Science AMA Series: Hurricane Patricia has gone from a tropical storm to one of the strongest hurricanes ever recorded, We're a team for WXShift and Climate Central.org, Ask Us Anything!

WXshift [1] and r/Science AMAs[1]

[1]Affiliation not available

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Abstract

Hurricane Patricia is now one of the strongest recorded storms on the planet and is likely to make landfall as a Category 5 storm in Mexico on Friday evening. It's a record-breaking meteorological marvel but could quickly turn into a major humanitarian crisis when it makes landfall. We're two journalists and a meteorologist who work at WXshift, a Climate Central powered weather website that provides climate context for your daily forecast. We're here to answer your questions about the records Patricia is setting, potential impacts and anything else you want to know about this storm or why this year has seen a record number of strong tropical cyclones in the northern hemisphere. Ask us anything! We are: Sean Sublette is an award-winning meteorologist at Climate Central and WXshift. He previously worked as the chief meteorologist at WSET in Lynchburg, Va. and currently hosts WXshift's Shift Ahead Andrea Thompson is a senior science writer at Climate Central and WXshift who focuses on extreme weather and climate change. Brian Kahn is a senior science writer at Climate Central and WXshift. His recent coverage has included Patricia as well as the recent northern hemisphere hurricane record. EDIT: Thank you all for your really thoughtful questions. We'll be continuing our coverage on the site as well as [Twitter](http://www.twitter.com/wxshift] so please follow along. And if you know anyone in the region, please tell them to be safe and seek shelter. This storm is serious.

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WXSHIFT R/SCIENCE

ABSTRACT

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What caused this storm to strengthen so much and so quickly?

Hauptbahnhof

One of the main factors is the incredibly warm water the storm went over -- that's the main source of a hurricane's energy. Waters in that region are much warmer than usual (by a couple degrees Celsius), primarily because of El Nino. - Andrea T.

Having gone through Katrina, I'm curious how this compares in two ways:

1. I think for most Americans Katrina is our metric for horrible hurricanes. How much worse will Patricia be?
2. Katrina is often called a man made disaster due to the various conditions on the ground that made

We're a team for WXShift and Climate Central.org, Ask Us Anything!, *The Winnower* 2:e144562.24810 , 2015 , DOI: 10.15200/winn.144562.24810

the humanitarian situation so much worse (everything from wetland loss to an inadequate evacuation plan). Are there similar issues on the ground in the likely impacted regions? What is being done to address them?

Lastly, if anyone wants to donate to an organization to help do you have any recommendations?

firedrops

Great questions. It can't be overstated that the threat of Patricia (or any storm for that matter) is compounded by the human elements on the ground and how prepared people are.

1) In regards to how much worse than Katrina it will be, tough to say. It's a more intense storm and will make landfall at or near it's peak intensity as opposed to Katrina, which weakened. But it's also smaller, will make landfall in a less populated area (though there are still 2.7 million people in the storm's path).

2) I honestly don't know a ton about environmental degradation in the area Patricia is forecast to make landfall. Mexico does seem to be taking the storm very seriously and is evacuating residents, but there are still potentially millions in the storm's path that will deal with impacts inland. Even after it winds down wind-wise, there's still the issue of up to 20 inches of rain in mountainous areas inland. Mudslides could leave communities cut off for weeks and infrastructure could be damaged for months afterwards. In short, it could be a huge humanitarian crisis even if the pictures of the aftermath aren't quite as iconic as a flooded major American city.

-Brian

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2. Katrina is often called a man made disaster due to the various conditions on the ground that made the humanitarian situation so much worse (everything from wetland loss to an inadequate evacuation plan). Are there similar issues on the ground in the likely impacted regions? What is being done to address them?

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firedrops

For your question, it depends a bit on how you frame the question. From a meteorological standpoint, Patricia is much stronger, but it's also smaller, so a more concentrated area will be ask risk. Also, the major concern with Patricia is the winds in that area that gets hit by the eyewall -- Katrina was very much a storm surge event, which as I understand isn't as major a concern here because of the particularly geography of this coastline. Another concern with Patricia will be the heavy rains it could bring, especially to mountainous areas, which could mean very dangerous flash floods and mudslides -- a known problem in this area. I'm afraid I don't know enough about the area to say how well prepared they are or not. - Andrea T.

If I remember correctly, Katrina weakened before making landfall as a Cat 3. How rare are Cat 5 landfalls?

chay99

Good question. There are only 3 on record for the U.S. (the 1935 Labor Day hurricane, Camille and Andrew), but I'm not sure about other areas. On the whole they're pretty rare, in part because Category 5 storms themselves are rare and in part because storms tend to weaken as they approach land (the interaction with the land creates friction and often water near the shore can be cooler). - Andrea T.

There's a bunch of people 'extrapolating' from the category system that this is a Cat 6 or even 7.

Is this storm likely to trigger an extension to the category system?

Sansha_Kuvakei

Doubtful. It takes a lot rewrite a scale like that. If it does happen, it would probably be decades away. - Sean S.

