Transcript for "Sarav Arunachalam, Deputy Director at the Institute for the Environment at the University of North Carolina at Chapel Hill"

Clear Skies Ahead: Conversations about Careers in Meteorology and Beyond

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Kelly Savoie:

Welcome to the American Meteorological Society's podcast series, Clear Skies Ahead: Conversations about Careers in Meteorology and Beyond. I'm Kelly Savoie and I'm here with Rex Horner, and we'll be your hosts. We're excited to give you the opportunity to step into the shoes of an expert working in weather, water, and climate sciences.

Rex Horner:

We're happy to introduce today's guest, Sarav Arunachalam, Deputy Director at the Institute for the Environment, and Acting Director for the Center for Environmental Modeling for Policy Development (the CEMPD), at the University of North Carolina at Chapel Hill. Welcome, Sarav. Thank you very much for joining us.

Kelly:

Sarav, could you tell us a little bit about your educational background and what sparked your interest in science?

Sarav Arunachalam:

Sure. I have three degrees in chemical engineering. I grew up in India, but I got my first degree, a [Bachelor of Technology] from Anna University in Chennai. Since then, I got my master's and Ph.D. from Rutgers University in New Jersey. So early on in high school, I was pretty fascinated by math and science in general. Chemistry was particularly appealing for me, and talking to some friends I learned how chemical engineering puts together multiple disciplines, and in fact it was all around me in most aspects of what I was seeing in my life. So then I decided to pursue a [Bachelor of Technology] in chemical engineering and started to have a fascination to study air pollution through my undergraduate degree. And further at that point, I decided that I wanted to pursue graduate studies in the U.S., with a focus on studying air pollution.

Rex:

So I understand, Sarav, that there is a difference between organic and inorganic chemistry. Where does your expertise fall and what is the difference between those two areas?

Sarav:

That's a great question, Rex. Studying air pollution, I do involve looking at both inorganic and organic components of chemistry. So if you think about the pollutants all around us, you have multiple types of chemicals. And as far as air pollution goes, one needs to look at both. Depending on one specific expertise or research opportunities, we may be looking at either of them, but at least in my field of research, I tend to look at both organic and inorganic chemistry.

Rex:

So for me, when I think of organic chemistry, I think of anything that's living, but that's hard when you're looking at elements because I don't think of elements as living necessarily, but they are, I believe. So can you help me understand what makes something organic versus inorganic?

Sarav:

Sure. So with organic chemistry, the requirements are, the chemicals include carbon as well as hydrogen. So any extension of compounds that include carbon and hydrogen are typically considered to be organic compounds, and then inorganics is mostly other base elements such as, say, nitrogen or sulfur, for example. And then these, when oxidized, they form nitrogen oxide, sulfur oxides. And from an air pollution perspective, these are the kind of pollutants that I study and others study as well, to look at how nitrogen oxide, sulfur oxides lead to air pollution by themselves, or by reacting with other compounds, for example. So that's sort of the broad description that we have between the organic and inorganic compounds, and then what one may focus on as part of the research.

Rex:

Wow, that is an incredibly helpful distinction. I will certainly remember that. So Sarav, you seem like you had a very good focus on where you wanted your career to go, and I am curious what opportunities you pursued once you knew that your focus was in chemistry, that you knew would be beneficial to securing the job you wanted in your profession and in your field.

Sarav:

Yeah, so this all started with my graduate studies at Rutgers. So as part of my Ph.D., I got a GRA, or a graduate research assistantship, with the Ozone Research Center at Rutgers University. And this particular group was getting started with applying air quality models. These are urban scale air quality models to study ozone formation in urban airsheds. We were one of the first groups at that time in the early nineties to study air pollution through these urban scale models. I was lucky to work on a real world problem that affected millions of people in the region, specifically in the New York, New Jersey and Philadelphia urban airsheds, and to work with several state agencies and the U.S. EPA [Environmental Protection Agency] during my graduate school to study ozone formation through numerical models.

Sarav:

So one of the key findings that came out at that time was that one needs a combination of regional NOx controls and local scale VOC controls to address ozone. And I knew that the exposure I gained from that time during my graduate studies would allow me to explore options to do applied research further on for making policy at a government entity or a nonprofit entity and so on. But I think the very applied and real world research I did as part of my graduate school was fundamental in helping me bring to where I am today.

Kelly:

So you had mentioned you started off with degrees in chemical engineering, and now you're working with atmospheric chemistry. Was it an easy transition, going from the courses that you took for the engineering degree to be able to pursue the atmospheric science side of things? Or did you need to take additional coursework to be able to get up to speed in that?

