DETECTING & MEASURING MARINE PLASTIC DEBRIS FROM SPACE

Marine Plastic Debris

Approximately 60-80% of the word's litter is in form of plastic, and almost 10% of the annual production ends up into the oceans. (Carlo et al., 2017)

> The accumulation of marine plastic debris floating on the ocean surface is an environmental problem and impacts marine life.

To monitor impact and to improve our understanding, global observations are required. (Martínez-Vicente et al., 2019)

Photo by Jon Tyson on Unsplash

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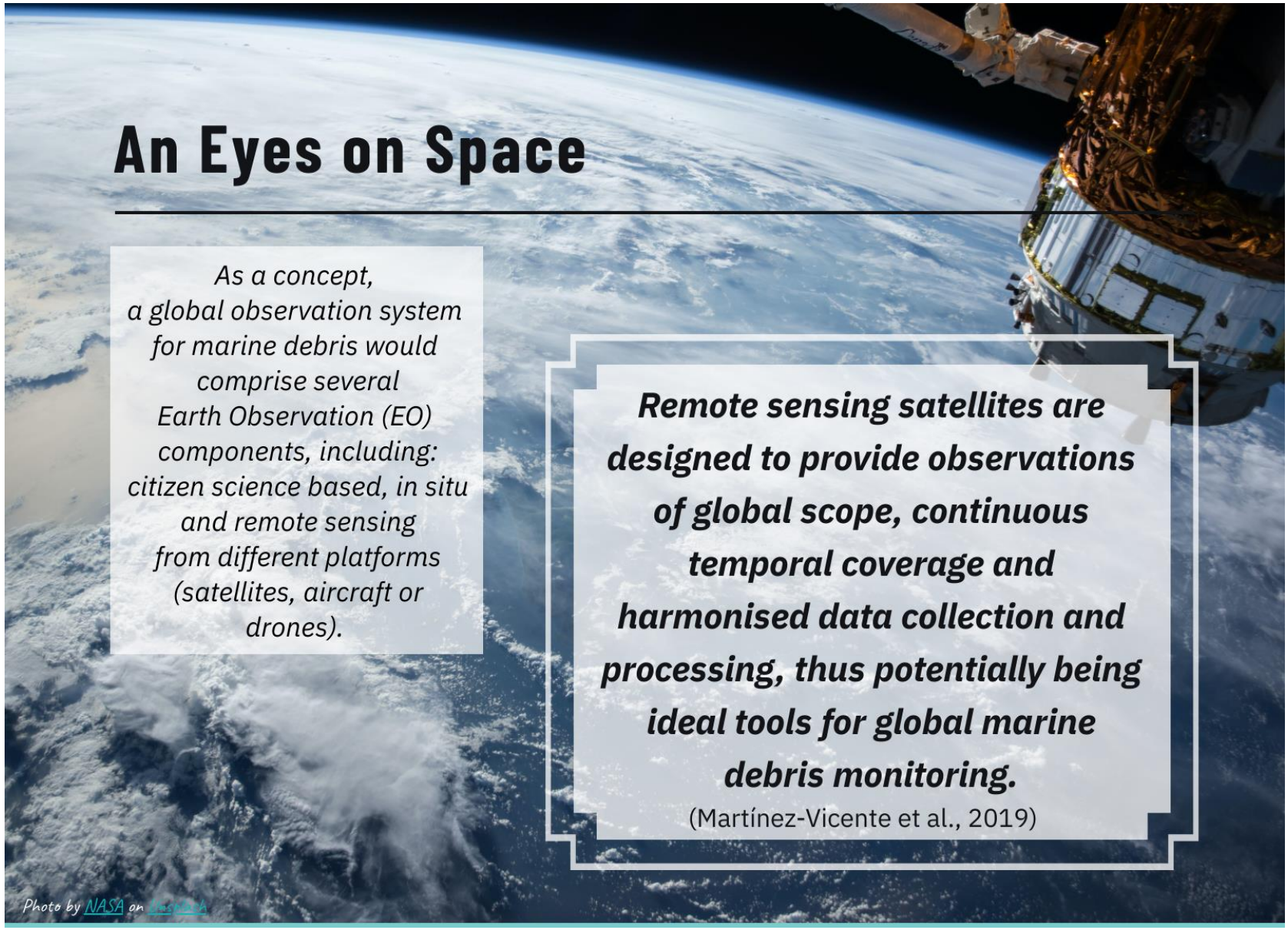
An Eyes on Space
As a concept, a global observation system for marine debris would comprise several Earth Observation (EO) components, including: citizen science based, in situ and remote sensing from different platforms (satellites, aircraft or drones).
Remote sensing satellites are designed to provide observations of global scope, continuous temporal coverage and harmonised data collection and processing, thus potentially being ideal tools for global marine debris monitoring.
(Martínez-Vicente et al., 2019)
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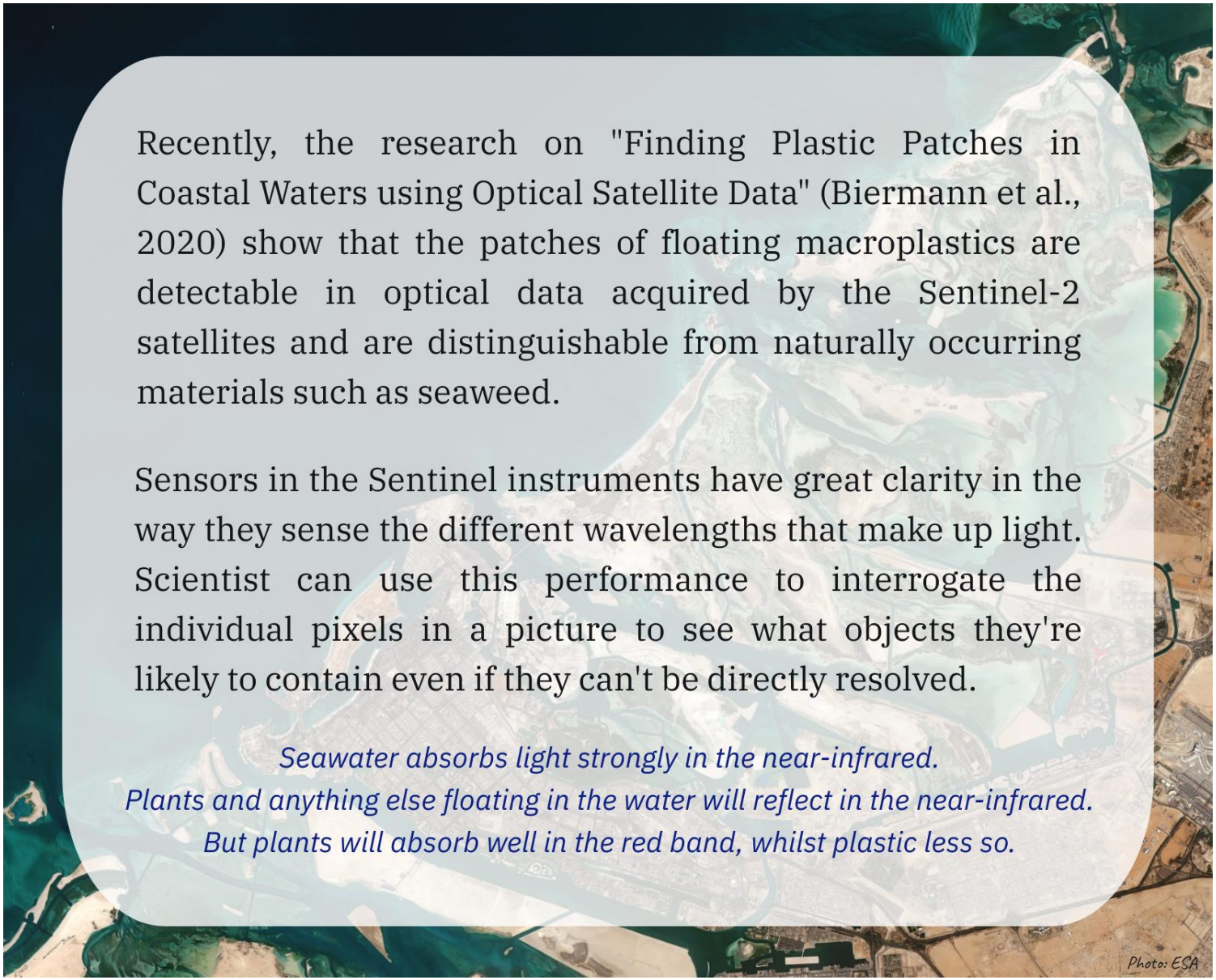
INTERNATIONAL INITIATIVES

