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SPEAKERS
Michaela Kandzer, Ricky Telg, Phillip Stokes

Ricky Telg 00:04
This is Science by the Slice, a podcast from the University of Florida's Institute of Food and Agricultural Sciences Center for Public Issues Education. In this podcast, experts discuss the science of issues affecting our daily lives reveal the motivations behind the decisions people make, and ultimately provide insight to solutions for our lives.

Phillip Stokes 00:35
Hello, and welcome to Science by the Slice and our second episode and our hurricane series. This is Phillip Stokes, and that sound you're hearing. That's the sound of eight fans, each one almost five feet in diameter, which are part of the boundary layer wind tunnel at the University of Florida is Powell family structure and materials laboratory. This wind hazard facility experimentally evaluates the way extreme winds interact with manmade structures, like houses and other buildings. And much of the work done here informs building codes and other practical applications that make infrastructure more resistant to the extreme winds of hurricanes and other storms. And in a few minutes, we're going to take you so to speak to this laboratory, where Michela Kandzer sat down with a researcher to discuss the facility in the work he does regarding hurricanes. But first, let's turn off those fans. That's better. Now Michaela also spoke briefly with Dr. Angie Lindsay, who you heard from on episode one of this series, Dr. Lindsay discusses resources that are available to residents to help with hurricane preparedness. And she'll also introduce our previously mentioned guest.

Michaela Kandzer 01:52
Hi, Dr. Lindsay. Thanks for being with us on Science by the Slice today.

01:56
Hi, great. Thank you for having me. I'm very excited to be here.

Michaela Kandzer 01:59

Yeah, we're so excited for you to be here. And for you to talk a little bit about some of the resources that are available related to hurricane preparedness. We know that through your appointment at the University of Florida and also with EDEN she talks about in the last podcast episode, that you have a little bit of a hand and these resources and you are very familiar with the resources that are available to people in the state of Florida and otherwise. So can you tell us a little bit about some of those resources that are your go to resources during the time of a disaster. And before a disaster?

02:25
We'll sure absolutely. And of course, a shameless plug, obviously, for the disaster.ifas.ufl.edu, some of the IFAS disaster website and some of those resources as well, in addition to some of the EDIS documents that we have on the University of Florida and IFAS website as well regarding disaster preparedness, mitigation, response and recovery also. And then, in addition to a lot of the Florida Eden resources that we have developed, including Eden readiness series that is on the PIE Center website, which is piecenter.com. And those are some great resources that we actually work with researchers here at the University of Florida and within IFAS to kind of put together so a lot of research based ones. But there's in addition to the resources that we work with here at University of Florida, IFAS. There's a lot of great resources out there. We know regarding disaster preparedness, mitigation, response and recovery, the FEMA website is a great website, in addition to the ready.gov, I have some great programs, and as well as some fact sheets. And there's a lot of information on there, that folks can use not only for individuals, but for families and also for youth. And then it's targeted to a lot of different target audiences. So it's a great resource, obviously, some of your weather type information is out there, and some really good resources and well, including NOAA National Weather Service as well. CDC also has some really, really great information out there. And they came up with some great resources last year and looking at how to prepare for hurricanes in the time of a global pandemic. So some really great information out there as well. And in addition, I would tell folks, you know, look for those trusted sources that you may already be working with, you know, if you're familiar with your local Red Cross or Red Cross, there's some great resources on there as well, in addition to a lot of nonprofits that work in disaster mitigation and response and recovery as well. In addition, a lot of the news outlets have some great resources on their page also. So there's a lot of great information out there. And I would just tell people that you know, find one that that you're familiar with, and you like the information and make sure that you're updating that at least twice a year, going into hurricane season as well. But finding those resources is usually pretty easy here in Florida and we just hope that everyone can access those and, and make sure that they are keeping their plans up to date with some of those great resources that are out there.

Michaela Kandzer 04:54
That is awesome. Okay, so I know that you're familiar with the Homeowners Handbook, can you tell us a little bit more about and what that is.

