Forecast Webinar: Hurricanes

Friday Forum: June 5, 2026
1h 20m 05s

Keith Porter 00:00:20
I welcome everyone. We'll give it another five seconds before we start. All right, welcome everyone. Welcome to Friday Forum, our forecast series. This is June 5, 2026 This is our 200 and 41st Friday forum in the series. The series is hosted by ICLR, the Institute for Catastrophic Loss Reduction. We're Canada's leading source for disaster resilience knowledge. Our mission is to make Canada more resilient to natural disasters. Each month we present recent research related to that mission. I'm your host, ICLR Chief Engineer Dr. Keith Porter. I'm speaking to you from London, Ontario, traditional lands of the Anishinaabe, Haudenosaunee, Lenapewa, and Atta Wander in nations. Last week, on may 29 my ICLR colleague, Emilia Cameron, summarized about 40 municipal incentive programs that promote basement flood protection. If you missed that, you can find the video, the speaker slides, and transcripts at www.iclr.org/workshops Our next Friday forum in three weeks, on June 26 is going to be my ICR colleague Dan Sandink. He's going to present a field trial for building above code wildfire resilient homes in British Columbia. Today, we bring you Bob Robichaud of the Canadian Hurricane Center. Today, as he's done almost every year since 2010 he's going to present the 2026 annual hurricane forecast. The 2026 annual hurricane season started on june 1, and it ends on november 30. Bob is going to remind us how hurricanes and post tropical storms work. He's going to recap last season's last year's hurricane season, and he's going to tell us how active this season is expected to be, and probably more, Bob serves as Warning Preparedness Meteorologist at the Canadian Hurricane Center. He's been a meteorologist for 31 years. He was briefly a weather forecaster in the private sector, but he served in the Canadian government since 1998 Everybody turns to him for hurricane forecasts: insurers, CatIQ, the media, environment, climate change, Canada, US, and probably others. As always, we are grateful to have him with us. Before Bob begins, here's our agenda. Our webinar is going to last 90 minutes. Bob is going to present for about half that time, then I'm going to moderate Q and A for the second half. Please feel free to chat your questions into the Q and A box. I'll try to pose your questions in the order they appear in the Q and A box. If we have a lot of questions, I may only pose your first one. I may only pose your first question. Then I'll move on to others. Then I'll circle back to your additional questions. Remember that our webinar is recorded, and we will post our speakers' slides and a link to the video and other products in the next day or so. If you have colleagues who couldn't attend, let them know. You can find all these materials at www.iclr.org/workshops And with that, I will turn it over to Bob.

Bob Robichaud 00:03:38
Good afternoon, everyone. Thank you, Keith. I'll just share my slides here. Okay,

Keith Porter 00:03:51
Looks good.

Bob Robichaud 00:03:54
Perfect. Great. So, following the same sort of format that I follow every year. We'll do a quick review of tropical cyclones, since we only get to deal with these things over a certain part of the year. We'll do a quick overview of last season, which was interesting in a couple of different ways. We'll look at some resources and some new stuff that's coming along in terms of how we, we produce forecasts and some of the products that are available, and how those are going to change, and then we'll look at some of the factors at play for this coming hurricane season. So, tropical cyclones, the term tropical cyclone is essentially a term, a generic term for all these types of storms, hurricanes, tropical storms, tropical depressions, and typhoons, depending on which ocean basin you're dealing with, but they all have the same structure, and the sin, and this is the structure that these things have. They're very vertical in nature, so they start off at the surface of the ocean, and then the clouds tend to build and start to swirl around the center. This is a cross section of a well-developed hurricane. You can see that in most of the storm, the air is rising. The closer you are to the center, the faster that air is rising. Most of it flows up over the top, but some of it actually sinks down into the center of the storm. Whenever you have sinking air, that air gets compressed and it dries out, and that's why the center of these storms are often clear right to the ocean surface. There's a tremendous amount of inflow of air towards the center, so there has to be that strong outflow at the top to take into account all that air that's rising. So you have to have a lot of different things in place for that storm to develop, and some of the things that we have in terms of what we need for these storms to develop, the building blocks are pre-existing disturbance, or an area of spin within that, that that area of lower pressure, you have to be a couple of degrees north of the equator, otherwise the Coriolis force is not strong enough to really get things going, and you need very little change in wind direction or speed as you go up in altitude, so in terms of the fuel, you need a warm source of water, warm water in the ocean, at least 26 degrees is kind of the point at which we look at for well developed storm to get going, an unstable atmosphere, so colder in the higher levels, warmer in the lower levels, and plenty of moisture, high relative humidity in the lower levels of the atmosphere. So, going back to the building blocks, I've highlighted little change in wind speed or direction as you go up in altitude. That's very important. If you go back and look at how these things are structured again, very vertical in terms of the development, so this is going to become important later on in the presentation. Is this wind shear? So hurricanes don't like environments that have a lot of wind shear, so we're looking for low wind shear in the atmosphere for these things to develop. More on that later. So there are different types of storms that we get, depending on their level of development. Typically things start off as a tropical disturbance, so a kind of semi-organized area of cloud and perhaps some thunderstorm activity, but not not a well-defined center of circulation. You can see it on