Sarav:

Actually, not at all. There is some sort of misperception, I may say, to think that chemical engineering far removed from studying atmospheric science. So if you think of air pollution, specifically the scales that we study, typically from urban to regional scales to perhaps global scales, you study the atmosphere as what I consider as a chemical reactor so to speak, in space, and then you're mixing all the different sources, the various emissions, and then the chemistry happens in the atmosphere in a so-called chemical reactor. So what you study in chemical engineering is basically how reactions occur in a controlled system and how they may form additional compounds at some timescales, and then knowing the basic kinetics of chemistry.

Sarav:

So I believe it's all related, to some degree. And then at the end of the day, chemical engineers are known to put things together to study air pollution problems, for example, as a system. And that's what I felt that I got the training to do as part of my graduate studies, and that I was able to apply for my subsequent career.

Kelly:

Do you think it would be more difficult if it was the other way around, if somebody had an atmospheric science degree and then wanted to pursue chemical engineering?

Sarav:

Yeah. That is slightly different because with chemical engineering or with any engineering, for example, you have different sort of a coursework that you go through. So transitioning from chemistry to engineering may be slightly different from transitioning from engineering to chemistry.

Kelly:

So what was your first job in the field, and how did you end up at the University of North Carolina?

Sarav:

Yeah, that's a good question. So right after my graduate school at Rutgers, I was offered a position at the New Jersey state DEP [Department of Environmental Protection] for a short while. The motivation there was, the state was funding the work that Rutgers was doing, and then they would like to bring me over and then start a research program. But I was there for a very short while, and then what happened was, at one of the conferences, I met somebody from the Research Triangle Park in North Carolina. They knew of the work I was doing for the states up north, and they needed somebody to come down here to assist with their program.

Sarav:

This was MCNC in the Research Triangle Park, and they had a position open and somebody wanted me to apply. I applied, and this group was then just starting to develop the third generation of air quality models under a corporate agreement with the EPA. And I applied. I was lucky to be offered the position, and then decided to move down here from New Jersey. So this particular group laid the foundation for the Models-3 or the CMAQ model, which is now internationally used to study air pollution. And incidentally, I direct the EPA-funded CMAS Center at UNC to support a global community of modelers.

Rex:

So Sarav, you said the word “research triangle” a few times. Can you expand on what that means?

Sarav:

Yeah, Research Triangle Park. This is right here in central North Carolina, and the triangle is a rough region that sort of comprises the area in between three cities or towns, Raleigh, the capital of North Carolina, Chapel Hill, where the university is, and Durham, another town. So the area in between these three towns or cities is called Research Triangle Park. 50 plus years ago, the then governor of North Carolina and the local council decided to create this area to foster economic growth and make this a hub for technology and high-tech. So over the years, this area has grown extensively to have multiple large companies with a very strong tech focus, including in biotech pharmaceuticals, and IT.

Rex:

So it's a destination for people that are interested in those areas.

Sarav:

That is correct. The local towns and cities have been on *Money* magazine's top places to live quite a few times because of the very strong high-tech industry and the jobs that go around this. And of course we have three wonderful universities that anchor the three areas, UNC Chapel Hill, NC State in Raleigh, and Duke is in Durham. So these three universities, coupled with the large employer base, this seems to be a destination place for a lot of people to move down here.

Rex:

And I understand that the University of North Carolina at Chapel Hill is a pretty special institution. I've heard it's been called the equivalent of a public Ivy League university, in that its academic experience is on par with the research and the education of an Ivy League school. Is that a local perception as well, and can you talk about what that means?

Sarav:

Yes. So UNC is the first public institution in the nation. So I have heard references to UNC similar to the vein that you just mentioned, Rex, and interestingly last fall, the chancellor of UNC organized a bus tour for UNC faculty. So this was done many, many years ago and then stopped for some reason. And then the current chancellor decided to revive and take the faculty on a tour. The idea was to get faculty across campus from multiple disciplines, and then put them in three buses, and then we spent a few days going into different parts of the state. So three buses covered different parts of the state. The idea was to go and see hands-on, first person to see what was happening in different areas of the state, and really make a connection to the people on the ground and the students and the communities out there, and both learn what the issues were as well as inform what UNC Chapel Hill was doing.

