



Earth Gauge

A National Environmental Education Foundation Program

## Climate Cycles and North Atlantic Tropical Cyclones

### ***NORTH ATLANTIC TROPICAL CYCLONES: HISTORICAL RECORDS***

The task of assessing trends in North Atlantic tropical cyclone (TC) activity is plagued by a lack of long-term instrumental records. Most long-term trends are based on estimates calculated from sediment cores. The information gained from these sediment cores coupled with an understanding of the variables conducive to hurricane formation suggests the following:

- Over the past 5,000 years, intervals when intense tropical cyclones were relatively frequent happened between 5,400 and 3,600 years before present (yr BP, with present being conventionally defined as 1950), 2,500 to 1,000 yr BP, and 250 yr BP to today. “Quiet” periods happened from 3,600 to 2,500 yr BP and 1,000 to 250 yr BP.
- Warm sea surface temperatures are generally conducive to TC formation and high storm intensity. Despite cold North Atlantic sea surface temperatures during the end of the Little Ice Age (1700 – 1815), this period was characterized by relatively frequent intense hurricanes.
- While hurricanes have been relatively frequent since the 1700’s, their numbers gradually declined throughout this period until the 1970’s and 1980’s, which were decades when TC activity was particularly low. Since the early 1990’s, there has been a significant increase in North Atlantic TC activity.



### ***TELECONNECTIONS BETWEEN GLOBAL CLIMATE CYCLES AND NORTH ATLANTIC TC FORMATION***

The century-long trends listed above and the year-to-year variability in Atlantic TC behavior have been linked to long-term patterns in the behavior of and interactions between the following global climate cycles.

- **The El Niño Southern Oscillation (ENSO):** El Niño events stimulate vertical wind shear over the Caribbean, which works to suppress tropical cyclone formation. There are 10 percent fewer TCs during El Niño years than average, and 15 percent more TCs than average during La Niña years. TCs are also more likely to make landfall during La Niña years.
- **The Arctic Oscillation (AO):** The AO is the oscillation of pressure difference between the middle and high latitudes in the Northern Hemisphere. Negative phases occur when there is relatively high pressure over the polar regions and low pressure over the mid-latitudes, with positive phases featuring the opposite characteristics. Since the 1970’s, the index has been predominately positive. Positive phases correspond to decreased vertical wind-shear over the North Atlantic. Seven of the ten most active TC seasons since 1950 occurred during positive AO phases, while during the same period, seven of the ten least active seasons occurred during negative phases.
- **The Atlantic Multidecadal Oscillation (AMO):** Warm (positive) phases of the AMO, or periods when the North Atlantic is warmer than average, correspond to less vertical wind-shear and above average TC activity. The opposite is true of cold (negative) phases. The AMO came out of its negative phase at about the same time that North Atlantic TC activity began to increase (circa 1995), and the AMO is likely to stay positive for several more decades.

The interactions between these cycles can result in either amplified or dampened effects on TC formation. For example, La Niña years that occur during positive phases of the AO (with both phases conducive to TC formation) feature an average of 35 percent more TCs than El Niño years that happen during negative phases of the AO (both phases being detrimental to TC formation).

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