SURFACE WEATHER ANALYSIS: WHERE IT'S BEEN, WHERE IT'S GOING

ORAL HISTORIES

DAVID ROTH
JULY 29TH, 2010
WORLD WEATHER BUILDING IN CAMP SPRINGS, MD

INTERVIEWER: Can you state your name, your birthday and your home town?

DAVID ROTH: My name is David Roth and I was born in Miami Beach, Florida. I was born on December 15, 1972.

INTERVIEWER: Okay. Can you tell me, uhm, where you studied meteorology?

DAVID ROTH: I studied meteorology at the, the Florida State University.

INTERVIEWER: And how or when did you become interested in meteorology?

DAVID ROTH: When I was a kid. Uhm, it became a hobby of mine when I was 10. I'm not quite sure why, but I mean, having a hurricane pass by my place when I was 7 is probably not a bad start. I was kind of aware that when I was a young kid, but I don't know if it was the discovery of the Weather Channel or not, because it seemed to coincide with starting to watch the Weather Channel in '83.

INTERVIEWER: And how long have you been with the Weather Service?

DAVID ROTH: I have been with the Weather Service continuously, according to my SCD, uhm, since May of 1993, although I did have a stint as a summer student in '92.

INTERVIEWER: Nice. And can you tell me about your career?

DAVID ROTH: While I was at Florida State University, uhm, Todd Kimberlain, a co-student, classmate, whatever, of mine; uh, we had known each other since the beginning of freshman year and I guess it was after the first summer of college, he had called me -- which is very rare for Todd -- he had called me about a job that they were had an, an opening on a meteorology project that occurred after we were out of college because Florida State ended in April. The job posting was later. And he had me fill out some paperwork and I got to work on this project called CAPE -- I think it was Convection and Precipitation and Electrification experiment that they had in Melbourne, Florida, uhm, during the summer of '91 -- mainly July and August. So he got, he got, I guess the Hurricane Center told him, he told me and we ended up being the two representatives from Florida State on the project. After being on that project, which lasted six weeks -- it was pretty much mid-July through Bob, when Bob occurred in '91. Uhm, I worked at the map room at Florida State and the next summer, a temporary position, a summer aide position came available at the National Weather Service at Miami. And we knew ahead of time that this was happening, so I put in the application and I came back with a score of 100. So I got the position.

INTERVIEWER: Nice.

DAVID ROTH: GS-3. And so I was a GS-3 that sum, during the summer of '92. I was there from June 1st through August 14th. It was the day that Andrew's wave came off of Africa. So I went away to college and then a position came up for a student trainee position -- kind of like what they would call co-op or SCEP nowadays. And it wasn't for college credit, but it was for money. And since I'd been a GS-3 the previous summer, got to GS-4. And uhm, I was hired the second time -- this was around May 17th of '93 -- and my main job there was I was part of the public service unit at the State Forecast Office in Miami, which meant we took phone calls from the media, the public, and it was our job to deflect calls from the National Hurricane Center and answer them. The only exception that I was given was if John Hope calls, you direct it straight to the Hurricane Specialists; otherwise, try to answer everything. But I was there during summers permanent summers of '94, '95, still going to college. And when I graduated December '94, as an extension of that position, Southern Region could've placed me anywhere. And they did. They placed me in Lake Charles, Louisiana. I could've declined, but they said it wasn't a smart idea. My boss at Miami, Paul Hebert -- who has probably been retired about ten years now -- he's like, "I'm from Louisiana. I think you'll like it." It took me three years to begin to like it, but I liked it. I was there from January '95 through November '98 as a, as an intern.

INTERVIEWER: Okay.

