

CleanAtlantic

Tackling marine litter in the Atlantic Area

Modelling and marine litter

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As part of the modelling group in CleanAtlantic: IST, IEO, INTECMAR, CEFAS, MI, DGRM, DROTA, IFREMER

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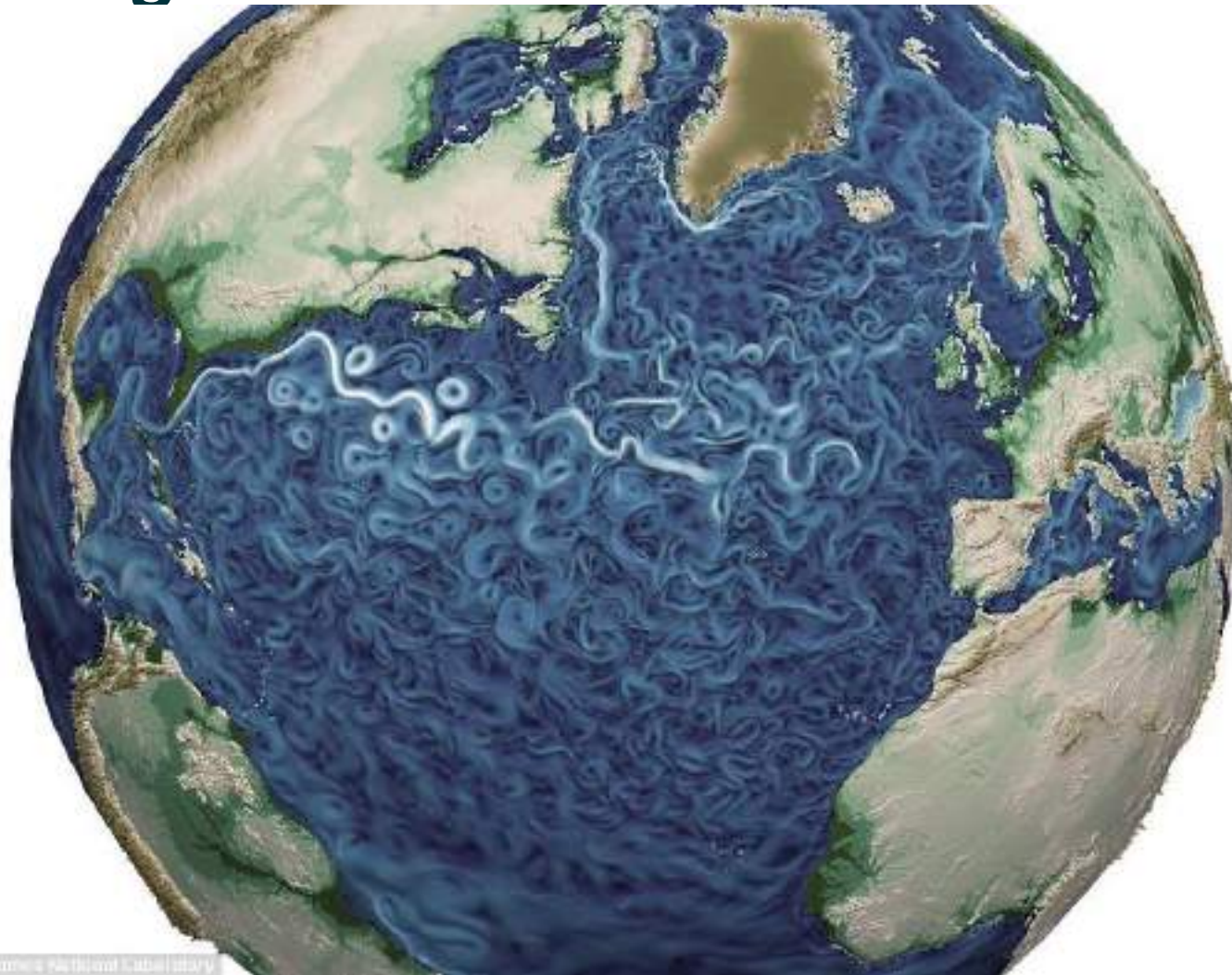
1. The problem
2. Working with the Ocean
3. Why modelling
4. How we model
5. How we model marine litter
6. CleanAtlantic project & preliminary results



The problem



Working with the Ocean



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Working with the Ocean

The Ocean is a **big place**. **70%** of the planet's surface is Ocean.

Yet **more than 80%** of our ocean is **unmapped, unobserved, and unexplored.** [NOAA 2018]

Imagine you want to *clean the Ocean of plastics.*

Area ≈ 360 million km^2 , Average depth ≈ 3700 m Volume \approx **1.4 billion km^3**