satellite, the clouds are getting taller, the clouds are covering a larger area, but it's very difficult to find that defined, well-defined center of circulation. Once that develops, then in this case, you can see that there is some swirl to the cloudiness towards a common center, so this particular storm does have a well-defined center, but the winds aren't quite strong enough. We look at winds of less than 63 kilometers per hour, but when we do have a storm like this, we give it a number, and it's, and it's referred to as a tropical depression. A lot of these tropical depressions will form, but then they'll weaken within about 24 hours, but some of them will continue to intensify, and once the winds reach 63 kilometers per hour or more, up to 118 provided that that center of circulation is still there. It's at that point that the storm gets a name, and of course, if the storm continues to intensify and the winds exceed 118 that's when the storm gets classified as a hurricane, and of course, there are five categories of hurricane, to which is meant to convey the level of damage associated with the wind, with these, with these storms. The wind is something we can measure objectively with these storms, as opposed to some of the other hazards, of which, of course, there are wind, or in addition to wind, there's the heavy rainfall, or flooding, coastal coastal flooding as well, even tornadoes, and some of the some of the stronger storms, and then, of course, there's the post-tropical storm. This is a storm that has started off as tropical in terms of its structure, but then it's transformed into something from a structural point of view that looks more like a winter storm. It has a cold part of the storm, it has a warm part of the storm, which hurricanes do not have. The hurricanes are referred to as warm core storms. It's warm all the way around the storm. In the case of a winter type storm, we have a warm section and a cold section. These post-tropical storms look more like those winter type storm structures that we see. However, there are still some tropical characteristics to these things. It can maintain very strong winds that can actually re-intensify as a post-tropical storm, and sometimes be even stronger than the original tropical storm. And why is that important for us? Because if we do an analysis of where these things are most likely to transform from tropical to post-tropical, it's right off the coast of New England, and even more so, Atlantic Canada. So, this is where it happens the most often. So, that's why this is particularly important to us, and there are many examples over the years of storms, devastating storms that have been classified as post-tropical at landfall, so certain things happen to these storms when they do go through this transition. One of the things that is quite clear is these things accelerate, so they start moving a lot faster as, as purely tropical systems, they tend to move fairly slowly, maybe 1520 kilometers per hour, but once they start moving into the higher latitudes, they start moving a lot faster. So then we have to really take into account the speed of forward motion of the storm, as well as the circulation around it, so since the circulation around these things in the Northern Hemisphere are counterclockwise, we actually have to have to add the speed of forward motion to the speed of circulation on the right hand side of the track, and then subtract the speed of forward motion on the left, so you end up with a storm that has a much windier right side than a left side, and in some analysis that was done, the area that you're most likely to encounter the strongest winds in storms that enter our Canadian hurricane center response zone is actually in the right hand lower quadrant, that's

typically where we get our strongest winds or strongest wind gusts, is in that particular quadrant of storm. Rainfall is the opposite, the rainfall tends to shift to the left hand side of the storm, so this is a whole process that can take 12 to 24 hours. So, what stage is the storm in, in terms of this process, when it actually goes through a certain area, is something that we put a lot of time and effort in trying to predict, and then in terms of the storm surge and waves, since the winds are stronger on the right, that's typically where we see certainly our highest waves, and more often than not our highest surge, but you can have situations where you still have significant surge on the left hand side of the track, particularly for instance, when a storm will cross Nova Scotia, and then you end up with onshore winds in, say, PEI, and along the eastern coast of New Brunswick, and the North Shore of Nova Scotia, so that can happen as well, but these are some of the hazards that we see with storms, particularly the storms that transition to post-tropical, so whether do these things develop early in the year, where the water is warmer in the Gulf of Mexico and off the East Coast of the US, that's typically where we see our first storm pop up in June, and then we typically get a couple more in July. That area of development usually expands farther towards the east as the summer goes on, with September being our peak month of hurricane season, and then things start to wind down again in October and into November, so as you can see, these are all the storms on record back to dating back to 1851 that have entered Canadian territory. So obviously these are things that that we pay close attention to and are a threat here in Canada as well, some people, especially in the Caribbean, don't don't realize that we do get impacts from tropical cyclones, and this map usually gets that message across fairly clearly. So, with that, we'll transition a little bit and talk about last hurricane season. I mentioned that it was interesting in a couple of different ways. Looking at the number of storms that we got was 13. The predictions were for 13 to 19 name storms. We had five hurricanes, and the predictions were six to 10, and then four of those five hurricanes made it to major hurricane status, and actually three of those four made it to hurricane or to category five status, so even though with the average being about 14, so it was slightly below average in terms of the number of storms, we did have five category five storms, which is fairly exceptional as well, with the strongest being Melissa, which I'll talk a little bit more about shortly. So, looking at the distribution of storms over the season, it was late June when we had our first couple of storms with Andrea and Barry developing, and then Chantal developed in early July, and Chantal had some significant impacts in the US with some, some fatalities there, and about half a million or half a billion dollars in damage, mostly due to flooding, and then Aaron, Aaron was a very interesting storm as it intensified extremely rapidly, and then tracked well offshore of Atlantic Canada, but at the time we were dealing with a severe forest fire situation here in Nova Scotia, and we were watching that storm very closely, it became fairly apparent quickly in the game that we weren't going to get any precipitation from that storm, but we were just on the fringe of the circulation of the storm, and that was going to result in some not very strong winds, but certainly some winds that were tied to it, so there was a lot of concern there, and then it ended up that it wasn't, wasn't too, too strong, but it did have a slight impact on the fire situation. In terms of later in the season, things were fairly quiet

