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

ORAL HISTORIES

BRUCE SULLIVAN
AUGUST 24TH, 2010
WORLD WEATHER BUILDING IN CAMP SPRINGS, MD

INTERVIEWER: And can you state your name?

BRUCE SULLIVAN: My name is Bruce Sullivan.

INTERVIEWER: And your birthday and hometown.

BRUCE SULLIVAN: My – my birthday is – my birthday is November 17, 1953, and I currently live in Bowie, Maryland.

INTERVIEWER: Where did you study meteorology?

BRUCE SULLIVAN: Um, I – I studied meteorology at the University of Maryland. I attended there in 1973 through 1976.

INTERVIEWER: And how did you become interested in meteorology?

BRUCE SULLIVAN: That's a good question. I became interested in meteorology when I was quite young, actually. Um, my dad was a really big into weather and we used to, actually anytime it would snow we would all go out and walk around when it was snowing and in the evening. And I remember particularly the big storm of 1966 there was a blizzard and you know we – there was a party at our house that night and he had to go get beer and stuff at the store so we –we walked, and it was really quiet. Snow was falling down, and we were the only two out there, and we had to walk about a mile to – to get the beer and – and uh, it was just neat. Neat walking with my dad and just talking, and it was so quiet, and so it was kind of back in that time I guess that is when I really started getting interested in weather and – and anticipating snow storms and anticipating getting off of school from snow storms.

INTERVIEWER: And how long have you been with the weather service?

BRUCE SULLIVAN: I started with the weather service in March 1980, so I have been with them over 30 years now.

INTERVIEWER: And can you tell me a little bit about your career with the weather service?

BRUCE SULLIVAN: My career? I started as an intern in Jackson, Mississippi. Started there in March 1980. Uh was there through 1984 and uh, it was a neat little office because we had a lot of the programs we had a – a surface observation desk, radar observation, we had upper air. Uh, back then they actually had a NOAA weather radio room that was actually handled by contractors that worked – worked for the uh, office. Um, I think they were out of um, Mississippi State University. We had a hydrology desk and we had the forecast desk, aviation desk, uh, am I missing anything

else? I can't think of anything. Back then they had that was a – Jackson was considered a weather service forecast office. You had weather service forecast offices and I can't remember how many of those we had across the country but uh, there were fewer of those they were called like the super WFO, they were weather service forecast offices and weather forecast offices um, a lot of those were uh maintained or uh staffed by met techs. And although they didn't forecast, they might have put out local forecasts that was about it. Other than that their main functions were to do uh, either upper air or radar and – and surface operations.

INTERVIEWER: And then how did you get to HPC or when did you go to HPC?

BRUCE SULLIVAN: Well, I went from the Jackson office and uh from there I went to uh weather service headquarters in Washington and what was called the RADOT 2 program. It was kind of like a precursor to next uh NEXRAD they did volume metric uh one of the first volume metric radar samplings uh, they did um and they were at about a 10 to 12 offices they just uh it was a computer hooked onto the conventional WSR 57 radars and they also had a color radar display and a lot of products that we are now seeing in – and now what we now see in NEXRAD like uh severe weather probability, uh, I think they had accumulated rain fall. So anyways I was – I was the program manager for that for a little over a year. And then I came to HPC in 1985, which at the time was, um, we were the forecast operations branch for the in the um meteorological operations division and I can meteorological operations division consisted of um the forecast operations branch and I think the aviation branch, SDMs were part of that. Um, we did not have, um marine branch at the time that I am aware of.

INTERVIEWER: When you first came to HPC, what was your initial position?

BRUCE SULLIVAN: When I first came to HPC I was hired as a surface analyst and there were at – at the time there were only three of us; I think Steve Flood, myself and Davey Volz. There was a fourth not too long after that but uh, there were there were four of us assigned strictly to the surface analysts and um, at the time we were all GS-13's. The surface analysis position was a GS 13.

INTERVIEWER: How long were you a surface analyst for?