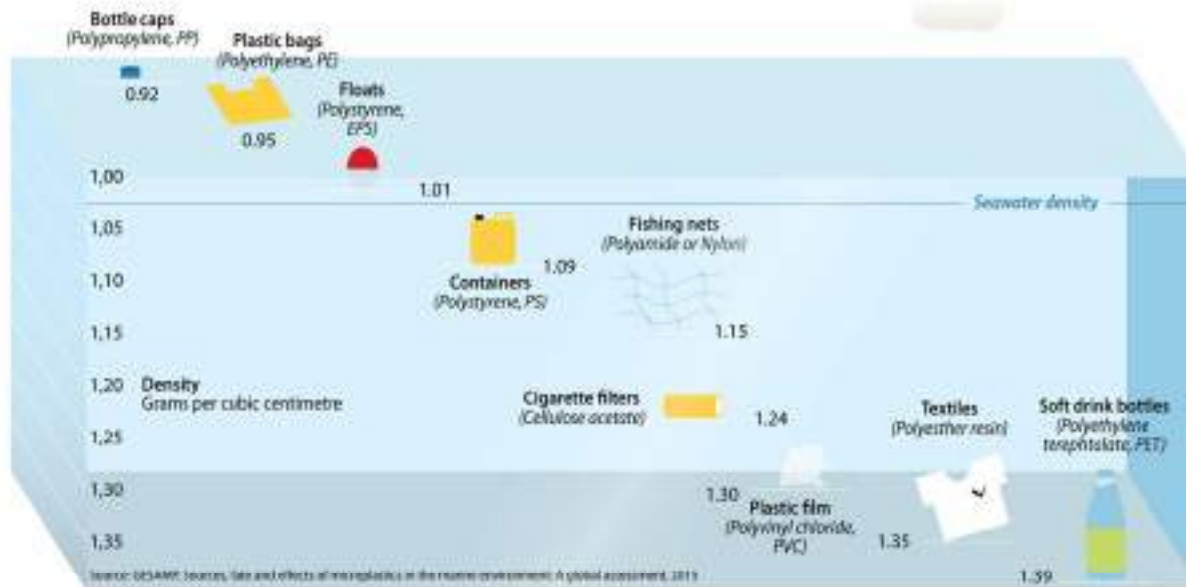
At **1€/m³** of cleaning that is
 $1.4 \times 10^{17} \text{€}$

Global GDP 2017 $\approx 0.00095 \times 10^{17} \text{€}$

Why modelling

Imagine you want to *clean the Ocean of plastics*

Which plastics float and which sink in seawater?

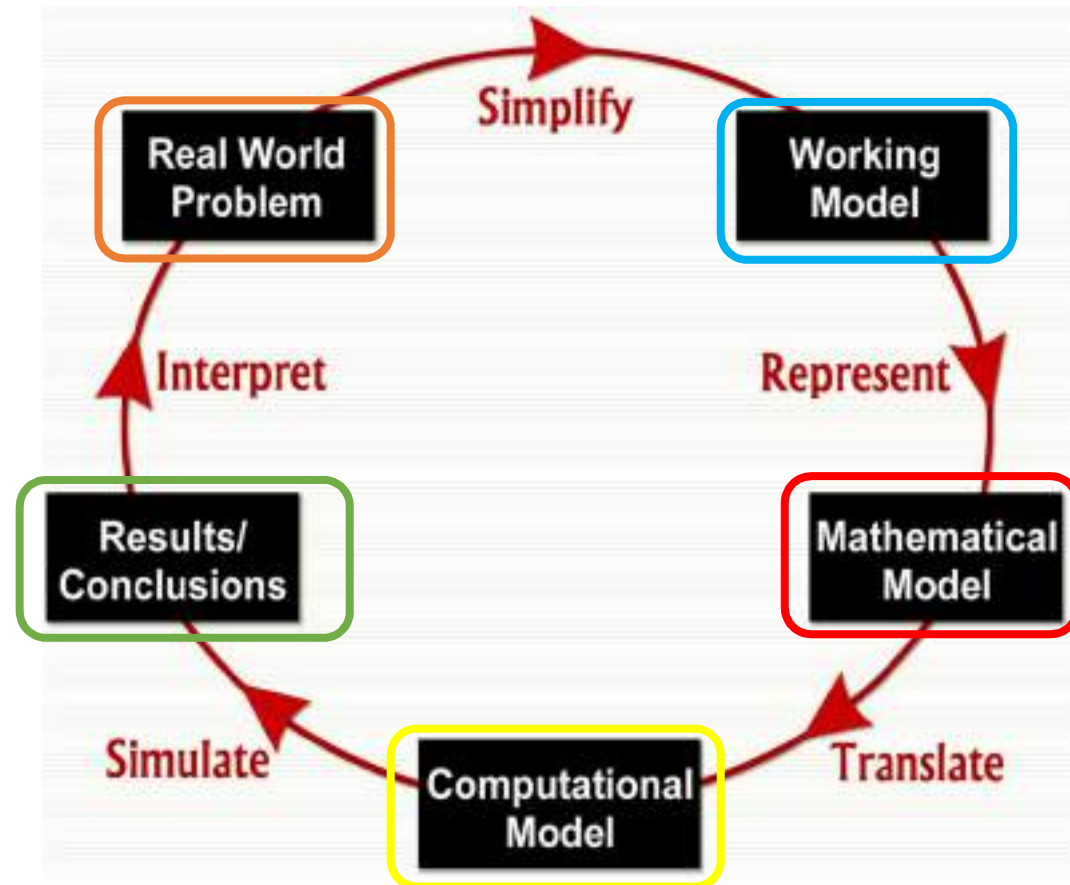


- Where do they go?
- How can we find them?
- Do different debris go to different places?

