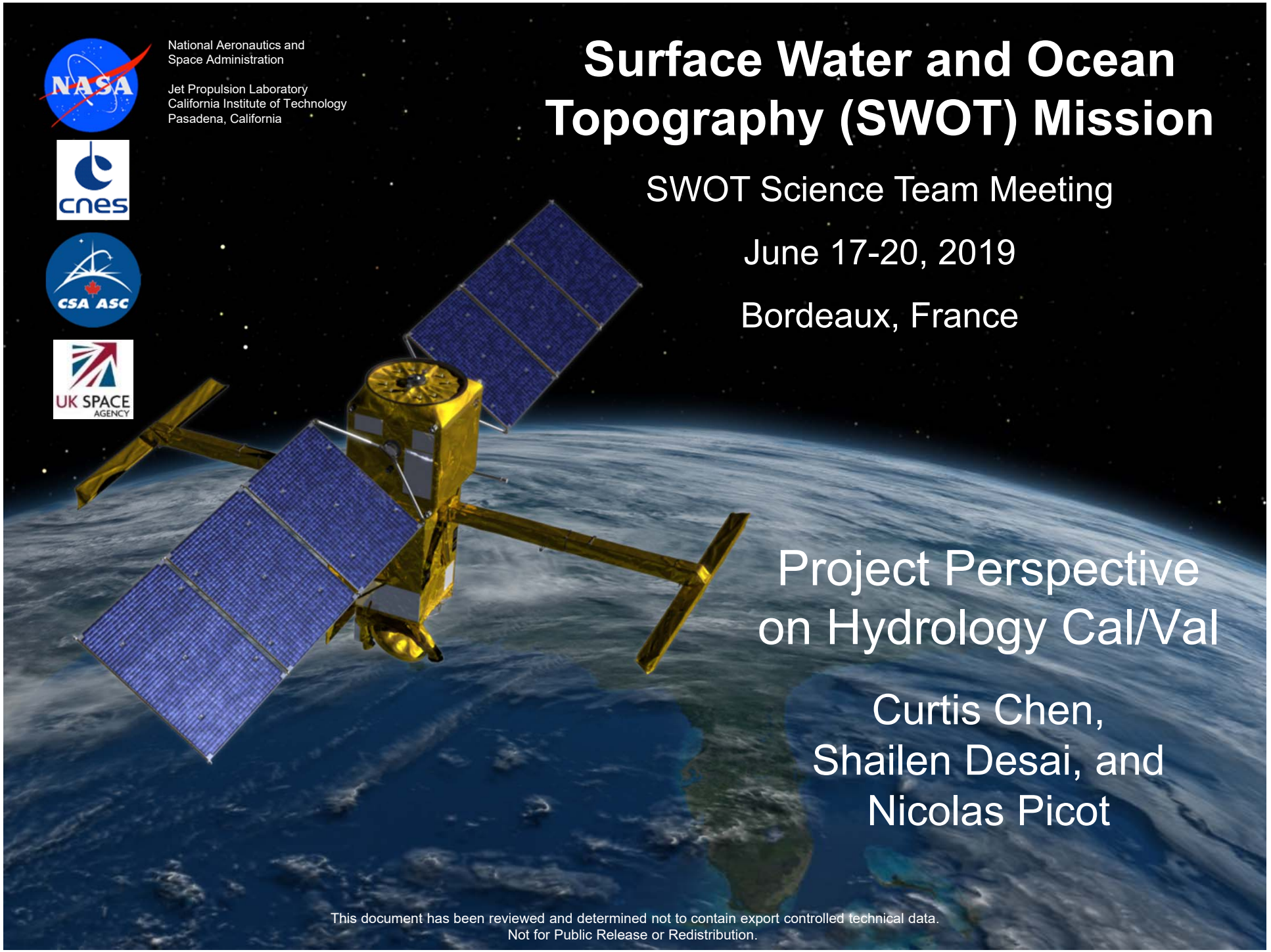
National Aeronautics and
Space Administration
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California
Surface Water and Ocean Topography (SWOT) Mission
SWOT Science Team Meeting
June 17-20, 2019
Bordeaux, France
Project Perspective on Hydrology Cal/Val