BRUCE SULLIVAN: Well, I did it on and off for a long time because even if you did something else you still had to work the uh surface desk, analysis desk. I would say that I was pretty much a pure surface analyst for about a year and a half and – and then I went from there to the basic weather desk.

INTERVIEWER: Can you give me a definition in your own words of surface analysis?

BRUCE SULLIVAN: Surface analysis; that's the uh basically what we did was using uh data uh that was uh compiled over in Suitland, Maryland consisting of um, uh, observation surface observation from land based stations and from ship based stations, buoys, some automated stations it was all compiled over in Suitland and plotted out on maps. And uh, these maps we would uh actually uh analyze them for – for where fronts where, where we thought fronts would be and analyze pressures across the maps. So it was just analyzing surface data.

INTERVIEWER: Okay, and can you list the features that are included on a surface weather map?

BRUCE SULLIVAN: Well there are certain features that are definitely that are automated that were automated when I first got there. Actually when I got there in 75 uh in 85 it had been 10 years since the last hand plotted map, so that was all automated when I got there in 85, all the data was plotted on these maps and uh, those maps were then pieced together by the technicians and brought out to us and then on the surface uh plotted data would have things like it would have the temperature, pressure, present weather indicator, pressure tendencies, um, it had wind speed and direction. Um and I may have left a few things out but those were the core things. We would analyze every three hours we would do a North American uh analysis and included in that we would of course draw where we thought cold fronts, warm fronts, stationary fronts uh would be and also analyze pressures uh every four millibars.

INTERVIEWER: Okay, and why do you think surface analysis is important to the field?

BRUCE SULLIVAN: Uh, surface analysis is really uh important uh for the fact that it is kind of a basis for a lot of weather. We live on the ground and uh what falls from the sky comes to the ground so we – we want surface maps. There is an indication of the present weather, temperature, course is important, we want to see what is coming toward us, uh, so analyze where the fronts are is important uh for uh a number of uh just people aviation industry um, a lot of things.

INTERVIEWER: Who are the main users of surface analysis charts?

BRUCE SULLIVAN: Main users of surface analysis chart, well, when you think of it where most people see it is on TV, I think that most of the public would see a surface map on TV but not to the extent that we draw it. Usually it is very simplified on TV. They draw uh where fronts are and the high and low pressure systems. So it is a very simplified map but the – the um the other forecast offices would use it um of course, others might be some other government agencies would use it, pilots use it for briefing, for pilot briefing. Those are the main ones I can think of off hand.

INTERVIEWER: Do you personally use a surface map ever?

BRUCE SULLIVAN: Uh yea? Do I use a surface map? I use it all the time, especially depending on what job I am doing at the time. Uh, knowing where fronts and – and high and low pressure systems are are important for doing uh quantitative precipitation forecasts, which I do most of the time. But other desks as well look at that.

INTERVIEWER: Alright, and thinking about when you first started working a desk, and then what it is today, what are some major changes that have taken place?

BRUCE SULLIVAN: How has the surface map changed over the years? Well, when I first got here um, there were a lot of people that worked on the map. You had one surface analyst usually during the evening and night. During the day time you had two. The surface analyst was responsible for analyzing fronts and high and low pressure systems over uh the lower 48 and most of the land mass of Canada. Over the ocean areas you might have a met tech or another meteorologist doing either the Atlantic or Pacific, so you usually had three people working on a map. Um, we did the map on a light table. The map would be, um, plotted on a plotter about 20 minutes past the top of the hour. That would be considered our – I think we called it our raw one data. We get that plotted out. Of course we put it, again, we put it on a light table. We usually put the old map underneath there so we could kind of gage where the old fronts were and uh and then we begin our, we would put on the acetate over the top, usually clear acetate over top and then we

