Mapping the National Seagrass Extent of Venezuela

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Introduction

Background/Situation:

- Venezuela has many seagrass meadows (Vera *et al.*, 2008).
- There is currently no nationwide seagrass map for Venezuela, only a collection of polygon and point data (UNEP-WCMC & Short, 2021) as well as two mapped islands (Wabnitz *et al.*, 2009; Schweizer *et al.*, 2005).
- It is crucial to establish the presence of Venezuela's native seagrasses, especially when faced with the invasive *Halophila stipulacea* (Vera *et al.*, 2014; Rodriguez *et al.*, 2018).

Challenge:

- Seagrass data is mostly dispersed across the nation. As such, an established multitemporal approach could be used as an initial stopgap approach to map seagrasses (Traganos *et al.*, 2018; Blume *et al.*, 2023).
- The presence of clouds causes issues with image quality, which cannot be fully mitigated by multitemporal composition alone. To better manage the cloudy pixels, the Cloud Score+ Product was used to identify and mask out cloud pixels (Pasquarella *et al.*, 2023).

Study aim:

- Produce an initial seagrass map of Venezuela.
- Explore the use of Cloud Score+ to improve the image composites.

Methods and Materials

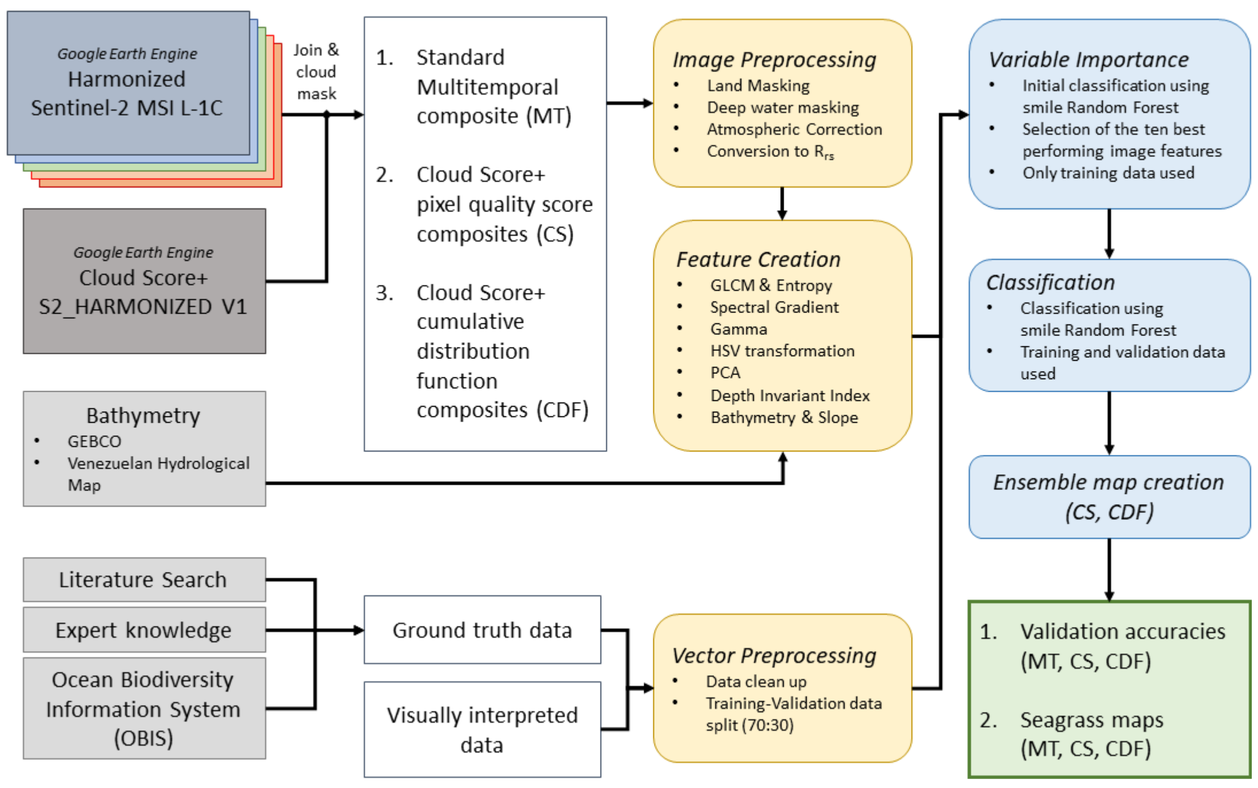

Image processing:

- MT products span over the full archive, as well as only for 2022 and 2023. CS and CDF products cover 2022 and 2023 for now (Pasquarella *et al.*, 2023).
- The CS product uses a pixel quality score, while the CDF uses a distribution function value. Higher CS thresholds may result in missing pixels (Figure M1).