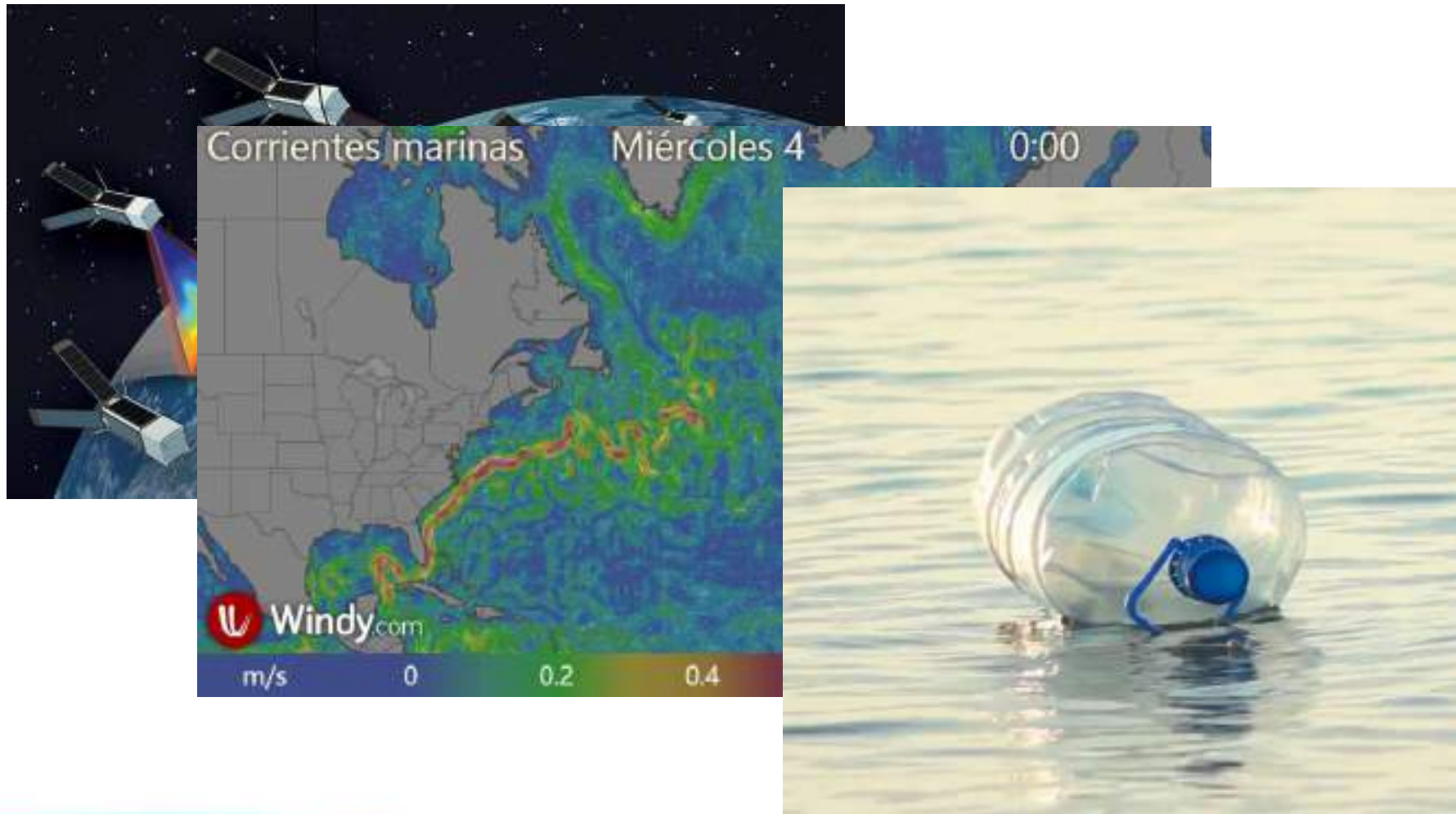
How we model



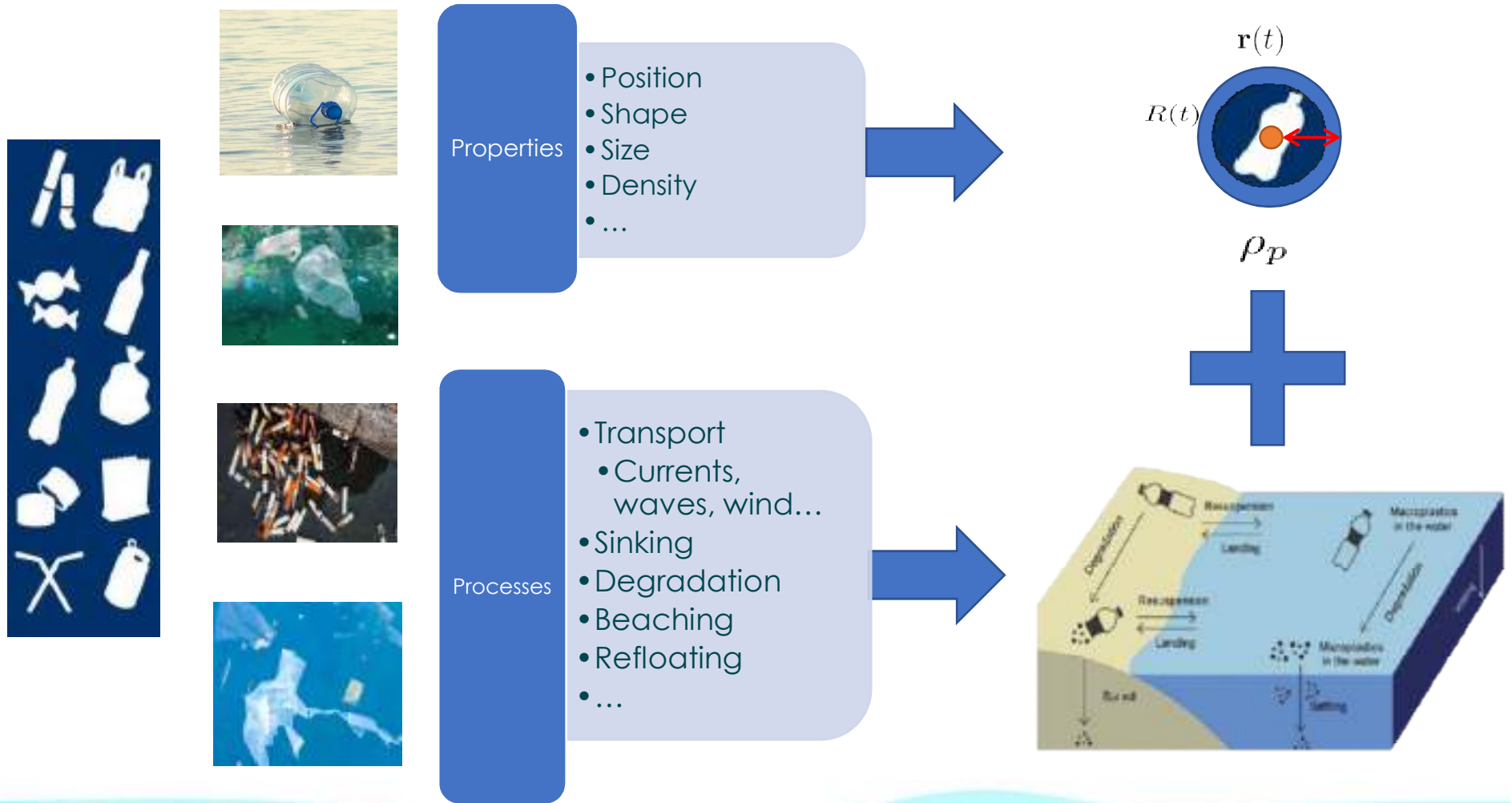
<http://www.tonywublog.com/journal/the-problem-of-garbage-in-the-oceans>