would analyze the data using a grease pencil at the time. Um, we also, what, we would also would give fronts a three letter there numerical three digit character. Uh that character represented the uh what type of front, the character of the front, and the intensity of the front. For instance, like a cold front would have been a – a 4, let's say a 4-2-O. Four meaning cold, second that it was weak, 0 meant no change in the intensity. The first number of it was zero it was stationary, if it was six it was occlusion, two was a warm. I think a seven was we use that for a squall line. The second number again was the intensity of the front, the low numbers meant it was fairly weak, higher numbers meant it was fairly strong, and the last number again was the um, character of the front. Five usually meant it was a forming front, and eight meant it was a very diffuse front. Zero was no change. I'm trying to remember all these. Uh, seven – seven was with waves. So you had, a like a two, so you have 2-5-7, that was a warm, uh moderate warm front with waves. You know we would analyze all of North America and the ocean with grease pencils, and we would have a little rag, and if you made a mistake you would erase it with a rag and re-draw again.

And then you get another a raw two. You got that about an hour past the top of the hour. That would include all data that was uh, um, collected at Suitland at 40 minutes past the hour I believe. That was sent to us. We would use that raw two data plot, which again had additional data, put that on underneath. Usually what we would do is put that underneath of the um, new map, and we would circle underneath, you could see which was new data, circle it and then again put the acetate on top. You could just look at the new data to see what you might have to change. Usually the change would be more over the ocean than any place else. And uh at uh not too long after that you got about maybe 10 more minutes then uh, then the real push came because then that uh about 10 minutes quarter about 15 minutes after the hour then we would have to trace, and we would all trace with a, I believe we used pencils and then we went toward a uh black felt tip at some point, but initially I believe it was pencil. Um, and we would again trace all the all of the isobars, trace all of the high and low pressure systems, get all the pressure values uh, fronts had hash marks. We would again put a coding for all the fronts, and then we would sign our map. And then that map would be taken, again, you would usually have like four or five people come over and help you trace that map because it had to be done quick. The map would be scanned on a digitizer uh and it had to meet this fax deadline. So you had to rush and take that map in. Sometimes, depending on what time, I think on the synoptic times we actually sent out three sections of that chart there was a Canadian section, an Alaskan section, and a north a US section, so sometimes the met techs would take the map, make a Xerox copy, cut it, and uh those portions to get digitized and you take the map over to the digitizer, put it in the digitizer, punch in the digitizer code for that corresponding time because there was a 15Z map you had to punch in the digitizer code of the 15Z map and then it would scan it. And um, all those maps, all the North American maps and the Northern Hemisphere maps had specific times they had to be in there because they all had fax deadlines, the facsimiles would start uh sending out those maps um at a certain time. If the map wasn't in, it would go out blank and you wouldn't have any other chance to get that map out because there was not another allotted slot for that. It was critical you got that map out into that digitizer at a certain time.

Back then we used to – we tried to draw toward the Norwegian cyclone model. Uh, we had a lot of rules of thumb on how to draw fronts through certain areas of the country. We had a list of good stations out in the mountain areas, some bad ones not to follow, we actually had an underlay that we would put on. We would have uh, check uh some of the stations. And back then we didn't really have a lot of the tools that we have today. We didn't have satellite data we had kind of a static satellite display with a punch – punch uh key punch that you could get different sectors of the country but you couldn't change those readily. Those were all set by NESDIS at the time, so you might have a VIS over the U.S. but you couldn't zoom in over that. Over the larger ocean areas we

had to rely a lot on NESDIS for that information when we did our North American maps. Uh there was no um marine prediction center at the time or OPC, ocean prediction center, um, so we did – we did everything. Uh we did the North American every three hours, we did a north Northern Hemisphere map every six hours. And again several people worked on that – that those maps. Um, since then I think, I believe sometime in the late 80's early 90's we actually went to an automated isobaric map for a time period and it was because of budget concerns. And we would just draw fronts in there, and actually we weren't allowed to modify the isobars. And beyond that time, we gradually transitioned uh toward workstations, we got away from actually doing the analysis on a work station, we got less staff and we transitioned to only one person doing the analysis.

