



Tracking sea floating plastics using CMS data through a novel application of the TrackMPD model



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ABSTRACT

The marine pollution caused by the release of plastics' elements is a growing problem. The main sources of plastic litter found at sea are land-based: rivers, plants discharges, beaches, etc. One of the crucial phase to fight this problem is tracking these particles with the aim to identify their paths and thus their accumulation. In this framework, the TrackMPD model of Jalón-Rojas et al., 2019 was modified to allow the tracking of particles released in a long time series each day from some known locations (i.e. a number of rivers' estuaries). Moreover, two new outputs were generated: density and beaching maps. The study was carried out in the patch of coastal area between the Liberia and the Gulf of Guinea within the GDA AID Marine Environment & Blue Economy project. The project, funded by the European Space Agency in collaboration with the Asian Development Bank and World Bank, aims at implementing innovative Earth Observation services to assist International Funding Institutions teams in the framework of the marine environment and Blue Economy. The study is part of two Use Cases for the World Bank's PROBLUE and West Africa Coastal Areas (WACA) programs, which focus in the west Africa coastal area. Simulations were performed for the whole 2021 at daily scale by releasing five macroplastics from the main five rivers of the Liberia's region. Copernicus marine services CMS sea current fields were considered as forcing (product GLOBAL_ANALYSISFORECAST_PHY_001_024) together with other ancillary data. Results confirmed that the plastic pollution at sea is a boundless issue, hard to be tackled.

CASE STUDY

The study area is located in the west Africa considering the release of macroplastics from Liberian region. The source of particles are the five main rivers of Liberia (Figure 1, red box – bolded rivers). For each river estuarine 5 particles per day were deployed and thus tracked during 2021.

