

FAQ •

Atlantic hurricanes & climate



The purpose of this document is to respond to frequently asked questions on the topic of Atlantic hurricanes and climate. This document reflects the current state of the science, which is based on official data sets and results presented in peer-reviewed publications. It does not contain any statements of policy or positions of NOAA, the Department of Commerce or the U.S. Government.

Has hurricane activity changed in the 20th century?

- Atlantic hurricane seasons since 1995 have been significantly more active. There are more hurricanes, and hurricanes are more intense than the previous two decades. (figure 1)
- Earlier periods, such as from 1945 to 1970 (and perhaps earlier), were as active as the most recent decade.
- More hurricanes have made U.S. landfall in the past decade, but periods of even higher landfalls occurred early in the century. (figure 2)

What are major issues associated with this increased hurricane frequency and intensity?

- Strong natural decadal variations, as well as changes in data quality, density, sources, and methodologies for estimating hurricane strengths, lie at the heart of arguments whether or not a global warming contribution to a trend in hurricane intensities can be detected.
- Global warming has impacted Atlantic Ocean temperatures. Over the 20th century, global ocean temperatures and sea surface temperatures where hurricanes typically develop in the tropical Atlantic and Gulf of Mexico have warmed at similar rates, indicating a role for global warming in these regions. (figure 3) Ocean temperatures have risen about one degree Fahrenheit (half a degree Celsius) in tropical water.

Figure 2: Landfalling Hurricanes and Major Hurricanes (cat. 3-5) in United States

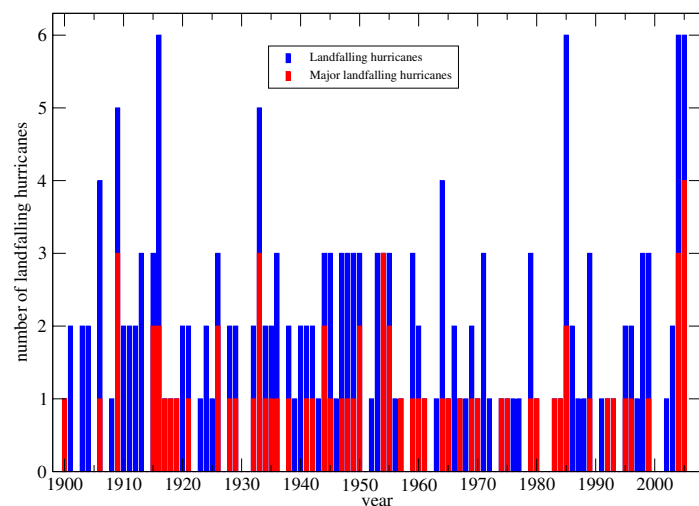
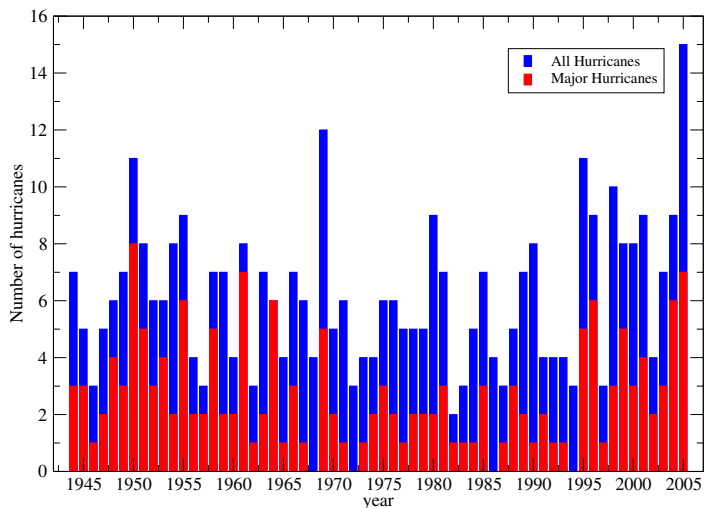


Figure 1: Number of Hurricanes and Major Hurricanes (cat. 3-5); Atlantic Basin (1945-2005)



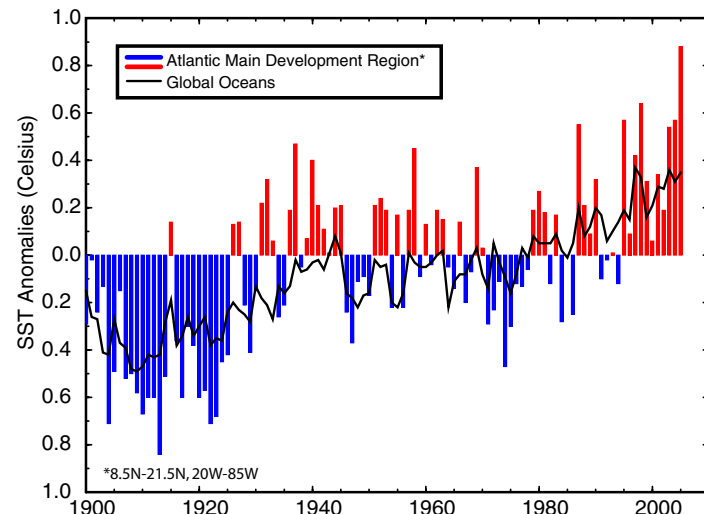
- It should be noted that anomalous sea surface temperatures in the tropical Atlantic were significantly warmer than the global average from about 1930 to 1970 and after 2000. This warming is attributed to the Atlantic Multi-decadal Oscillation, a slow cycle of natural fluctuation in atmospheric conditions and water temperatures.