Curtis Chen,
Shailen Desai, and
Nicolas Picot
This document has been reviewed and determined not to contain export controlled technical data.
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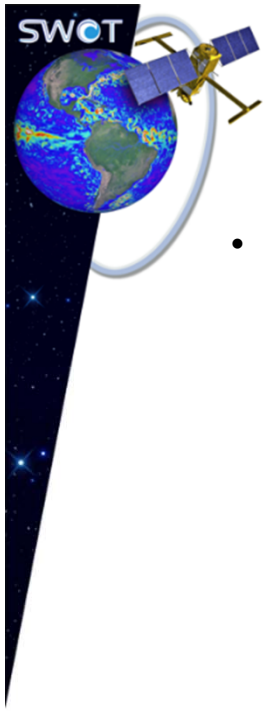
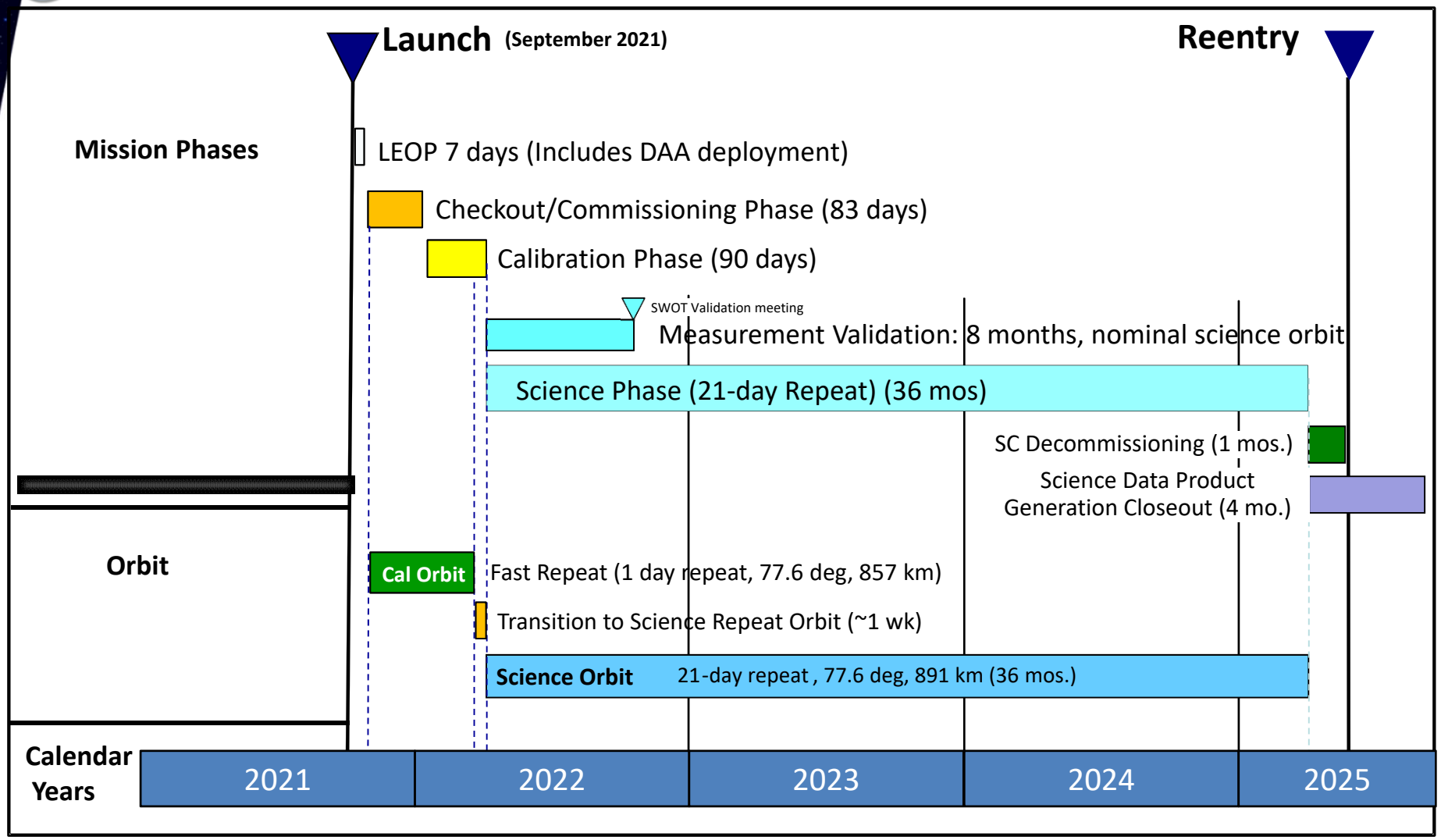