05:01
Sure, absolutely the homeowner handbook is a is a great resource. It's a project that Florida did with a lot of the Gulf Coast states with the Gulf of Mexico Alliance. And it's a project that was that was catered towards coastal states on and dealing with hurricanes, as well as other tropical disasters, including floods and tornadoes, wind events. But I will tell you having worked with the document that this

particular book is applicable to whether you live on the coast, or whether you live inland, and it's a great resource, very comprehensive, that not only talks about, basically, you know, your insurance and making sure that you keep your family safe, but also that you keep in your structure safe as well. And so there's a very comprehensive Table of Contents with this that, that provides a lot of information in one document is really helpful to folks, not only like I said, not only on the coastal counties, but also inland as well.

Michaela Kandzer 06:01
That's really awesome. That's incredible. We'll be sure to link some of these resources down in the description of this podcast. So that way, all of our listeners can easily access those resources and learn more about hurricane preparedness for their families and in their area. But our next guest is someone that you are familiar with. And he does some of the research behind the scenes that is used to inform resources like the Homeowners Handbook, can you introduce our guests to our listeners, and tell them a little bit about him?

06:28
Sure, absolutely. So very excited to have Dr. Gurley here with us today. And Dr. Gurley primary areas of research are wind effects on residential structures, and modeling some of those extreme winds and structural resistance. So he actually has a wind tunnel lab here at the University of Florida, where they actually model different vulnerability residential structures to Hurricane and wind damage. So knowing that this type of research is being done in the University of Florida, and that this is information and the results of this can help us look at building codes or how best to protect Florida residents in the future with certain building codes and how exactly to build certain structures. And it's really exciting to have that basically in our backyard, this type of research happening in our backyard. And Dr. Gurley is great about getting out there, and providing tips on how best to prepare for hurricanes and also talk about the work that they are doing within the wind tunnel lab as well. And so it's very exciting to hear some of the work they're doing, but also some of the impact that his research has done here in the state of Florida.

Michaela Kandzer 07:35
Yeah, and I was lucky enough to go out to the wind tunnel this past week, and get to interview Dr. Gurley and get to see the research and action. And so I'm so excited for all of you to get to listen to our interview with him keep listening to hear from Dr. Kurtis Gurley, professor and Associate Director of the engineering school of sustainable infrastructure and environment at the University of Florida.

07:56
So can you tell me a little bit about your wind tunnel here that we're visiting today and about the research that is done here?

08:02
Sure. So we're in what's called a boundary layer wind tunnel facility. It's located in East Campus, the University of Florida powel structures and materials laboratory, it's distinct from the kind of wind tunnel, one would use to investigate or determine the performance of high performance aircraft or you know, airplane wings, that sort of thing. So people have probably seen pictures of models of airplanes in a wind tunnel, the kind of wind tunnel we run here is quite different. We're intending to replicate ground

level winds as it moves in and around the natural and the built infrastructure. And so our major concern here is to be able to quantify and measure how do buildings feel the loads that are produced by strong winds moving in and around them, as an engineer, my primary concern, when I'm given a task of designing a building, is to know what loads it has to resist. And so this kind of facility allows us to precisely quantify how a house, building or bridge might feel an extreme wind event.

09:03
So that is really cool. So us in the PIE center team here, we were lucky enough to get to go inside the wind tunnel and see what it looks like and have you kind of explain what all the different parts so can you kind of take our listeners on that tour also and tell them what the tunnel looks like and what it's like to conduct research in there and the different moving parts.