With the growing technology with computers we, uh, nowadays we are able to I guess we started in the early 2000's or late 1990's we went to the work – workstation where you could uh do your analysis with a uh a mouse uh and you could uh um underlay or overlay satellite data, radar data. That is another thing – we didn't have radar data back in the – the mid 80's initially. We got that soon after I got there, but again, it is kind of a uh, it is a national radar map. You couldn't underlay it on the map. A lot of stuff you did back then you had to kind of eyeball it. You might have a satellite you eyeball it and radar you had to eyeball it and sometimes we didn't get the data it wasn't uh we didn't get it on time or we had some um, problem with the data getting there so it is where we progressed quite a bit since the 80's. Doing the data now at the workstation, the analysis on the workstation we get more data, uh of course you can underlay satellite data, radar data, model data, a lot more model fields we have now than we had back then. It uh, it really has changed quite a bit. Probably for the better and of course we get those centers that are uh again back then we were MOD, Forecast Operations Branch, uh now we and since then we got the ocean – ocean prediction center uh and TPC all doing their own analysis and blending the maps together.

INTERVIEWER: Alright. You listed a lot of changes in technology, I mean going from drawing to um, drawing with the grease pencils to going to the workstations, and they all seem to be very positive changes. There is a lot more data available, but can you think of any negative impacts it has had on the surface analysis chart?

BRUCE SULLIVAN: Well I tell – I tell you, to me uh there is no substitute for doing uh an analysis on paper. You can see a much broader, bigger area, um, you can't really replicate the drawing of a hand with a mouse. Um, so in that aspect I think we are going to take it a step back. I think doing an analysis on paper is much easier than doing it on a workstation, but the workstation compared to back in the 80's, you can put so much more data on there and you can make it look neater. Uh, drawing it with hand isn't as smooth as drawing it with a mouse and you can, you know, apply some corrections with a smoothing and things like that with the computer which you can't do when you are drawing. Unless you got a very neat hand styler.

INTERVIEWER: So all in all, it has been mostly positive changes?

BRUCE SULLIVAN: Mostly positive.

INTERVIEWER: Yea. And then talking about when you worked the surface desk, if you worked the surface desk here, or if you made a surface map um, what is your procedure, what do you look at? What is your personal go-to methods for creating a surface map?

BRUCE SULLIVAN: Uh, we were always taught that fronts lie in troughs. Um, so I would and – and that is just the way we were, we were taught, and you uh you get uh I wouldn't say you get smacked, but you had to follow the rules back then. And that was basically, you weren't a rebel, you followed the rules. So uh when they said fronts lie, tended to lie in troughs, we would put fronts in troughs. Uh, we would look for wind shifts, of course, pressure troughs, um and uh, well you always, we used to have some contention about certain things like coastal, coastal fronts or troughs were always a little different because in the winter time you got that natural uh tendency for the ocean was always warmer than, especially when you got very cold air masses coming in across the Northeast, you tend to get set up a really strong baroclinic zone along the coast. So any time you got any bit of an east wind coming in, you bring some of that warmer air in – in across the ocean into the land areas you develop a – a natural wind shift line and – and a big thermal contrast but it is usually very shallow. So we were always taught that fronts had to be vertically consistent too. So if you had a cold front on the surface you had to have one, you know at 850(mb) and all, again, following some concept, maybe part of that Norwegian cycle model. But those coastal troughs are normally very shallow, again, so they don't really fit for the classic vertical consistency of true cold fronts. So that always brought up contention; is it a front, do we draw it as a front or a trough. So a lot of us would draw it as a trough. Nowadays we see people putting it as an inverted front north of lows.

So yea basically we try to draw fronts in troughs. It is not so easily noted that there is a good pressure trough in there, especially in the west with the mountainous terrain it is really hard sometimes to see a well-defined trough with fronts, so sometimes you would look for uh these three hour pressure tendencies, you would see these check rises behind the front, uh so that is kind of other things you look for. Sometimes with very weak fronts you might look for where there is a dew point, pretty sharp dew point contrast, but sometimes they don't, they lag well behind the fronts or way behind the pressure trough. So it just doesn't mix out, some of those fronts it doesn't mix out right at the front, it takes a while before the dry air mixes in.

INTERVIEWER: How do you find a cold front?