until mid September, and things really picked up again in mid September, and we had storms on a fairly regular basis, right up to Melissa. That was the final storm of 2025 So, again, 13 named storms, five hurricanes, for major hurricanes. We had two that had minor impacts here in Canada. We had, as I mentioned, Aaron. We were on the fringes of that circulation that resulted in a wind shift for those fires. We also saw some gusty or some wave significant wave heights along the Atlantic coast. Later in the season, we had Melissa that resulted in 30 to 50 millimeters of rain, heavy at times in parts of Newfoundland, but other than that, it was, it was not too, too bad in terms of impacts here in Canada. Ironically, the same weather system, semi-permanent area of high pressure over central northern Quebec that kind of kept all the low pressure systems away, resulting in the drought conditions that we saw, and the significant fire season that we saw. That same feature kept all the hurricanes offshore. You can see that most of the hurricanes last year, there was hardly anything in the Gulf of Mexico, but everything was was in the in the Atlantic, and took a pretty much all took a fairly sharp right turn and tracked well offshore of Canada, so the one storm, despite 13 named storms, which is just slightly below the long-term average. One of them was Melissa, which eventually made it to the into the record books as the strongest storm ever recorded in the Atlantic, tied with Hurricane Allen from 1980 so in a year where perhaps the total number of storms was below average, one of them was the strongest ever, or tied with the strongest ever in the Atlantic, so you can not always go by the numbers in terms of what number of storms that is expected, this one storm, which devastated parts of Jamaica and Cuba, certainly had significant impacts there, and there was an estimated $12 billion in damage, with 125 fatalities, so I mentioned some of the land impact, so we had Barry that made landfall in Mexico, resulting in eight direct fatalities there, mostly due to flooding and rough surf. Mentioned Chantal with half a billion dollars in damage in the US, along with six fatalities, and then we had every now and then we have a storm that survives the western track, and then the subsequent turn towards the east or northeast, and may makes it to to Europe as a post-tropical storm, and that happened last year with Gabriel, that impacted the Azores, and then Imelda that impacted the Bahamas and Bermuda, caused a couple of flooding fatalities in Cuba. So we had two major hurricane landfalls last year, and it's actually the same hurricane, the first landfall was as a Cat Five in New Hope, Jamaica, and with the second one being as a Cat Three after it across Jamaica in Cuba just the day after, so speaking to some people in, in Jamaica, there they were. It was october 15, and the last of the storms, at least they thought, had dissipated, and they thought, okay, well, we dodged another bullet this year. We, we didn't have the impacts from any hurricane, but of course Melissa developed several days later, and then ended up impacting the western part of the island as a category five, basically devastating that part of the island, so goes to show that hurricane season, this is never over until it's over, and I mentioned that the cap fives that we had, we had three of them, and now another thing that is becoming a bigger focus in the forecasting side of things is this concept of rapid Intensification, which is defined as about a 60 kilometer per hour increase in wind speed in the in an hour, so we had a number of instances of rapid Intensification last year. Aaron, for instance, intensified 139 kilometers per hour in 24 hours,

which is over twice the the criteria for Intensification. Gabrielle also intensified rapidly in Berto, and then Melissa 194 kilometers per hour in 72 hours. That just goes to show that it went from a mid-range tropical storm to a category five hurricane in very, very short order, which becomes very, very, very dangerous proposition if you're forecasting this and trying to determine where these storms are going to go and the preparation that needs to be done as you're dealing with these storms, so we're used to, we're kind of used to these storms providing a lot of advanced notice of their arrival. In these cases, you only have a couple of days before you go from nothing to something catastrophic. So, this is something that we're seeing, certainly more is this rapid intenscrumb, and we're going to be better at detecting it, and we're also going to be better at forecasting it, as well. Sun, aa, una, Melissa, a, a, most, te, we're, want, an in damage, just just as a result of Melissa, so on top of all the other storms as well, and then some of the some meetings I attended recently, there was talk about even this $8.8 billion being about $3 billion short of where they're there actually are now with the damage estimates. Set a number of records, as I mentioned, tied for the strongest maximum sustained winds at 306 tied for the strongest landfall hurricane at 296 kilometers per hour, tied for the third lowest minimum central pressure at 892 millibars, and second lowest landfall pressure at 897 millibars. So, again, a season that had 13 storms, one of them was Melissa, which is one of the strongest that we've seen in a lifetime, really, so looking at some of the operational procedures that we have, and some new things that are, that are being developed for this and forthcoming hurricane seasons. Most people know that there's a hurricane center in Miami, and then we also have the hurricane center here in Halifax, as well, Canadian Hurricane Center. So, the, the, the National Hurricane Center, located in Miami, is the, the regional specialized meteorological center, as designated by the World Meteorological Organization. So, they are, they have the ultimate responsibility for issuing track and intensity forecast for tropical cyclones in the Atlantic, so they are they, they, they run a desk 24/7 throughout hurricane season, even on the fringes as well, and issue bulletins on a regular basis on activity that is taking place in the Atlantic, and if there is a storm that develops, they have all the details on the storm. We also monitor everything that happens in the Atlantic, but we only really message storms that are expected to have some sort of an impact on Canadian territory, so what we do is we have a procedure where we would activate our hurricane desk and issue our own track maps and our own text bulletins and our own details on the storm as it relates to Canada when a storm is expected to enter our Canadian hurricane center response zone within about a 72 hour period, and I say about 72 hours, because it is a forecast, nobody can say exactly 72 hours prior where that storm will be, so there's some operational flexibility there in terms of when we start, but typically it's around 72 hours prior to the storm entering that area shaded in red is when you would start to get more details from the Canadian Hurricane Center. Anything outside those times, the details would be from the hurricane center in Miami. So this is kind of our, our timeline here in terms of what we do and what kind of products that you can look at, because the Hurricane Center in Miami also has significant useful products that supplement what we do as well. We add some more detail from a Canadian perspective, but

