Kelly

Welcome to the American Meteorological Society's podcast series on careers in the atmospheric and related sciences. I'm Kelly Savoie and I'm here with Jason Emmanuel, and we will be your hosts. Our podcast series will give you the opportunity to step into the shoes of an expert working in weather, water, and climate sciences.

Jason

We're happy to introduce today's guest, Tony Praino, chief engineer and meteorologist at IBM Research in Yorktown Heights, New York. Welcome, Tony! Thanks so much for joining us.

Kelly

Tony, tell us a little bit about your educational background. Did you start off majoring in atmospheric sciences, or did you switch majors?

Tony

So I guess a little bit of both. I have a sort of a longer story, and I'll try to keep in succinct. I had originally intended to major in meteorology back in—I guess I'm dating myself here—back in the '70s. And at that time, as a result of limitations in job choices and local college availability, I pursued that for a while, but ultimately changed my major to engineering. I had passion both for meteorology since childhood as well as engineering, taking things apart and putting them back together. So while it was somewhat of a difficult decision at the time to make that switch, in hindsight it was probably one of the best choices I could make. And I'm hoping that as we get further through the process here that will become more apparent. But I did indeed start off majoring in meteorology but ultimately changed my major to engineering.

Jason

Yeah that seems like a good choice. So outside of school and coursework did you pursue any opportunities that you knew would help secure a job in your field?

Tony

I guess more in the sense of in hindsight. At the time, allied skills in engineering and software

weren't perhaps as critical and as obvious for the field of atmospheric science and meteorology as they are now. But having the background in engineering that I have, in particular, both on the hardware side, and perhaps more importantly on the software side, those really were skills and experiences that were ultimately critical to my path back to the atmospheric sciences about 20 years ago and the work ever since.

Jason
What exactly are the skills on the software side that you developed?

Tony
So I would say mostly coding and programming. And I'll admit here as sort of a further connection to the AMS that I serve on a couple of AMS committees — the AMS Board of Private Sector Meteorologists as well as on the ad hoc committee on career advancement and enhancement for the AMS. One of the things that I'm focusing on these days is writing some documentation that hopefully will be shared with the AMS Centennial committee is indeed the skills requirements around allied skills such as software. So in particular as I mentioned things like coding. When I started out in the field a lot of work that I did when we started, [like] the Deep Thunder Project at IBM about 19 years ago, I was using Perl to do a lot of automation. I essentially wrote a good portion of the automation background that runs the Deep Thunder model and has run it for many years. The past few years, we switched to Python. So when I speak to undergraduate students — and I do indeed do some outreach at some of the local universities here, do some adjunct presentations — I do mention programming, and Python in particular since that in the atmospheric science field is quickly becoming I think one of the standard programming languages, if not *the* standard for people to do various tasks. One of the great things about Python is that it's relatively easy to learn, and students and professionals can actually do quite a bit with it.

Kelly
What was your first job in the field and how did you end up at IBM?

Tony

So my first job actually in the field of engineering predates IBM. I started out in biomedical engineering and to this day that's an area of strong interest for me. I worked at a company that made all of the biomedical instruments, EEGs, EKGs, and things along those lines. All along, however, I'd grown up in the area where IBM Research is located, Yorktown Heights, New York. That's about 35 miles north of New York City. I grew up in that area and I remember very early on driving by the lab, and while I didn't know exactly what went on in the building, it's an iconic building designed by world-renowned architect, I knew that they did some pretty cool stuff there and I always wanted to work there. And while it took several tries over the years, I did, indeed, make it into IBM Research. But my first work was in the biomedical side. I then worked for a short time for a company right across the street from IBM's headquarters in Armonk, New York, that made computer-aided design systems, all the while obviously still pursuing my dream and my goal to work at IBM Research. I did indeed begin working in IBM Research, and again I'm dating myself, in 1983. I've been there ever since. I guess I'm sort of a research person. And while there's many opportunities within IBM, different divisions and different areas one could go in, I was always driven by my passion for the research environment and research development. So I spent the first half my career at IBM doing more traditional engineering. In particular, all of the on-disk storage systems and disk drives and computers and servers that we all take for granted. Storage has become extremely cheap, and it enables a lot of the modeling that we do. We're generating, as you probably know, terabytes and petabytes of data. Those are all supported by the storage systems, and so that was my first— Basically I've done two things at IBM research: one was storage systems and research and development, and the second half of my career, my passion in life has been meteorology and atmospheric sciences for about the last 19, 19 1/2 years.

