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PLASTIC MONITOR: Detecting riverine plastic conglomerations, fluxes and pathways in Indonesia

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Rivers function as major pathways of transport of plastic litter, from land-based sources into the ocean. Efforts to quantify riverine plastic inputs and fluxes are increasing but are currently hindered by limited observations. In the downstream travel of floating plastic, it accumulates at places where the flow is locally reduced, to form larger patches. In this study we investigate such accumulations of floating debris using images from different satellite sensors. Applying this monitoring method to rivers enables us to detect plastic litter before it reaches the oceans.

Although current satellite mission concepts were not specifically designed for the detection of plastic debris, there is potential for some sensors to be utilized in the detection of plastics. With support from the ESA Discovery Campaign, we have access to the range of different satellite sensors needed to develop a multi-sensor monitoring method for detecting floating plastic litter. These satellite datasets, together with the data that we are collecting in an onsite clean-up initiative, help to fill-in the lack of observation data that are needed to advance data science techniques for plastic detection. Time-lapse images and photographs in combination with waste sampling at the accumulation hotspot site enable characterisation of percentage areal coverage of floating debris on the water surface and waste composition.

First results comprise a prototype software for extracting statistics on floating debris based on time-lapse camera images. The underlying algorithm uses the difference in brightness between the background water surface and the floating debris objects to be detected. The software produces a video highlighting debris passing through a selected zone within the frame, and generates statistics on the total number of frames used for the analysis, the total number of debris items, total area (in pixels or, if geo-referenced, in areal units), maximum flux of debris items and maximum areal flux of debris items. The in situ results support the development and improvement of the debris detection from satellite data and the validation of the resulting plastic maps. Ultimately, these techniques will enable us to validate model estimates of riverine fluxes, to improve our understanding of global riverine plastic fluxes from source to sea, and to contribute to integrated assessments of the state of pollution. Another outcome will be recommendations for informing ESA's future satellite missions by utilizing our results of the plastic detection capacity of existing sensors to inspire future mission design.