Intercomparing Open Source Surface Water Extent Mapping Products & Software Packages

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I. Introduction

A joint initiative of NASA, USAID, and leading geospatial organizations in Asia, Africa, and Latin America SERVIR partners with geospatial organizations to apply Earth Observation data to address critical challenges in weather & climate resilience, agriculture & food security, and other thematic areas

SERVIR has created surface water extent mapping software using Earth Observations to address flooding challenges in our Hindu Kush Himalaya and Southeast Asia hubs. Multiple international organizations (e.g. Copernicus, NOAA, NASA) have recently released their own open source surface water extent products derived from Earth Observations.

Thus, SERVIR has launched the **Flood Mapping Intercomparison Project**, aiming to inform decision makers regarding which contexts open source surface water extent mapping products and software may perform better than others. In the first phase of this project, SERVIR will intercompare six open source products and software packages that map surface water extent in near-real-time, and will release publications and capacity building materials regarding the products themselves and our intercomparison workflow.

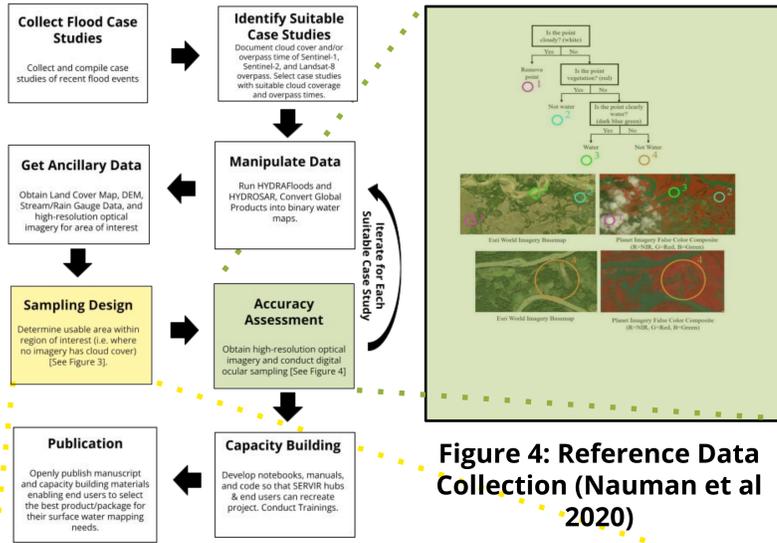**Figure 1: Map of SERVIR Countries**
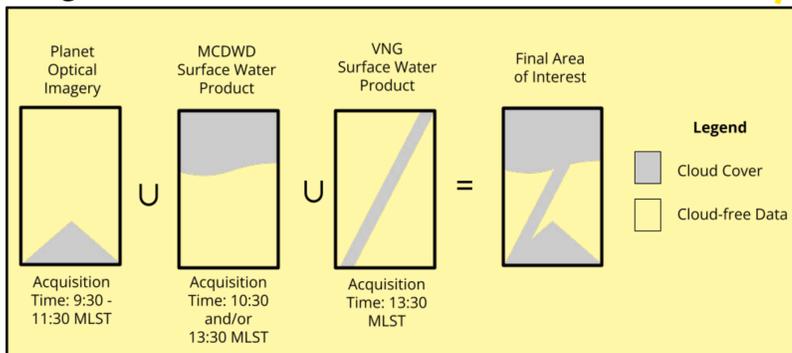
II. Overview

Figure 2: Phase 1 Workflow

Figure 3: Area of Interest Determination

Figure 4: Reference Data Collection (Nauman et al 2020)