# Cal/Val Objectives

- 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 science interest may best establish link between SWOT measurements and science objectives underlying SWOT requirements

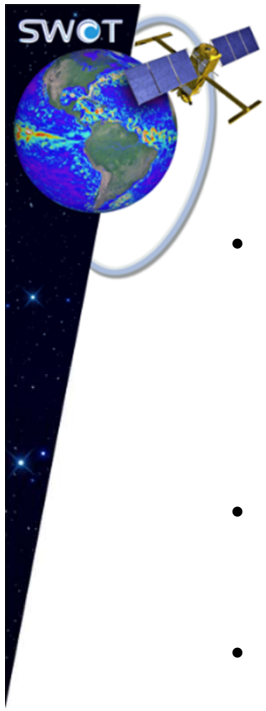
[1] SWOT Cal/Val Plan, Sects. 1.2-1.3

# Mission Phases/Timeline



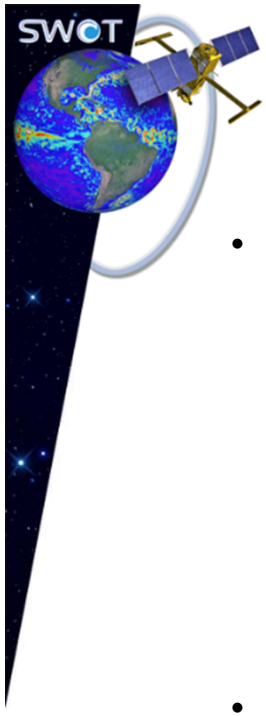

# Programmatic Context

- Cal/Val plan released as JPL document (D-75724) in January 2018
- Cal/Val status and plans have been formally reviewed
  - Pre-PDR Measurement Review (Feb 2016)
  - Pre-CDR Measurement Review (Dec 2017)
  - Project CDR (Feb 2018)
    - Ocean Cal/Val received request for action (RFA) from board to complete glider and lidar validation
    - RFA did not take exception with plan, but action was to carry out plan




# Ocean and Hydro Cal/Val Relationships

- Calibration is in general split between instruments (KaRIn, AMR, etc.), not between ocean and hydro
  - Hydrology slope requirement drives phase screen calibration accuracy, but phase screen is likely to be calibrated with ocean data
- Crossover/operational calibration is area of direct overlap between ocean and hydro measurements
- Error budget validation involves overlap between ocean and hydro Cal/Val where objective is to validate fundamental measurement physics shared by ocean and hydro measurements
  - Corner reflector deployment is organized with hydro Cal/Val but data validate basic SWOT imaging performance that is fundamental to both ocean and hydro data streams
- **Ocean and hydro Cal/Val are not completely independent; project members will represent ocean community at this hydro meeting**




# Project Objectives for Meeting

- Discuss big picture of how different Cal/Val activities fit together in order to guide and prioritize future efforts:
  - Provide status on plans for major hydro Cal/Val activities:
  - Discuss overall scope and extent of activities needed to meet Cal/Val objectives described above (calibration, error-budget or performance validation, data-product or measurement validation)
  - Discuss relationships between different Cal/Val activities
- Discuss technical feasibility, benefits, and risks associated with individual activities and identify risk mitigations where needed
  - Coverage of Cal/Val objectives by activity
  - Ability of proposed activities to collect data of sufficient accuracy
  - Ability to interpret and inter-compare SWOT and other data sets
  - Robustness of plans to launch date changes, logistical challenges, etc.
- Identify next steps for refining Cal/Val plans in order to make them as sound, as robust, and as efficient as practical

# CNES CalVal approach

- Hydro CalVal will be based on :
  - Dedicated CalVal insitu sites → refer to S. Calmant and JF. Crétaux presentations
  - But also the contribution of available networks (GRDC, French SCHAPI…),
  - other satellite projects (Sentinel-3 nadir payload, Jason-CS, …)
  - and the satellite constellation (altimetry, imagery, …)

- CalVal activities in France since early 2017:
  - Seine & Gironde campaigns → refer to P. Bonnefond presentation on Thursday, including several means (GPS carpet, Drone, ADCP, Lidar, GPS buoys, …)
  - Rhine workplan defined by H. Yésou