Kelly

So you had said it took a couple tries to get into IBM. What advice would you give to someone who is looking for a job? What finally worked for you?

Tony

So again I have to predicate this by indicating that perhaps the workforce and the requirements were quite a bit different back in 1983 than they are now. The research lab in particular is and

was, was and is I should say, a world-renowned location. We are probably the last industrial research lab of this scale, both across the globe as well as in multidisciplinary research, that exists. And so in those days coming into the lab with an undergraduate degree was a lot more challenging than it is now. These days to come into the lab with an undergraduate degree or Master's level graduate degree is a much more straightforward process. And so these days for the workforce that the IBM brings into the research division, we have any number of skills on the software side, obviously, as well as the hard sciences like physics and chemistry, material science and engineering, and to some degree a good representation in the atmospheric sciences. What our listeners may not be aware of is IBM acquired The Weather Company in 2015, so I am not kidding when I say we went from probably three or four meteorologists in IBM — and I'm proud to be named as one of those — to probably well over 100, between 100 and 200 meteorologists, when IBM acquired The Weather Company in 2015. So the atmospheric sciences in particular have really grown quite a bit over the last several years. I think there's a real recognition in the private sector of the importance of the atmospheric and environmental sciences and how the allied fields can obviously contribute to and become an integral part of that.

Kelly

So I guess you're saying it was more difficult back then to get a position, so good for you, you managed to persevere and meet the right people and get a job.

Tony

Yes it was. I guess, to summarize, yes, it was much more difficult to come into IBM Research the way I did in those days than it is now. That's certainly the case.

Jason

Yeah that's great you got to realize that dream of working at IBM, though. And you had mentioned different education levels or degrees that people get to work there now. But in your current position, what level of education is required to be like a chief engineer or meteorologist at IBM or even a different company?

Tony

So again I'll provide a little bit of background for my particular case. Not only was my journey to the atmospheric sciences through engineering probably somewhat less traditional, and I think in that sense hopefully gives our listeners a flavor for the breadth in different experiences people have and the opportunities that present themselves. I did most of my undergraduate and graduate education while I was working at IBM, so I essentially went to night school. I completed my undergraduate and graduate degrees in electrical and computer engineering while I was working, and then thereafter I completed the certification in meteorology from the U.S. Department of Agriculture's graduate school. That course sequence unfortunately no longer exists. It probably ended a few years ago because perhaps the numbers weren't great enough. The unique aspect of that program, however, was that it is and was recognized by both the AMS and the government, NOAA and the National Weather Service, as being the equivalent to an undergraduate degree in meteorology. And that's in particular because it's a rigorous calculus-based physics approach. Since I had already had all of the undergraduate mathematics and physics, as well as graduate-level mathematics and physics, I essentially only had to backfill the meteorology courses, which I was able to do via the distance program. Again, that program probably goes back long enough that it was paper-based. We did communicate via email, but it's not— These days, as many early career professionals and students may know, it's much easier to do online education. In those days that was certainly not the case. But my approach to that certainly was less traditional, perhaps, than it is today. But having said that, I would say undergraduate requirements in computer science, engineering, or meteorology with programming skills and experience, obviously, I think are extremely important these days for private-sector atmospheric scientists and meteorologists, as well as those perhaps maybe in allied fields that are interested in working in the atmospheric sciences.