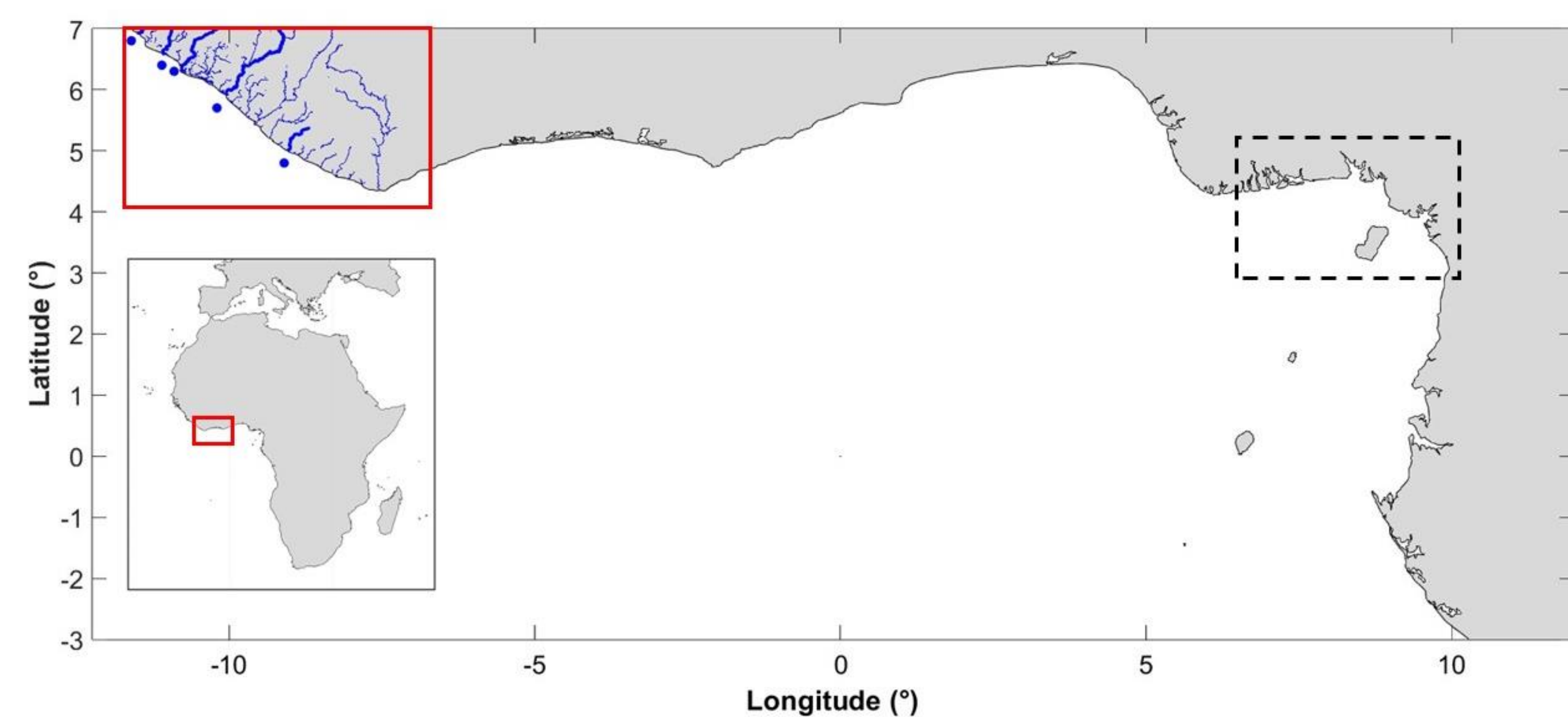


Figure 1 – Study area: Red box represents the input zone while the dashed black box represents the are where the accumulation maps are displayed in the result section.

MATERIALS AND METHODS

The particle tracking is performed by means of the TrackMPD model. It was modified to allow the simulation of the pathways of particles daily released from known locations (i.e. the rivers' estuaries).

The model's forcing are the U (Eastward) and V (Northward) Copernicus marine services (CMS) velocities at surface (product "GLOBAL_ANALYSISFORECAST_PHY_001_024"). The 2D simulations were performed at 1 day temporal and $0.083^\circ \times 0.083^\circ$ (i.e., ~ 9 km) spatial scales. Other input data were needed to achieve the simulations (Figure 2). Among the three output of the model the density map represents the number of particles per pixel; whereas the beaching accounting for the density map computed within a coastal buffer of 2 times the spatial resolution of the CMS grid (i.e., ~ 18 km).

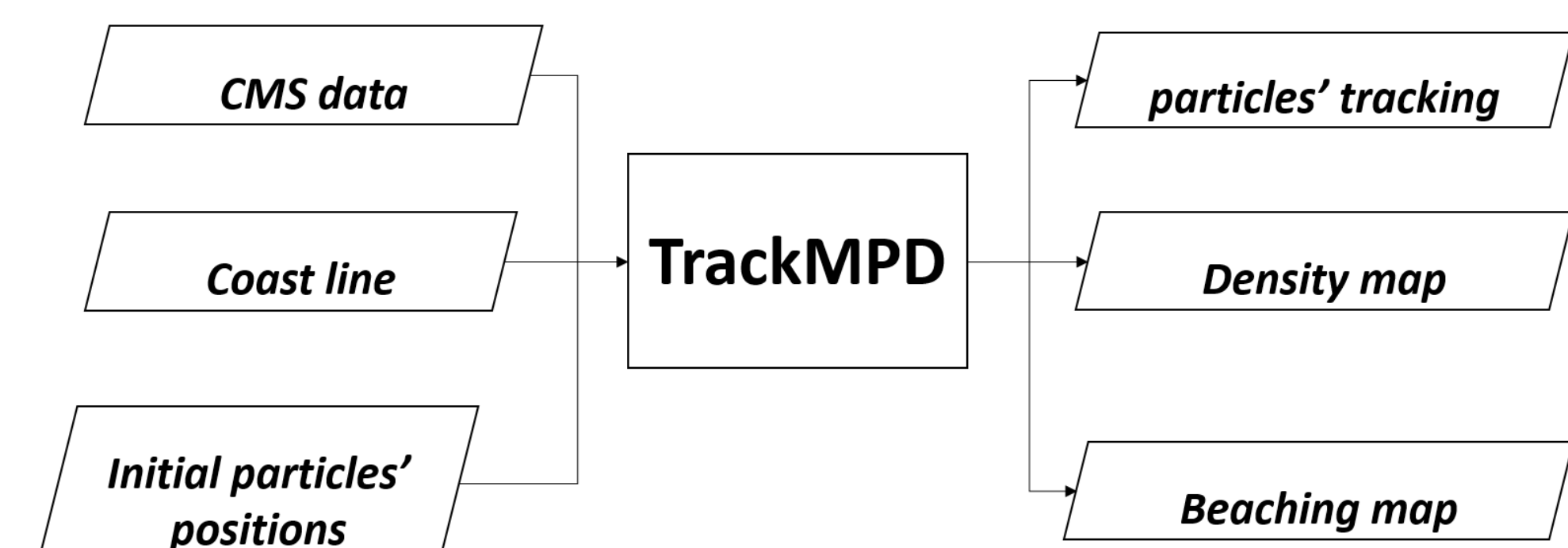


Figure 2 – Research workflow.