- International Calibration → S. Calmant and JF. Crétaux

# Nadir satellite contribution

- S3A and S3B will provide a very dense network of water measurements worldwide with numerous ‘cross overs segments’ between S3A/B ground track and SWOT swath

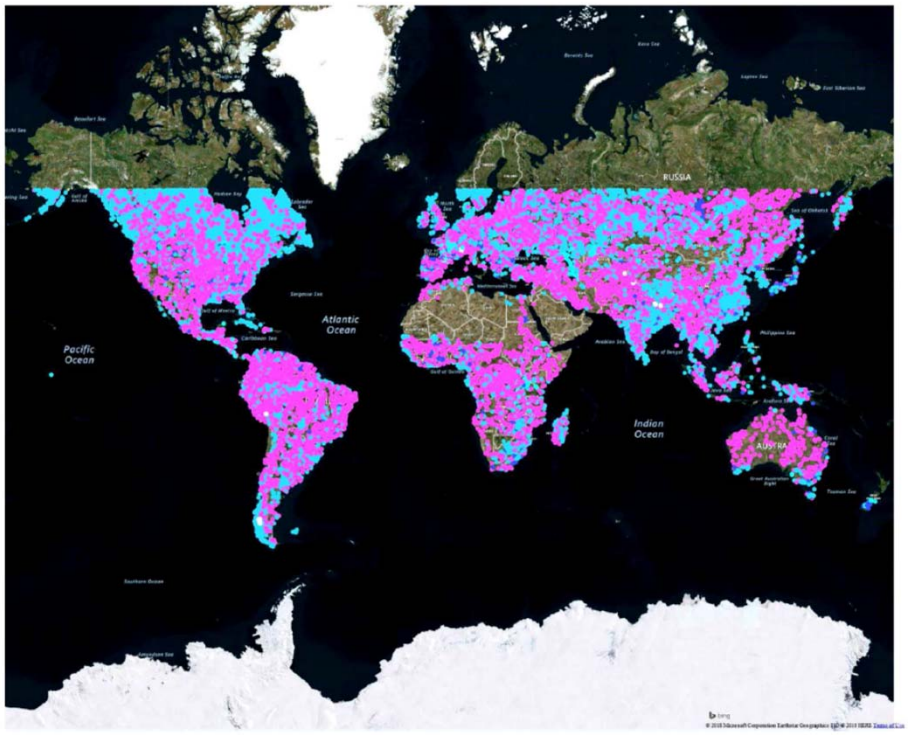
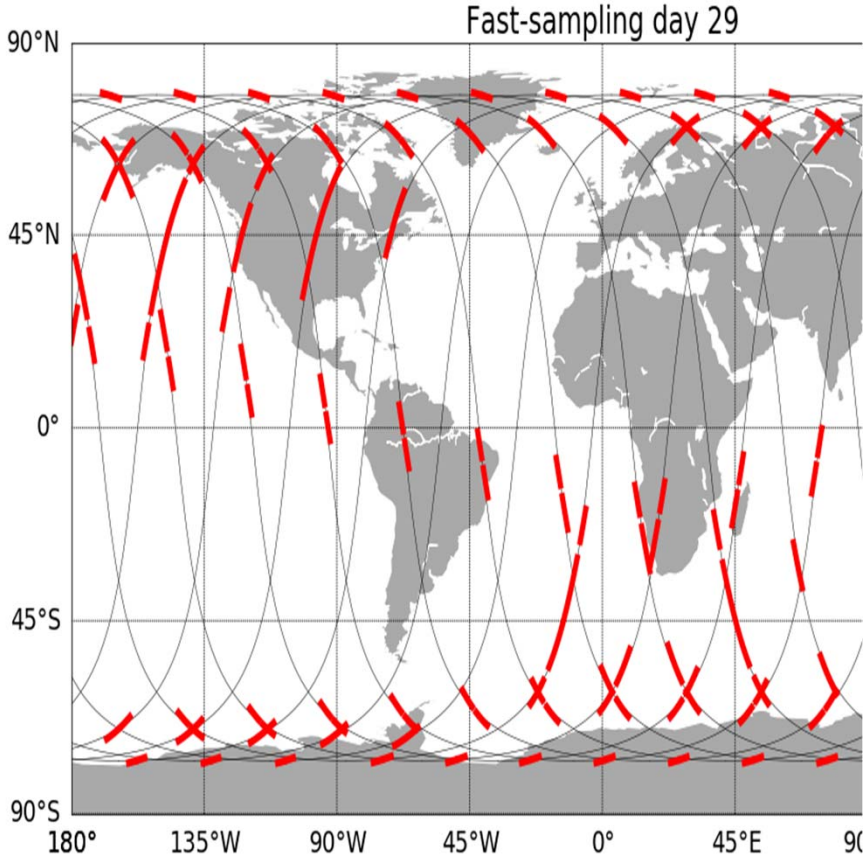