Jason

Thanks, that's great to know.

Kelly

So what's your typical day on the job like at IBM? What do you usually do?

Tony

So one of my responsibilities, among several, is—as is the case by my title, the chief engineer—I'm responsible for all of the systems engineering of the infrastructure we have. So that includes two high-performance computing clusters. Those clusters are used to support our numerical weather prediction modeling research and development. So I mentioned earlier the work in running local models. One of the, I think, hallmarks of the Deep Thunder project, which again we started in 2000. We developed an operational model that we began running in 2001 for the New York City metropolitan area, that's run, with the exception unfortunately of a one-year gap that we had about a year and a half ago when we had to move to a new hardware platform, ran continuously during that whole time. That model, the Deep Thunder model for New York City, was down to 1- or 2-km resolution. Back in 2001, running at 1- to 2-km resolution was unheard of operationally. There was certainly some work in academia, in the government, perhaps at NCAR, but operational instances of a model running at extremely high resolution — even to this day, 1 to 2 km is not common for operational numerical weather prediction — that was really the leading edge of the capabilities. So, in order to do that, one must have a high-performance computing cluster, better known perhaps as a supercomputer. And these are not just a group of servers, but these are many hundreds of cores of processors that allow one to decompose a local geography into a topology that a weather model can actually operate on. And we actually run the physical equations of the atmosphere. So this is what's known as a deterministic model. It's not statistical. It's not AI. I know those are two very common and popular approaches to different modeling techniques these days. This is a full-physics, deterministic model of the atmosphere, so those clusters are critical to actually being able to run the model and also support our R&D. In addition to the clusters, there's probably a few dozen servers that we also run in workstations that enable my research group to actually do the work that they do.

Kelly

So how many people are in your group?

Tony

My group is known as the Environmental Sciences Research Group, and that includes both folks on the atmospheric sciences side as well as people that do research into environmental modeling around water bodies, so freshwater bodies like lakes, for instance. We're probably about a dozen to a dozen and a half of us on the core research team, and they're spread out among a couple of IBM labs. Most of us are located in Yorktown Heights. We do have a good number of our team that are also remote. They're based remotely. A couple of my colleagues are based at Lake George up in New York. I'll probably give a little plug here for one of the projects that I've been working on, known as the Jefferson Project, on Lake George. That's an extremely— it's perhaps in my tenure at IBM I would say probably one of the best projects and teams that I've had the opportunity to work with. And that merges both atmospheric as well as freshwater sciences, with the ultimate goal of understanding the ecology of a water body — in this case Lake George, which is a fairly pristine water body — and serves as a benchmark for some of the other work we do in other geographies and understanding and modeling the challenges around freshwater body ecosystems, everything from the weather to the water to the ecosystem, including the biological activities that go on in the lake.

Kelly

Sounds really cool.

Jason

So you've mentioned Deep Thunder a couple of times. Could you just give like a layperson's summary or overview of what it is?

Tony

So Deep Thunder is, it's our instantiation of a high-resolution mesoscale numerical weather prediction model. So, if you will, these days, again, a term that's used a lot is *hyperlocal*. So it would be a hyperlocal weather prediction system. And that allows us, obviously, to focus at a very local scale to the impacts of the weather. One of the things that when I get the chance to speak to clients, and that does occur from time to time, I like to say that it's really not about the weather at the end of the day. And I get a lot of raised eyebrows because people look at me and

say, “Yeah but you’re a meteorologist. Why would you say it’s not about the weather?” Because from a business perspective, or even from a societal perspective, it’s how the weather *affects* the things that we care about. So whether that includes, you know, if I’m going to bring a jacket to go out today or an umbrella. Or it impacts my supply chain if I’m a surface transportation company and I have to ship product, but I have to be aware of the weather impacts on the road system and delays or detours that that may cause. So the ability to forecast at an extremely local scale allows one to zoom in on all types of problems. If it’s a coastal area it might be storm surge or it might be a runoff from a heavy rainstorm. It could be thunderstorm activity that may have impacts on the electrical distribution grid. Those really are the things that happen at a local scale, even though we all understand that obviously weather spans many scales from, obviously, global to continental, to regional, to our local scales. And understanding what happens at a local scale, and more importantly, not only what happens from a weather perspective but what the impacts of that are on any number of things that we care about or that a business is focused on is really part of the work that we do in developing solutions and applications for work with clients.