What factors influence hurricanes?

- Hurricanes respond to a variety of factors besides local ocean temperatures. In particular, the vertical wind structure is of crucial importance; favorable wind conditions in conjunction with warmer ocean temperatures contribute to active periods.
- The Atlantic Multi-decadal Oscillation and the El Niño/La Niña cycle are important factors in determining the environ-

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Figure 3: June - November Average Sea Surface Temperature Anomalies



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mental conditions for seasonal to multi-decadal extremes in hurricane activity.

- Models simulate approximately a one-half category increase on the Saffir-Simpson scale of strong hurricanes late in the 21st century, if tropical sea surface temperatures are about 1.75 degrees Celsius warmer than at present. The models also show an approximately 20 percent increase in near-storm rainfall rate under those conditions.

How long will the current active period last?

- Scientists disagree as to whether currently a sound basis exists for making projections on how long the current active period will last. The viewpoints include:
 - ❖ Limited understanding of natural decadal variability, combined with its irregular temporal behavior, preclude definitive statements about how long the active period will last.
 - ❖ One might expect ongoing high levels of hurricane activity and U.S. landfalls for the next decade and beyond since the previous active period (1945-1970) lasted at least 25 years.
 - ❖ Because of global warming the active period could persist.
- Programs of improvements to data sets, diagnostic studies for improved understanding, and systematic numerical experimentation studies will help to reveal the underlying causes for the recent active period and to predict how long the period of increased activity will last. NOAA is actively engaged in each of these activities.

What key research is NOAA working on?

- Understanding the dynamics of the Atlantic Multi-decadal Oscillation, its links to the larger-scale tropical climate variability, and developing an ocean monitoring and decadal prediction capability.
- Improving the quality and scope of hurricane relevant data sets.
- Numerically simulating and developing a predictive understanding of seasonal to decadal hurricane variability.
- Understanding whether or not and to what degree human induced changes to the environment are having an influence on hurricanes.
- Making improvements to short range hurricane track and intensity forecasts and development of additional observing capabilities for hurricanes.

NOAA Resources for Additional Information

• NOAA National Weather Service

- ❖ National Centers for Environmental Prediction

Climate Prediction Center: intraseasonal to multi-season climate forecasts; seasonal hurricane forecasts; diagnostic studies of major climate anomalies; real time monitoring of climate.

<http://www.cpc.noaa.gov>

Tropical Prediction Center / National Hurricane Center: issues operational hurricane forecasts; maintain and update the official Atlantic and northeast Pacific hurricane databases from which observational climate studies are conducted

<http://www.nhc.noaa.gov>

• NOAA Satellite and Information Service

National Climatic Data Center: official archive for climate data sets; development of global tropical cyclone databases, analysis of historical frequency and strength of Atlantic Basin hurricanes, analyses of climate trends, monitoring and historical perspective on current seasons.

<http://www.ncdc.noaa.gov>

National Coastal Data Development Center: distributes data and information associated with natural and man-made events that impact coastal areas.

<http://www.ncddc.noaa.gov>

• NOAA Office of Oceanic and Atmospheric Research

Atlantic Oceanographic and Meteorological Laboratory / Hurricane Research Division / Physical Oceanography Division: physical understanding of hurricane dynamics through use of research aircraft and field studies; improvements to hurricane track and intensity forecasts; monitoring of Atlantic ocean circulations; studies of Atlantic climate.

<http://www.aoml.noaa.gov>

Geophysical Fluid Dynamics Laboratory: studies of climate variability and change; development and use of the required climate models; development of models used for operational hurricane forecasts by NOAA and the Navy; numerical studies of climate impacts on hurricanes and their decadal variability.

<http://www.gfdl.noaa.gov>

Earth System Research Laboratory: diagnostic studies of climate variability and changes; impacts of climate on extreme events.

<http://www.esrl.noaa.gov>

Climate Program Office: intramural and extramural support for development of a predictive understanding of the climate system, the required observational capabilities, delivery of climate services.

<http://www.climate.noaa.gov>



NOAA is dedicated to enhancing economic security and national safety through the prediction and research of weather and climate-related events and providing environmental stewardship of the nation's coastal and marine resources.

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