

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 excited to introduce today's guest, Jim Kurdzo, a radar meteorologist at MIT Lincoln Laboratory. Welcome Jim! Thanks so much for joining us.

Jim

Thanks for having me.

Kelly

Jim, when did you decide you wanted to be a meteorologist? What sparked your interest?

Jim

I think like a lot of meteorologists it was very young, probably around age five or six. I was living in Connecticut at the time of the Blizzard of '93, I think it's also called the storm of the century—although there've been many of those. There were nearly 20 inches of snow in Western Connecticut, so I got really interested in that, and then my parents got me a weather station, and it just kinda took off from there.

Jason

Oh, cool. So what was your first job?

Jim

My first job was, uh, I did a number of internships. Um, and then I went to graduate school, and that was similar to a job, but now my, my current job is my first real job, as a staff member at Lincoln Laboratory.

Jason

Ah, nice. So, how long have you been there now?

Jim

A little over three years.

Kelly

So, did you major in meteorology? Or were you—did you major in something else first and then switch?

Jim

I took a weird path. I did, I did my undergraduate at Millersville University in meteorology—that's in Pennsylvania. Um, and then I really took a liking to severe weather and radar. And so I did my masters degree in meteorology at the University of Oklahoma, but as I became more interested in radar, I realized that I needed to understand more about the radar hardware in the engineering side, so actually did a second Masters in electrical engineering, and then I did my PhD in meteorology, but it incorporated a lot of engineering work as well.

Jason

Yeah, so you had, like, a pretty broad educational background. So when you were first looking for your first job, was there anything that you felt was a must-have in a resume, just in preparation?

Jim

Yeah, I definitely think that programming is the primary experience that's really needed. And this is not just in radar meteorology; it's through a lot of meteorology. You know, many schools now—undergraduate programs and graduate programs—are including programming in their, in their curricula. And I-I started with Fortran, which is a very typical programming language for Earth sciences, it's used in a lot of modeling. Now in radar, I use a lot of Matlab and Python. Very, very critical to be able to program.

Jason

Okay, so what do you use these languages for in your day-to-day job?

Jim

A lot of analysis, algorithm development, and—so we're doing things like creating real-time algorithms for the WSR88D weather radar network, we're analyzing case studies, we're doing

statistical research on things we see on weather radar—just a whole bunch of different things that it's very helpful to have program experience for.

Kelly

What other courses or skills beyond, you know, required math, science, and computer skills would be most helpful for somebody wanted to be a radar meteorologist? You know, the soft skills that some people usually need for, for positions.

Jim

Well, you know, I'll just mention again, programming, even though you said computer skills. Programming can be learned outside of the classroom, especially, even at the middle school and high school level. Something like Python is open source, there's lots of documentation, you can learn it on your own, you can become proficient very quickly, and it costs you nothing. You can get free radar data, you can start analyzing the data and doing cool things with it, but other than that, you know, if you really want to go into radar meteorology, I'd say even just a basic course in some signal processing, very basic introduction to the electrical engineering, not circuits and things like that, but some signal processing and maybe, you know, a little bit more of an engineering heavy radar course.

Kelly

What about presentation skills or writing skills? Do you have to do technical writing or present at any conferences? Would that be helpful?

Jim

Yes, it really does depend on what you end up doing with your education. I would say that a lot of people at the bachelor's level go into something like, um—for example, bachelors and masters level may go into the National Weather Service where there are very radar savvy people, including researchers. There are people who work at the National Weather Service radar operation center and they were doing a lot of technical work and algorithm work, but as you get more up into academia and the national labs at the at the PhD level, and during grad school, you do do a lot of presentations, a lot of manuscript writing, journal publications. That is a big part of my job, yeah.

Jason

So, in your experience, had you taken coursework in school for programming or had you done a boot camp or something like that?

Jim

In my program at Millersville, we learned Fortran sophomore year, and that was really my introduction to programming and then we had a couple other courses. One was IDL and then there was another one in Python, and I think they've really moved to focus on Fortran and Python, since then, and then I took another Python course in graduate school, and then a lot of, a lot of courses just you can use whatever program language you want to hone your skills and do the projects, and so, I'm always, I've always been a big Matlab guy. It's just where I feel comfortable

Jason

Okay, yeah. What's your typical day on the job like?