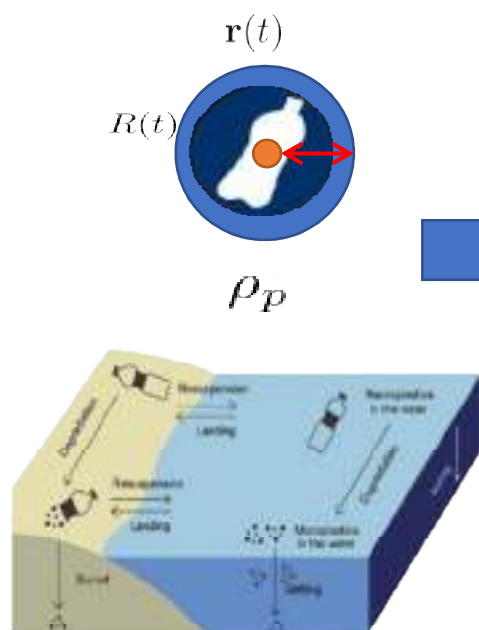
How we model marine litter



Conceptual model



Conceptual Model



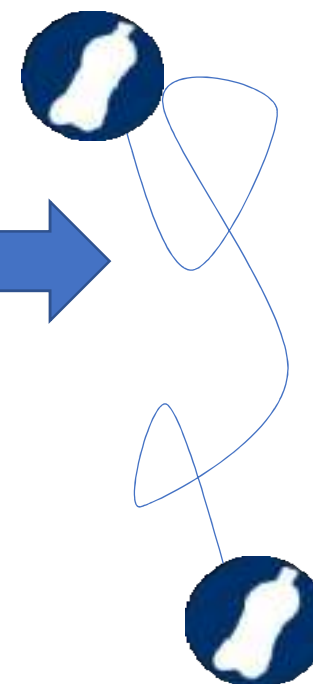
Mathematical model

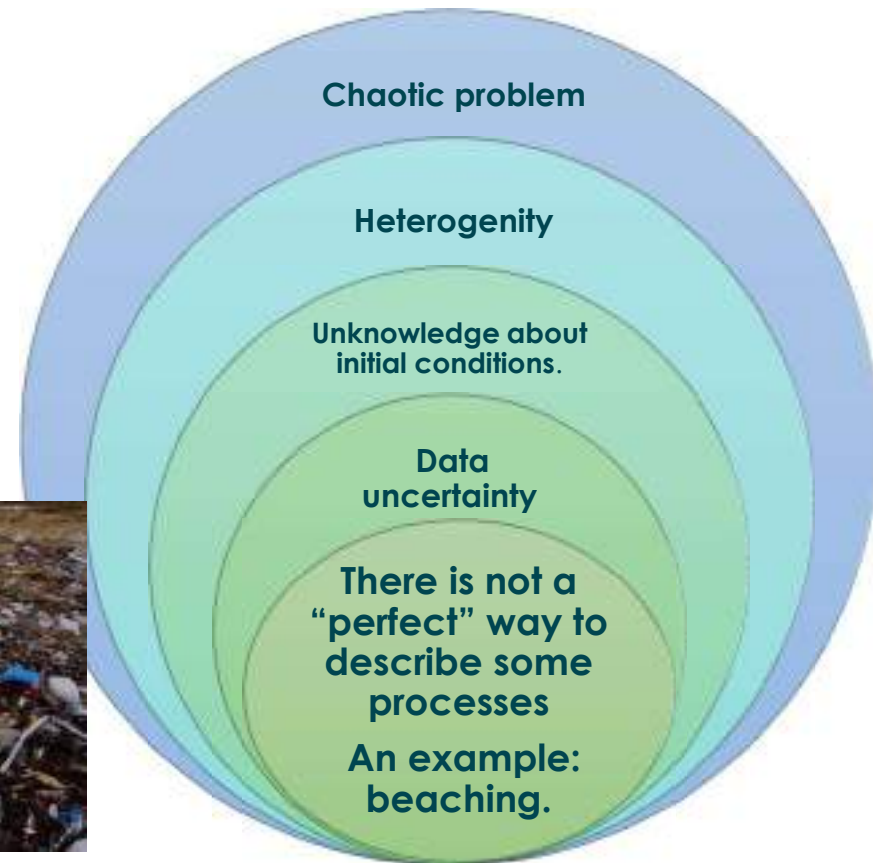
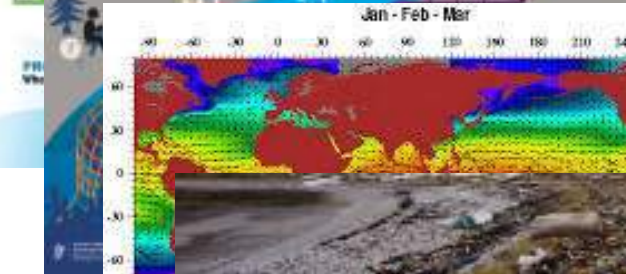
$$\begin{aligned} \frac{d\mathbf{r}}{dt} = & \mathbf{v}_f(\mathbf{r}(t), t) + \\ & \mathbf{R}_n \sqrt{D_f K_h \Delta t} + C_h \left(\frac{ga}{8c} \right) \\ & + \sqrt{\frac{\rho_a C d_a A_a}{\rho_w C d_w A_w}} \mathbf{w}_f + \\ & 0.223 R \left(\frac{(\rho_f - \rho_p) R^2 g^2}{\rho_f \nu} \right) + \\ & \dots \end{aligned}$$