III. Data

Product/Software Package	Full Name	Creator(s)	Temporal Extent	Temporal Resolution	Spatial Extent	Spatial Resolution	Source Dataset	Acquisition Time (in Mean Local Solar Time)	DOI
OPERA DSWx-HLS	**O**perational **P**roducts for **E**nd Users from **R**emote Sensing **A**nalysis **D**ynamic **S**urface **W**ater E**x**tent – Harmonized **L**andsat-**S**entinel	- Operational Products for End Users from Remote Sensing Analysis (OPERA) - Jet Propulsion Laboratory - NASA Goddard Space Flight Center - United States Geological Survey	April 2023 - present [Version 1]	~2.9 days	Near-Global (all landmasses excluding Antarctica)	30 meters	Harmonized Landsat-Sentinel (HLS)	Landsat 8: 10:00 Sentinel-2: 10:30	10.5067/OPDSW-PCVV1
MCDWD	**M**ODIS **C**ombined **W**ater **D**etection aka MODIS Near Real-Time Global Flood Product (Collection 61) (Release 1)	- NASA LANCE (Land, Atmosphere Near Real Time Capability for Earth Observations) - NASA Goddard Space Flight Center	Mar 8 2021 - present	Daily	Near-Global	0.0020833 degrees (~232 m at the equator) [Slayback et al 2022]	MODIS combined product (i.e. AQUA and TERRA, abbreviated as MCD)	TERA: 10:30 AQUA: 13:30	10.5067/MODIS/MCDWD_L3_NRT.061
VNG Flood	VIIRS Flood Detection Map (aka VIIRS NOAA & GMU Flood)	- National Oceanic and Atmospheric Administration (NOAA) - George Mason University	2012 - present	Daily	NRT Subproduct: Global (80 S and 80N) (actually ranges between 76 and 85 depending on DOY [see ATBD]) 1-day composite & 5-day composite subproducts: global land between 60S and 75 N	375 meters	VIIRS	13:30	10.1016/j.rse.2017.09.032
GFM	Global Flood Monitoring	- European Commission Copernicus Emergency Management Service / Copernicus Global Flood Awareness System - Luxembourg Institute of Science and Technology - German Aerospace Center (DLR) - Wien Technological University (TU Wien)	2015 - present	12 days (6 days when Sentinel 1-B is available)	Global	20 meters	Sentinel-1	18:00	10.2760/362585
HYDRAFloods	**Hy**drologic **R**emote Sensing **A**nalysis for **F**loods	- SERVIR Science Coordination Office / University of Alabama in Huntsville - Asian Disaster Preparedness Center (ADPC) - Spatial Informatics Group	2015 - present	12 days (6 days when Sentinel 1-B is available)	Operationally run over SE Asia, but able to be run Globally	30 meters	Sentinel-1	18:00	N/A
HYDROSAR	N/A	- University of Alaska Fairbanks - NASA Alaska Satellite Facility - NASA Marshall Space Flight Center - University of Alabama in Huntsville - NASA Goddard Space Flight Center - Jet Propulsion Laboratory	2015 - present	12 days (6 days when Sentinel 1-B is available)	Operationally run for the Hindu-kush-Himalaya region, but able to be run Globally	30 meters	Sentinel-1	18:00	N/A

Table I: Characteristics of Flood Products/Packages

IV. Limitations

➢ In an analysis of 119 Sentinel-1 Scenes covering flood case studies...
  ■ 18 had low cloud coverage % (union of cloud masks < 90%)...
    ● 9 of which had a synchronous HLS overpass
    ● 0 of which were located in Southeast Asia

V. Capacity Building

Scan this QR code to access our Github, to learn more about these products and implement our workflow yourself!

SCAN ME

VII. Acknowledgements

VI. References

- Bato, Grace, et al. "Observational Products for End-Users from Remote Sensing Analysis (OPERA) Product Description Version 1.4." National Aeronautics and Space Administration, 13 May 2022.
- European Space Organization. "S1 Mission." *SentiWiki Home*, sentiwiki.copernicus.eu/web/s1-mission. Accessed 31 May 2024.
- European Space Organization. "S2 Mission." *SentiWiki Home*, sentiwiki.copernicus.eu/web/s2-mission#:~:text=Sentinel%2D2A%20and%20Sentinel%2D2B%20occupy%20the%20same%20orbit%20separated,10%3A30%20(am). Accessed 31 May 2024.
- Nauman, Claire. "Evaluation of Flood Forecasting and Surface Water Mapping System Performance in Cambodia." *University of Alabama in Huntsville*, 2020.
- Planet Labs. "Planet Fusion Monitoring." *Calibration, Analysis Ready Data, and InterOperability (CARDIO) Operations*, 1 Mar. 2022, assets.planet.com/docs/Fusion-Tech-Spec_v1.0.0.pdf.
- Satellite Products and Services Review Board. "Algorithm Theoretical Basis Document: NOAA JPSS/VIIRS Flood Mapping (VFM) Product." National Oceanic and Atmospheric Administration, 1 June 2021.
- Slayback, Dan. "MODIS NRT Global Flood Product User Guide Revision C." NASA Goddard Space Flight Center, 12 Jan. 2023.

ALLIANCE

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