Figure 1 : Map of 33,261 virtual stations provided by OLTC users, LEGOS and CNES (rivers in pink, lakes and reservoirs in blue, glaciers in white) for Sentinel-3A.

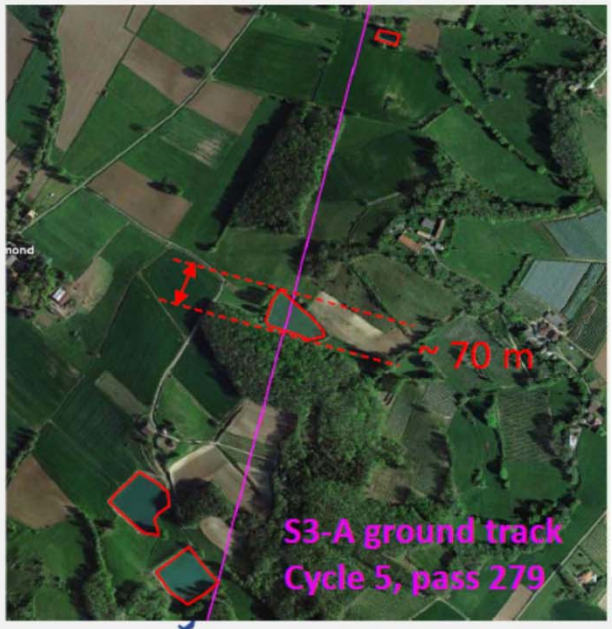


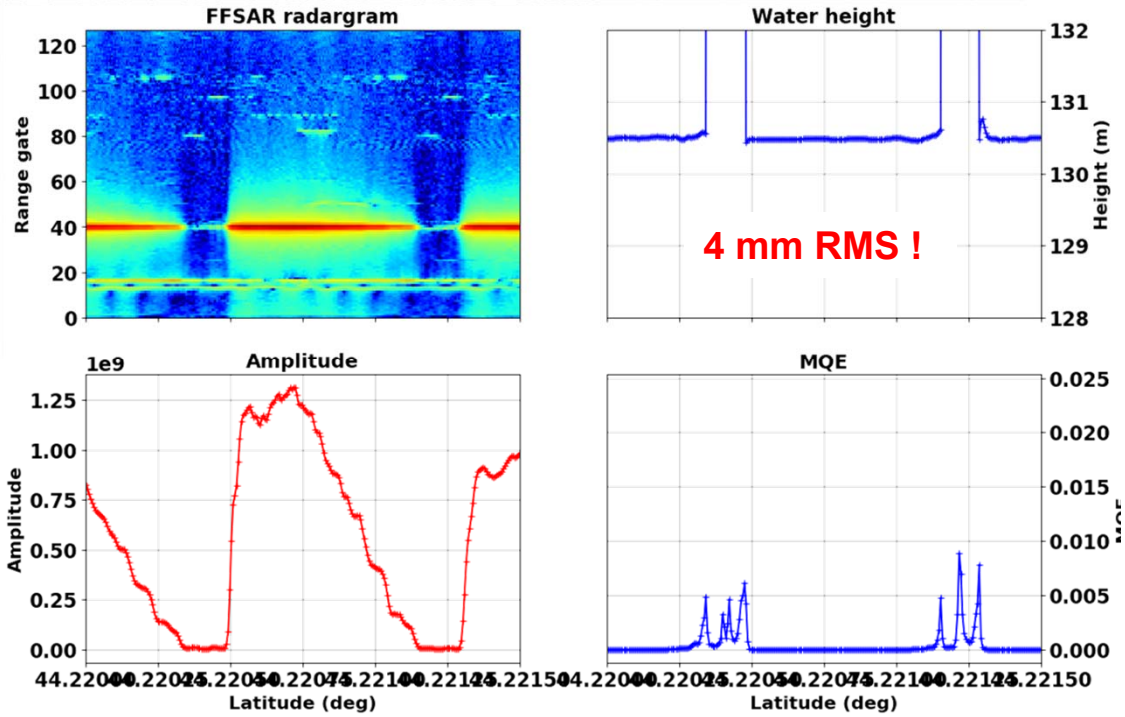
# Nadir satellite contribution

New SAR processing methods (FF-SAR) have been prototyped and will be tested on large number of rivers and lakes to assess data quality in 2019-2020

