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Starting in 2011, coastal areas of the Caribbean Sea and tropical Atlantic Ocean began to experience extraordinary yearly accumulations of pelagic Sargassum brown alga. Prior to 2011, historical reports place large quantities of pelagic Sargassum mostly in the Gulf of Mexico and the Sargasso Sea. Using multiple lines of evidence, including numerical particle-tracking, wind and current reanalysis data, drogued and undrogued drifting buoy trajectories, in-situ Sargassum net tow observations, satellite ocean color imagery, and historical hydrographic data, we identified the origin of the Sargassum population that invaded the central tropical North Atlantic and Caribbean Sea, and the mechanisms for its continued seasonal recurrence (Johns et al., 2020). Our analyses suggest that during the extreme negative phase of the winter 2009-2010 North Atlantic Oscillation (NAO), unusually strong and southward-shifted westerly winds drove the transport of Sargassum from the Sargasso Sea into the far eastern North Atlantic. Lagrangian and numerical model analyses of the regional circulation, with the addition of "windage", show that part of the Sargassum then drifted to the southwest in the North Equatorial Current (NEC), arriving in the eastern Caribbean by the spring of 2011. At the same time, another portion of the Sargassum population was advected southward along the coast of Africa in the Canary Current, eventually joining the seasonally-varying system of tropical Atlantic currents.

Since then, large Sargassum patches are observed to aggregate in the tropical

Atlantic from March to September. Their location follows the seasonal shift in position of the Inter-Tropical Convergence Zone (ITCZ). Following the springtime breakdown of the North Brazil Current (NBC) retroflection, currents flowing to the northwest from the western tropical Atlantic bring the Sargassum into the Caribbean Sea, where it wreaks havoc on beaches, fishing areas, and coastal ecosystems, with important economic and ecological consequences. The extreme 2009-2010 NAO wind anomaly triggered a biosphere "tipping point". Understanding whether this new expanded geographic range of massive Sargassum blooms (which continue unabated as of early spring 2021) is temporary or whether it will eventually revert to its pre-2010 distribution will require sustained monitoring and research.

Presentation file

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