

River discharge estimations from Near-Infrared satellite data within the ESA river discharge Climate Change Initiative project

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START

River Discharge (RD) is a crucial variable for understanding water availability and climate impacts, but in-situ monitoring is limited by sparse gauging networks. Satellite remote sensing (RS) offers a valuable alternative, using radar altimetry and optical sensors to estimate discharge. Reflectance-based methods leverage multispectral imagery to estimate discharge using pixel classifications. These methods are promising for frequent, global monitoring but face challenges like cloud cover, sediment interference, and sensor limitations. Here, CM and CMW are tested across multiple global sites in a multi-mission approach that aim to improve accuracy and coverage of the estimated RD.

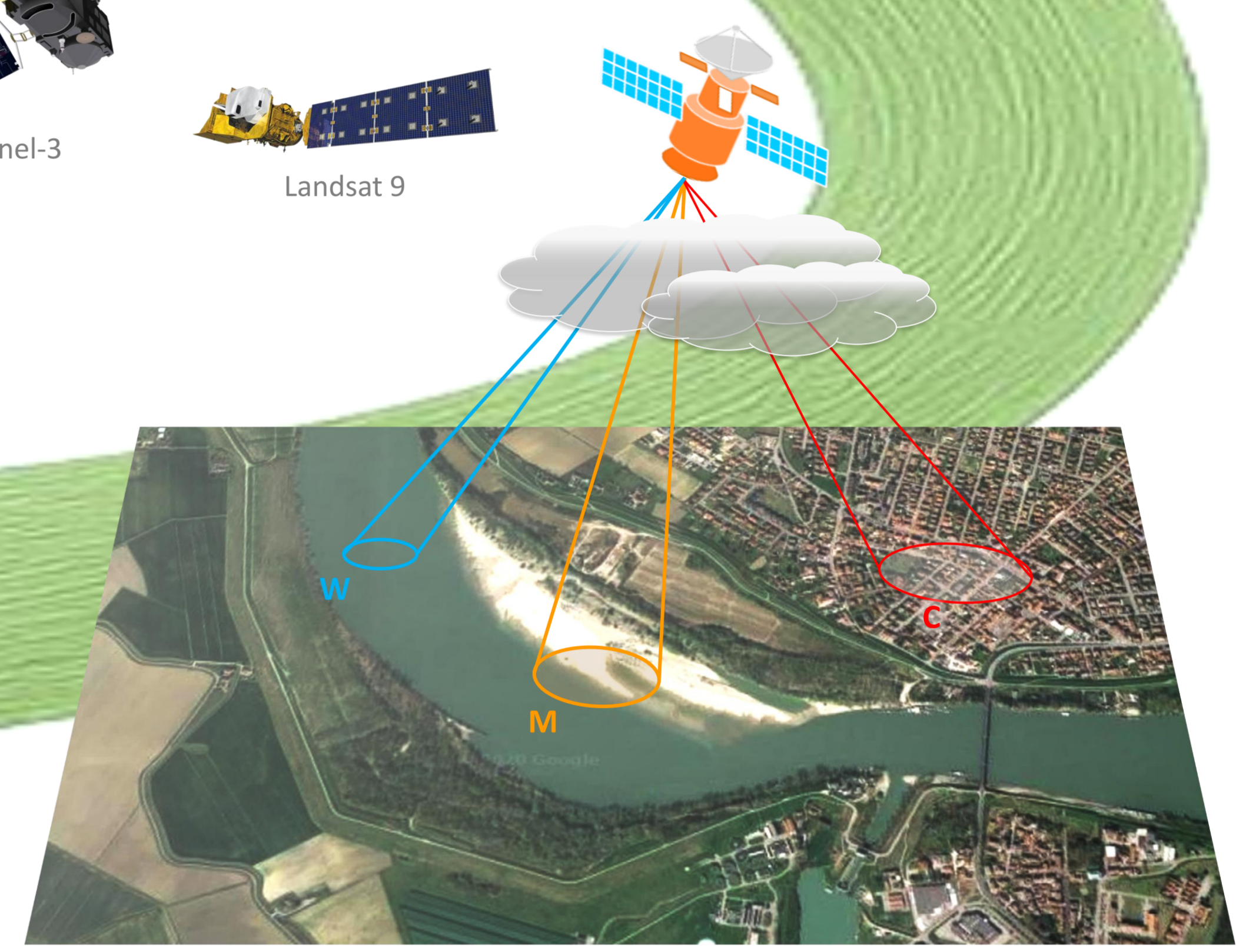
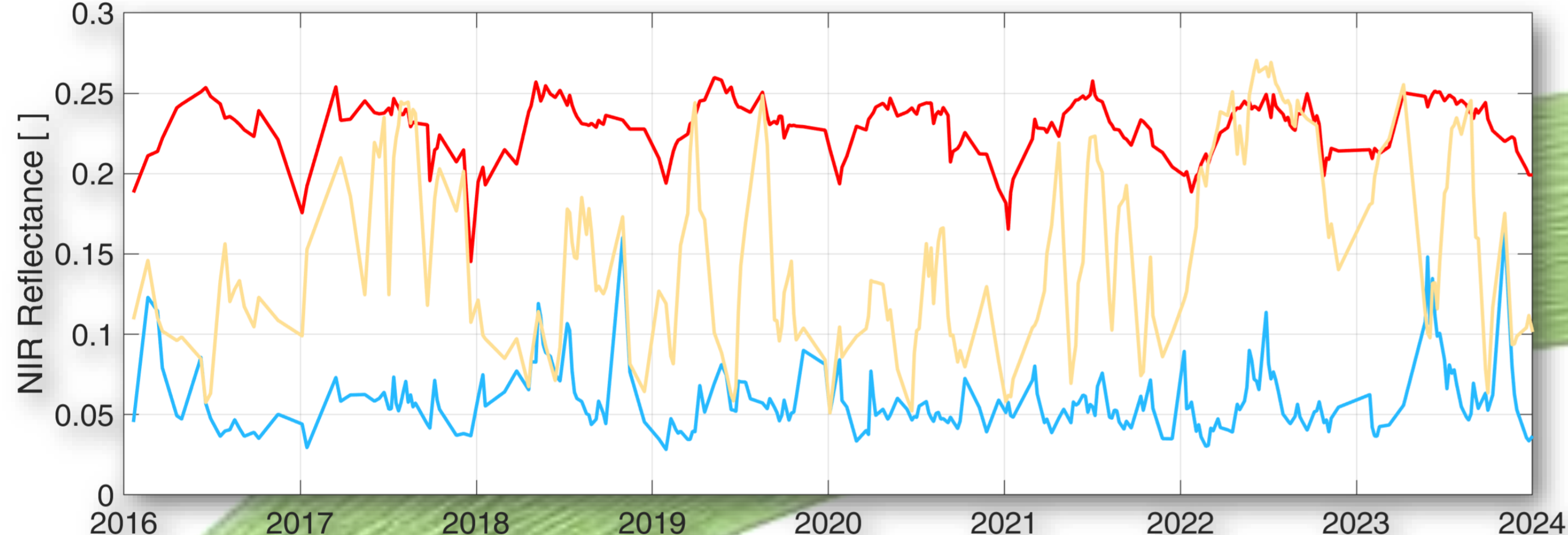
Analyze multiple sites worldwide