## Focusing on a real target

Small pond on the S3-A ground track w
many other water bodies nearby

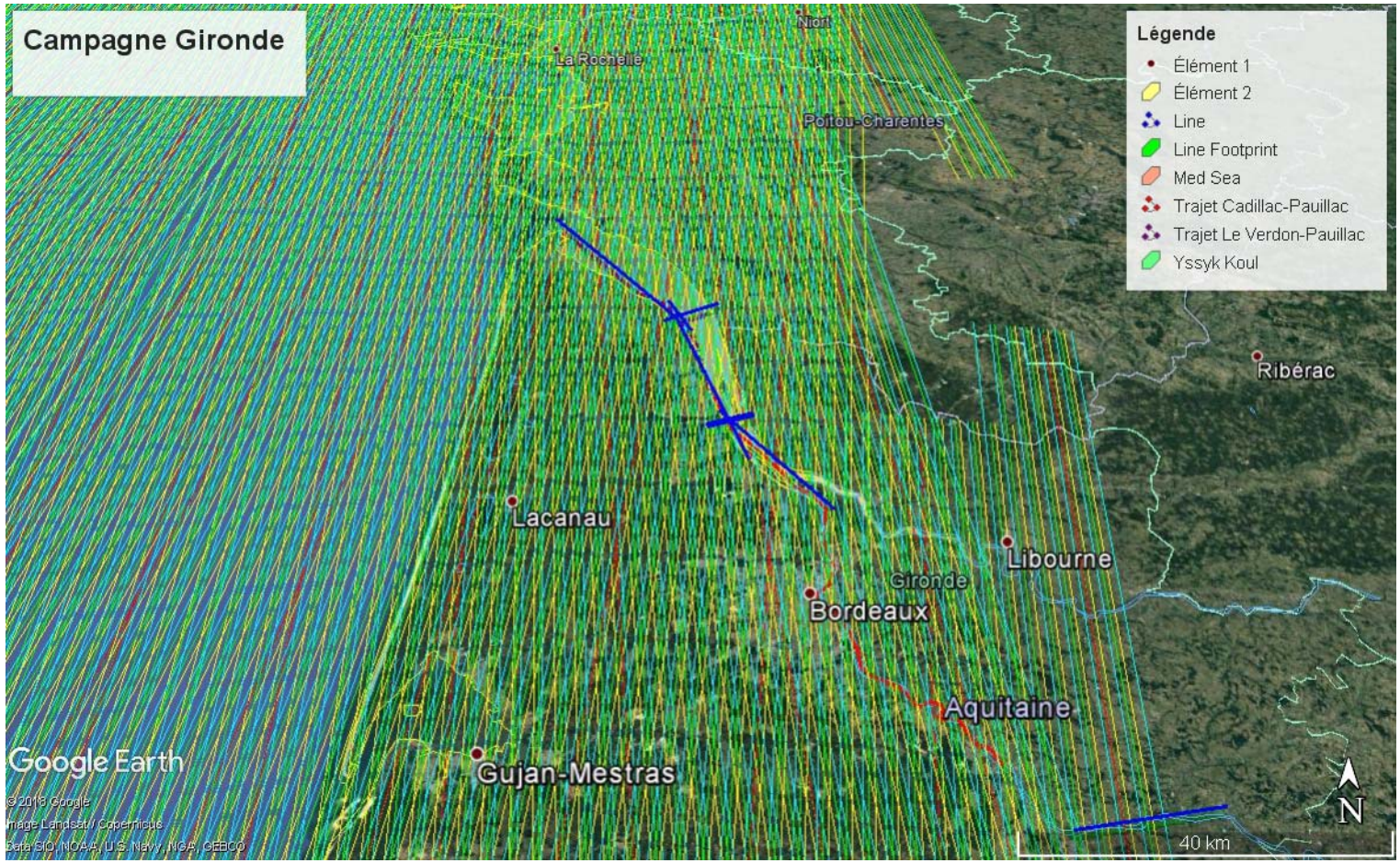



OSTST, Sept. 2018, Ponta Delgada

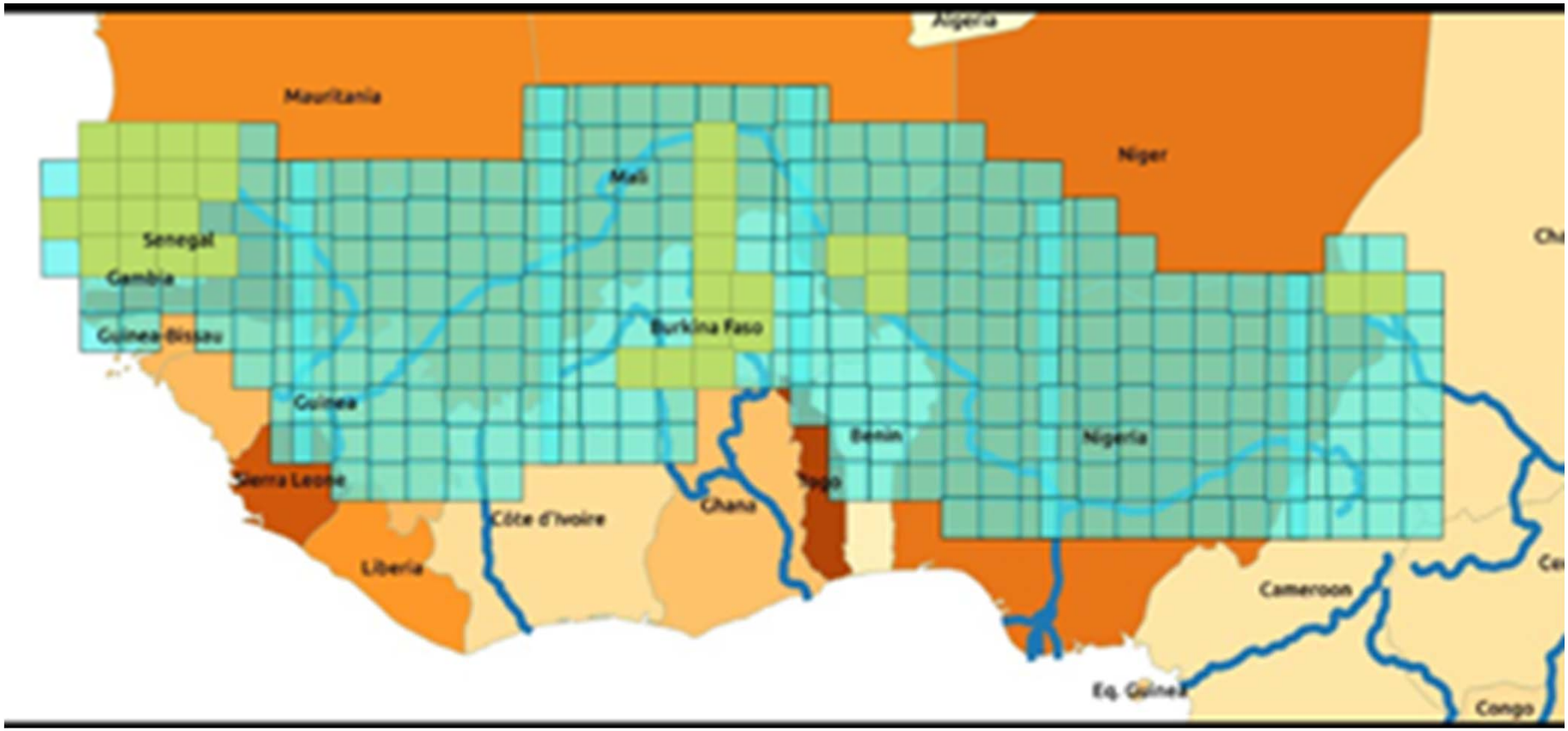
# IceSat-2

- This mission could provide very valuable data to assess water height (and bathymetry!) with a very dense coverage



# Satellite imagery = Surfwater (dynamic water mask)

- Ongoing development on CNES side to generate dynamic water masks with Sentinel-1 and Sentinel-2 data : will be an important mean to compare with SWOT water mask




# Backup