DAVID ROTH: Meteorologist intern. So that was GS-5 through 11. Uhm, and then I bid on a number of positions. There was a mass bid for forecast slots but because of the way they dealt with the mass bid, even though I was in the top few of some of the panels, they couldn't hire me because of the way the selection went. So getting desperate to bid on positions, I bid on HPC and Brownsville at the same time. And HPC called me offering me a position a day before Brownsville did. And I asked if I could think about it and Dave Reynolds, who was the boss at the time, he's like, "Don't take too long. Uhm, I need, I would like your decision by this afternoon." So I called back and accepted the position. The next day, Brownsville called in offering me a forecast position and I'm like, "I'm sorry, I've already accepted the one at HPC. I still would've worked with a couple of the same people who ended up coming through Texas anyway. It turns out it's good that I ended up here. Uhm, my start as a surface analyst as a GS-12, uhm, it was still a GS-12 position. It was just considered a meteorologist position -- not an intern, not a forecaster, just meteorologist. When I got here, they were short several analysts. So there were just three of us. I guess there should've been five. And after I was here a couple weeks, Bill Gartner got a position at State College and he disappeared. So then there were just two of us, so I had a very limited training; my surface analysis when I went on shift and I had scheduled overtime. So after a few months, uhm, some people began to question my skill at surface analysis so uh, I ended up being recertified. And by Mark Klein, who at that point, he didn't see anything wrong. But it got me off midnight shifts for a few months, so it worked out fine. But because of that, Dave Reynolds established checklists on all the desks, not just surface. And Mark Klein was designed the surface focal point and after a year and a half or two, Mark dropped the focal point. And at that point, I asked if he could ask me that sort of I could be the next surface focal point. So I became the next surface focal point. And there was, that was around the time I became a… well, we had, all the 12s transitioned from surface analysts to basic weather forecasters in 1999.

INTERVIEWER: Okay.

DAVID ROTH: That was after we'd draw up the Pacific analysis, which we used to do between the 12 and 15 and 0 and 3Z maps.

INTERVIEWER: Okay.

DAVID ROTH: But uhm, anyway, we transitioned to basic weather. So there wasn't a conflict of interest; me being a surface analyst and the focal point. I was a basic weather forecaster. So uhm, I've been the focal point since 2001, I believe. It's either late 2000 or early 2001, which is a long time. But Mark did a lot of work in the couple years that he was the focal point uhm, between '99 and 2001. I used to see him all the time outside of work working on the… he wouldn't be able to socialize because he was working. He spent a lot of time on that large manual we used to have, which in 2003, Doug shortened substantially.

INTERVIEWER: It sounds like you've been heavily involved in surface analysis.

DAVID ROTH: Yeah.

INTERVIEWER: Uhm, so in your opinion, why do you feel that it's important?

DAVID ROTH: Well, the polar front, particularly from an HPC perspective, is usually the front that has the highest, uh, precipitable water values. So that's where your heaviest rain falls. In my mind, it's very, very important to find the polar front, regardless of how vague or broad it is. Because that's going to be your focus for the heaviest rains or if there's a mesoscale convective systems in the summer. I know a lot of, some people don't feel that way.

INTERVIEWER: Mm hmm.

DAVID ROTH: And the later of Sanders' work, it didn't feel that way. But from our perspective, it's very important to find the polar front. And that's where our philosophy differs from the uhm, operational people at the Tropical Prediction Center and Ocean Prediction Center, since they're more worried about wind increases. Those can be particularly strong behind secondary cold fronts. So there's a kind of a philosophical difference there between the different analysts. So.

INTERVIEWER: Uhm, so you mentioned, you know, using the surface analysis internally here at HPC for areas of precip and, SPC using it, OPC using it. Who are other users, uhm, inside and outside the government?

DAVID ROTH: Well, ultimately, TPC uhm, finds surface analyses important, too, especially when tropical cyclones are transitioning to extratropical. If it's clear that the cold front is caught up to the center, then they would declare something extratropical. So it's important in that vantage point. But just people who have an interest in general, who want to know, will it get cooler? You know, if you see a cold front coming through, usually it gets colder afterwards.

INTERVIEWER: Do you personally use a surface analysis?

DAVID ROTH: I look at it. I look at the loop online, the infrared loop with the uhm, the cloud, the colorized cloud imagery and the, and the fronts. Just like Louis (*Uccellini*) does.

INTERVIEWER: If you had to give a general definition of surface weather analysis, how would you describe it?

DAVID ROTH: The analysis of weather features and the isobars across North America.

INTERVIEWER: End of statement.

DAVID ROTH: Yeah.

INTERVIEWER: Okay. So moving on, uhm, starting back and you remember back when you first started working compared to now, what have been some major changes that have taken place?

