

Atmospheric Drivers of Oceanic North swells in the Eastern Caribbean

Large wintertime ocean swells in the Caribbean, known as north swells, generate high surf and expose communities, ecosystems, and infrastructure to hazardous conditions. Empirical orthogonal functions and cluster analyses using ERA5 reanalysis swell data are performed to characterize north swells in the eastern Caribbean and to establish a ranked list of historical events. ERA5 atmospheric and swell data are used to create basin-scale sea-level pressure, surface wind and swell composites for north swell events of different magnitudes. Additionally, storm events are identified in the mid-latitude North Atlantic Ocean. North swells are predominantly generated by storms that intensify off the North American east coast. However, there is a subset of moderately sized swells associated with a westward-located high-pressure system in the North Atlantic. While lower sea-level pressure and stronger surface winds are important for generating larger swells, the location of the low-pressure center and storm track as well the zonal speed of the storm are critical in the development of large eastern Caribbean north swells. The largest such events are associated with storms located comparatively further southeast, with a more zonal trajectory, and slower zonal speed. Large storms located further northwest, with a more southwest to northeast trajectory, and faster zonal speeds are associated with weaker north swells or in many cases, no significant north swell in the eastern Caribbean.