Computational model



Results





CleanAtlantic Work Package 6 – what is it?



Objective:

The aim of this WP is to develop sub regional or regional maps of hotspots of floating litter, based on models mapping of circulation of floating masses of marine litter, and identification of hotspots of accumulation on coastal areas and the role of prevailing currents and winds.



Partners:

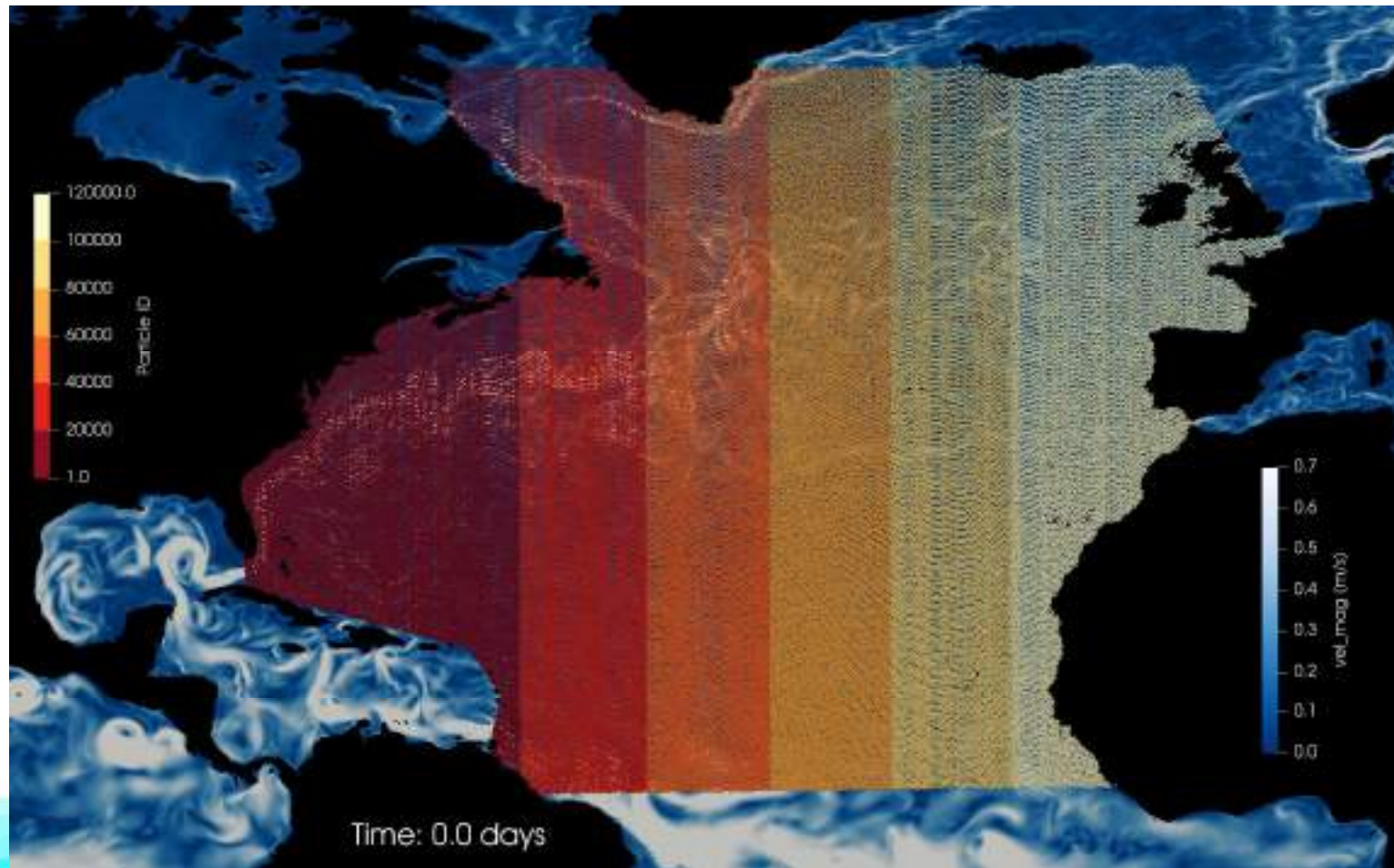
- IST, CETMAR, INTECMAR, USC, IEO, DGRM, DROTA, IFREMER, Cedre, CEFAS, IMI, ARDITI