09:19
So the first thing to understand is we're doing things down on a scaled down level physically. So our wind tunnel does not need to study the effects of Hurricane winds on structures, we don't need to actually produce hurricane level winds, like we have, if we're doing a study of the way a residential home might feel winds, the building itself, the model of the building might only be 150 at scale. And so the wind speeds don't have to move as fast because the size is being scaled down and the timescale speeds up. What the wind field what the wind tunnel actually looks like, is a really giant long rectangular hallway. both ends of that hallway are open to the open to the outside, and a one end of the hallway is a big bank of what's called veiny axial fans that can push when quite quickly down the hallway. As so the fans are in one end of the hallway, the subject that we're testing, the building is on the other end of the hallway, it's maybe 40 meters in length, the difference between them. Along the way, as the wind goes from the inlet to the building, there are a series of mechanical devices that condition the way the wind is behaving. And what we're specifically trying to replicate is a scaled down version of what's called the boundary layer in the Earth's atmosphere so close to the ground, you just imagine the house the listener at home lives in right now, there are all sorts of trees and buildings surrounding the building that you live in very likely. And so the as the wind is flowing from whatever direction it's coming towards your house, it has to navigate around the trees around the other buildings and so on. That changes the nature of how the wind behave by the time it impacts your structure. And so, between the fans and the model, we have a series of what are called roughness elements that replicate the presence of buildings and trees, and so on. So we're intentionally creating turbulence. That is a scaled version of the turbulence one might see in reality, again, just as a contrast, a wind tunnel that is designed to test aircraft performance, want to minimize the turbulence, in this kind of a wind tunnel, we want to not only account for its presence, but precisely control the nature of that turbulence.

11:25
Earlier, you gave me the analogy of a stream and putting bricks in it and how that relates to the wind tunnel, can you kind of tell our listeners that analogy and maybe help them understand again, a little bit more about what the wind tunnel looks like, and how the research is being conducted?

11:39
Yeah, so this, this goes back to being able to control the precise nature of the turbulence as it's approaching the model that we're measuring. So if you were to imagine yourself standing at the side of

a very nice, smooth, slow moving stream, and you don't even see any ripples in the water, but you might, you know, it's moving from right to left. Now, if you took a brick, and just placed it very carefully in the stream, and say, the stream is only two feet deep, if you place a brick in that stream and move your hand, you can now see the water having to maneuver around that brick, and you'll see the turbulence that it creates in the water, right, even if you put a little leaf to float down the top, instead of that leaf just moving nice and slow, you'll see it start spinning as it tries to go around the brick, right. So if you put lots of bricks, or really short bricks, or tall bricks, lots of bricks closely spaced together, all of those things would change the way the nature of the turbulence in the water that you can observe in our wind tunnel, it's the same thing the fluid from water becomes wind, wind is another fluid. And we are controlling the turbulence in the wind by placing bricks in the path. That's what we call the roughness element configuration. So the wind comes off of the fan bank very smoothly by design. And then we intentionally throw rocks in the stream of wind, as it moves along what's called the fetch by the time it gets to the model. And so we know from lots of observation, trial and error, and theoretical calculations, and so on, that if we put this many bricks this far apart than the resulting turbulence will be a. And if we put fewer bricks farther apart, then the resulting turbines will be b. So that's how we control and again, the difference between a and b might be a house in the middle of the farmland, and a house built right next to the ocean where the wind is coming off of the ocean, that's very smooth.

13:18
That is so interesting. So I know, there's a lot of like land codes and codes, again, whenever you build houses next to the ocean. So well, this research kind of inform some of those codes.

13:26
Sure, this is one of the different universities in Florida and around the country that help generate the kind of information that's used by the people, the professionals that develop building codes. So for example, the Florida building code is a fairly progressive meaning regularly updated building code essentially gives the blueprint or the instructions to the people who actually physically build the houses, you know, the rules and regulations of how they need to be built. And there's lots of parts of the building code, plumbing, and electrical and so on. But it's certainly a big part of it is how to design houses that are able to resist the external loads they will feel in their lifetime. If it's up in the Midwest, they might be considered more concerned with snow loads, or if it's in California, the building code would be more concerned with seismic loads from earthquake. And in Florida, the southeast, the building codes are built around making sure the structures are more wind hazard resistant. And so the information from a facility like this does help to inform the people who create those codes because it's fairly easy if you had a bottomless checkbook to create a design that would be virtually wind impervious. It's just not cost effective to do that. And so the engineer has to walk that line or balance what is a reasonably set of instructions that will make this house resistant in a safe place to be in an extreme wind event, but not cost a fortune to a typical potential homeowner.