Vector processing:

- Four classes: Sand, Seagrass, Coral, and Turbid.

Classification & Ensemble:

- All the products of each method (MT, CS, CDF) were ensembled
- Mode: Majority vote
- All: All pixel must be labelled "seagrass"

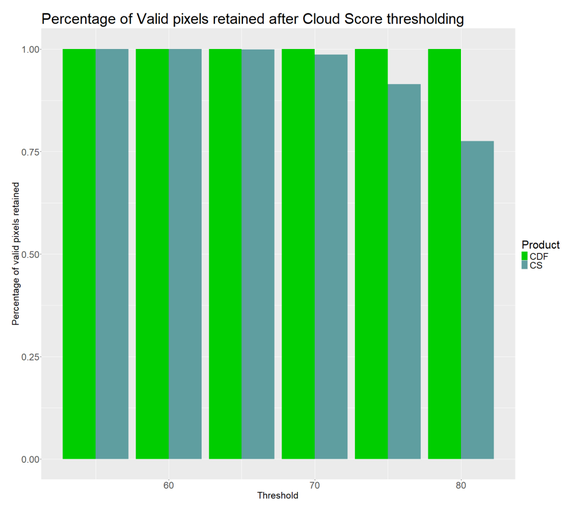

Figure 1. Percentage of valid pixels remaining at the different filter thresholds used (55, 60, 65, 70, 75 and 80) for the CS and CDF images. The larger the threshold value, the stricter it is.

Results

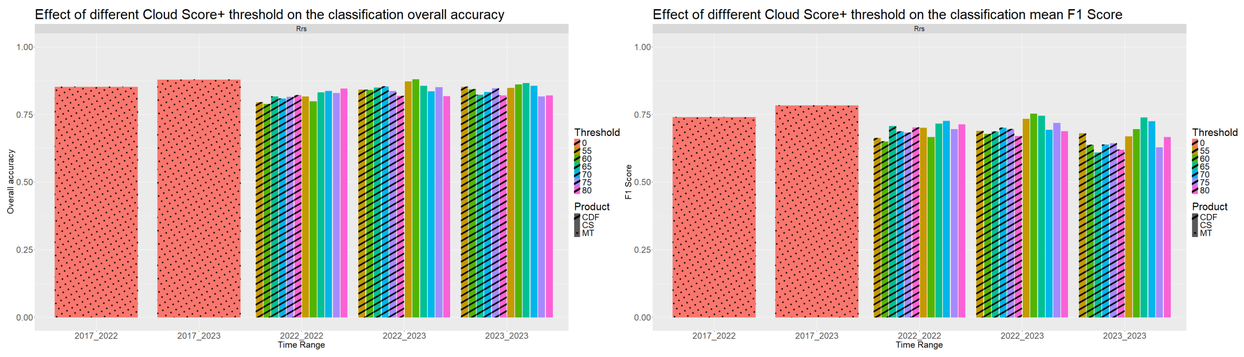

Figure 2. Overall accuracies **(left)** and Mean F1 score **(right)** per classification using the four classes. MT — Standard full archive multitemporal composites (no valid thresholds), CS — Multitemporal composites using the Cloud Score+ pixel quality score cloud for cloud masking, CDF — Multitemporal composites using the Cloud Score+ cumulative distribution function for cloud masking.

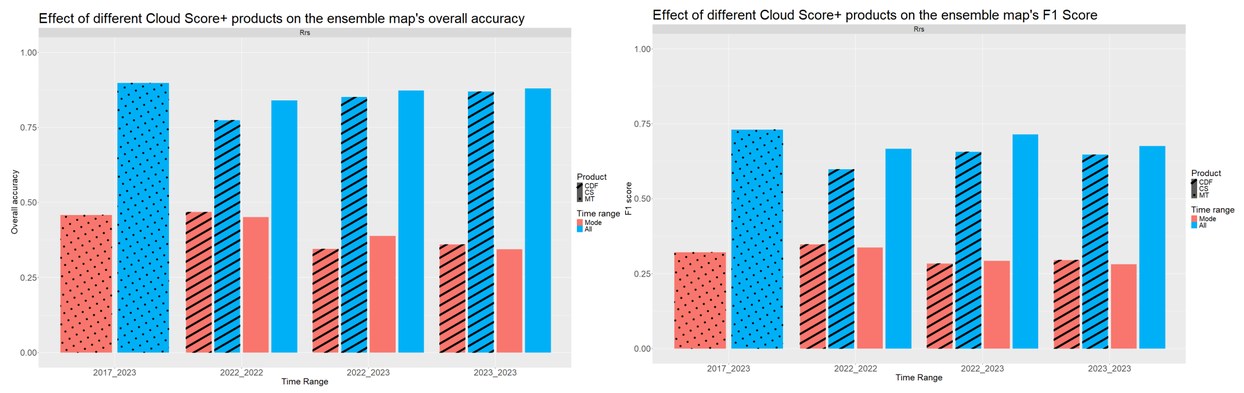

Figure 3. Overall accuracies **(left)** and Mean F1 score **(right)** per ensemble (binary, seagrass/non-seagrass) classification map.