DAVID ROTH: When I first started working here in November '98, we were still using Intergraph, which had really large monitors, you could zoom in. But the numbers got bigger. So people like working surface analysis. But the problem was you really couldn't get any more data when you zoomed in -- just the numbers got bigger. And you couldn't underlay any other fields; it was just surface obs. So it was a little clumsy. You had to keep using these up, up/right, right, down/right, down; you had a series of arrows to use. Although some of the functions on it were actually pretty nifty and when we went into NMAP, like the circle command, that was transitioned from Intergraph because it was a very nice tool to have an Intergraph. But uhm, in Intergraph, you had to wait until about 30 minutes after synoptic for the observations to be available for the map and for the objective analysis to be available, as well, of the isobaric field. So we couldn't even start the map until 30 minutes after synoptic. And then, we only had until -- depending on the map -- we only had until +127 to +144 to do the map. So we had between 57 minutes and an hour 14. And we did that three times a shift, so at that time, we did do the 9 and 21 Z analyses. And between the 12 and the 15Z maps and the 0 and 3Z maps, we do a Pacific analysis on a light table. And we'd have to blow up the surface analysis to like 150%, 160% -- might have been closer to 170 to, to pretty much the dimensions of the light table. It wasn't just a surface map. It was also that that was the 1000-850(*mb*) thickness. Uhm, sometimes we'd get a satellite image from SAB and we would blow it up. But we'd keep it off to the side and we had this printout of 1000-500(*mb*) thickness over North America we keep off on the side, too, as a check. And what you do is you'd, you'd use this acetate, this plastic-like material that you could see through, turn on the lights and see the couple layers of maps underneath. And then you draw on the acetate with this grease pencil and after you're done and sure you have things in the right place, then you transfer from acetate onto paper and usually, somebody will be willing to help you. Steve Flood was always willing to help when transitioning that to the paper. But then you had to clean off the acetate and at the time, they were using a cleaner that had a warning for cancer and it wasn't nice stuff. Uhm, so I transitioned to just using water, which didn't clean it effectively. In fact, it turned the thing orange pretty quick. But at least I wasn't exposed to that stuff because it wasn't, the area we had wasn't very well ventilated.

But that's how things were until February '99. In February '99, NMAP became operational for surface analysis. We were still doing the Pacific analysis at the time, so they had to come up with various file names that would work for both the Pacific analysis and the North American analyses. And that's why all the file names are like, have the underscore "noam_sfc" at the end. That, even though it says "noam_sfc", it's meant for all of them. So it has the data for the entire world on it. We had to make sure that all the Asian data, the Pacific data was on there, along with the synoptic data and the ship buoy data.

Uhm, that was a big change and then we dropped the Pacific analysis, I believe, in March '99. OPC finally got operational responsibility for the Pacific analysis. The Atlantic analysis had been dropped for years. So once we dropped the Pacific, there was no longer any relics of the Northern Hemisphere analysis we used to do from the 50s into the 90s. And we were just left with America.

But before the Unified, I believe it was Frank Pereira came up with a web page that had all the various centers worldwide that had maps that overlaid uh, or bridged over into North America. There were nine. One was SMN, which is the Mexican Weather Service, Environment Canada had one, Germany had one, the UK Met had one, TPC had one, OPC had one; I can't even remember what the other three were. But we had so many on this web page. It's nice; you can see how the other centers analyze things near the border. But they rarely agreed. So we tried to do what we could within the North American area. We did look at the other analyses, but we didn't let it dictate what we drew. But of course, that changed with the Unifed Surface Analysis.

INTERVIEWER: So the Unified Analysis, uhm, did it come about because of these differences in opinions?

DAVID ROTH: Probably so. I think it was Louie's (*Uccellini*)… you'd have to ask Louie about this, but I'm… This was directed from way above. I think it was Louie's vision to create analyses across all the national centers that led to less duplication of effort. Now, the North American analysis the way it was, significantly bridged over a lot of OPC's area and a decent portion of TPC's area. So we went to the Unifed; we had a much smaller area to draw for, which was helpful. But the problem is we still ended up with isobars over the ocean. So it didn't really reduce effort very much, but at least for HPC, it did reduce effort. I'm not sure the same could be said for OPC or TPC. They end up doing a lot more in a lot shorter time frame than they used to. They used to take six hours to do a surface analysis; now they're down to three.