14:47
I've never bought a house before. I don't live on the coast of Florida. I do live in Florida. But can you talk a little bit more about building codes and what that kind of looks like for our listeners that may not be familiar with building codes?

14:56
Sure there's many many components to a building code, most of which are I'm not comfortable speaking to with any expertise either because, again, it's a, it's a giant puzzle. And you know, one, I'm contributing to one little piece. But, for example, a part of the bill of the building code is not an entity that exists in and of itself. It references other documents that have been produced by bodies of engineers. So for example, if one were to propose to build a home someplace in Alachua, county, or someplace in Monroe County, way down south, the way that home would be built would be different, because the code does take into consideration the fact that the worst most extreme wind hazard in Alachua County is less severe than the most likely extreme wind hazard down in Monroe County. So it's very regionally dependent in terms of when I said it's kind of an instruction book or a guideline, it's very regionally dependent. So for example, the American Society of Civil Engineering ASCE, has a design guide that is meant to provide engineers with guidance in terms of determining what for example, wind loads are appropriate for your structure. So someone using the Florida building code would be told to go to this ASCE document in that document, there would be a picture of Florida with contours drawn on it. And those contours represent what are called design wind speeds. And so as you get closer to the coast, those the numbers associated those contours get larger and larger, meaning the engineer is told, if you're designing a building here, you need to design to resist 140 mile an hour wind, if you're designing over there, it's 100 mile an hour wind, those mile an hour can be converted to pounds per square foot, or pressure acting on the surface of the building. That conversion is what we learn in the wind tunnel in a facility like this one, right, the filter that takes the shape of the building, and the wind speed that's trying to break the building, and throws it into a bucket and comes up with what is the building really feeling and every square inch of the surface of the building. So that's all mapped out in the building code as well. From there, engineer pieces it together, okay, if the roof is experiencing this much wind suction and the garage doors experiencing this much pressure, now they can start making decisions, okay, I need this kind of garage door, I knew this kind of window. And these, you know, this thickness of nail and so on. When I say it's an instruction book, it's not as simple as a recipe that anyone can open up and understand what to do. It takes licensed trained professionals to utilize it properly. And so another good part of being in Florida, I think, is the enforcement of the building code is quite rigorous. So it's very hard for a home builder to cut corners and get away with it. And most of them, don't try it. They don't want to they want to build safe structures, right.

17:36
So how does your research directly relate to hurricanes and natural disasters and natural disaster preparedness?

17:42
It actually it goes back to our discussion about building codes. Right? So in Florida, I think of preparedness, there's preparedness on the individual level. So if you live in an area of Florida that is more prone to experiencing winds, there's preparedness in terms of making sure you have the right backup of your medications and make sure you have extra gasoline or an evacuation procedure depending on where you know, specifically, you live on a barrier island. But at the state level, there's preparedness in terms of making sure that we progress in the way we build our structures. So a typical residential building that was built three years ago, might look very similar to a house that was built in the 1970s in Florida from the outside in, you know, one story shingle roof, windows and doors, that kind

of thing. But the nature of the bones of that structure, how it's put together, this engineering details are quite different. And so when this facility is able to perceive or quantify the way that a building feels those loads, it allows engineers to determine, well, this means the nails should be this far apart. And the nails should be this long. And the fit and the sheathing on the roof should be this thickness of plywood and so on. So all these little details. So that goes into in terms of preparedness, if you're living in a modern constructed house in Florida, it's been designed specifically using information that comes from facilities like this facility.

19:03
That is so so interesting. So whenever I think about hurricanes, or think about natural disasters in Florida, it's crazy to think about all the work that's going on behind the scenes, besides you know, just what you see on the day of a hurricane when you see you know, people out helping people get resources or you're learning things online on the news, and you're trying to prepare your family. It's so interesting to hear about all this work that's being done way before a hurricane ever happens to help prepare our homes for us as they're being built. So it's really interesting. So what are some of the findings from your research that you would say would be helpful to listeners as they prepare for future disasters?