BRUCE SULLIVAN: How do I find a cold front? I look for where uh, of course there is usually a good wind – with cold fronts, there usually is a good wind shift, and with the wind shift there is usually a good pressure trough, and there should be uh some cooling behind there, so it is very, very simple if you look at uh like a thickness chart there is probably a really good thickness packing along the front, along the leading edge of the front. So those are the kinds of things to look for.

INTERVIEWER: Okay, and then how do you find a warm front?

BRUCE SULLIVAN: Warm front is a little bit more difficult to find. Uh, um, they do tend to lie in troughs as well, uh you see there is a slight, uh, it can be a pretty dramatic wind shift um, uh but sometimes not a very strong wind shift at all. Just, the slope the warm fronts are not as sharp as cold fronts. So you are not going to see very often times a sharp contrast, but again it is kind of the same things you look for in a cold front you look for um you know, wind shifts, troughs, um, pressures will fall behind the warm front, but not as fast as they are falling north of the warm front so that is another thing you tend to look for. You might see like a uh three millibar – three millibar fall in three hours north of the front and just south of it a little bit less like maybe one millibar. So that kind of a thing, those kind of things, you might look for. Oh, and also, I forgot about this – but sometimes you will see uh, especially with a warm front that has got some precipitation with it, you will see a lot of times fog around the warm front and then just to the south of the front it clears out

where there is no fog at all, the ceiling lifts. Those kind of things you might, that is another thing you might want to look for.

INTERVIEWER: Are there ever difference in opinions on frontal structure placement?

BRUCE SULLIVAN: Oh yea. We actually had, somebody may have told you this already, but we had a bunch of professors here many years ago. They were all working on a surface map and told to analyze it, and I forget how many people we had here, but they all came up with a different answer. And it is just basically um, what their perception of a front is. Some people think uh the cold air might lag behind a front, where it drops off significantly is where the cold front is. Other people look where the wind shift is and the trough is. Um, you know, there is a lot of differences in opinion with frontal placement with weak fronts. With strong fronts I think there is you know, there is usually pretty good agreement. It is the weak ones, that again we have trouble with because sometimes a lot of – a lot of things are very subtle. And who is to say who is right.

INTERVIEWER: Have you noticed a change in the style of analyzing surface maps?

BRUCE SULLIVAN: The style has certainly changed. Back in the 80's we drew main synoptic features. Uh, since then we tend to draw a lot more mesoscale features which – which are pretty important like outflow boundaries. We always used to draw squall lines, uh, but we do draw a lot more outflow boundaries, um, than we used to. Yea, I would say we do a lot more outflow boundaries. Probably more squall lines as well because we have the radar capability that we didn't have back – back then. But I tell you, the surface map was a high visibility product, even the director and the deputy director uh of NMC at the time would come up and look at the maps, and they would draw on the maps when they saw something that wasn't correct. And the bosses at the time were told we think this front is out here, so it was a very high visibility. It got scrutinized more than anything uh that we did here, the surface map surely got scrutinized.

INTERVIEWER: And thinking about the future of surface analysis, what do you see as the next step in technology?

BRUCE SULLIVAN: Hopefully somewhere in the next, not too distant future, we would be able to have something to actually replicate the actual hand motion of drawing. Um, something where you could actually, just on a tablet maybe, draw with your thumb or uh a touch sense screen where you could rapidly draw isobars and draw a front in and erase it easily. Something that would, again, replicate what you would naturally do with a hand and maybe a pencil and pen. Hopefully that is what we are going to go towards.

INTERVIEWER: Have you ever thought about the future use of surface analysis or products that are being issued?

BRUCE SULLIVAN: Have I thought of future use? No.

INTERVIEWER: Do you think the human analyst will be replaced?

BRUCE SULLIVAN: I would suspect at some point, um, but uh, the question is do I think the surface analyst would ever be replaced sometime in the future. And I think it is a possibility but we have been thinking that a lot of our tasks would be replaced by now, but they haven't because we

are still able to add value uh to the products. As long as we can add value I think there is a need to keep the analyst or meteorologist.