Sarav:

And during the tour, we talked about this notion that you just brought up about how sometimes UNC is perceived as an Ivy League or a top school. And it did get the appreciation, just meeting people from across the state, that people look up to UNC as a top destination to go to. In terms of research, UNC is up there, in terms of the amount of research that is done, both in terms of the quality as well as

quantity. We bring in a lot of money from mostly federal agencies for research, and the School of Public Health where I have an adjunct appointment, is the top public school for public health in the nation.

Kelly:

What a fantastic idea, the bus tour. That is excellent, professors being able to talk to potential students and have them learn more about the university. I think that's fantastic.

Sarav:

Yeah. I thought that was a fantastic opportunity. I was grateful that I was invited and selected to go on this tour, and I got to spend quality time with other faculty on campus who I may or may not have met otherwise. So they mix and match people from different disciplines across campus, and we got to spend a full week on the buses and then late evenings for dinner and so on, and learn both what each other is doing as well as what the university was doing for the state and what the state needs. So it was a very, very good educational opportunity for the faculty.

Rex:

And I think there's kind of a push globally in academia that interdisciplinary work should be embraced maybe more than it has been in the past, so this sounds like a great way to foster that as well.

Sarav:

I think so. It was an eye-opener for me on multiple levels in understanding the state itself. I've lived here in the Research Triangle Park area for almost 20 plus years now. Of course, this is a very urban high-tech area, like I mentioned earlier, but of course the state is very diverse in terms of what it offers, and it was eye-opening for me from multiple perspectives. It was a good experience and I would like to do another one if I can.

Rex:

Could you walk us through a typical day on the job as the Deputy Director for your Institute, and as the Acting Director for the Center for Environmental Modeling for Policy Development?

Sarav:

No two days are the same. So I have quite a bit of variety on a daily basis with my schedule, but as a typical day perspective, like you're asking, Rex, so both as a center director and being a PI on multiple projects, I tend to have a lot of meetings, both at my project team on the technical side, with the support staff on the administrative side, and with my sponsors routinely. And in addition, there's a constant churn of either writing, reviewing reports and drafts of manuscripts for the students and postdocs that are part of my team. Of course with COVID, like you're doing right now, it's a lot of Zoom calls of late, the past few months especially.

Sarav:

So a typical day, I usually start work around 8:45 or so on a daily basis, either when I used to go to work physically, or now with the remote option. I do a quick scan of emails. I get, I don't know, 70 to 80 emails on average overnight, and then average, about 200 emails a day. So I will tell you that that's something that I'm still learning, how to regulate time spent on responding to emails, but we'll get to that in a minute.

Sarav:

But in general, I have somewhere between four to five meetings or calls a day, often back to back. And depending on the day of the month, it might be time to review about a dozen or so monthly reports before they go to the sponsor. And sometimes there's an email I see from a colleague or a collaborative or a new project proposal idea from either within or outside UNC. I start to think about the problem and do some research, but most often before I can finish thinking about it, it's time for the next call. Then I take a break at around 6:00 PM for a few hours, and then sign in again at 10:00 PM and work another two to three hours on reports and perhaps getting to emails I didn't finish at the beginning of the day.

Sarav:

The bottom line is that there is a lot of meetings and calls and emails. Email tends to be a time sink, and I'm still learning, like I said, how to regulate time spent on responding to emails. So I try to devise, explore new technologies to help me get on top of what I do and not be constantly behind. But otherwise, it's a fascinating variety on a daily basis between monitoring, mentoring people on ongoing work, as well as thinking about new projects and ideas.

Rex:

Can you share any of those technologies that you've discovered that help you keep updated on email?

Sarav:

Sure. One specific product I've started to move towards is Microsoft Teams. I don't necessarily mean to make a plug for Microsoft, but just the Teams software, which is a product within the Office 365 suite. It has a feature to basically organize conversations around projects. And so what I've done in the past year or so is to heavily move away from emails, and have project focused discussion where I have created multiple projects within Teams, and then I add people based upon the projects they belong to. And all conversation is through chats within the particular project, and I also organize all the files and meeting minutes and notes and such around the projects. So this way, on a given day and time, when I switch between the calls, I just go to the specific projects and I know what the conversation is on that particular project and what the latest discussion is around, and find the files and the minutes around the particular project.

Sarav:

So it seems to be helping quite a bit of late. And like I said, I am trying to reduce email burden.

Rex:

I believe it's similar to Slack. Have you heard of that program as well?

Sarav:

Yes. I've used Slack as well, in fact, for one of my projects based upon the other external collaborator I work with. Slack is very similar to that. I don't know if Slack offers files and meeting minutes and such, but Slack is superb for instant communication around a specific team on a project.