they have some interesting products, and so about beyond five days before a storm is expected, or if there's no storm out there, there's constant monitoring. The hurricane center will actually issue the National Hurricane Center will actually issue tropical weather outlooks, so it'll show areas of potential development once the storm actually forms. Is kind of when we start increasing our activity levels. We usually start discussions with emergency management agencies early on, just to give them a heads up that something is there that could cause a problem several days down the road, but again, the errors involved in predicting these things a week ahead of time are still fairly large once we get into that four day time frame, if there's expected to be impacts in Canada, we may issue a bulletin, say once a day. We won't issue our own track forecast at that point, but we might issue a bulletin that explains what our plan is, but also what we expect will happen with the storm. So, if we expect, like the next day, to start issuing our bulletins and our track forecast will actually indicate that in that, in that one bulletin that we would issue, say maybe four or five days ahead of time, once we get into that 72 hour time frame, things really start to ramp up, there we would be issuing our products every six hours or track forecast or our text bulletins, all the GIS information that that is tied to those products. We would be at that point about 72 hours holding daily briefings with our emergency management agencies. Once we get into that 36 hour time frame is typically when we would start to issue watches, and then about 24 hours prior to the event is where needed, we would elevate the watches to warnings in the appropriate areas, and then all these, these other activities continue on a daily basis. If, if it's going to be a high impact event, we would also have media technical briefings as well, just to go over what is expected and where, just prior to the storm's arrival, some of our meteorologists could actually deploy to provincial emergency management centers, and then work the storm from those from those centers, which we've done several times in the, in the past, in terms of the the track forecast and the potential track area, or otherwise known as the cone of uncertainty, those are built based on the past errors in forecasting tropical cyclones, so and it's the errors, average error from the past five years, so every year it gets updated with the previous year, and then the previous four, and then that that to six year gets dropped, and so on and so forth every year. So the what we would do is we are the hurricane center in Miami would take all of their forecasts, because they would issue all the forecasts on storms that we may not be issuing forecasts on, so all of their forecasts include a position for the storm at 1224 36 hours, and so on. So, what they would do for each of the forecasts, for every storm that they should forecast on, they would measure the distance between where that storm actually was and where it was predicted to be in that forecast, and that is the error for that particular time. So, again, they do that for every storm, for every forecast that they issue on that storm, so you end up with a fairly large data set of errors, so you take the average error and that gives you a circle error around the position of the storm, and then further out in time you go, the larger that error is, obviously, because it's more difficult to forecast longer at longer lead times, so by joining the edges of the circles you end up with the cone of uncertainty, and the way it's defined now is that it encompasses 67% of the errors in this cone of uncertainty, meaning that there's a 67% chance that the center of

the storm will say will stay within this this cone, so these are the errors that are going to be used this year. So, at 12 hours out, there's still about a 45 to 50 kilometer error on either side of where that storm is going to go, and the cone itself is actually part of the forecast, so that has to be taken into account now. That is, that's the way we've been doing it for for a couple of decades now. There is some work that's being done to change that somewhat. So, these are some of the new things for 2026 So, the first adjustment in, in that is going to be taking into consideration the biases in some of the errors that that are calculated, so I mentioned that all the errors are taken into consideration, and then the average error is taken into account, and then you draw a circle based on, based on that, on the errors for that forecast time, but we know when we have known for years that that there is a tendency to have larger areas errors along the track, as opposed to across the track, so that tends to cause more issues in forecasting the timing of the storm, as opposed to exactly where it's going to go left or right. So there's a larger, larger areas errors along the track and across the track, so we take that into consideration, and I mentioned earlier that because storms that go from tropical to post-tropical are accelerating, these errors are particularly evident in the storms that move into our Canadian Hurricane Center response zone, so that's this is one of the things that's going to be taken into account this year to create an experimental cone. The cone I just described earlier is still going to be used operationally this year. However, there's going to be another cone, which is experimental this year, that will take into account this, the fact that the along track errors are larger than the cross track errors, the other, the other assumption that's going to be made is rather than encompass two thirds of of that error bar, if you will, it's going to encompass 90% of the errors, so it'll end up with a slightly larger cone, however, there's a much more confidence that the storm will be contained in that cone, so if we look at differences between how this is going to look so on the on the left here is the current way of doing it, which again will be done this year, but the National Hurricane Center, we won't be doing it here in Canada, but yet at least, but at the National Hurricane Center they will be using this experimental approach, and you can see just quickly looking at it, it looks about the same, but you can see that the the errors are not perfect circles, they're ellipses, because there's larger errors along the track than the left or right across the track, so this is what's going to be used this year, if we look at an example here in Canada. Again, this is from an example that was used to illustrate the differences. This is from this is an actual storm. This is Ari in 2021 The shaded area is what the cone would look like under under this new way of doing it, and the the area in the dashed red line would be the cone that was actually issued during that time, or that would be issued based on this year's errors, so cone is going to be a little bit bigger on the experimental version, but essentially it has a much higher confidence level that the storm is going to be contained in in that area, and when I talk about the storm, I mean the center of the storm. So this is this is kind of a new approach. It is the first step, I guess you could call it the first step between what we have now and what we would like to see, which is probably a few years down the road, is a dynamic, so what we call a dynamic cone. So right now all this cone is constructed based on past forecast performance or past verification. Some storms we know are

