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Transport dynamics of pelagic sargassum in the Mexican Caribbean: sensitivity studies to the wind and depth of the transporting ocean layer

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The possible fate of pelagic sargassum in the Mexican Caribbean during aug-2018, sep-2018, and apr-2019 is analyzed using a particle-tracking model coupled to diverse datasets of wind [ERA5 reanalysis and the NCEP Climate Forecast System (CFSv2)] and ocean current velocities (HYCOM experiments of high and lower resolution). Advection of particles was computed considering 0, 1, 2, or 3 % of the wind magnitude and either surface currents (0 m) or the averaged currents from the surface to 5 m depth. For each day of the three months, virtual particles were initially located at the vertices of a uniform mesh within the Mexican Caribbean and subsequently tracked for 10 days. Results revealed that the percentage of the wind magnitude accounted for the transport had the greatest impact on the number of particles that ran aground in the Mexican Caribbean: with a higher percentage of the wind magnitude more particles reached the land. The depth of the layer of the ocean currents used in the transport was also important in the results: particle stranding was higher when only surface currents were used. On the other hand, the different data sources had less influence in the results: the simulations using CFSv2 winds resulted in more stranding of particles than those using ERA5 winds, although the differences were relatively small. The number of stranded particles was virtually insensitive to the selection of the ocean data resolution (i. e. HYCOM of high or lower resolution). In general, virtual particles located closer to the coast and further south in the Mexican Caribbean showed the highest probability of running aground on the shores of the Mexican Caribbean. The arrival time depended on the distance from the shore and the wind magnitude. With the wind and current conditions of the three months used for the study, particles located less than 50 km from the shore usually required less than 3 days to run aground. Particles between 50 and 200 km from the shore usually had an arrival time between 3 and 10 days. The dynamics of the particles were similar during each of the months. However, the greatest differences corresponded to apr-2019, when shifting winds and northerlies were observed. This provides an insight of the variations that most likely would result for different months and years. However, sargassum arrivals are expected to occur during the summer, hence these results are

relevant for the local preparedness of managing strategies for massive sargassum stranding in the Mexican Caribbean.