Kelly:

Wow. It sounds like you have a pretty long day. So what do you like most about your job? And I'm guessing it's not answering emails.

Sarav:

Yeah. You got that right. There are several aspects that I absolutely enjoy as part of my job. To begin with, are the daily challenges that vary, and the satisfaction that comes from mentoring junior scientists, specifically students and postdocs. So to see how students and postdocs from the point that they come in and join my group to seeing them graduate, I think that's very rewarding. And more importantly, almost all the work that I do within the Center and Institute directly benefits public health. And that is through reducing, addressing air pollution. And what we do primarily is to provide the scientific basis to study air pollution and help make public policy.

Sarav:

So that part of my output from my research is very rewarding, and I like that I'm able to contribute in my own way through the group that I have here with the Institute, to contribute to that. Of course, being in an academic setting, I tend to pursue research that excites me, of course, as long as it gets funded. But still, that sort of freedom is very rewarding, and that's something that I cherish.

Rex:

You've discussed how you have to write reports to the sponsors (i.e. the funders) of your various research projects that you are the principal investigator or the PI for. Would you say that the monetary aspect is a challenge in your field, or are there other challenges that you would think that you face in your field?

Sarav:

Yes. The monetary aspect, that's one key challenge, that is to continue secure adequate funding, both to pursue the ideas that are exciting and relevant to society today, as well as to keep the group funded and doing what they do well. I do hope that with the new administration that is on the cusp of inauguration, I hope that the environment will come to the forefront again, and there will be continued focus on developing the scientific basis. I think that's the key. We should not move away from understanding that science is the key. So the focus needs to be on developing scientific basis, and that's part of the research that I do, is to provide the scientific basis to protect public health.

Sarav:

The inherent challenge here, Rex, is that air pollution that I study a lot is invisible. So sometimes it is not always on people's radar, unlike say other natural disasters like flooding, which is very obvious. You see it in front of you. But unless air pollution is directly visible, of course the fires are there in the western US right now, and that brings smoke plumes and it's visible. But on a regular basis, when you have high levels of air pollution, it is not directly visible. So sometimes it is not always on people's priorities, so it takes extra communication to bring the issue to the forefront of decision makers. So overall, finding adequate funding and making sure that this is a key issue, I think is a challenge in this field.

Sarav:

The other challenge I have is of course, finding the right skills. I sometimes see that people are less motivated to pursue sciences, specifically in higher degrees, partly because they are motivated by perhaps, look at the workforce in other disciplines, in diet industry, or financial sector and so on. But the same time, I see there is somewhat of a less motivation, less commitment to single-mindedly pursue a problem related to the sciences and make that as part of their career.

Rex:

Wow. That's really interesting. So it's really two-fold. So there's the aspect that almost ties back to where you got your roots in working in the New Jersey area, I believe, with the EPA and I believe the regional environmental departments there, and now you're again looking towards how to sculpt sound environmental policy. And you're also trying to ensure that there's the right people who have the dedication to stay focused on this area, and that that might be a challenge for some folks.

Sarav:

That's right, Rex.

Rex:

So for our student listeners, these new people who are ready to dedicate themselves to the issues that you passionately believe in and that you work on, what types of positions are available in atmospheric chemistry and in chemical engineering for them to pursue, and how is the job outlook in general for them as they enter the workforce?

Sarav:

I believe that, in the last year or so, I have felt that these are extremely good times for students graduating. I say this partly because I, myself, am always on the lookout for good students and good postdocs and so on. And I think the economy is doing good, and these issues are quite in the forefront to some degree. And there's a good demand for students too, who are graduating and taking these offers.

Sarav:

As we speak, I'm aware of multiple positions that are posted, Rex. The U.S. EPA, for example, has several student positions open for internships this coming year. And then on top of this, the U.S. EPA's ORD, that's the Office of Research and Development, has multiple internships for full-time through the program called ORISE. But in general, even with the DOE labs outside, I have seen that a lot of job postings are available for environmental chemists beginning starting career positions.

Sarav:

So overall, I feel that the graduating classes in the last year or so is fairly lucky to have a lot of opportunities. Of course, they can always come and talk to me here at UNC to see if they want to start to pursue a PhD or a postdoc position in my group. But in general, I think these are good times for students who are graduating, plenty of opportunity. Just keep your eyes and ears open, talk to your faculty mentors or professional associations like AMS, for example, to see where there are job opportunities. But these are good times.

