

Establishing a career in the atmospheric sciences can be challenging. There are many paths to take and open questions. Fortunately, those paths and questions have been thoroughly explored by members of our community and their experiences can provide guidance. In light of this, last September Ali Hoshyaripour [Early Career Scientists (ECS) representative of the European Geoscience Union's Atmospheric Sciences division (EGU-AS)] and Monique Kuglitsch [Senior International Outreach/Communications Specialist at the American Meteorological Society (AMS)] collaborated on a virtual interview of the presidents of our organizations: Annica Ekmann (AE) and Fred Carr (FC), respectively, with questions provided by early career scientists. Please find the questions and answers below.

### **On education**

**Red Latinoamericana de estudiantes en Ciencias Atmosféricas y Meteorología (RedLAtM) opened the interview series by asking AE and FC, “did something important mark your life?”**

*AE: I can't think of any specific event that changed my life, but spending some time abroad as a Post-Doc and visiting scientist has been very important to me. Both from a professional point of view, to learn from a new environment, but also on a personal level.*

*FC: I didn't have a major life-changing moment but several very important ones. In 1969, after I received my B.S. degree, 100% of college graduates were drafted into the military (this was at the height of the Vietnam War). However, because I had a slight hearing deficit, I was ineligible for military service, and I was able to begin graduate school. Had I served in the military, my career path would have been much different. Later, after receiving my PhD and while working as a post-doc for Dr. Lance Bosart at SUNY-Albany, I began applying for faculty positions. I eventually had to decide between an offer from the University of Oklahoma (OU) and waiting for another university to decide among several candidates. I chose the “bird-in-the-hand” option, and joined the School of Meteorology at OU, which at that time had only 6 full-time faculty and was housed in the oldest building on campus. Now we have over 20 faculty and are housed in the magnificent National Weather Center, so that was a fortunate decision. And, of course, getting married to my wonderful wife Meg in 1972, and the birth of my son Brett in 1985 were very positive milestones in my life.*

**RedLAtM followed-up by asking AE and FC, “why did you both decide to pursue a career in atmospheric sciences?”**

*AE: My path into science in general, and atmospheric science in particular, was not straight-forward. I've always liked math and started my undergraduate education in math and physics. I soon found myself a bit “lost in theory” and wanted concrete problems where I could apply the knowledge. That was how I was drawn towards a Master's program in meteorology. I was sure my future career would be as a weather forecaster until I started working on my degree project. I really enjoyed this first experience working as a scientist; learning about the problem, developing a tool to study the problem (in my case a numerical model), analyzing the results and then summarizing and presenting the results. So after my degree project I applied for a PhD student position. Then one thing just followed after another... I really*

*enjoy working as scientist, I like the challenges it brings and also that I constantly learn new things from students and colleagues.*

*FC: I developed a strong interest in atmospheric science because of my love of skiing (which I started at age 5) and subsequent love of snowstorms. I grew up on the Massachusetts coast just northeast of Boston (Beverly) which meant that we were near the rain–snow line of almost every winter storm that passed over the northeast U.S. Thus I followed the weather forecasts and snow observations extremely closely, and decided I wanted to be a meteorologist. My interest in atmospheric science has increased ever since and today, at age 69, I am still skiing and still vicariously following closely all U.S. snowstorms and snow amount reports!*

**RedLAtM also wanted to know from AE and FC, “how should a young person guide his/her path as student and scientist in order to reach those institutions like the ones you lead?”**

*AE: A solid PhD education followed by a Postdoctoral position in a good lab is of course important. But I also think it’s essential to be in an environment where you personally and professionally feel appreciated and get good support, otherwise it’s easy to lose the enthusiasm when things turn difficult—which they will at some point. After a Post-Doc, other characteristics than your scientific skills will also become more and more important; project management skills, time management skills, leadership skills, administration skills, etc. If there are opportunities to learn these skills on the way, even at a small scale, it’s a good idea to take them.*