very predictable. They behave very nicely. They follow what the models think is going to happen. Other model, other storms do not, and some of them, the modeling shows that if we get a storm where the models are showing the storm going in every which direction, and that does happen, the confidence of where the storm is going to go is very low. You have other storms where all the model predictions are very, very, very very tightly clustered in those situations. We have very high confidence of where the storm is going to go. In that respect, the cone that we use based on past performance might be too big, so we're looking at ways we can shrink or expand the cone, depending on what the predictability of that particular storm is so this is something for a couple of years down the road, but this is kind of the first step in moving in in that direction. Another thing for for us here in Canada, you've probably seen at the end of last fall we moved towards a more of an impact-based alerting system where we have different color codes for different different weather events, depending on severity and confidence level. So, there are two things to take into consideration there, and that will also apply to hurricanes as well. So, what we do is we follow a matrix where we have, where we look at the impacts, the possible impacts, and then the confidence that we're going to get the weather that will result in those impacts happening. So you can see that there is, there's a number of different combinations that we can have here, but there's only one way you can get a red alert is that we're looking at extreme conditions at a very high confidence level. You could have extreme conditions or extreme impacts, but if your confidence level is high or moderate, it's still only going to show up as an orange alert. So that's this is some something new that we implemented last fall. These are just some of the definitions here. So low doesn't really play into this, but moderate is possible, high is probable, and once we get into very likely, we basically think it is going to happen, and then in terms of the impact levels won't go through all of them here, but you can see that once we get into extreme, we're talking about major prolonged disruption to society, expected widespread extensive damage and impacts, and that would also require a lengthy recovery period, so that those are kind of the definitions that we use for low, moderate, high, and extreme impact levels. So, how does this going to work from from a hurricane perspective? Obviously, from a tropical storm point of view, we wouldn't net, we would never get into the extreme impacts as a result of a tropical storm, because if, if you're dealing with this sort of storm and you're looking at extreme impacts, it's not going to be a tropical storm, it's going to be a hurricane. So, in terms of tropical storm, they will pretty much all be yellow, but once we go to hurricane, then it could be it could be yellow, it could be orange, or it could be red. In the old way of looking at at these things, if you looked at our what we call our battle board, all warnings would show up in red. It things will be different now. This is just a mock up of Fiona in 2022 showing the areas of extreme impact, areas of high impact, and the areas of moderate impact. So visually it really pops out the areas that are expected to be most severely impacted by this specific storm, so we didn't have that in 2022 when we had Fiona, and we've, we haven't really had any. This is the first year hurricane season that we're using this system, so this is this is something to keep in mind as well as we, if we do get one of these storms this year. Another thing that we're working with our partners at

NHC is the inclusion of our inland warnings on their hurricane map, so these will not be in the same color scheme that we use for our tiered alerting system, but they will nonetheless show up on on the hurricane center map. Before it was just coastal warnings, and now they will include inland warnings. They did some testing with their own warnings in the US last year. This year they're operationalizing that, so it's become operational in the US. Now they're looking at international, so they're starting with us. So we're working closely with them, so they can include our inland warnings on their map, not just the coastal areas being highlighted. So we're working with them closely on that. So with that, we will transition to seem to be frozen here. Let's just start this again, I

Keith Porter 00:44:36
Let me know if you want me to bring up the PDF of your deck.

Bob Robichaud 00:44:40
Yeah, it should. This is what happened during the testing, so I'm not sure why it's doing that. All right, so here we go. So, what about this hurricane season, the upcoming 2026 hurricane season? So, here are some of the things that we look at, large scale, there goes into much more depth than this, but we're sorry. Foremost,

Keith Porter 00:45:08
I'm not, I'm not seeing your deck, Niki. Are you seeing it?

Niki Kovacs 00:45:15
No, the share was just turned off, so just have to turn that back on, Bob.

Bob Robichaud 00:45:20
Okay, here you go.

Keith Porter 00:45:33
Awesome, great.

Bob Robichaud 00:45:41
All right, yeah. So the first thing we look at, since the fuel for these things are the warm water in warm waters in the Atlantic, that's what we look at first. And when the water is warmer, we tend to get more storms, stronger storms. When the water is colder, we get fewer storms. Then we kind of shift our gaze towards the Pacific. When the water is colder, there tends to be less windshear. So, in that second or third slide, where I had that area highlighted about windshear, this is where it becomes important. So, when there's warmer water in the Equatorial Pacific, that tends to result in more windshear, especially in the Gulf of Mexico and most of the Caribbean, and it tends to, that windshear tends to weaken farther east, but we definitely see

more windshear when the water is warmer in the, in the Pacific, which we call, of course, El Nino, and we also look at whether it's going to be active. We're going to have a number of systems coming off the coast of Africa. If it's not expected to be active, then then there's probably going to be slightly fewer storms, so you don't have quite a that spin to to kick things up. This is harder to predict at the seasonal timescale, but these are kind of the things that we look at. So, first and foremost, the foremost, the water temperature. So, this is sea surface temperature as of today, and you can see that in the Atlantic things are a little bit cooler on average there, if you consider, if you go all the way into the Caribbean and the Gulf of Mexico, water temperatures are very close to average, even though it's showing just slightly below, however, in the Pacific, Equatorial Pacific, we can see the lots of orange and red, which indicate that indicates that water is warmer in that area. So this is what we look at for El Nino, and of course, there's been a lot of of of in information pretty much everywhere on this developing El Nino, which could become a record level El Nino, so we look at the departure from the long term average of the average temperature, average water temperature in roughly this rectangle, so that is what is being predicted here within a series of different models that predict these things. So we are, as the water is warm now, we are very, very close to this being declared in El Nino. I think the WMO just issued a El Nino warning, basically just to advise that this phenomenon is developing, which, of course, is a natural phenomenon that occurs every few years. So we are right at the edge here of an El Nino. The waters are probably warm enough, but it has to be over a period of three months, so that's why we're not quite there yet, but I expect that either here in June or in July that this will become an El Nino, and you can see all these different models have continuous warming up into the late fall and early winter, and then it starts to subside slightly again. So we have weak El Nino, moderate El Nino, strong, and very strong. Notice that there is no Jurassic El Nino, there's no mega El Nino, there's not even a strong or super El Nino, those are all terms that are being kind of liberally bounced around, but these are the actual definitions, so there is a potential based on some of these models that we could in be into the strong or very strong El Nino once we get into the fall, and we, as I say, a few models actually have the record is about 2.5 so anything above that would be a record. So that's something that we're monitoring closely from a tropical cyclone perspective. Yeah, what warmer water in these areas will definitely result in more storms in the Pacific, but in the Atlantic we expect more windshear, and that's why, that's why the numbers are a little bit below average for this year. Now, this is the predicted water temperature. I showed you water temperature as of today, this is the predicted sea surface temperature anomaly for August, September, and October, which is the peak of hurricane season, and we do expect some warming in, in the tropics, and even in the subtropics as well, as well as the Gulf of Mexico, so that's something we're going to be monitoring closely. The last El Nino that we had, albeit it wasn't a very strong El Nino, we that was to 2023 and going into the season we were wondering, okay, we have, we had exceptionally warm waters in the Atlantic, warmer than what we're seeing now, warmer than what was being, what is currently being predicted for this year, but we also had an El Nino as well, so we were wondering, there was a lot of uncertainty as to