19:37
Well, in terms of the individuals, I'll say that again, back to the discussion of building codes, people should be aware that a building code is not intended to prevent the building that you're in from suffering any damage it's met the threshold for building performance of buildings that are built under a building code is usually life safety. That means a properly designed the building to resist wind and flow. The wall should not collapse and the roof should not get torn off. It doesn't mean it won't be an extremely uncomfortable place to be during the hurricane, it doesn't mean you won't lose power, it doesn't mean a window won't break, doesn't mean water won't get in and ruin all your furniture. So individuals should not rely on the building code to take care of all the things that might concern an individual. So primarily when you're preparing, make sure you what your trusted news sources going to be as the hurricane seasons coming in and pay close attention. When the news is saying the hurricanes are approaching Florida pay really close attention to emergency evacuation orders, right? What we learn in a facility like this doesn't really have much to do with your immediate safety during a hurricane, your responsibility is to pay attention to the local authorities and do exactly what they're telling you to do for your own personal safety.

20:49
Yes, I like that, that's a very important point to bring up. And to make clear is that just because your building may not collapse during a hurricane, due to the way that it was built, or to the code that it's built up to, it doesn't mean that you should stay there. It means that you will probably have some semblance of a house left when you come back, which is good. So what is the biggest takeaway from your research for listeners?

21:09
I think I mean, my own experience when I came to Florida in 1997, coming I was a Midwestern person my whole life, believe it or not studying hurricanes in the Midwest was a safe place to do it. Right. Yeah.

But now, when I came here, I was actually, I took a lot of comfort in the fact that the officials, the engineers, the policymakers that are in charge of making sure they're doing what they can to responsibly build our infrastructure to be safe in hurricanes is an ongoing, evolving process. So every three years, there's a cycle where the Florida building code can make changes and upgrades, it doesn't necessarily focus on wind hazard. It might be plumbing, or electrical, mechanical, lots of things that go into building a home. But the fact that the state has a very, very progressive approach to making sure they're understanding learning, and in many cases sponsoring some of the science that's used to make decisions on how to build homes better. It's not there, there are parts of the country that pay much less attention to their responsibility to build properly than they really should. Florida is really not one of those places. Again, it does this statement doesn't guarantee your safety. But I go to bed at night sleeping a little bit better. Knowing there are lots of people who are paid to make sure they cost effectively upgrade the way that homes are supposed to be built to keep us safe.

22:25
Yeah, I feel like that's really helpful for listeners to hear and to think about as well, as they're thinking we're heading into hurricane season, right? It starts in June. So something to consider is looking at when their home was built and what kind of building code their home is built to. And then what kind of modifications or maintenance they could do to their home to make it even more wind resistant and more resilient going through these hurricane seasons. Going back to the wind tunnel, though. So that's exactly what you guys are doing here. You can use the wind tunnel to create these different terrain. So you can create a terrain that resembles more of what a terrain on the coast would look like. And then you can create a terrain that looks more about a house here in alachua county will look by right or I think earlier, we were speaking compared creating a terrain that similar to a home that is on the coast of Florida versus creating a terrain that is more similar to a home built in the middle of suburban Miami, can you talk a little bit more about that and what that looks like?