How much has the increase in power been facilitated by El Niño?

lovemeloveher

El Nino is definitely a factor here as it has helped to boost ocean temperatures in the region, which are providing the fuel for the storm. It's been a boost to activity in the Pacific as a whole this year, with lots of records being set: http://wxshift.com/news/the-northern-hemisphere-just-set-a-cyclone-record - Andrea T.

How much has the increase in power been facilitated by El Niño?

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That is hard to quantify, as there are other factors at play (wind flow aloft, moisture in the middle part of the atmosphere). -Sean S.

Given that this is the "strongest recorded storms in history" which has some pretty incredible data(mainly the temperature at the hunters flight altitude which was about 82 degrees), do you think a storm bigger than this could form next year, and could it become an annual occurrence?

pizzabyAlfredo

Saying with any certainty what hurricane activity will be like year-to-year is pretty tricky. Forecasters will do seasonal forecasts on the number of storms total and the number of major ones, but only much closer to the season, when some of the factors that shape that activity (like El Nino) are much clearer. There's usually major hurricanes somewhere around the world (often in the Western Pacific) each year, but we really can't say when the next one like this might form. In the long term, the best science does tell us that hurricanes overall may become less frequent but that major storms will become more frequent. - Andrea T.

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pizzabyAlfredo

Certainly, larger storms can form, and probably will. However, the size of the storm is not directly related to its maximum wind speed. An annual occurrence of a storm with the level of wind is not likely. -Sean S.

How is Patricia the strongest hurricane on record? Is it because of wind speeds or pressure? Just asking because I believe I've seen other hurricanes with much lower pressure than Patricia yet it's among the strongest.

IrateBarnacle

It has the strongest wind speeds ever directly measured (i.e. by hurricane hunter aircraft). It's possible that Typhoon Haiyan had higher winds, but we could only estimate from satellites, which is more uncertain. By pressure it's only the strongest in the Western Hemisphere. Typhoon Tip had the lowest pressure on record, 870 mb. - Andrea T.

With sustained winds over 200mph, this makes the hurricane as powerful in terms of windspeed as an EF4 tornado, except the winds experienced in a single location could last for much longer than they would in a tornado.

Given the nature of a tornado (tight, circular winds) and a hurricane (generally blowing in 1 direction, but for longer), would the damage profile between the two be similar purely due to windspeed, or would we expect significant differences? In short, can you compare this storm to an EF4 tornado?

Finally, given the incredible strength of this storm, will we now see the creation of Category 6 or even 7 for rating hurricanes?

Lokabf3

True, but remember that the 200mph winds are not throughout the entire storm. They are confined to the eyewall... which is immediately around the eye. Hurricane recon reports hurricane force winds extend 35 miles away from the center. Comparison to a tornado is tricky, but I think there are similarities. At this time, Category 5 storms are for anything with sustained winds in excess of 157mph. Even these are a small percentage of total storms, so I would not expect a Cat 6 developed any time soon. - Sean S.

Do you think Patricia's pressure has dropped/will drop below the record low?

LastGreyWolf

So it's already dropped below the record for the Western Hemisphere, which was 882 mb, set by Wilma in 2005. It's very doubtful it would beat the overall record, which is held by Typhoon Tip (870 mb) because it's already starting to interact with land and will begin to weaken pretty quickly after its eye makes landfall. - Andrea T.

I don't mean to sound selfish, or to distract from the danger posed to Mexico, but as a resident in southeast Texas, what can we expect to see in the US? From what I've seen there's already a tropical system in the gulf and remnants of Patricia may well "join" with it.

mostnormal

Yup, you've got it. Basically it's just providing more moisture which means more potential rainfall. Here are the current rainfall totals the NWS expects in the next 5 days: http://www.wpc.ncep.noaa.gov/qpf/p120i.gif?1445625893 - Andrea T.

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mostnormal

Heavy rain is expected late this weekend and into Monday in southeast Texas, yes. Be prepared for flooding. - Sean S.

What are the factors that have made Patricia grow so powerful so quickly? I assume ocean temperature had a lot to do with it, but what else? Are these factors going to become more common in the future as global warming gets worse?

Caleb-Rentpayer

The very warm water was a big issue here. It was some of the warmest water on the planet... middle 80s Fahrenheit. Slow moving systems and a moist middle atmosphere also contribute to strengthening. However, there is still much to be learned about rapid intensification. - Sean S.

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Caleb-Rentpayer

See Hauptbahnhof's question for an answer on the first question. As for whether those conditions become more common with global warming, it's a tricky one to answer. Overall, the oceans are warming, but they're not the only factor that affects hurricane development. If the atmosphere isn't as friendly to storm formation, we don't quite know how those two issues might combine. Overall though, scientists think storms will become a bit less frequent but more intense. - Andrea T.

Hi, thank you for the work that you do! I have a few questions...