which of the two competing factors would end up being the one that kind of overtook hurricane season, and it ended up being that we had an active hurricane season, despite the El Nino that we had during that time, so we expect the El Nino to be stronger now, and the waters to in the Atlantic to be not as warm as they were in 2023 which is why we have the current predictions that were issued by NOAA a couple of weeks ago, on May 20-first, they're calling for eight to 14 named storms, three to six hurricanes, and one to three major hurricanes. So that's near to below average, so about a 90% chance that we will be in that near to below average range, and only about a 10% chance that will be above average. So, if you're wondering how that those forecasts actually play out, this is going back to when they started issuing these seasonal outlooks, and you can see the blue dots are the actual number of storms of named storms that year the upper red line here is the upper range, and the lower one is lower range. The yellow is the average. So, for the most part, the actual number of storms has either been within the range or fairly close to it, there's a couple of years, 2005 and 2020 that were hyperactive years that were that were very much underestimated, but for the most part the forecasts are pretty good. Most other agencies are forecasting a similar kind of scenario as for what it means here in Canada, of course, we, we started tracking these things since the inception of the hurricane center in 1987 and typically we look at the number of storms that enter our response zone versus the total number of storms in the Atlantic, and that number has stayed reasonably steady at between 35 and 40% So that's what we typically get on a particular year. As I mentioned, some of the other agencies issue these outlooks as well, Colorado State is another one that we, that will take a close look at. They do, they predict a number of storms, but they also look at other things as well. One of the things that they look at is analog years, so they look at years where ocean conditions and atmospheric conditions are close to the current year, and these are the analogs that they've come out with their first outlook, which was issued way back in April. They are due to update their outlook, I think, next week, so that will be coming out, something to look for the next week, and this could change, but in their initial outlook for the 2026 season, they have analogs of 2006 2009 2015 and three years ago, 2023 and just plotting the storms that have occurred during those years, you know, there have been a few that have had impacts here in Eastern Canada. So, just because there's an El Nino, and just because there might be fewer storms than average, we can still definitely get storms affecting us here in Canada. Another thing that they have at Colorado State is they calculate the the impact probability, so on an average year they do this for name storms, hurricanes, and major hurricanes. What I've shown here is the impact probability for hurricanes, so as a whole, for Canada, the probability of seeing some sort of impact from a hurricane on any given year is about 29% So this year they have it at 21% so a reduction in 8% in terms of probability of seeing the impacts of a hurricane, and they define that as a hurricane coming within 60 nautical miles of a particular area, so that's so, again, not zero, so again, it's it's important to prepare every year to sing this exact same way, regardless of what these predictions are saying, because we can't say that the probability is going to be zero on any given year, whether it's predicted to be kind of a quieter year or a busier year, it only takes that one storm to really

make a difference. So, in terms of the names that we're going to be using this year. This is the same list that we used back in 2020 with one or two names being replaced, because that season was very, very active. So, the first storm, whenever that happens to be, will be Arthur, followed by Bertha Cristobal, and so on. So, whenever we start to get these storms, this is the list we are going to use. We still have that list, that supplemental list, in the event that we do exhaust the first list for that year, but based on pretty much all the predictions, it's very unlikely that we'll have to dip into that supplemental list. So, with that, I will turn it back to you, Keith. So, again, just a reminder that it doesn't really matter how many storms you get. Yet last year was a perfect example. We only got 13 named storms, but one of them was Melissa, and it only takes that one storm to make it a bad year.

Keith Porter 00:57:42
Absolutely, thank you so much, Bob. That was great talk, as usual. While we wait for people to gather their thoughts and ask questions, I have a - I have a few. This upcoming change to the cone of uncertainty and this new Rita system is super interesting. Are you, is there anything sort of farther out on the research horizon that piques your interest, something that may or may not come to fruition, but that you are eager to see develop.

Bob Robichaud 00:58:18
Yeah, one of the things that we've been watching closely, and actually it looks like, like the National Hurricane Center is is kind of moving away from that, at least for the time being, but there was a lot of talk over the last few years of adding a day six and day seven position for the track forecasts that would have may not be totally intuitive right at the outset, but for Canada that would have been a kind of a major development, because we would start to be in the cone of uncertainty two days earlier, whenever a storm is approaching, which then starts all kinds of wheels in motion in terms of working with our emergency management partners and working with our media partners on on getting information out. There's a lot of questions that come up when we're when whenever Canada ends up being in in a cone for any kind of storm that's approaching, things get very, very active from our perspective. So, having that all happening two days early would have been a major deal, but it just doing the, they've been doing day six and day seven internal forecasts at NHC for a few years now, and the errors involved are so large that it's not something that that is going to be operational anytime soon. So that's that's one thing in terms of some of the satellite imagery that's out there, in terms of giving us a much better picture of these storms. There's a lot of work being done there as well that will improve the detection and the and the monitoring of these storms as as they develop, because of course these things form over the water where there's less data surface data to use to actually analyze these things,

Keith Porter 01:00:25
Yeah. And speaking of surface data, see, there was something in the news just a couple of days

ago about the Trump administration removing some instruments from the Atlantic, I can't remember what the name of that network is. Oh, the Deep Ocean Monitoring System. Does that matter to prediction?