*FC: My advice will be targeted toward becoming involved in the American Meteorological Society (AMS). One can begin as an undergraduate student by attending scientific meetings, especially the AMS Annual Meeting that has so many activities (Career Fair, Student Conference, Exhibit Hall, etc.) from which they can benefit. As a graduate student, one can begin giving oral and poster presentations at the many conferences/symposia the AMS sponsors every year. The AMS also has meetings that are attractive to the private sector as well (Broadcast; Weather and Forecasting; Washington Forum, etc.), so you can remain involved in the AMS no matter what your career path is. The AMS has over 100 Boards and Committees addressing a wide spectrum of issues, many of which are listed here: <https://www.ametsoc.org/ams/index.cfm/about-ams/ams-commissions-boards-and-committees/complete-list-of-commissions-boards-and-committees/> and nearly all of them desire to have 1–2 student members. For early career scientists seeking more involvement in the AMS, I recommend joining one of the 30 Scientific and Technological Activities Commission (STAC) committees in the discipline that matches your interest. Also note the “Student Opportunities” link on the STAC website (<https://www.ametsoc.org/stac/>). The Commissions on Professional Affairs and on the Weather, Water and Climate Enterprise have many volunteer opportunities for those in the private and public sectors (see first URL above). As your career proceeds, you can become more involved in the leadership of the various commissions, boards and committees, and eventually to major leadership positions in the Society.*

**RedLAtM posed their next question to FC, “which universities are the best for doing postgraduate studies in Tropical/Subtropical Dynamic applied in numerical weather prediction for tropical cyclone**

**forecasting? I'm from Mexico and we have systems coming from two basins: the Atlantic and the Northeast Pacific."**

FC: *By "postgraduate studies", I will assume that you mean research opportunities as a recent PhD recipient. First, your PhD advisor may know of post-doctoral opportunities in his/her own research group or in tropical research groups at other institutions such as the Universities of Miami or Hawaii. In the U.S., it is possible for almost every doctoral program in atmospheric sciences to have 1–2 experts in tropical meteorology, so one could look over these program for research topics in your areas of interest (the following web site provides a list of these doctoral institutions:*

*[http://ametsoc.org/amsucar\\_curricula/index.cfm](http://ametsoc.org/amsucar_curricula/index.cfm)). The National Research Council has postdoctoral research opportunities at several organizations such as NOAA, Naval Research Lab, etc. that perform tropical research; the list of these organizations is at <http://nrc58.nas.edu/RAPLab10/Opportunity/Programs.aspx>. Finally, I will mention NCAR's Advanced Study Program Postdoctoral Program (at [http://www.asp.ucar.edu/pd/pd\\_announcement.php](http://www.asp.ucar.edu/pd/pd_announcement.php)) in which accepted candidates can work with any NCAR scientist they wish, a few of which do study tropical cyclones.*

#### **On career**

**Under the topic of career, Anonymous asked AE and FC "have you experienced 'impostor syndrome' and do you have advice for early career researchers who have it?"**

AE: *I have often felt that I'm not "good enough" and that everybody else is so much smarter and better than I. Personally, what I tended to do was to put all the good characteristics of a number of other people into **one** ideal person, and then I compared myself with that ideal person, which of course never was a very favorable comparison.... So I've stopped doing that 😊. From a general perspective, I think a good mentor can be very helpful.*

FC: *I believe I may have experienced a mild form of this syndrome when I first became a professor and I didn't see myself at the same level as the distinguished professors at Florida State University where I was a student. However, I was getting papers published and receiving research grants, so I must have been doing something right. Eventually I learned that all scientists, being human, have their strengths and weaknesses, and that one can become a colleague of your distinguished peers by recognizing your own strengths and making contributions in these areas. My advice for those who may have impostor syndrome is to talk with people who you admire (one should always try to find mentors wherever you work), as they may have also experienced similar feelings. Also, develop a strong support system among your friends and colleagues, and look at your resume every once in a while to see all the wonderful things you have accomplished!*

**RedLAtM wanted to know from AE, "do you consider you had to sacrifice more than your male colleagues in order to achieve what have you done as a scientist in atmospheric sciences?"**

AE: *I don't feel that I have made specific sacrifices to be a scientist. It's been challenging sometimes, like many others I do have problems balancing work and private life. But I don't think it's a problem that's*

*unique for academia. It's unfortunate that the role model of a successful scientist tends to be a person that works day and night, I wish we could change this image. Personally, I would like to see more research groups that do not rely upon, or are focused around, one single person.*