CleanAtlantic Work Package 6 – results

Showing you several working scales, from the oceanic to the harbour



Assessment of the fate of marine litter using models: hotspots



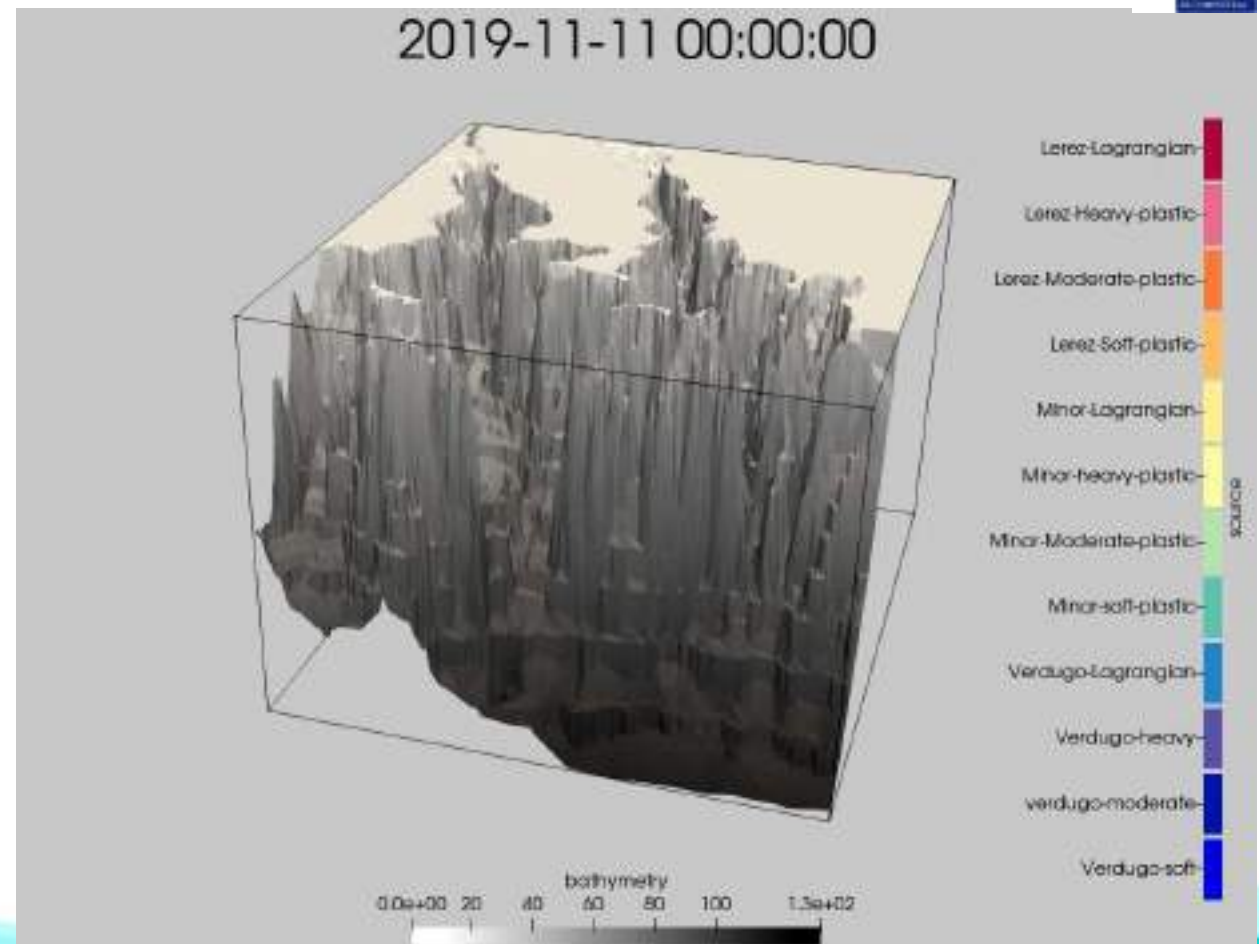
Modelling influence of **river and land-based** sources of marine litter

