

## Engineering Applications of the Surface Water Ocean Topography (SWOT) Satellite Mission

2019 SWOT Early Adopter Workshop, May 20-21, 2019, Paris, France

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SWOT is a research satellite mission (Fig 1), planned for launch in 2021, and developed jointly by NASA and Centre for National D'Etudes Spatiales (CNES), with participation from the Canadian and UK space agencies. SWOT mission will serve both the hydrology and oceanography communities. Designed to make the first-ever global survey of Earth's surface water, SWOT satellite mission will collect detailed measurements of how water bodies on Earth change over time. The satellite will survey at least 90 percent of the globe, studying Earth's lakes, rivers, reservoirs and oceans at least twice every 21 days to improve ocean circulation models, and weather and climate predictions, and aid in freshwater management around the world.

During May 20-21, 2019, a workshop was organized at CNES headquarters (HQ) in Paris (France) for SWOT Early Adopters (EA). These EAs had earlier proposed a tangible plan to proactively assess the utility of future SWOT data to address the needs of their respective agencies on surface water or ocean related applications. With two years to launch, it was considered an opportune time to re-engage with the EAs to provide further hands-on training, understand the progress they have made, document the hurdles and needs they face and identify clear pathways to accelerate

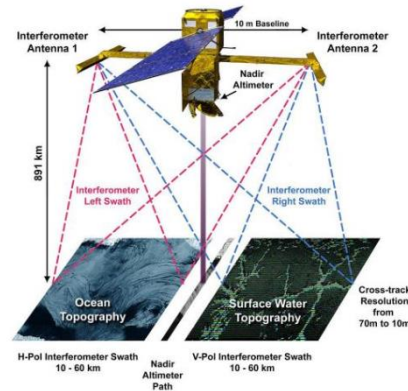


Figure 1. The SWOT satellite mission

successful use of SWOT data after launch. The workshop was organized by the SWOT Application Working Group (SAWG) leads with support provided by the NASA Applied Sciences Program, the SWOT Project, and CNES. This is the second such EA workshop designed to explore ways to maximize the user-readiness of SWOT data after launch. The Civil Engineering Profession and in particular the water practitioner community stands to benefit from SWOT mission data.

The participants who attended the workshop (Fig. 2) represented various stakeholder agencies from the public and private sector that deal with water issues including;



Figure 2. Participants of the 2019 SWOT Early Adopter Workshop

Asian Disaster Preparedness Center (ADPC), Indian Institute of Technology (IIT), Pakistan Council for Research in Water Resources (PCRWR), Collecte Localisation Satellites (CLS), BRL Ingénierie (BRLi), Consortium of Universities to Advance Hydrologic Science Institute (CUAHSI), NASA SPoRT, Compagnie Nationale du Rhône (CNR), Mercator, University of Bonn, Mercator-Océan and FM Global. A hands-on training session on the use of cloud computing for SWOT-like data was organized in recognition that SWOT mission data would be hosted on a cloud-computing platform after launch. EAs were shown a demonstration of an open-source tool developed by CNES for generation of SWOT-like data for inland water bodies (Figure 3).

EAs shared a futuristic vision of where they would like their project to evolve after SWOT launch with anticipated future press release titles. These press release titles summarized the desired newspaper headline each EA aspired to achieve after demonstrating a successful societal application or benefit from SWOT data after launch. A poll was carried out among participants to identify the top 3 such newspaper headlines that appeared most feasible and important for the Mission. These are as follows (note the date and newspaper title are imaginary):

1. EOS-AGU, July 2022 - Assimilation of SWOT data improves forecasting skill of NOAA National Water Model (by NASA SPoRT)
2. DAWN Newspaper, September 2023 - SWOT data enables populate and blameless management of waterlogging in Sindh province of Pakistan (by PCRWR)
3. EOS-AGU, July 2022 - SWOT Follow-on Mission in development after successful use of SWOT data in operational forecasting (by NASA SPoRT)

The key take home messages extracted from this workshop are:

- Most EAs have identified clear pathways to assessing the use of SWOT data for exploring value to their decision-making or societal application needs within their existing infrastructure and operations.
- EAs identified the lack of SWOT simulated data with realistic geophysical representation over their study region as a key hurdle to successful completion of their project, and look forward to SWOT simulated data sets from the SWOT project in the near future.
- EAs urged for continued support and guidance from the SWOT Application Working Group to address training needs for SWOT data handling in the cloud and use of ancillary tools and satellite data.
- Immersive learning and training experiences at research or academic centers relevant to SWOT followed by hackathons for rapid prototyping of targeted solutions were identified as timely for EAs.



Figure 3. Workshop participants during a tutorial session on cloud computing and demonstration of open source simulator developed by CNES