Bob Robichaud 01:00:51
Yeah, I did hear something about that as well. It's something that I think will give us more, that or gives us insight into while the Gulf Stream is behaving, so that current of warm water. I did hear there was something, but I didn't hear the details of what would be changed, so I can't really comment on any of that, because I heard there was something, but I haven't actually seen the article.

Keith Porter 01:01:21
Okay. Okay, how do you, how do you estimate the impact level for that risk-tiered alerting? Is there exposure and vulnerability modeling? Is it just where the track goes, and it's, and it's SSI at the time that it hits places? Or how does that work?

Bob Robichaud 01:01:39
So, what we do is obviously we we are very in tune as to where these hazards are going to be relative to the track, so that's in one of the earlier slides I mentioned where the rain typically happens and where the stronger winds typically happen, so we typically have a good idea of that as the storm is approaching, and what we have done over the years is to develop kind of some internal knowledge as to what type of impacts that we get with certain types of winds, so certain types of wind speeds, certain types of wind direction, and we work very, very closely with our emergency management and utility partners in terms of determining what impacts might, might happen. Our companies, for example, they have some modeling that where there are a number of weather inputs, and then that gives them an output of the potential number of customers that will lose power, so so we would work closely with some of our utility partners. There we know that if the power is going to be out for an extended period of time, then we start to lose cell phone towers, so cell phone coverage may be compromised after about eight hours once the power goes out. We have some very good information based on our, again, our partnerships with emergency management agent agencies, not at just at the federal, but certainly the provincial and municipal level as well, that if the waters reach a certain level along parts of the coast, certain areas are going to be flooded. So we take all that information into consideration, and then determine, you know, how rare an event those impacts will be, and then that helps us determine what impact level to use. Now, keep in mind that we just went operational with this last November, so there's certain things that we're still.. that there's a certain learning curve for, for not just the public, but everybody involved, including the forecasters and, and the meteorologists like myself, who work with emergency managers on how best to use this, but it, as I've shown in the example of Fiona, it does present a much

better representation visually as to where those larger impacts or more severe impacts would be

Keith Porter 01:04:25
cool. Thanks. Alan Castonguy asks, as we saw in 2024 with hurricanes Helene and Milton, the most significant damage seems to be associated with tropical storms that once they make landfall move very slowly, and they're accompanied by large amounts of rain. Is this a trend to monitor, or we were these examples anomalies?

Bob Robichaud 01:04:50
Well, there is some studies that have shown that overall, over the past number of decades, that some of these storms, not all of them, but some of these tend to slow down a lot more, and with a warmer climate that can the atmosphere can hold more moisture, and then when you have a slow moving system, that means that heavier rain is going to stay over a certain area for an extended period of time, and then layer on top of that, if you have that extended period of extreme rainfall rates over hilly or a mountainous terrain, that is certainly a recipe for disaster. So that is something that that is being monitored closely. In the case of Helene, we had a non-tropical system that created significant rainfall over the few days leading up to when Helene arrived. So we were looking at a situation where the ground was saturated, it was over mountainous terrain, and we had extreme rainfall rates as a result of the tropical system, and it just caused absolute devastation in parts of Western North Carolina. With that, they're still to this day recovering from that,

Keith Porter 01:06:13
and I think Ellen was saying, you know, was that unusual, or is that sort of becoming a new normal, or what do you think about that, these stalled storms dropping a bunch of rain,

Robichaud, Bob (ECCC) 01:06:24
that there have been a lot of examples over the years, over the last few years, Florence, a few years ago, and in South Carolina, if we look at storm that impacted Houston a number of years ago, which generated about over 1600 millimeters of rain in about a three day period, so we're, we're seeing more of that. There is, like I said, some work that's being done to, to determine whether we're seeing a slowdown of some of these systems, and it is showing that, so whenever you, you have the combination of a slow system and rain, yeah, you're going to get some pretty severe inland flooding.

Keith Porter 01:07:14
Cool. Now, on the sort of following up on a lens thread of trends, I remember back in 2007 or so, when Chris Mooney published Storm World, he said that at the time, among meteorologists, there were doubts about climate change producing greater numbers of

hurricanes, although there was more confidence about increasing severity of hurricanes, as I remember, the you showed the normal range of number of hurricanes incrementing by it looked like two named storms starting a couple of years ago, so would look like it had jumped from 12 to 14 or so, sort of long term average, if if I read that correctly, and I'm remembering Chris Mooney's narrative correctly, are meteorologists thinking about the increasing frequency? Is it thinking changing about climate change driving up the number of tropical storms,

Bob Robichaud 01:08:23
yeah, not quite yet. We know that there are periods of higher tropical cyclone activity, and then you get these periods of lower tropical cyclone activity. Those periods can and outlast the period of record that we use to compare average, so we know that we're in an active overall large scale active period since 1995 so if we look at what we use in terms of average, the average average, that 30 year average covers a period, essentially 1990 to 2020 or 91 to 2020 It covers almost that entire period, except for about five years. So it's certainly expected that the, that the average number of storms are going to increase over that time span. If you take your 30 years and cover that active period, there's another aspect to this, is what I mentioned earlier about the satellite imagery. We are seeing storms develop that only about maybe 1520 years ago may not have been actually declared a tropical cyclone or stone that may not have been given a name simply because it formed quickly, it didn't become very strong, and then it weakened right after, so in some of these, the analysis of hurricane seasons, one of the things that I tend to look at is look at what we call shorties, the storms that don't last very long. In some cases, they only last about six to 12 hours, and then they weaken again, but they still get counted as a named storm, so because the satellites are getting so better that we can actually detect these things where you know previously we might not have detected them, that is something that also has to be taken into consideration, but overall, if you look at the modeling, if you look at tropical cyclones globally, so what I had earlier shown the little uptick in the average number, so that was just for the Atlantic. If you look at things globally, things are still pretty steady, and the modeling still suggests that the number, the frequency of the storms would not increase significantly, but the higher end storms may become a bit more frequent, so the proportion of those storms there might be a bit more of those that form that become those really intense storms like the four that we saw last year