INTERVIEWER: So who else is involved in the Unified Analysis?

DAVID ROTH: Well, there's us. There's HPC, there's Ocean Prediction Center -- OPC, Tropical Prediction Center -- TPC, and the Honolulu Forecast Office, which is also the Central Pacific Hurricane Center. They do analyses that cover a lot of the North Pacific all the way down south and to the equator. TPC's actual map also goes up to about 50 north and goes down, I think, slightly south of the equator. So there alone, you can see how both bridged well into the North American surface area.

INTERVIEWER: If you could go start to finish, like, how do you describe how the Unified gets done. You know, like starting 0Z, when the obs come in at 0Z…

DAVID ROTH: Okay.

INTERVIEWER: What's the process?

DAVID ROTH: When the observations come in at 0Z, we start our surface analysis for North America. Now with 0Z, we don't have to deal with fronts over the oceans because OPC will provide that. But we still have to deal with the isobars. So usually, we start with the analysis over the United States because the Canada obs aren't available till about ten after a synoptic. So after you're done with the United States, then you go up into Canada and it's preferable to do like a roam ten so you can see almost all observations that are available, except in some of the metro areas. You do the Canadian analysis and then before the clipping begins, you look over the oceans north of 30, north of the Pacific and north of 31 in the Atlantic and see if the auto, automated analysis, the objective analysis has actually done a reasonably good job. But it's good that you got last because ship obs can continue coming in until hours after synoptic -- but particularly until three hours after synoptic.

That's part of the reason why the ocean centers have such a long deadline compared to us. Uhm, over land, you have pretty much all you're going to have by 15 minutes after synoptic. But then you check over the isobars and then at the top of the hour, uhm, in theory, the Tropical Prediction Center and the Ocean Prediction Center, between and hour and an hour 15 they're supposed to finish their analyses and let us know when it's done. Uhm, if they let us know early, it's best to wait anyway in case they're going to change something. But then you clip, I've been in the process of clipping TPC before OPC because you have to deal with isobars in additional fronts and you have to connect the isobars, connect the fronts, coordinate if the fronts are really at a tolerance or a front goes to a trough or a trough goes into a front, then you may have to collaborate with TPC and same with OPC. At least with OPC, you're just clipping in front. It's not pressures. And then you have to modify your pressures to fit their fronts. And then our part of the process is done by an hour 30 after synoptic. After that, portions of our map go to OPC and TPC. OPC separates our map at 105 west longitude, splits it apart. The eastern portion goes to the Atlantic desk, the western portion goes to the Pacific desk. They change nothing over land. They draw their analyses, re-stitch them together, wait for the Tropical Prediction Center's analysis to be done, which is around two hours and 15 to two 30 after synoptic. Then once that's done, OPC re-stitches both half of their analyses with the TPC portion -- stitches it all together -- and then by three hours 15 after synoptic, they send everything out as the Unified Surface Analysis. And that only goes on the web. For now, as far as I know, it's still not the analysis of record. But it's the closest thing the Weather Service has outside of daily weather map.

INTERVIEWER: Okay.

DAVID ROTH: It covers a much larger area than daily weather map. Not quite the scope of the northern hemisphere analysis, but it gets over half.

INTERVIEWER: Okay. Now going to when you personally worked the desk, can you tell me about the procedure and the methodology you use when you're sitting down and the obs come in; how do you draw your map?

