

TRANSCRIPT FROM GFDL CLIMATE RESEARCH CONVERSATION AUDIO PODCAST
[ATLANTIC TROPICAL CYCLONE DURATIONS](#)

FEATURING THOMAS KNUTSON AND GABRIEL VECCHI

[PRODUCTION DATE: AUGUST 2009; AUDIO LENGTH: APPROX 12:57]

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ANNOUNCER [KD] – For today’s Climate Research Conversation, we will hear from Tom Knutson and Gabriel Vecchi, research scientists at NOAA’s Geophysical Fluid Dynamics Laboratory in Princeton, New Jersey.

The topic will be the very active research field that investigates trends and variations in tropical storms.

Tom and Gabe, along with colleagues from the National Hurricane Center in Miami and the University of Reading in England, are co-authors of a study that appeared in the online version of the Journal of Climate in August 2009.

The study’s title is “Impact of Duration Thresholds on Atlantic Tropical Cyclone Counts”.

You’ll now hear climate scientist Rym Msadek ask Tom and Gabe a few questions about this paper and about their related work.

[music ~5 seconds]

Question 1 [RM] – We all know that hurricanes and tropical storms can have a big impact on people’s lives and property. And many people are interested in how the number or strength of future Atlantic tropical storms may or may not change from what has taken place in the past.

So in this new study, you and your colleagues try to address part of this research puzzle by looking back over more than 100 years of information about these storms – information that is stored in a database that has been used in many previous research projects.

Gabe, can you tell us what were the main findings of this new study?

Answer [GV] – The main findings of this study are that there’s been a very pronounced increase, in the North Atlantic, of tropical storms that last two days and less.

So, the shortest storms – the shortest duration storms in the North Atlantic- have shown a very, very pronounced increase since the end of the 19th century.

Meanwhile, longer duration storms – storms that last longer than two days – have not shown an increase. They’ve remained at a pretty constant level over the long term, even though

they show ups and downs on decade to decade and year to year time scales.

Question 2 [RM] – Tom, why is it that the data records for the North Atlantic only show an increase in the short duration tropical storms? Do you have any physical explanation for that?

Answer [TK] – Well, we don't know for sure why only the short duration storms are showing an increase. In fact, we can't think of a reason to expect this type of response from a climate change scenario.

So, we speculate in this study that this change is due to improvements in observing practices. And specifically, now that we have satellites, we're able to see and detect these short lived storms – particularly the ones that are occurring far out in the basin.

And because we're able to see them better with the satellite technology, we think that that's creating an artificial trend in the database, where we have this apparent increase in short lived storms over time, but it's not really a true climate change.

Question 3 [RM] – So you're saying that over time people and technology have gotten better at detecting these storms and that in the past some storms were missed – in other words, nobody saw them.

Gabe, I was wondering, is that why in this study and in another paper you recently published you propose that adjustments should be made to this widely used tropical cyclone database? If so, can you tell us how you determined that there are storms missing from this dataset and how you could estimate how many past storms are missing from the database?

Answer [GV] – If one looks at where tropical storms have formed over the satellite era – that is, over the period in which we are very certain that we have not missed any tropical cyclones in the record – one notices that they tend to form in the eastern tropical Atlantic.

The eastern tropical Atlantic traditionally – before the advent of satellites – had been one of the least monitored places in the tropical Atlantic. Ships tended to go around it – either to go around Africa or to go through the Panama Canal. And so we have reason to believe that storms may have been formed there and not seen.

So, our methodology in this and in the previous study was to take the storms that we know happened during the satellite era and ask the question, “If these storms had happened sometime in the past, how likely would they have been to slip

through the cracks of ships and pass unobserved?" We repeated this experiment many, many, many times and estimated, based on this, the number of storms that we couldn't exclude as having been missed in the past.

Now it's important, and perhaps obvious to note, that nobody will ever be certain about how many storms we didn't see in the past. It is possible that we saw all the storms in the past, although we judge that to be relatively unlikely.

So we think that it is very possible that we missed as many two to three storms a year in the late 1800s and the early 1900s.

Question 4 [RM] - So Tom, does this study mean that global warming does not affect tropical cyclones at all?

Answer [TK] - No. That's an over-interpretation of this study.

This study just deals with numbers of tropical storms in the Atlantic Basin.

If we look overall at the projected impacts of global warming on tropical cyclone activity (and these projections are based on our climate models and downscaling regional studies from climate models)... if we look overall, what we find in the models is typically a decrease - that the models project a decrease in the overall numbers of tropical storms. We find this in particular in the Atlantic basin in a recent study.

