REMOTE SENSING FOR MARINE LITTER

Remote Sensing of MD: Why

From a management perspective, we need improved information and knowledge that can help target and monitor actions for:

- **prevention** (avoid waste to reach the sea)
- **remediation** (remove waste that is already in the sea)

Prevention

What are the main items and activities that originate MD (e.g. DFG-fisheries; consumer packaging-tourism)

→ **1. Characteristics / Composition of MD:** it's important the identification of the precise nature (e.g. bottle) and material/composition (eg polystyrene) and corresponding **2. Amounts**

What are the main geographic point of entrance in the marine environment (e.g. rivers)

→ **2. Amounts** and **3. Distribution**

What is the fate of MD: circulation, accumulation, sinking, fragmentation, etc.

→ **2. Amounts** and **3. Distribution**

Remediation

To better target cleanup action (make it more efficient, target more critical areas such as protected/sensitive areas)

→ **2. Amounts** and **3. Distribution**

More about why

- To identify areas mainly interested by the problem:
  - to keep the issue under monitoring (it is a threat for environment);
  - to contribute to/validate predictive models;
  - to provide clear data for policy-makers to take measures against the increasing production of (plastic) marine litter;
  - to monitor the effectiveness of these measures;
  - to guide potential cleaning missions.

- To pinpoint the major sources of litter (by scanning coast waters, estuaries, large rivers):
  - How much plastic litter enters the oceans and through which rivers/coasts?

Baseline

Ideally we should monitor to know how much stuff of what kind we have in one site at a given time (and possibly track it).

This information can support prevention and possibly cleaning.

What to detect?

It is important to differentiate Marine Debris targets and the associated monitoring technology

Combination of technologies can be used on multi-sensor platform for detecting specific items (large or small, plastic or other material) in order to improve detection/identification

Technology approach: “Visual” Imaging

Optical imaging for objects > 50 (?) cm: interpretation based on the shape/color/visible features

→ need image interpretation: is this MD item or not? Subjective and uncertain + time consuming to interpret a large amount of input

→ useful for e.g. large areas of accumulation, specially on the coast but low resolution in terms of material type, nature of items, etc.

→ Only applicable to larger items => it excludes a large % of MD

Technology approach: SAR and Spectroscopy

For MD < 50 (?) cm but sensitivity depending on concentration (not among specs so far…=> to define by lab experiment the detection threshold with current technology)

<u>Passive detection</u>: multi/hyper-spectral analysis of the reflected solar light;

→ can give an indication of the nature of the items
→ minimum concentration/pixel to have a clear signal is tbd
→ restricted to surface if MIR-TIR is used (so floating debris/coast)

<u>Active detection</u>:

- **SAR**

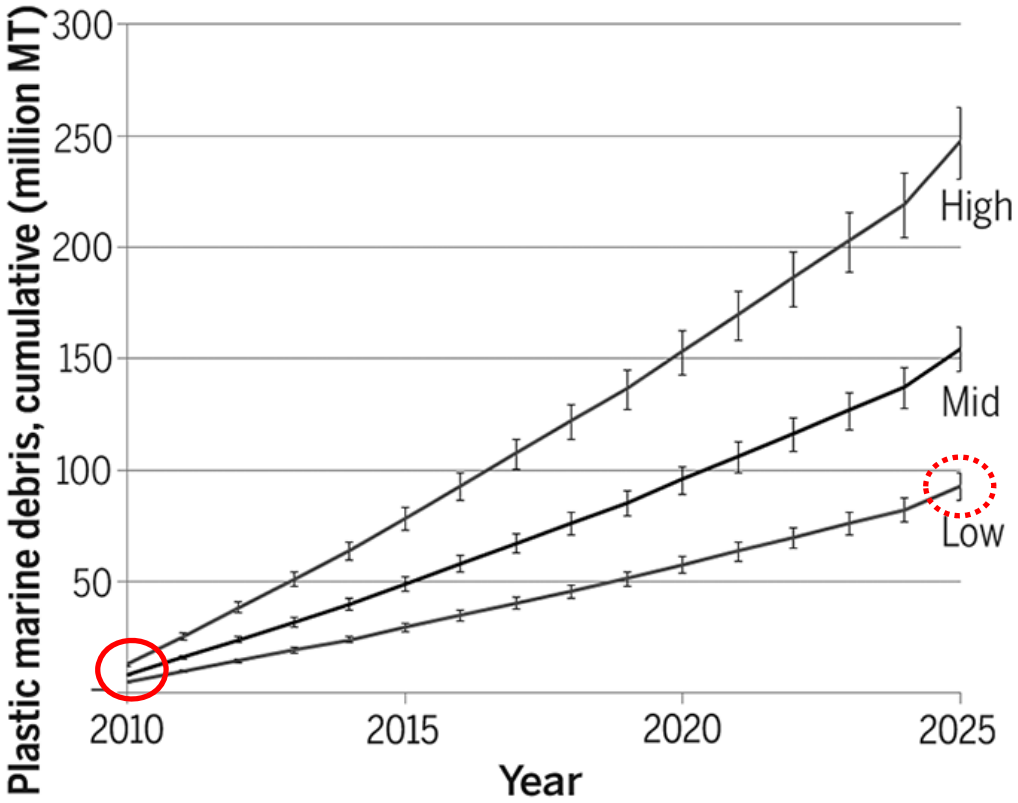
- **LASER-based**
  - minimum concentration/pixel to have a clear signal is tbd
  - can go deeper in the water column (visible laser)
  - Raman-based spectroscopy => not affected by water, unique signatures of chemicals, possible additional information available (e.g. absorbed chemicals like PCBs)

Plastic Marine Debris: estimations

From Science (13 FEBRUARY 2015 - VOL 347 ISSUE 6223):

It is calculated that in 2010:

- 275 Mtons of plastic waste generated in 192 coastal countries.
- **4.8-12.5 Mtons entered the oceans**



Estimated mass of mismanaged plastic waste input to the ocean (by populations living within 50 km of a coast in 192 countries), plotted as cumulative sum.

Plastic Marine Debris: estimations