23:14
So if you've if, if you stood on, you know, on the beach, on a windy day, you might feel sort of a steady pressure from the wind because the wind has a certain mean wind speed. And every once in a while you get kind of knocked back and forth by little gusts that are coming in writing on top of the wind, that gust riding on top of an average wind speed happens all over Florida, it happens during hurricanes till you sort of have this extreme wind speed. It has a larger average wind speed and then gusting how much that gusting changes on top of the mean wind speed is largely a function of what that wind had to move in and around before it got to where you were standing, a house in the middle of a farmland, or a house in the middle of a dense suburb would each perceive or feel 100 mile an hour wind quite differently. And so an important aspect of the boundary layer wind tunnel facility we have here is the ability to quickly change the nature of the wind that the model is experiencing. So we can test we can take a model of a house and test it under what's called open terrain conditions or marine terrain conditions. And they are what they sound like or suburban terrain conditions. And very quickly map out the pressure or the surface of the building. And engineers designing the real thing of that model would design and build them potentially quite differently in those three different scenarios. So it's not again, it's not a unique thing at this facility to be able to control the nature of the turbulence. What's unique about this facility is the automation that's involved to achieve that. So all the different elements that we put literally just big blunt, brake light objects that we lay along the floor to generate mechanical turbulence

as the wind flows from the fans to the model. We can very rapidly adjust the height of all those different bricks. And how many of them are flush with the floor. One of them are sticking up. So rapidly go through lots of different experiments, I guess the bottom line is, we can learn a lot more about how a given model, a shape would feel when in a lot of different environments, all within a day's work. When earlier versions of boundary layer wind tunnels, it might take weeks, weeks or months to achieve the same pitch, there's a lot more laborious process.

25:23
So if you listen closely, now, you'll get to hear a little bit of the research happening live right now. And Dr. Gurley is going to kind of talk us through what's going on in the lab.

25:31
So if hear that hum in the background. That's the sound of the big eight fans that are now pushing when, through a big rectangular hallway or wind tunnel test section. And at the end of the test section, we're using a type of remote sensing technology, that is a sheet of laser that is shined from the roof of the wind tunnel down to the floor. And then within the flow itself, we're injecting very, very small particles of olive oil is parasols, olive oil, those particles of olive oil will pass through the laser sheet. High speed cameras are taking pictures of the laser sheet. And then we piece it all together and do the analysis, we can then track the path of each individual particle of olive oil that passes through the sheet. It's a way of us getting a very, very fine description of the nature of the turbulence at the test section. So we're doing right now is really quantifying the behavior of the wind field itself, as opposed to measuring what's happening to a to a model.

26:24
So I think that's all the questions I have for you today. Dr. Gurley, do you have anything else that you would like to add or any parting thoughts for our listeners?

26:31
Hurricane seasons approaching us. So be aware, stay alert, do Never underestimate the dangers. Even after an event. If you're in a neighborhood in an area that was impacted by a hurricane or a tornado or any sort of strong weather event, the common sense stuff you hear all the time I can repeat. There's lots of good online sources. Don't assume that if you're in a modern constructed home that you can ignore evacuation warnings because we don't build homes to not get knocked down by storm surge. We build homes to be a safe place to shelter if the only part of the hurricane you need to worry about is the wind and not the water. It's all about taking personal responsibility about your own home, your own property, your family, your medications, your pets, and knowing what your trusted news sources are and paying close attention. Just don't take the hazard lightly. I do often hear people say well, I've lived in this part of Florida for 45 years, and we've never had a hurricane so I'm safe. It doesn't really work that way. You can be an area that hasn't been impacted in 150 years could be the next one in line. So pay attention.

Phillip Stokes 27:41
I want to extend a very big thank you to Dr. Kurtis Gurley and Dr. Angie Lindsay for being on today's episode of Science by the Slice. This concludes our two-part series on hurricanes and hurricane

preparedness. I hope everyone listening learned something from our guests about ways you can prepare for this hurricane season, which started June 1, and will include links to hurricane preparedness resources, such as the homeowners Handbook, in this episode description. Also, if you want to see some behind the scenes footage from our time visiting the power family structure and materials laboratory, check out the PI center social media and maybe follow us while you're there. We'll be sure to include those social media links in the episode description. I want to thank everyone who worked on this podcast series Michaela Kandzer, Rachel Rayben, Valentina Castano, Sydney Honeycutt, Ricky Telg, Ashley McLeod-Morin and Alena Poulin. Be sure to join us next time on Science by the Slice.