Satellites collecting optical data offer a unique perspective from which to observe the problem of plastic litter in the marine environment. Previously, limiting factors have included temporal, spatial and spectral coarseness of available data.

With the launch of the Sentinel-2A and 2B Earth Observation satellites by the European Space Agency (ESA) in 2015 and 2017, respectively, resolution may have improved sufficiently for detection of floating macroplastics from low-earth orbit.



Recently, the research on "Finding Plastic Patches in Coastal Waters using Optical Satellite Data" (Biermann et al., 2020) show that the patches of floating macroplastics are detectable in optical data acquired by the Sentinel-2 satellites and are distinguishable from naturally occurring materials such as seaweed.

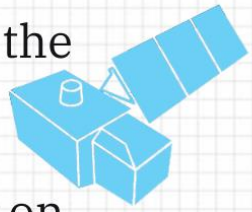
Sensors in the Sentinel instruments have great clarity in the way they sense the different wavelengths that make up light. Scientist can use this performance to interrogate the individual pixels in a picture to see what objects they're likely to contain even if they can't be directly resolved.

Seawater absorbs light strongly in the near-infrared.
Plants and anything else floating in the water will reflect in the near-infrared.
But plants will absorb well in the red band, whilst plastic less so.

Photo: ESA

The case studies from four countries where suspected macroplastics were detected in Sentinel-2 Earth Observation data.

Patches of materials on the ocean surface were highlighted using a novel Floating Debris Index (FDI) developed for the Sentinel-2 Multi-Spectral Instrument (MSI).



In all cases, floating aggregations were detectable on sub-pixel scales, and appeared to be composed of a mix of seaweed, sea foam, and macroplastics.

Building first steps toward a future monitoring system, we leveraged spectral shape to identify macroplastics, and a Naïve Bayes algorithm to classify mixed materials.

Suspected plastics were successfully classified as plastics with an accuracy of 86%.

One of the next phases would be to apply machine-learning algorithms to the analysis of images. Searching the pictures manually is time-consuming and ultimately not practical. Automation is the only way to go.

This data will help build awareness of the global plastic pollution issue, and inspire action on the issue.

plastic PNG Designed By 祭二 from Pngtree.com

Reference

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- Martínez-Vicente, V. et al., 2019. Measuring Marine Plastic Debris from Space: Initial Assessment of Observation Requirements. Remote Sensing, 11 (20): 2443. Available at: http://dx.doi.org/10.3390/rs11202443.
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