Jim

Well, I do a lot of coding. I keep talking about programming. I do, I do a lot of Matlab, some Python, um, I've actually been doing some C and C++, which is interesting for real-time work. I do a lot of radar analysis of various case studies. So, we worked on tornado cases, flash flood cases, and various different things. I work with sponsors and manage programs and people. I think for me getting a PhD was really about wanting to guide the scientific vision and goals of various projects and having that has allowed me to manage programs and people, and, and kind of guide the vision of the science and the projects.

Kelly

Do ever do any field work or, you now, the typical storm chasing? Maybe when you we're in college. Did you ever experience any of that?

Jim

Yeah. So in graduate school actually took part in vortex and pecan field projects, and then I was very, very lucky to be able to run my own field program for four years at the University of Oklahoma. I-I ran our atmospheric imaging radar convective field program, where we brought a

very advanced phased-array radar all around the plains to try to scan tornadoes at close range, and so—i-it's actually funny, I was very afraid of thunderstorms until late in high school, and now I've seen something like 25 tornadoes.

[laughter]

Jason

When you say close range, how close are you talking?

Jim

I think the closest we got was probably about 4 to 5 km so not, not extremely close, but close enough to get a good look.

Jason

So, would you be like running analysis on the tornadoes? Or what would your role be in that program?

Jim

So back then in graduate school, I was working both on the radar hardware—maintaining the radar, updating the radar—because it was a, it was built at the University of Oklahoma. It wasn't something we had bought. So there was a lot of maintenance to be done, but then yes, we were also analyzing the cases. I've worked with a couple of students since then who analyzing cases that we collected and doing a lot of interesting things. Then one of the things that was really exciting about that project is that we were fortunate enough to be able to publish in BAMS in 2017, a collection of cases that we had put together and analyzed, and we were even luckier; we got to be on the cover BAMS with a picture of the radar in a tornado and it was a lot of fun. It was really probably the highlight for me of my career so far.

Kelly

That's so exciting. So you touched on where radar meteorologists work. Do certain sectors hire radar meteorologist more than others? Or is it kind of just, you know, spread out?

Jim

It is kinda spread out, but I'd say that academia and national labs are pretty common places for

algorithm development and research, which is more of what I do so, the severe storm labs, NCAR, federally funded research development centers, FFRDC's. Places like that are pretty common to hire radar meteorologist. The National Weather Service, as I said, has the radar operation center, not to mention forecasters who use the radar a lot. But another big sector is industry. There's multiple companies out there that build weather radars and develop radar products, including for television. There's a lot of different opportunities out there. I know some people who work for the state, depending on what state they're in—state climatology offices; people that work in wind energy that do radar; people who work on ingesting radar into model data for real-time forecasting, a lot of different things to do.

Kelly

So, would you say that the job market's pretty good if you wanted to go into radar meteorology? Do you think there's a pretty good amount of jobs available?

Jim

There are. You know, I think that the radar meteorology field isn't particularly huge. There's not a lot of us. And, you know, for me, I originally wanted to be a forecaster. I love forecasting, and then one day I read a paper about, about radar phased-array radar and I really fell in love with it, and I realized there are other things meteorology and I'm really, really interested in this. So I'd say that given that we're—there's not a lot of us, and there is a need, there's definitely people out there who need radar meteorologist—I see listings all the time—and it's it's a great place to be.

Jason

Yeah so you had mentioned that there are openings in industry like in terms of building radar and so forth, could you have an engineering background and enter that field or would you need to have majored in meteorology?

Jim

Absolutely engineering works, and I'll say that one of the biggest difficulties in radar meteorology is the disconnect between meteorology and electrical engineering. There are very few people out there that understand both and, you know, it's hard to have a meteorologist who understands all the technical details about RF circuitry, pulse compression, and all these interesting things and then you know the meteorol— sorry, the engineers I don't necessarily

understand why we need the sensitivity to see clear air in a gust front, so both of those fields are very heavily involved and need to communicate well with each other. If you can be a little bit in both fields that's ideal, but yeah, I mean you have the people who are building the radars which are more of the engineers and then you have the people that are developing the radar products which are often more like the meteorologist.

Jason

So, you've done a good job of bridging the gap, it seems like.