RESULTS

Figure 3 shows the output achieved for three representative days and in particular the density and the beaching maps.

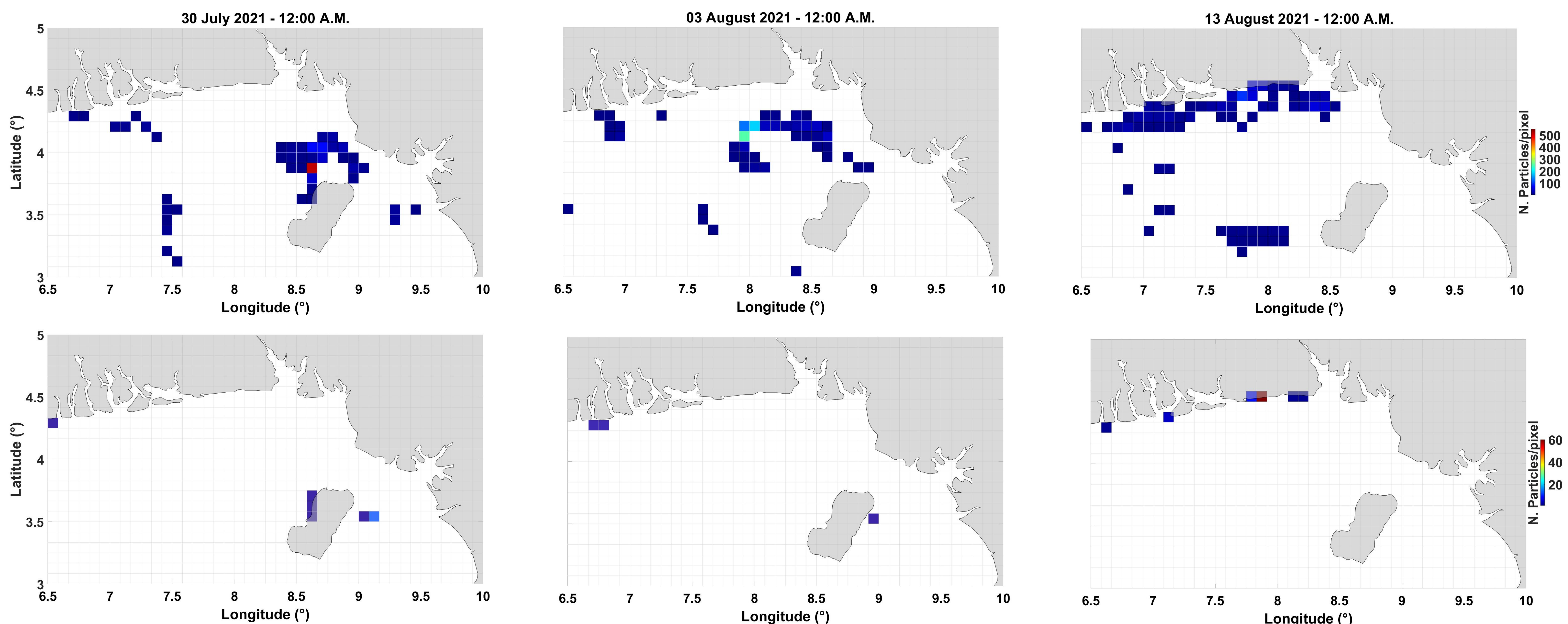


Figure 3 – Density (upper panels) and beaching maps (lower panels) for three rappresentative days.

CONCLUSIONS

Exploiting CMS data, this study confirms that the problem of plastics released at sea is a boundless issue; thus, a transboundary coordination is mandatory to tackle this growing kind of marine pollution. Results indeed show that in the considered scenario the discharge from Liberia's rivers can affects areas which are quite distant from the source rivers. Next steps will be the use of different forcing (such as hourly-scale sea current fields) and the application to a real case study where in situ sampling are available related e.g. to quantity of plastics discharged by rivers or beached in specific coastal areas. Also, the involved World Bank teams suggested to test the 3D model and to account for biofouling and refloating application of this method in the area of Mauritania to estimate sources of plastics beached in this area (backward simulation).