50+ sites (26 with recent observations, after 2016)



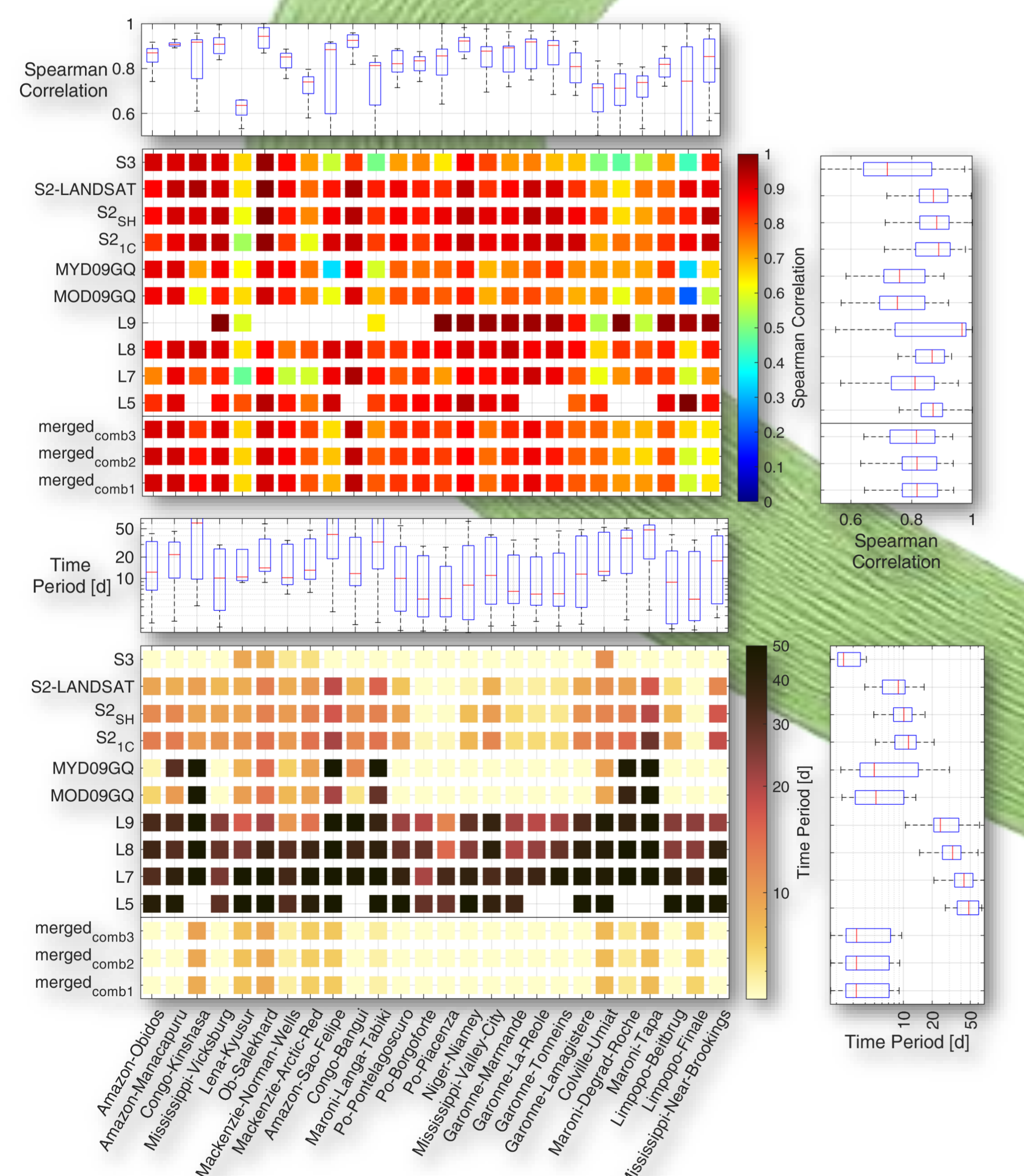
Combine NIR signals to obtain RD proxies

Eight different proxies obtained using 2 methods (CM, CMW), 2 aggregations kernels and 2 calibration approach