Keith Porter 01:11:22
decades ago, I was a cat modeler, and I remember looking at Noah's storm tracks for hurricane cat modeling purposes, and you know, this is the mid 90s, and those storm tracks showed almost nothing making landfall north of Cape May. Am I remembering that correctly? And has that changed

Bob Robichaud 01:11:49
the data set that we have called her that basically goes back to 1851 stayed fairly steady over the last number of years, there is some re-analysis that is being done with new information to look at some of the past history. So, there have been storms that have made it past that area, whether there is more now than there was, I got to go back and check, but it's entirely possible, but again, I'd have to go back and check to make sure that, but in terms of the data set, there is some change in, in some of those storms that are being reanalyzed, and they do that at the National Hurricane Center during the off season.

Keith Porter 01:12:46
Okay, speaking of the National Hurricane Center, how many people does it take to run that, and is Canada prepared to undertake what they do if their staffing goes down,

Bob Robichaud 01:13:02
they usually have a couple of forecasters on shift during hurricane season, and then when there's a storm, obviously it's, it's there are more people, because they, they're also responsible for forecasting in the eastern Pacific as well, so you might have a couple of forecasters in there forecasting storms in the eastern Pacific, and then you'll have forecasters that are assigned storms in the, in the Atlantic as well, so it can get pretty busy during some of these hurricane seasons because they're they're in charge or responsible for issuing products on on both those ocean bases, plus for us again, we're we don't necessarily duplicate what they do, but we would provide information on a subset of those storms, those who are expected to enter our response zone during a certain period of time, they don't necessarily have to make landfall, even something that comes into our response zone may have an impact on our marine community, for which we issue marine forecasts as well. So we would, we would issue kind of guidance on a particular storm that enters that response zone, so we've, we've never really had to, to go beyond a couple of forecasters of our own, just to, just to forecast these, these tropical cyclones. We've had cases where we've had to issue bulletins on multiple storms at the same time, it's never been a huge issue to handle so far. So, unless we see a huge uptick in storms, I don't anticipate that being much of an issue in terms of their capacity in Miami. Again, met with them earlier this spring, and, and they haven't been affected by any kind of changes, at least not yet, so they're pretty confident they can handle what, what's coming their way, even the the record season of 2020 it was, it was very, very busy for them, but they certainly, during the COVID year, were able to handle all those storms.

Keith Porter 01:15:28
So I'm going to continue to play amateur meteorologist and ask you dumb questions about meteorology. Am I correct that something called the Hadley cell has its north end creeping northward at something like 10 kilometers a year, and if I'm understanding that correctly, does it matter for hurricanes, and if so, what does that mean?

Bob Robichaud 01:15:50
Well, that's something that the, that the amnio can have an impact on. I haven't seen anything specific to that, whether it is moving northward or not, in terms of hurricanes. Most of the activity, again, that with the Hadley cell is centered around the equator. It might move a little bit northward in our northern hemisphere summer, and then dip a little bit further south in our winter, but in terms of hurricanes, it probably doesn't have a major, major impact on us, and I haven't seen anything that, not that there, that there hasn't been, but I haven't seen anything specific as to what, what the changes are being observed there,

Keith Porter 01:16:42
cool. Our I got one last question, and that is, do you work with the big catastrophe modelers? Are they using your operational products to estimate losses for their private customers? We

Bob Robichaud 01:16:59
haven't been working directly. Sometimes we, we have some insurance companies that will ask us a few basic questions on a particular approaching storm, but nothing beyond that that we know of that we're working directly, they may take our data that that we have available and do whatever they do with it, but not on a direct basis. If they do, it's something that we were not totally cognizant of, but we definitely be interested in knowing if that does happen, for sure.

Keith Porter 01:17:44
Cool, thanks. So, I don't have any more questions, and nobody else has answered the question. So, let me ask you, Bob, do you have any final thoughts for our attendees? Anything that we should know that, or that you think is most important about your talk today that we should remember?

Bob Robichaud 01:17:58
Yeah, and this is something again, that last slide here really drives it home is, is especially during a year where there is an El Nino, where we expect fewer than the average number of storms. How this gets conveyed to the public is, is certainly something that is, you see, on the media, and people start to talk about a quiet hurricane season, so people tend to let their guard down, and I think of the example of Jamaica last year, once they, once they reached october 15, they thought they were off the hook, and they had one of the worst hurricanes ever in the Atlantic. So, in a year where we're getting maybe fewer than the average number of storms is definitely not a time to let your guard down, and what we advocate is to prepare the same way every year as though hurricane might threaten your area, and hope that the fact that it is expected to be slower, you hope that none actually does affect your area, but like we say, like the slide says, it only takes one to make it a bad year, so particularly that's a strong message when we're expecting fewer than the average number of storms.

Keith Porter 01:19:26
Cool. Thank you so much. Thanks, Bob. To attendees, remember you're going to find video, audio, a transcript, and the speaker's deck by Monday. You'll find that at www.ir.org/workshop ww.iclr.org/workshops Now, please remember to join us on june 26 to learn about how practical it is to exceed the building code and better resist fire in the wildland urban interface. That's three weeks from today. So, I hope you, everybody, has a great weekend. Thanks again, Bob. And see you in a few weeks. Thank you.