Jim

Yeah, that was my goal. You know, once I found out that I was interested in radar meteorology, I really felt like the University of Oklahoma was a place where I could do both, a strong engineering program and a strong meteorology program and I think getting to run a field program with the radar that we all kinda pitched in to build on scratch money was pretty cool.

Kelly

So would you say that... So you get your meteorology degrees first and then you got an engineering degree, do you think that was the way to go, or if you had done it differently, would you have done the engineering first and then meteorology?

Jim

I know people who have done it both ways. I know people who have done a physics undergrad and then did a meteorology masters and an electrical engineering masters and the meteorology PhD. There are all sorts of different ways to do it, I'll say that in graduate school at least, we had a lot of people who came from different backgrounds, and that's not just in radar. That's in a lot of different areas. I think the idea that you have to have an undergraduate degree in meteorology specifically to do a lot of things in our field is a little far-fetched. There's a lot of different pieces of things that we need in, you know, you can do it either way.

Kelly

Did you have any advice from a faculty advisor on going into the engineering or was that something you just figured out on your own?

Jim

My advisor... I had two advisors, Bob Palmer and Boonleng Cheong from the University of Oklahoma and they were actually both engineers, which is kind of funny. And so when I got recruited to go to OU, there was actually another scientist who I still work with; David Bodine is really well-known radar meteorologist and he was the first one to be going through this dual masters program. And that was actually kind of upfront stated as, you know, this is a cool idea, we'd like to do this more, and so I was kinda brought into it by my advisors right away.

Jason

So with the dual masters, were they concurrent? Like you were taking coursework for both simultaneously?

Jim

I did the masters in meteorology first and then I did the masters in electrical engineering while I was doing the PhD in meteorology. And so the way that worked was the masters electrical engineering didn't have a thesis. It was a non-thesis option, which meant I have to take an exit exam, and basically just meant I had to take a bunch of extra courses while I was doing my PhD research.

Jason

Okay, I see, and you had mentioned publishing in *BAMS* and your other publications. Did you have a specific area of research that you focused on?

Jim

During my PhD I worked on a topic called pulse compression, which is a piece of radar engineering that we don't typically use in weather radar. It's more, it's been around in radar for decades, but we haven't used a weather radar much before. The idea behind pulse compression is that we can use much more affordable, low-power transmitters, possibly phase-array radars and things like that, and get much more sensitivity out of that radar, even though it's lower power by sending a longer pulse. And so the idea there is that you can make radars that are much more affordable, much smaller, and maybe have things like gap fillers and phased arrays with many, many elements. It's, its a use of solid-state transmitters. It's essentially the power of a light bulb but you're seeing hundreds of kilometers away by using pulse compression.

Jason

Okay, is that technology currently being developed or already in use somewhere?

Jim

Pulse compression is a very well-developed technology, but still has its issues for weather radar. It is being used in the research field quite a bit, and there are a number of companies that are selling radars to the meteorological community that use pulse compression, but we don't currently use it on, say, the WSR88D network.

Kelly

What type of professional development activities do you engage in usually?

Jim

Well, I have to say the AMS, of course. I'm on a number of AMS committees and boards, and I go to a lot of conferences. I really love the annual meeting. That's really one of my favorites. Also, Radar Meteorology and Severe Local Storms conference are really, really right up my alley. I like to present. I also really like to publish, and I'm really into STEM outreach. So, trying to get kids interested in careers just like this.

Jason

So we always like to ask our guest one last fun question at the end of the podcast. So, what's your favorite movie and why?

Jim

This is going to be the most unoriginal answer of all time for meteorologists, but it is *Twister*, for obvious reasons.

Jason, laughing: Oh why?

Jim

I don't know if I actually liked twister that much when I was a kid because I was afraid of thunderstorms, but it kinda became a thing between my grad school friends over the years to watch twister in March, before the storm season ramped up and, um, I don't know. I feel like I can quote almost the whole movie now.

Kelly

That seems to be a favorite of many meteorologists. It was a good movie! It was definitely entertaining.

Jim

Yeah.

Jason

It's a fitting choice.

Kelly

Well, that's our show for today. Thanks so much for joining us, Jim, and sharing your experiences as a radar meteorologist.

Jim

Thank you.

Jason

Please join us next time, rain or shine.