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An analysis of climate indexes and tropical cyclones in the Intra-Americas Seas

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The Intra-Americas Seas (IAS), consisting of the Gulf of Mexico, the Caribbean Sea, and the eastern tropical Pacific adjacent to southern Mexico, Central America, and northwestern South America, is a region characterized by high density of World Heritage sites and busy tropical cyclone (TC) activities. This paper, based on Amador et al. (2010), uses indexes of the IAS or Caribbean Low-Level Jet (IALLJ or CLLJ, respectively), Niño 3, Tropical North Atlantic (NATL), and Atlantic Multidecadal Oscillation (AMO), for the period 1950–2007 to analyze their relationship with TC frequency for summer–autumn of the Northern Hemisphere. An inverse relationship was found between both, the intensity of the wind speed at 925 hPa and the vertical wind shear at low levels, and the monthly relative frequency of TCs for two selected areas in the Caribbean. Both, the July peak in wind speed and the low-level vertical wind shear are associated with a minimum in the monthly relative frequency of TCs. On the contrary, a decrease in the wind speed and vertical shears are associated with a maximum value of the TCs relative frequency. Stronger (weaker) than normal IALLJ summer winds (July–August) during warm (cold) ENSO events imply a stronger (weaker) than normal vertical wind shear at low-levels in the Caribbean. This condition is known to inhibit (allow) deep convection, disfavoring (favoring) TC development. During El Niño years, low-level wind increases at the jet core strengthening the low level convergence near Central America at the jet exit and the low-level divergence in the central Caribbean at the jet entrance. The descending motion associated with the latter acts as an inhibiting factor for convection and TC development. TC activity in the Caribbean is not only sensitive to ENSO influences, but to the strength of the CLLJ vertical wind shear, to changes in the lateral wind shear, to the intensity of the regional scale descending motion associated with the jet entrance, and to the SST cooling generated by the CLLJ at the sea surface. Climatologies of a group of General Circulation Models used in the 2007 IPCC report were analyzed to study their ability to capture the low-level wind annual cycle over the Caribbean and the known CLLJ structure. Some models do not capture the basic characteristics of the jet, a relevant climate feature of the IAS, so affecting the regional predictability factor. A discussion of cyclone potential over the Caribbean, based on the relationships developed using the models climatology, is presented for the period 2010–2050. An estimation of the last decade losses in infrastructure and human lives due to TC activity is presented for the Central America region. As shown here, TCs heavily impact regional social life and worsen the already weak regional economies.

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