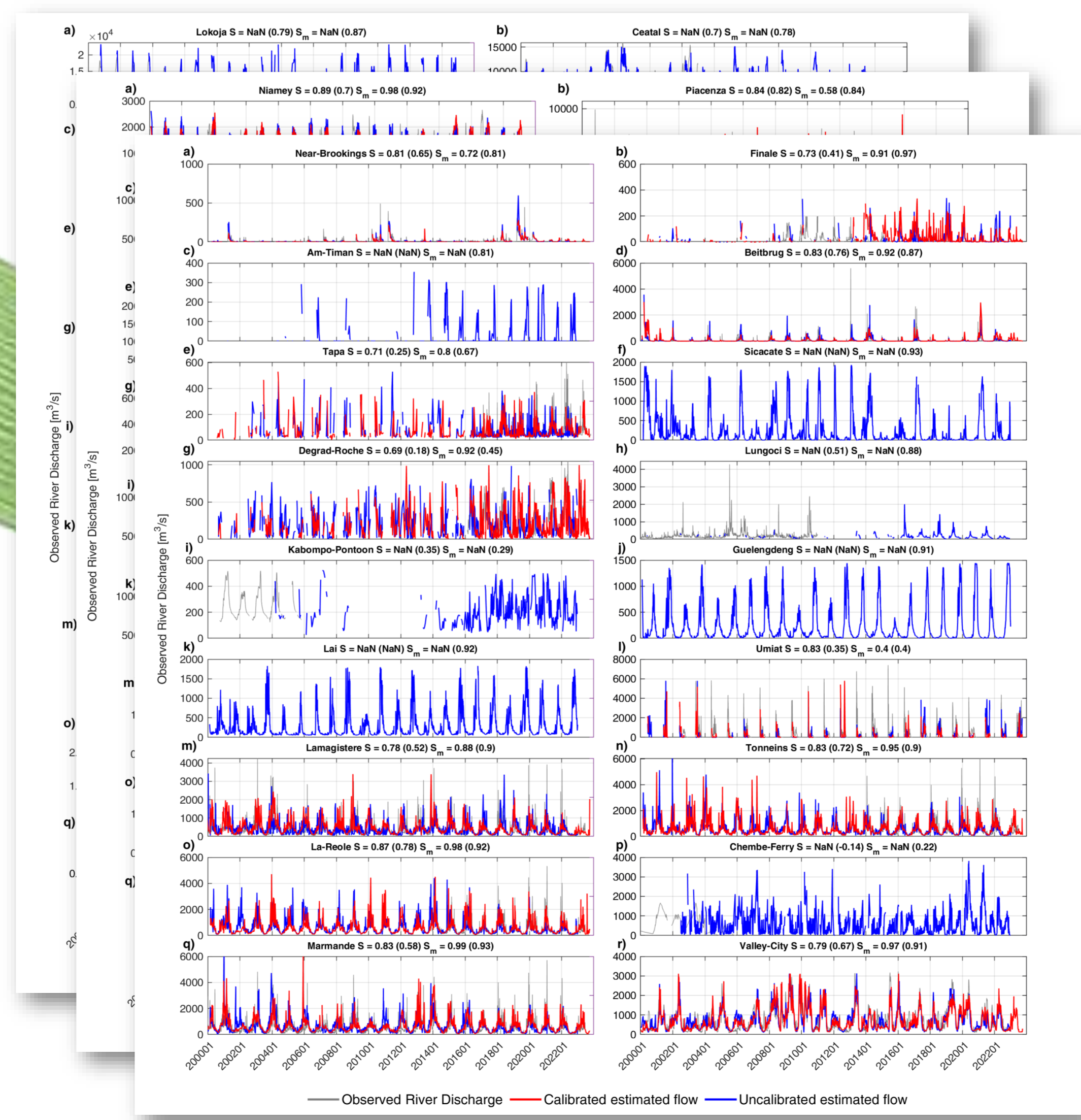
Extract river features information from 10 satellites products

C and W obtained with statistical method, M calibrated against observation and using an uncalibrated procedure



Estimate river discharge

RD is estimated by applying a Cumulative Distribution Function (CDF) matching between proxies and observations (not necessarily concurrent, Tarpanelli & Domeneghetti, 2021)



GET THE DATA

QR code for NIR+altimeter Derived RD estimates

QR code for NIR derived RD estimates

FINISH
for now...

- ❑ The multi-sensor CM-based approach successfully produced long-term river discharge estimates (2000–2023) at 54 global sites, showing strong performance in calibrated settings;
- ❑ Merging data from multiple satellites improved temporal coverage and accuracy;
- ❑ Uncalibrated approaches showed limited reliability in challenging environments (e.g., snowy, forested, or tropical regions) but remain valuable where no ground data exists.
- ❑ A new uncalibrated procedure and further improvements are currently under development in CCI-Discharge project – Phase II

Select the best performing proxies and merge multiple satellite information

Application of a stepwise Spearman's correlation maximization to obtain both the best algorithm for the calibrate stations and a working procedure for the uncalibrated ones.

Some useful References:

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 Tarpanelli et al. (2013). Toward the estimation of river discharge variations using MODIS data in ungauged basins. RSE, 136, 47-55.
 Tarpanelli & Domeneghetti (2021). Flow Duration Curves from Surface Reflectance in the Near Infrared Band. Appl. Sci., 11(8), 3458

Acknowledgments:

The Authors would like to acknowledge the support of the European Spatial Agency (ESA) through the projects CCI-Discharge (ESA Contract No. 4000139952/22/I-NB)

QR code for Project Website