Jason

Right, that’s a really good point. So it sounds like you have your hand in a lot of different projects. Do you have a favorite thing about your job?

Tony

Probably the favorite thing about my job is I get to do a lot of different things. I’m the sort of person that probably would get bored doing the same thing. And I’m going to circle back to one of my initial comments about starting off in the atmospheric sciences and then switching to engineering. Back in those times, I think people in general, and as a young person and a student, I was less aware of all of the different kinds of opportunities that are available in the atmospheric sciences. I really had no notion of atmospheric sciences research. To me, what a meteorologist did was operational meteorology or forecasting. And while I had a strong interest in that, I was unaware of the other things that a meteorologist could do. So I would say that the ability these days to go from working on developing a solution for a client, writing code to enable that, keeping the computing systems and high-performance computing clusters running, and then speaking to clients and understanding their business needs and the impacts they have are

probably some of the most interesting things that I do and allows me to spend everything from having a screwdriver in my hand and making sure the hardware continues to run to getting in front of a client and helping them understand how the work that I do with local-scale weather modeling impacts their operations and perhaps can provide a solution that will better enable them to run their business.

Kelly
What are some of the challenges you encounter in your work?

Tony
I think from a daily perspective, the challenges I think include balancing the time between perhaps things that need to get done now but may be low impact. For instance, if a server goes down and it's part of the R&D infrastructure, I may have to drop what I'm doing to work through that with our systems admin and if need be call in the hardware engineers to repair it. And perhaps then I'd had to drop some application development I was doing or if I'm working on input to a client proposal or to a research proposal, I may have to put that down. So sometimes balancing that — because I'm supporting, on a daily basis, a hardware-software infrastructure — can be a challenge. So I guess, you know, those low-impact tasks that may be time-sensitive with the higher-level work that may have longer time horizons, but obviously can have a higher impact. So I would say, if I had to choose one thing, it would be striking that balance, and that balance can change almost on a daily basis.

Jason
Speaking of balance at the workplace, it sounds like you keep very busy, but does your job allow for a good work–life balance?

Tony
Yes, it does. So one of the things that for me, personally, that is extremely important is flexibility and autonomy. And I would say that I have a good amount of that. So I have the flexibility to, you know, set my schedule on a daily and weekly basis. Obviously there's some constraints

around that. Again, if a server goes down or if one of the HPC clusters goes down, I have to drop everything and get into that, but, generally speaking, I have a fair amount of flexibility in how I schedule the work that I do, how I collaborate with colleagues and my team, and that really provides for a good balance.

Kelly
Are there shifts, or is it mostly a 9-to-5-type work environment?

Tony
For the research division I guess it'd be considered a single shift. Obviously my day can go anywhere from, you know, 8 hours to 12 hours or longer depending on what I'm working on. I tend to be more of a later morning, afternoon, and evening person. I'm not up at the crack of dawn, but I may be online in the evening, either checking on a system if need be or following up on emails, you know, at 10 PM at night. But having that flexibility allows me to do that. So I would say for research it's generally a single shift, but obviously people have a lot of latitude and flexibility about how they utilize the time.

Kelly
That's really good. That's important to a lot of people be able to have that flexibility. Is there anything you wish you had done differently in your career?