**RedLAtM wanted to know about FC's experiences at the National Centers for Environmental (NCEP) and his experiences with models, asking "what has been your experience in the [NCEP]? I mean, what are the challenges that models have nowadays?" and "what are the biggest challenges in modeling?"**

*FC: Early in my career, I realized that my modeling research efforts would be more worthwhile if the models I worked on were the U.S. operational models used by NCEP. I became one of the few university scientists who spent a sabbatical at NCEP (as well as many visits later on) and was fortunate to be able to make some major improvements to the precipitation forecasts in the NAM and GFS models. It was a wonderful experience working with the NCEP scientists and I encourage all NWP experts to spend time there at some point in their careers. The NWP models today still have room for improvement, which is a good thing since it means that forecasts are still going to get better in the future as we address the current challenges. Some of the major challenges include improving data assimilation (i.e., the way we use data from new observing systems such as dual-pol radar, current and new satellite sensors, pressure data from cell phones, etc.), improving the physics in the models, and how best to design an ensemble of convection-resolving models.*

*Some of the biggest challenges [in modeling] include: (1) Predictability—at both climate and convective time and space scales. That is, we need to know what the theoretical predictability of the climate system is to know how much room for improvement there is in our climate projections. We need to understand convective predictability to know how long a high-resolution forecast (e.g., 1 km) will successfully evolve convective phenomena. (2) Observations: We now have even operational models forecasting at resolutions much finer than the observational network that provides their initial conditions. We need measurements that, in general, provide higher time and space resolution than we have now, and also those that eliminate the gaps we have such as lower-tropospheric thermodynamic profiling. (3) Data Assimilation: This was mentioned above, and despite the sophistication of today's assimilation methods, there are still many issues that need research, such as assimilation for convection-resolving models. (4) Physics: We still need to improve our representation of microphysical processes (which are rarely verified), boundary layer turbulence, and surface processes under different wind, stability and vegetation regimes, to name a few. (5) Coupled modeling: Climate models and also medium-range forecasting models need to be coupled with, e.g., ocean models, sea ice models, and land-surface and hydrologic models. So, lots of research opportunities for everyone!*

**Nadine Borduas asked AE and FC, "is it better to focus on one aspect of [atmospheric sciences] or do a little of all three?"**

*AE: Difficult question, but I think we need both types in science. We need people that dig into the nitty-gritty details but also the ones that perhaps have a bit more superficial knowledge but are able to connect different subfields. In the beginning of a career, I would say that a relatively narrow focus is better so that you really become a specialist in a topic, method etc. But thereafter, I think it's good to*

*branch out more and more. Many of the interesting new discoveries today occur in the intersections between different disciplines or sub-disciplines.*

*FC: If “all three” means physical, dynamic and synoptic (observational) meteorology, then I would recommend that all atmospheric scientists have some knowledge of all three. Dynamicists and modelers still need to know what the observed structure of the atmosphere is, while observationalists (and modelers) need to know how to physically interpret observed (or modelled) behavior of the atmosphere. However, in order to do original research, one must focus on just 1–2 sub-specialty topics within these broad areas in order to achieve the depth one needs to advance the science.*

**Nadine Borduas also sought advice on developing a research group from AE and FC, asking “when establishing a research group in [atmospheric sciences] how much field/lab/model work to you incorporate in your proposals?”**

*AE: I assume you mean how much of **each one** of these components I would incorporate in a proposal? I’m a modeler myself, but collaborate strongly with people doing lab or field work. In most proposals, I therefore either have an experimentalist as a co-applicant and/or refer to specific people that can provide the necessary complementary data and expertise.*

*FC: If one were to form a new atmospheric research group, it probably would have to concentrate primary on one of two areas: climate and/or mesoscale modeling, or research using new observational tools. It would be difficult to have major expertise in both areas unless you had a very large group (such as at a national laboratory). A few research groups might be formed to do theoretical studies or pure experimental labs (e.g., wind tunnels, fluids laboratory) but these are not as well-funded these days. For a modeling research group, no field or lab work would be needed in the proposals. If you are designing/testing new radars, UAS or thermodynamic profiling systems, considerable field work is required, as well as some laboratory work to refine the instruments. If you were concentrating on measurements from space, then you have no local field or lab work to do (except perhaps some ground-truth validation studies), and your efforts would be concentrated on data processing, data analysis, and product development. Thus the answer depends on the primary purpose of the research group.*

