Past hurricane activity reconstructed using cave deposits: Have humans increased storm risk?

Reporting

Project Information

HURRICANE

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Final Report Summary - HURRICANE (Past hurricane activity reconstructed using cave deposits: Have humans increased storm risk?)

The HURRICANE Project's principal objective was to determine whether anthropogenic climate change

was affecting the frequency, strength, and/or position of tropical cyclones in the North Atlantic basin. By producing one of the highest resolution and most accurately dated palaeoclimate records ever produced for the low latitudes, and by developing a new statistical technique for its analysis, the research team has successfully obtained this objective. Our records indicate that tropical cyclone frequency basin-wide is not higher than preindustrial levels. However, we have concluded that tropical cyclones have migrated to the north due to not only carbon dioxide emissions, but also due to sulphate emissions, and that the storms are becoming more powerful. In short, the population and financial centres of the East Coast of North America can expect to be impacted by more frequent and more powerful storms if anthropogenic climate change continues unchecked. Conversely, Central America will be affected by fewer storms, potentially affecting water resources in the region.

Two unexpected results also constitute major achievements of the project, but were not initially envisaged. First, data we collected from our principal field site in Belize contributed to an exciting study providing the firmest evidence to date that the collapse of the Classic Maya Civilisation was caused by drought. This work not only helped solve a longstanding archaeological enigma, but also demonstrated that sophisticated societies are susceptible to climate change. Second, our research established that anthropogenic sulphate aerosol emissions derived from fossil fuel burning cooled the Northern Hemisphere more than the Southern Hemisphere, consequently shifting low latitude rain belts to the south. This triggered low latitude drought since widespread industrialisation in the 19th Century, most notably the sub-Saharan droughts in Ethiopia and elsewhere in the 1980s. This research also provides a new template for predicting future climate shifts, and highlights that aerosol forcing of climate is as important as that arising from greenhouse gases. Finally, the project provided new insights into the relationship between volcanic eruptions and climate change, by introducing the concept that major weather fronts are pushed away from the hemisphere that the eruption took place in. For example, a Northern Hemisphere volcanic eruption pushes tropical rain belts to the south, inducing drying in the Northern Hemisphere low latitudes, and increasing rainfall in the Southern Hemisphere low latitudes. This new concept was applied to known Quaternary volcanic eruptions, and it was determined that a significant relationship exists between Northern Hemisphere volcanism and abrupt Northern Hemisphere cooling across the interval 30,000 to 80,000 years ago. We also proposed a mechanism through which Southern Hemisphere eruptions could trigger Dansgaard Oeschger events, dramatic abrupt warming events in Greenland that had so far not been adequately explained.

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