Tony
Perhaps recognize sooner the importance of the allied skills required. As I mention, however, I think it was less obvious in the '70s and '80s and certainly most likely less important than it is now. I don't want to minimize the importance of, obviously, those allied skills back then, certainly on the software side, but I think there's really been an explosion of the requirements around programming and allied skills these days. And in fact a lot of that I've been able to have the opportunity to focus on and learn more about in the work that I'm doing both in the AMS BPSM committee as well as the committee on career advancement and enhancement for the Centennial — really understanding and watching the growth and the importance of those allied skills. So from my perspective, over the arc of my career, as I mentioned earlier, it worked out

for me in a way that perhaps I couldn't have predicted me. I joke sometimes that if I had tried to design or plan my career, I probably couldn't have done a better job. So, to some degree, I view it as, to take an atmospheric analogy: if we think of the Pineapple Express off the West Coast, which is the atmospheric river that drives moisture up through the Pacific Northwest, that has a general flow and direction, but along the way there's all these little swirls and eddies, low-pressure systems, and local disturbances that occur. I mean, in the arc of a long career there are some, you know, minor detours and some things along the way that allowed me to or perhaps forced me to focus on other things. But the direction that my skill base and experience and career has led me to, really when I look back on it, has been extremely gratifying and something that I would not change. So from that perspective I think just understanding the importance of those skills and having a broader look at the field I think perhaps would've been something that I wish I would've recognized sooner.

Kelly

So I don't know if you've ever done any hiring in the past, but if somebody really wanted to be, you know, their goal was to be a chief engineer with the meteorology focus, what are some of the things that you would look for on a resume where you'd be like, "Oh, this person's a really good fit"? I know you mentioned some of the allied skills, but is there anything else that you would look for?

Tony

I think if someone were looking for a position such as mine, which would be I guess a fairly senior position and in my case comes about from many, many years of experience and different kinds of opportunities, in addition to the software skills, I think a broad view of the field: understanding the connections of meteorology, business, and technology. I think that probably puts succinctly what I described earlier. So understanding the trends but also understanding the ability or the nexus, if you will, between atmospheric sciences, the business world, and the technological world. One of the things that I like to stress, again, to students when I get the chance to speak with them, is I think today it's probably more true than certainly it has been historically, creating our own opportunities from a synthesis of skills and experiences really is not only important but arguably critical. But one of the great things about the current market, the

market's understanding and private industry in particular, the private sector's understanding of the connection between these other skills and allied fields, including software and programming, and then understanding how an individual's experiences and skills create perhaps an opportunity that might be unique to that individual. And, perhaps, then the challenge then becomes, if you want an interview or if you're applying for a job, communicating how you as a candidate, your skills and your experience, your unique set of skills and experiences creates value for the business.

Kelly

So you would say that, you know, if somebody is going for a meteorology degree, it'd be good for them to take some business classes, some computer courses, maybe some communication classes, and just be well-rounded. And I'm assuming that internships are looked upon favorably. If people do internships in certain areas that you would find that to be very positive.

Tony

Yes, I would say internships are not just a nice thing to have anymore. I think they're almost critical. And I think it's certainly for any student, or, you know, undergraduate or graduate student, having those experiences I think really provides an advantage. IBM Research, we have a pretty robust and long-standing intern program that includes both what we call long-term interns, that may span a year or two, to our summer program, where we bring undergraduate and graduate students in for several months in any number of different areas. This year I think in our team we have one student. Actually his background is in engineering so that in particular just shows that the connection of an allied field with environmentalist science research is certainly one that happens quite commonly. So really understanding the connection of the atmospheric sciences to almost everything and the growing environmental impact over time with climate change, urbanization, and coastal development I think really provides a strong need for, you know, for the future workforce to have these skills in any number of areas. And I guess to circle back to your earlier comments, Kelly, about different fields, we all know how challenging it is at an undergraduate level, you know, to have enough of a breadth of experience. Given the limited number of electives that a student may have the opportunity, leveraging things like internships or outside interests and outside pursuits educationally I think is important because quite frankly