- Are huge storms like this a predictor that future storms will be increasing in size, or is that too hard to predict at this time?
- How are residents/visitors in coastal Mexico being warned, and how does evacuation work in those areas?
- Does this put Southern California on alert for bigger storms in the future at all? I read that large hurricanes are less of a threat in that region because the water is colder there, but I would love to know a bit more.

throughthebluemist

The storm size is actually not that great, as the size of the storm is not indicative of how strong the winds are with it. And this does not necessarily speak to a new normal. However, as the planet warms,

we should begin to see hurricanes with stronger winds and heavier rain. Although, early research suggests there may be fewer of them. Still a lot to study. I cannot speak to the evacuation process in Mexico... sorry. And this really does not change anything in SoCal. Unusual steering winds are largely responsible for driving the hurricane into the Mexican coast. And you are correct about the colder water along the California coast, it makes hurricane development exceedingly difficult. -Sean S.

You are doing awesome work! I would just like to know what you like most about your jobs?

KillSleigh

Personally, it's just great to be doing work I love about an issue I care about.

-Brian

You are doing awesome work! I would just like to know what you like most about your jobs?

KillSleigh

I get to ask really smart people who are doing really interesting work all sorts of questions! - Andrea T.

Does a storm's category affect how quickly it dissipates over land? I guess I am just wondering how long you think this storm will last once it makes landfall.

Zaogolas

Both the strength of the storm as well as the type of terrain it interacts with plays a role. Patricia, though incredibly strong, is coming up against some rugged terrain and is expected to weaken to a tropical storm by early tomorrow morning: http://www.nhc.noaa.gov/refresh/graphics_ep5+shtml/180133.shtml?5-daynl#contents - Andrea t.

Where in Mexico will it land and what sort of damage can we expect to see from this storm?

fataldarkness

Right now it's looking to hit around Manzanillo in the state of Colima. There will likely be some damage from storm surge, though the main concerns are the incredible winds -- whatever area gets the core of the storm will see extensive wind damage (i.e. downed trees, busted windows, roofs torn off). Inland there are major concerns about flash floods and mudslides from heavy rains. - Andrea T.

Can this monster cross Mexico and reform in the Gulf?

thatgrl

It's going to weaken very quickly once it's over land and away from the energy source of the ocean and interacts with the rugged terrain. It'll be a tropical storm by tomorrow morning and a depression by tomorrow night. - Andrea T.

Everyone's saying this grew from a small storm to something massive in about 36 hours. What causes

that to happen in such a brief period of time?

destructormuffin

As noted in another post upthread, the short answer is the incredibly warm ocean waters the storm went over, which drove its convection. But we don't have a good handle on why some storms strengthen so very quickly while others don't -- it's a definite thorn in the side of hurricane forecasters. - Andrea T.

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destructormuffin

In general, slow movement and warm water lead to intensification. But why this particular storm intensified so rapidly is something that will take a lot of further study, as it is a fairly rare occurrence. - Sean S.

Can you speak to the role of el nino on the current tropical storm season? I was under the impression that it creates unfavorable conditions for Atlantic storms but what role might it have played in Patricia's development?

PM_your_readinglist

Correct. The wind direction during an El Nino season creates more difficult conditions for hurricanes to form in the Atlantic. That is not the case in the Pacific. - Sean S.

People are saying this hurricane is like a huge EF5 tornado. Is this true in any way?

CouldBeWorse2410

So the windspeeds closest to the eye are similar to an EF5 tornado, but the dynamics of tornadoes and hurricanes are very different. Also the winds from a hurricane will affect an area for much longer than a tornado will. - Andrea T.

Hi- do you think we will ever develop the technology to verry accurately predict storm stracks over multiple days?

Drummr

Track forecasting has improved substantially in the past 20 years, and there is every reason to believe it will continue to improve. Intensity forecasts, unfortunately, have not seen the same amount of improvement. - Sean S.

I keep seeing climate change deniers citing a NOAA tropical cyclone metric Accumulated Cyclone Energy (ACE) as not having increased over the past 30 years as proof that the IPCC predictions for increasing tropical cyclone frequency and strength are false. Is this statistic actually used for what is claimed? The past couple years show relatively low ACE numbers, yet I've never heard so many "supertyphoons" in the news. Why aren't the supertyphoons raising the ACE statistic? Is the very rapid

intensification seen with Patricia something we can expect to become more common?

shiningPate

There's a lot to unpack here. ACE takes into account the strength of storms as well as their longevity and can be tallied up over a whole basin or the whole globe. It fluctuates from year to year for a lot of reason, including climate factors like El Nino. Often, when the Pacific has a lot of activity (and a high ACE), the Atlantic will have the opposite.

Looking for trends over time in hurricane data is very difficult, largely because the record is so short that it's limited in what it can tell us, but also because there are so many factors affecting hurricanes. More on the larger question of warming and hurricanes and where the science is at here: http://www.climatecentral.org/news/how-katrina-changed-climate-research-19386

As for the rapid intensification, I don't know that anyone has really looked at that specifically in the context of warming. It's not a well-understood process to begin with. - Andrea T.

I just heard a newscaster or news weatherman say that there was a theoretical upper limit to hurricane winds of 200 mph (if I heard correctly). Why would there be a "theoretical upper limit," and why 200 mph?

Edit: spelling and punctuation

chung_my_wang

The upper limit is related to the density of the air in our atmosphere, friction, and temperature. If the rest remain the same, and the temperature rises, higher wind speeds are plausible. - Sean S.