Atlantic Scenarios

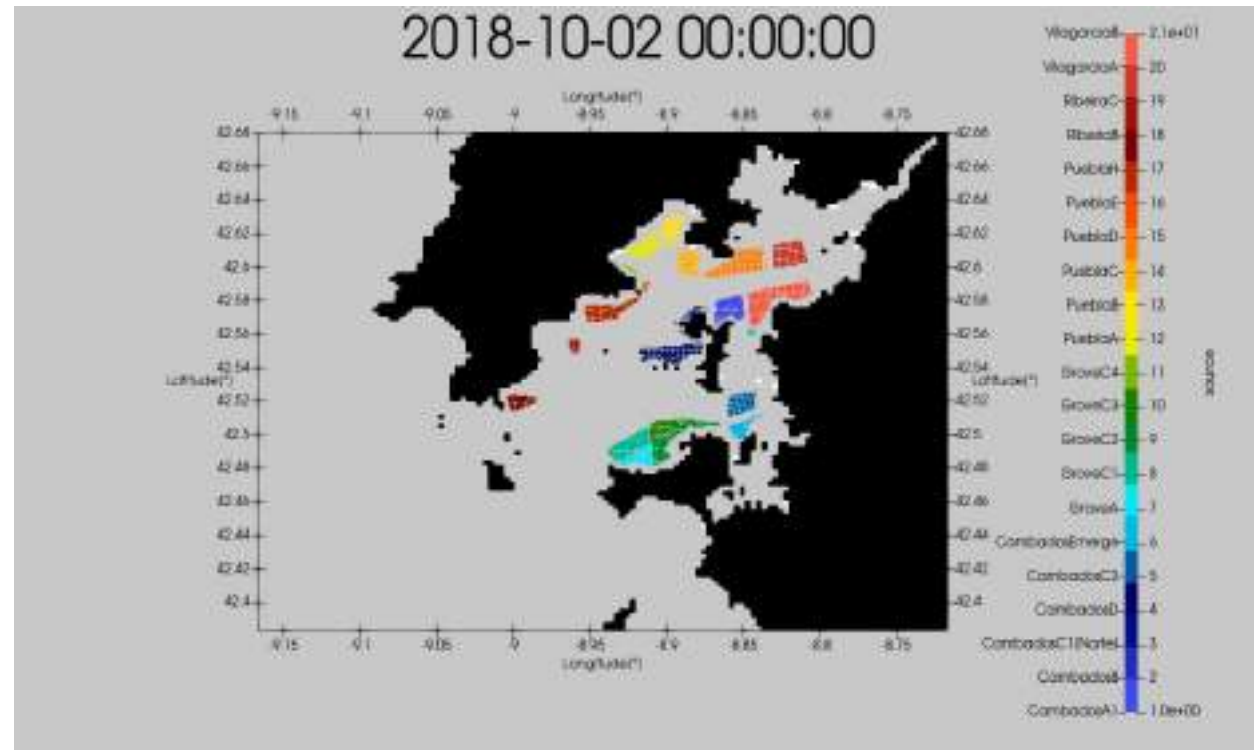
61 European Rivers
(daily average)