there's probably not enough electives available for an undergraduate student in the atmospheric sciences to take, you know, a couple of business courses or programming courses. I suppose if I had to choose an area, I would probably be biased toward the technology side and the software side because I see that all the time, not only in the work that we do with research but even in the work that The Weather Company business unit does at IBM in bringing new employees in, bringing new team members on, having that background and experience, even if it's not programming per se, but the information technology skills that go beyond the standard stuff like spreadsheets and word processors and perhaps things of that nature to more knowledge and things like "How can the cloud enable me to develop solutions?" Maybe I don't know how to program a cloud application, but understanding the connection between my particular area of discipline, be it atmospheric science, perhaps, or solutions development, or software engineering. Understanding how these particular disciplines can connect to create a solution, I think, having that broad view, or having a broader view, better known perhaps in the field as lateral thinking, sort of coming out of the silo and thinking across disciplines and across sectors, having that broad view I think is extremely important. And developing that as a student or as an early career professional, I would advise as being something that could serve someone well, not only for the company they work for but perhaps, you know, over the course of their career.

Kelly
That's definitely some good advice.

Jason
And because you have such a broad perspective on the industry, how do you see the future job market for careers in your field?

Tony
I think the market is extremely bright, and I think if anything it's getting better. When you think about how both the needs of the private sector from an atmospheric science and environmental science perspective and how the allied fields like, you know, the other sciences and engineering and computer science can work together to create new solutions and new capabilities, when I see that and I see the recognition of the and, perhaps a stronger word for recognition, *the critical*

need for those skills in the private sector related to both atmospheric and environmental sciences, I think things looking very bright going forward. The challenge I think is more perhaps helping the academic community better prepare students for the requirements for perhaps a broader set of skills. And this isn't unique to the atmospheric sciences. We see the same thing in the engineering disciplines: the limited amount of flexibility in engineering curricula and similarly in atmospheric curricula, to be able weave in those other skills and those allied fields in order to prepare the future workforce. I think that's a challenge in perhaps all the STEM areas that we really are working hard to try to address. I certainly know that it's one the AMS is looking at from an atmospheric sciences perspective. But really understanding, you know, and working with the academic sector to better prepare students. I think that's the real, perhaps the real focus and challenge. But I think from an employability standpoint the future looks very bright.

Kelly

Yeah, that's the direction AMS is hoping to go in here where we talk to faculty advisors, students, and people in the private sector, getting them to have a conversation so that they're all on the same page as to what skills are needed to give students the best opportunity to get positions once they graduate. So Tony, we always ask our guests one last question at the end of each of our podcasts. So what is your favorite band or musician and why?

Tony

Okay, this is an easy one for me, although my music tastes can be eclectic and broad. I'm a child of the '60s and '70s, so the Beatles. That's my band.

Jason

Yeah. Can't go wrong.

Kelly

That's my favorite—that's my favorite band too! Good choice!

Tony

One of the great things about the Beatles, if I could digress for a moment, is the—you talk about

the evolution in the span of a career, in a little over decade, if one listens, and Kelly I know you probably have listened to the early stuff and listened to the later stuff. To this day it still blows my mind that, you know, four young people could evolve that quickly, you know, in a musical sense. And again when I look at— when I try to use the analogy to other careers being able to evolve and to not only change with the times but in the case of the Beatles actually force that change, I think, was one of the unique things that follows me. I have a lot of bands that I, both on the rock side, but I enjoy classical music, I enjoy ambient music, I enjoy, you know, jazz. I don't claim to be a musical expert. I mean, I'm probably heavily weighted on the rock side. But the Beatles stand out to me because of, you know, that evolution. It's just so unique.

Kelly
I completely agree.

Jason: Yeah, definitely. Well thanks so much for joining us, Tony, and sharing your work experiences. That's our show for today. Please join us next time, rain or shine.