But the models also project that the stronger tropical storms - the higher category hurricanes, if you will - actually increase in intensity and increase in number in a warmer climate. Now the magnitude of the increase of intensity that we see in our simulations is on the order of a 5 or 6 percent increase of intensity by the late 21st century for a typical one of these climate change scenarios.

Another result that we find in our model simulations is that tropical cyclones and hurricanes in a warmer climate have higher rainfall rates than those in the present day climate. And this could have important implications for flooding.

And finally, climate warming - or greenhouse warming - is very likely to cause sea level to rise, and rise substantially. And as sea level rises, the storm surges caused by hurricanes will ride on a higher base level and lead to higher storm surge levels than we see in the present day climate.

So it is a complicated - somewhat complicated picture with fewer storms being projected in many basins, but the storms that occur being projected to be of somewhat higher intensity in the warmer climate. And all of this is happening on a background of rising sea level.

Question 5 [RM] – Do you understand why the number of long-lived tropical storms and hurricanes has varied the way it has from year to year and from decade to decade?

Answer [TK] – Well, as we found in our study, there has not been a significant long term increase over time in these medium to long lived storms.

Now, based on our modeling work here at GFDL, we actually do not expect greenhouse warming to lead to any increase in tropical storm numbers in the Atlantic basin. In fact, our models project that with strong warming in the future, due to greenhouse warming – even if it warms up the tropical Atlantic by two degrees Celsius – our models project that that will actually produce a decrease in overall numbers of tropical storms and perhaps a decrease in hurricane numbers, as well.

We've looked into the models and why they give this response, and it turns out that with greenhouse warming in the Atlantic basin that climate models typically are projecting an increase in vertical wind shear in the Atlantic basin to accompany the sea surface temperature warming. So this sea surface temperature warming acts to increase tropical storm activity, but the increase in vertical wind shear across the Caribbean acts to disrupt the formation of tropical storms and acts to suppress or decrease the number of tropical storms with climate warming.

So it's sort of a counter-intuitive result, but it seems to be robust in our models.

Question 6 [RM] – Obviously, people are most concerned with storms that hit land. What does your study say about land falling tropical storms?

Answer [TK] – Well, our study did not directly address the question of land falling storms. But previous analyses have shown that the number of land falling tropical storms and the number of land falling hurricanes in the Atlantic basin has not been increasing over time. If we look back to say the late 1800s and come forward there has not been a long term increase in numbers of land falling tropical storms or hurricanes in the Atlantic.

Now if one looks at the total number of storms in the basin in the conventional database, there does appear to be an increase. But that increase is happening far away from land – more in the eastern part of the basin. And it's that part of the basin where we suspect we have the most difficulty in observing tropical storms – or that we have had the most difficulty. And that's the part of the basin where we suspect there's likely to be the biggest problems in the database in terms of missing storms.

And we have done some further analysis of this using the ship track density to estimate numbers of missing storms. And using this method, we estimate that there have been significant numbers of missing storms - not close to land, but particularly far out in the basin and away from the main shipping traffic lanes.

And of course, this was all prior to the satellite era. Once we had the satellites up - that could observe the whole basin - then this problem of missing storms, we believe, has become much less of an issue.

Question 7 [RM] - Gabe, once you make the adjustments to account for missing storms in the past, does it still appear that there have been more Atlantic tropical storms in recent decades?

Answer [GV] - Yes. Overall Atlantic tropical storm frequency has increased in the past couple of decades.

Since the late 1980s, there has been a very pronounced increase in both short duration storms and long duration storms in the tropical Atlantic.

However, when we look longer in the record, it is only short duration storms that show an increase. Longer duration storms show periods of active and inactive frequency. But over the long term there has been no trend for an increase.

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ANNOUNCER [KD] - This discussion of trends and variations in the frequency of Atlantic tropical storms and hurricanes has featured Tom Knutson and Gabriel Vecchi, climate scientists at the National Oceanic and Atmospheric Administration's Geophysical Fluid Dynamics Laboratory located in Princeton, New Jersey.

This conversation was prompted by the publication of a paper in the Journal of Climate titled "Impact of Duration Thresholds on Atlantic Tropical Cyclone Counts."

It is co-authored by Christopher Landsea, Gabriel Vecchi, Lennart Bengtsson and Thomas Knutson.

For more information about the research done by Gabriel, Tom, and their colleagues at GFDL you can go to W-W-W dot G-F-D-L dot N-O-A-A dot "gov" (<http://www.gfdl.noaa.gov>).

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