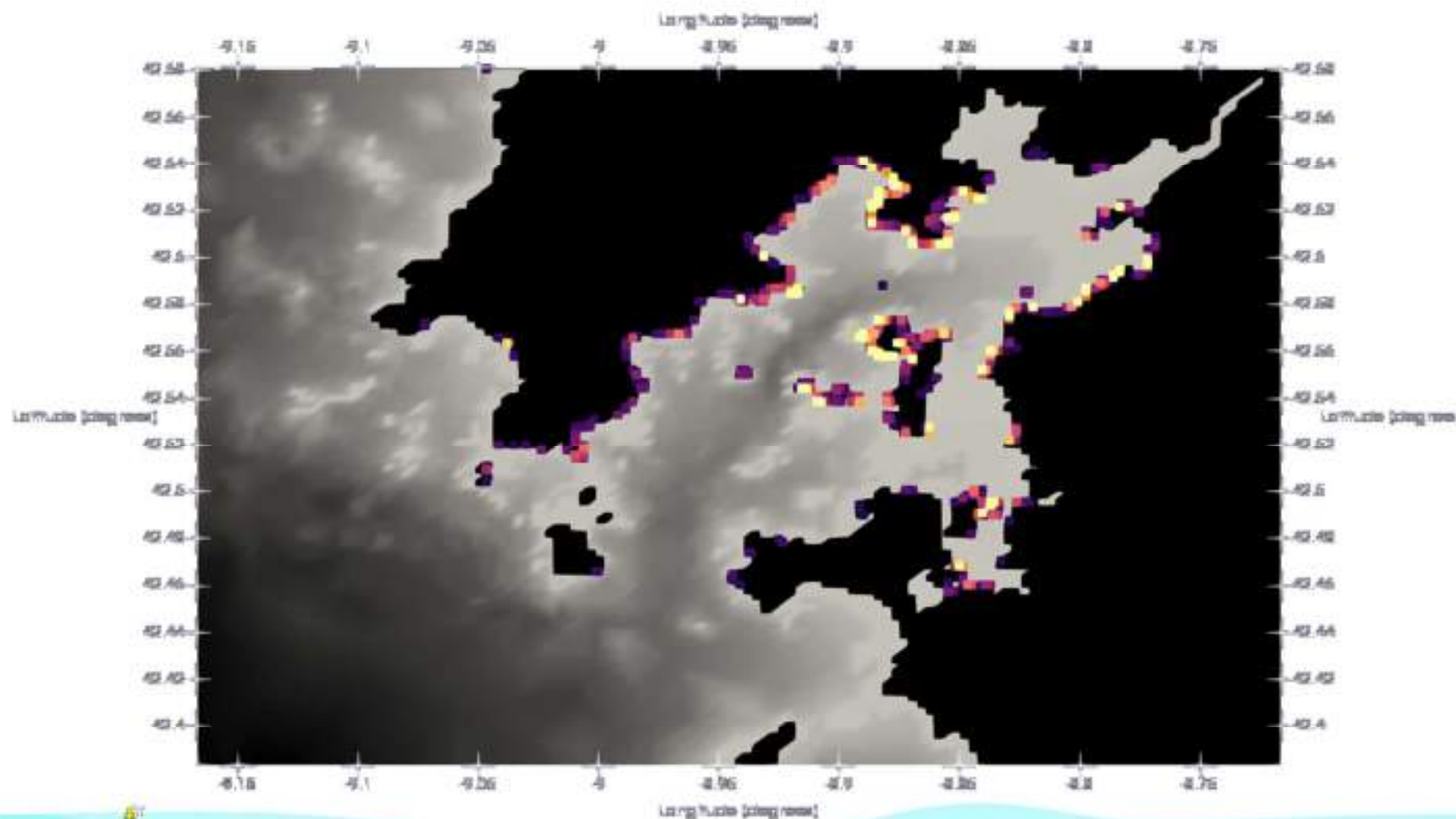


Modelling influence of river and land-based sources of marine litter



Modelling influence of **ocean-based** sources of marine litter



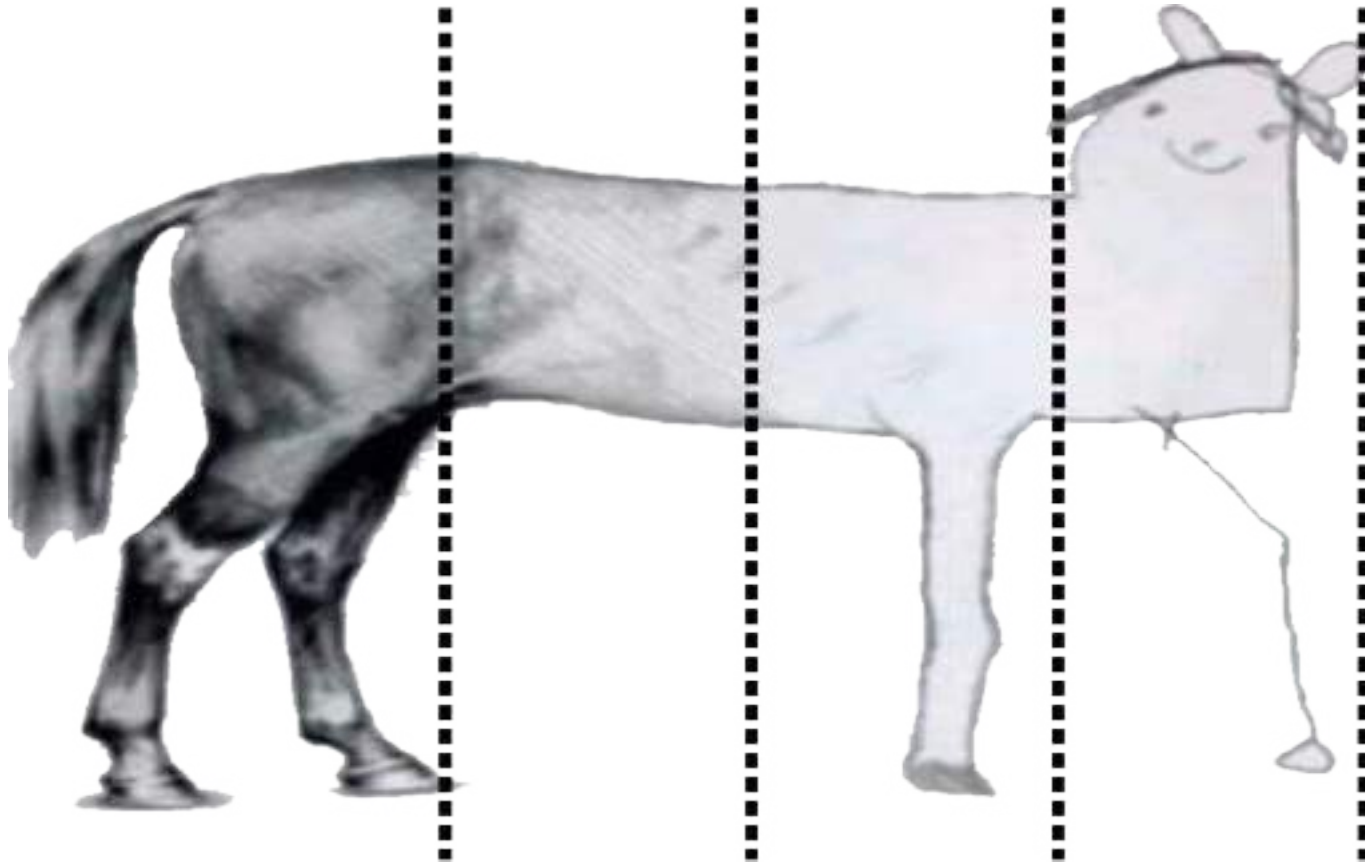


Conclusions

- Our work inside CleanAtlantic project is to develop mathematical models to describe the motion of marine litter.
- The goal is to develop a tool to simulate scenarios and provide useful information for those areas with higher accumulations of marine litter to support decision making.
- But remember ...



REALITY  MODEL



Modelling and marine litter
Galway, Ireland, 4th December 2019

Daniel Garaboa Paz
GFNL, University of Santiago de Compostela, USC

Thank you
Go raibh maith agat
Merci
Gracias
Obrigado