DAVID ROTH: Well, what I do is when the obs come in at the top of the hour, I go to a US map roam 10. And draw in the intermediates at first because you don't have the objective analysis before about 18 after. Draw in intermediates, find your boundaries, draw your boundaries. Place your lows, place your highs. Uhm, and then when the objective analysis comes in, uhm, append it. Now when you append it and you've already done some intermediates, then it actually becomes pretty easy to modify your actual isobars because you already have a good idea where the isobars need to be modified. Uhm, I can understand why other people do that, too. So then you go in, you change the regular isobars. If you don't feel the intermediates are all that rele, relevant, you can delete them. But it's nice to leave it in for detail, uh, particularly across the west, uhm, the high plains and the lee of the Appalachians to find your lee troughs or lee lows. Then you go into Canada and that, we have many fewer obs over Canada so it's much easier to draw and you can quickly. Usually, I spend about 30 minutes on the United States, then spend about 15 to 20 minutes on Canada and Alaska, uhm, of which we get all of mainland Alaska, but none of the Aleutians. And I usually do a Canadian map roam 10, draw in Canada. Then go to Alaska roam 4, which will get you all you need in Alaska. There just aren't as many obs. After that, go to the North American view, modify the isobars. Usually at that point, it's 50, 55 after so you've got five or ten minutes to modify the isobars over the ocean before you clip in TPC and OPC. I usually try clipping in TPC first at about an hour, or whenever I finish Canada and Alaska. Because I don't clip them before I finish with Canada and Alaska. Uhm, clip them in, connect the isobars, connect the fronts. Collaborate if you

have to. Uhm, if there's a difference between OPC and TPC, let them know but compromise for the time being. They really don't need to come up with a collaborative solution near their border quite yet. So they don't have to, and sometimes they don't. So then it's left up to us on our map to do what we need to do over the ocean. Because no matter what we do over the ocean anyway, it's clipped out for the uhm, Unified. So send the map anywhere between 1:15 and 1:30, depending upon when you finish.

INTERVIEWER: It's out the door.

DAVID ROTH: Yeah.

INTERVIEWER: Uhm, can you list the features that are on a surface map?

DAVID ROTH: Okay. Well, we have surface highs on, on the map, surface lows, troughs, fronts, tropical waves. Our map doesn't particularly have the ITCZ. It's a little south of our map area. But we do have shear lines. Let's see; cold fronts, occluded fronts, stationary fronts, warm fronts. We do outflow boundaries with a trough symbol and we group labeling to it, for outflow boundary. For squall lines, we have a special symbol for that and we label it "squall line." Shear lines we label for "shear line," at least locally. There's no decision yet, uh, through all the national centers. The label is shear line but both us and TPC are for that. So we're on their side when it comes to that. Uhm, I believe that's it. Oh, dry lines.

INTERVIEWER: Okay.

DAVID ROTH: Dry lines. And we don't have to label those because they're such a unique symbol. But they always point into the moist air mass. They're the one front we have that doesn't point in the direction of motion all the time.

INTERVIEWER: How do you personally find a cold front?

DAVID ROTH: Looking at the obs.

INTERVIEWER: How do you find a warm front?

DAVID ROTH: Looking at the obs. But all, with warm fronts, what you like to look at is areas of stratiform rain and make sure there's areas of stratiform rain rather than a warm conveyor belt. Because it can be very confusing at times when you're just looking at observations. Uhm, cold fronts are usually very obvious and have a line of thunder storms -- that's easy enough -- and stratiform rain behind them. But sometimes you get outflow boundaries and squall lines that run out in advance. So if you see something with northwest flow behind it, look back 100, 200 miles to see if there's another wind change. And if there is, your front's still back there. Uhm, usually we like to err on the side of caution and go inside, wake depressions with our fronts. That way, we're not getting too far forward.

INTERVIEWER: When you say "looking at the obs," what specifically do you, what's your go-to that you look for when finding a front?

DAVID ROTH: The station model. I mean, I use the station model and draw intermediates or use the isobars and I, I look at the temperature pattern. I don't particularly need to look at an isotherm

pattern. I mean, I can see the pattern in the obs. Look north to south and east to west, look for gradients. Uh, because, I mean, if you're behind the polar front, the temperature will drop off with latitude. But if you're not, it won't. Uhm, and you have to be careful with the troughs and dry lines because there could be cold air behind them, too, because of the lower dew points. But basically, it's the observation field. I usually don't use derived fields initially. I mean, I've always got the 1000-850(*mb*) thickness underlay but I don't pay that much attention for a while. And then out west, you really can't. You have to use a 850-700(*mb*). And even then, that can, uhm, confound you in the spine of the Rockies. So then you use your judgement and what the obs tell you. When the winds are southwest at Grand Junction, the front's probably not passed them, that kind of stuff.

