

Physical environments of the Caribbean Sea

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The Caribbean Sea encompasses a vast range of physical environmental conditions that have a profound influence on the organisms that live there. Here we utilize a range of satellite and in situ products to undertake a region-wide categorization of the physical environments of the Caribbean Sea (PECS). The classification approach is hierarchical and focuses on physical constraints that drive many aspects of coastal ecology, including species distributions, ecosystem function, and disturbance. The first level represents physicochemical properties including metrics of satellite sea surface temperature, water clarity, and in situ salinity. The second level considers mechanical disturbance and includes both chronic disturbance from wind-driven wave exposure and acute disturbance from hurricanes. The maps have a spatial resolution of 1 km². An unsupervised neural network classification produced 16 physicochemical provinces that can be categorized into six broad groups: (1) low water clarity and low salinity and average temperatures; (2) low water clarity but average salinity and temperature, broadly distributed in the basin; (3) low salinity but average water clarity and temperature; (4) upwelling; (5) high latitude; and (6) offshore waters of the inner Caribbean. Additional mechanical disturbance layers impose additional pattern that operates over different spatial scales. Because physical environments underpin so much of coastal ecosystem structure and function, we anticipate that the PECS classification, which will be freely distributed as geographic information system layers, will facilitate comparative analyses and inform the stratification of studies across environmental provinces in the Caribbean basin.

Chollett, I., P. J. Mumby, F. E. Müller-Karger, and C. Hu. 2012. Physical environments of the Caribbean Sea. *Limnology and Oceanography* 57:1233-1244. doi:10.4319/lo.2012.57.4.1233