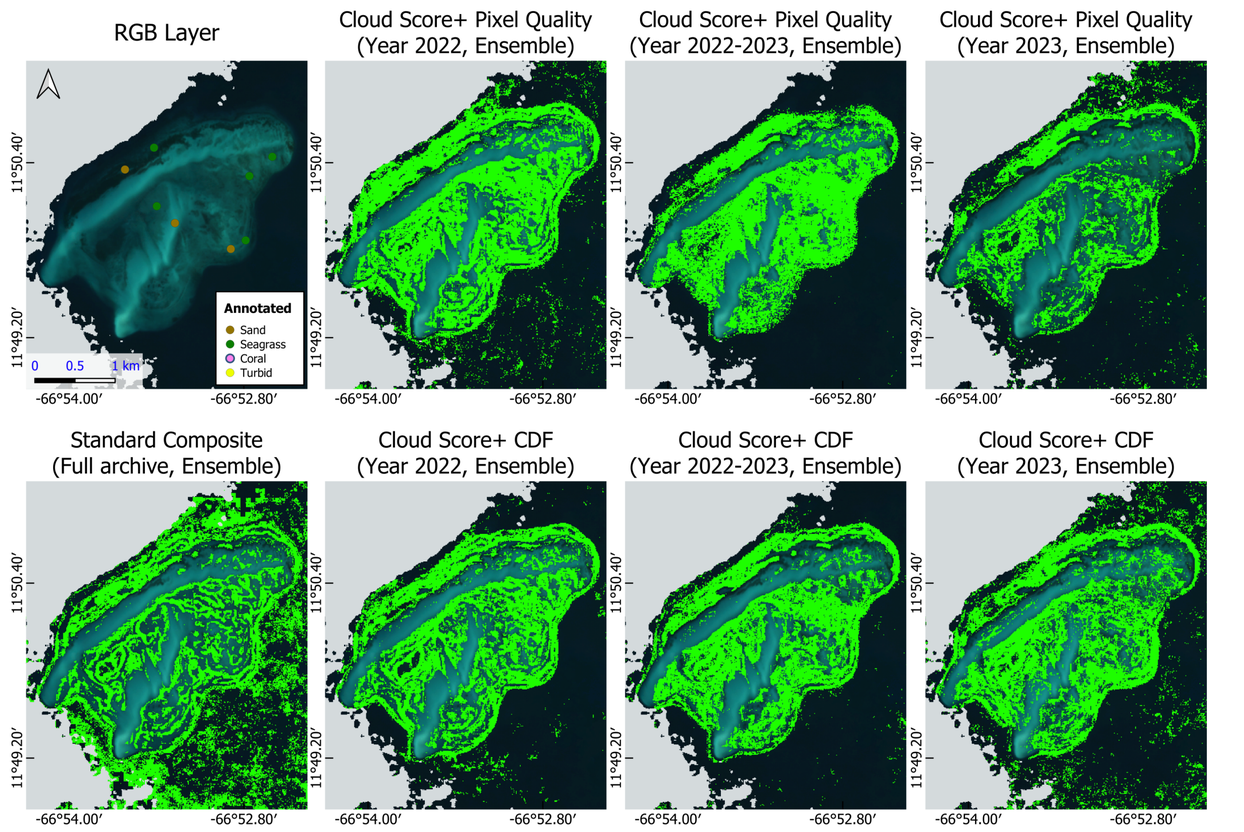

Figure 4. Sample ensemble (binary, seagrass/non-seagrass) classification performance of the standard composite and the various Cloud Score+ products, ensembled across different thresholds for the different time ranges. The RGB composite of the reef north of Dos Mosquises, Los Roques, Venezuela, is provided on the top-left for reference.

Discussion

Cloud Score+ performance:

- Quantitatively "worse" than MT *(no statistical comparison done)*; CS and CDF products perform similarly, with CS being "slightly better".
- No perceivable improvement in overall accuracy and F1 score with ensemble combining, despite less noisier maps.
- Cloud Score+ products only limited to 2022 and 2023; On-going work to create them for the earlier images (Pasquarella *et al.*, 2023).
- More temporally representative than MT maps.
- Ignores other factors such as sunglint or cloud shadows over water pixels.

Future direction:

- Production of an estimated seagrass areal coverage.
- Species identification is currently not possible, requires more work.

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