INTERVIEWER: Just by listening to you talk, it sounds like there can be controversy-- at least coordination needed--between us and TPC and OPC about the location and placement of fronts. Uhm, what do you think the major disagreements are in surface analysis?

DAVID ROTH: Well, one of the bigger disagreements is in warm fronts and that's as true as much internally as externally. Uhm, some people feel you should only look at the temperature pattern. Others of us feel you should also look at the moisture pattern. And especially during the warm season, you may end up with warm temperatures way north of where the warm front may actually reside because you don't have the stratus in the warm season most of the time. You don't have the overrunning drizzle that you might have in the cold season. You may just have some convection and that's that. So some people look much more for wind shear, but sometimes you're just not going to have wind shear along your warm front -- at least not noticeable wind shear. We see that in autumn and fall, winter and spring -- unidirectional southwesterlies and you see 80s and 70s generally fall off to 60s, 50s, 40s, 30s. Some people want to go way up with the southwest, or southerly flow changes to easterly, which could be 60 degrees into your cold sector. Uhm, I like the old Norwegian cyclone model because it actually does address three-dimensional structure if you have fog or stratus or drizzle, then you're pretty sure you're in the cold sector. Uhm, I also, we had a mid-latitude book by Carlson, who actually ends up being a professor at Penn State. He was very much for going more for dew point than temperature and that really helps you out in the warm season. I think if you're going to err towards the side of caution, you have to go with dew point break above temperature break. But then there are other people, like Sanders, that late in their career thought you should only go for strong temperature differences. If that's true, you'll never have a front in the western United States. You may rarely have a front this time of year (*summer*) in the United States if that's true. Makes surface a lot easier.

INTERVIEWER: So it's been a while since the last major change in technology for surface. It's been almost ten years.

DAVID ROTH: Yeah, I guess it's been, eleven? Yeah, eleven years. It's been since '99.

INTERVIEWER: So have you ever given a thought about what the next major change in the technology of where surface analysis is headed in the future?

DAVID ROTH: Not really. It sounds bad, but uhm, surface analysis has been roughly the same since 1918. I mean, we didn't adopt it as an agency until about 1946 -- or no, that's wrong -- 1942. It was during World War II that we adopted surface analysis. Uhm, it might have even been'43, or sometime during World War II that we adopted it. And when it comes right down to it, I mean, granted, we're not plotting data on paper any more. The computer's been plotting the data since the mid-70s. Uhm, we not doing isotherms ourselves any more. They're being done by the Forecast

Guidance. The only thing I could really imagine that'd be different with surface analysis in the future is if we had an easy way of looking at things three-dimensionally so you can actually see the wedge, the leading edge of the wedge of cool air with a cold front and have it more of a surface. But we're nowhere near that day. We, our computational resources and our bandwidth would have to be so much higher than they are now. It's going to be a very long time till we get that. Then you can see the really shallow slope of the warm fronts. Then you can see the really strong curve of the cold front at the leading edge of a, the surface high. But it's going to be so long that I'm probably not going to be the focal point when this change is made. There may be a few more focal points before any real change is made. The biggest change we made, I think, with surface was being able to underlay the derived fields. That helped things greatly -- able to underlay the satellite or the radar -- that was important. That's the biggest change I think there has been here in surface, in our history of surface analysis. And unless we can start doing things three-dimensionally any time in the near future, I don't foresee a change.

INTERVIEWER: Uhm, do you ever think that the human analyst will be replaced?

DAVID ROTH: Maybe. I mean, if we're able to place things in two dimensions, or even three dimensions, there's got to be a way to create an algorithm to depict where the frontal surface is, as well. I mean, don't, I know the people who have come closest to this is I guess Mary, her name was Mary. I think she was at MIT. She came up with a way of using the RUC initialization to find boundaries. She didn't call them fronts; they were boundaries. Half of them would be troughs, half of them were fronts. But that's only useful east of the mountains. That's not especially useful in the west. I'm sure there's a way of doing it. It's just nobody's come up with a good way yet. If we had a perfect definition for frontal analysis, it would've been done by now. If we had perfect agreement on what a front was, it would've been done.