**RedLAtM wanted to know from FC, “what inspired the foundation of the COMET program?”**

*FC: The National Weather Service, as it was implementing the “modernization” effort in radars, satellites and workstations in the 1990’s, realized that most forecasters at the time were not well-trained in interpretation of the observations from these systems, nor in convective and mesoscale observations and dynamics, nor in new data analysis software. They wanted a training program much more rigorous than typically given by NWS training courses and thus asked UCAR for assistance. Since each of the NWS Forecast Offices (FO) had a new position known as a Science Operations Officer (SOO), the idea was to train the SOOs at COMET with graduate-level course material, and the SOOs would then be the training focal point at each of the 120 NWS FOs. The instructors for each SOO course would be both university professors and veteran NWS forecasters. I was one of the first COMET instructors of the SOO course, and it was one of the most intense and rewarding teaching experiences I have ever had.*

### **On the role as president of EGU-AS (AE) or AMS (FC)**

**In regards to her role as President of EGU AS, RedLaTM asked AE, “from your point of view, what is the biggest challenge for women in Atmospheric Sciences? What we have to face in order to leader organizations like EGU AS? Do we have the same opportunities as men have?”**

*AE: I think that on paper, women and men have the same opportunities to do a career in atmospheric sciences. Still, it's a fact that more women than men leave science after their PhD or Post-Doc, and you don't see them as often in leadership positions as men. This problem needs to be fixed, but there is no single and easy solution. I think supporting networks and role models are important, we need to see as big diversity in this respect among women as among men.*

**RedLaTM also asked AE “what are the youth programs you have supported since you've been elected president of EGU AS?”**

*AE: During the last year we were looking for a new ECS representative for the AS Division and eventually Ali Hoshyaripour was elected for the position. But we had such a large number of really good candidates, so together with Ali, we decided to form an AS Division ECS group that together could come up with activities and help spread information relevant for the AS ECS community. I'm really happy about this initiative, and think it will be a great resource for the AS Division as a whole. In addition, I have of course participated in activities organized by the EGU for early career scientists to meet Division Presidents and other more senior people.*

**From FC, RedLaTM wanted to know “how we can set up an AMS student chapter in Latin-America?”**

*FC: I will keep this answer short. The following website explains exactly what is needed to start a Local or Student Chapter of the AMS: <https://www.ametsoc.org/ams/index.cfm/about-ams/ams-local-chapters/how-to-start-or-reactivate-a-local-chapter/>. I hope you will do so!*

**Oghenechovwen Christopher Oghenekevwe asked FC about Memoranda of Understanding. Specifically, “does an MoU exist between AMS and any Pan-African institution that allows undergraduate students Meteorology and Climate Science further their career with access to mentorship?”**

*FC: I don't believe any MOU currently exists between the AMS and any African countries or organizations. The AMS does have agreements with the meteorological societies in Canada, Australia, India and China, and we will be glad to consider others. Since you mentioned students, you might investigate possible collaborations with the AMS Education Program (<https://www.ametsoc.org/ams/index.cfm/education-careers/>) and see if some of the teacher training programs could be adapted to student mentoring programs. The head of the Education Program is Wendy Abshire ([abshire@ucar.edu](mailto:abshire@ucar.edu)) and I recommend that you contact her.*

**Finally, Chrysanctus Onyeanusu asked FC, “does this society have any scholarship scheme for young meteorology students like me?”**

FC: *The AMS has Freshman and Minority Scholarships for college freshman and sophomores, and Named Scholarships for seniors. Information about them is at <https://www.ametsoc.org/ams/index.cfm/information-for/students/ams-scholarships-and-fellowships/>. However, I note that one must be a U.S. citizen or have permanent resident status to be eligible, so if you are an international student, we do not yet have a program for such students. However, it seems to me that we should have one, so I will pass this suggestion to our Centennial Committee, which is thinking about new activities the AMS can engage in as we celebrate our 100<sup>th</sup> Anniversary in 2019.*