Rex:

So there is demand, and networking is important, and don't be afraid to reach out, even to you.

Sarav:

That is correct. I'll be happy to point people in the right direction if somebody is looking for a position.

Kelly:

And let's hope that continues in the future for the future students, so they can continue to pursue those types of opportunities. So, Sarav, before we end the podcast, we always ask our guests one last fun question. Are you ready for your fun question?

Sarav:

Bring it on.

Kelly:

What is your all time favorite book?

Sarav:

That's a tough question, Kelly, because I love reading, though with my recent job profile, I've devoted less time to reading, but I do find the time to pick up a book here and there. I used to read a lot five to 10 years ago and have walls of books that I read. So I wish I had even more time to read, but of course, the priorities of my job takes over, and I look forward to finding more time.

Sarav:

But to answer your question, I love reading a lot, but I'm going to just point out one particular book that was pretty fascinating and inspiring for me. And that was *Paths of Glory* by Jeffrey Archer. So this goes back to a real-world incident that happened. This is the story of George Mallory, who died attempting to climb Mount Everest in the 1920s. This is a fictional take on the particular story, but the key is, this particular book was inspired by George Mallory, who died attempting to climb Mount Everest, and brings to life what I think is one of history's most enduring characters. While it is fiction, I was fascinated by the single-minded dedication that George had to do something that he absolutely loved and excelled at, and that was to climb mountains after mountains. His philosophy was, if it's there to climb, he will climb it. That was his philosophy. In fact, in one of the real world interviews, he told an American reporter way back when that he wanted to climb Mount Everest because it is there, as simple as that.

Rex:

Wow.

Kelly:

I've read a few books about mountain climbing as well, and it takes a lot of courage, and you have to really train for things like that. I find it amazing. I think it's super exciting. I don't think I have the guts to do something like that, so I really admire people who can just do it. It's amazing.

Rex:

Right. It's physical, and it's also incredibly mental, the focus and the psychological dedication it takes to achieve these climbs up these mountains. I think a very famous one is Jon Krakauer wrote *Into Thin Air* about a tragedy that happened with climbers on Everest. Over a couple days, there was a few deaths and it's an area that provokes a lot of strong emotions and brings a certain type of person to the front.

Sarav:

Yeah. And the good thing about this book is, as much as it inspires you in terms of how George grew from a little kid to being this fantastic mountain climber who went all the way up to Mount Everest, there is a little anecdotal story after the fact where he died in the twenties, trying to climb Mount Everest, and nobody knows today if he actually ever did climb all the way to the peak. His body was found about a few hundred meters below the summit recently, in 1999 or so. And there is debate amongst historians on, who really climbed Mount Everest first? Was it the New Zealander or the Brit? That debate is always there.

Sarav:

So I find that little debate after the fact interesting, but this is a fascinating book and I recommend somebody who likes adventure and fiction, and to go after your passion. I think that's the key. He loved something and how he would do all it took to continue what his passion was. I thought that was very inspiring.

Rex:

Isn't that amazing. 1924, he goes missing. 1999, his body is found on top of Everest.

Kelly:

Well let's just hope he made it to the top, and he was on his way back down. I'm hoping that is the case.

Sarav:

So when the story came, obviously Sir Edmund Hillary was not happy, or at least the foundation was not happy with this whole sort of debate. There are theories about how much he loved his wife, Ruth, and he would always put a picture of his wife Ruth where he climbed. I believe they did not find a copy of the picture with him, so that again poses some thoughts on what really happened.

Rex:

Well, Sarav, thank you so much for joining us. We'll look for the book, *Paths of Glory* by Jeffrey Archer. It's been incredible having you on the podcast and sharing your work experiences with us.

Sarav:

Thank you very much, Rex and Kelly. It was my pleasure to talk to you and make me also reflect on some of what I'm doing. I hope this is of some use to the member community AMS, and thank you again.

Kelly:

Well, that's our show for today. Please join us next time, rain or shine.

Rex:

Clear Skies Ahead: Conversations about Careers and Meteorology and Beyond is a podcast by the American Meteorological Society. Our show is produced by Brandon Crose, and edited by Peter Trepke. Our theme music is composed and performed by Steve Savoie, and the show is hosted by Rex Horner and Kelly Savoie. You can learn more about the show online at www.ametsoc.org/clearskies, and can

contact us at skypodcast@ametsoc.org, if you have any feedback or if you would like to become a future guest.