The American Meteorological Society in collaboration with
the University of Wisconsin-Madison Space Science and Engineering Center

An interview with

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NATHANS: This is Jinny Nathans, librarian and curator at the American Meteorological Society. It's October 1, [2019], and I'm at the Joint Satellite Conference in Boston with Jean Phillips from the University of Wisconsin-Madison from the SSEC [Space Science and Engineering Center], and we are interviewing Johannes Schmetz, also from Wisconsin.

SCHMETZ: Well not quite, I'm from Germany, yet I often visited Madison over recent decades. [. . .]

[. . .]

PHILLIPS: Thank you so much for agreeing to participate in this interview. Jinny and I have been looking forward to having this conversation with you. First, I'd like to hear a little bit about your academic training before we get into sort of your working career and other facets of that, but talk about your academic training and mentors perhaps that you had during that period.

SCHMETZ: First of all, thanks very much to you, Jean and Jinny, for giving me the opportunity to do this interview. It's a pleasure and an honor to do that.

My mentors? I certainly had good mentors. My first Professor, I got my PhD from him, was one of the first to work on radiation budget data from satellites. His name is Professor Ehrhard Raschke. He worked with Prof. Thomas Vonderhaar who is disciple of Prof. Verner Suomi. Ehrhard Raschke is certainly the reason why I eventually came into satellite meteorology. First, I worked with him on different topics.

Basis for my Ph.D. work was an aircraft experiment which was the first experiment of a brand-new German aircraft. That experiment was about radiation and boundary layer clouds. He asked me whether I would be interested to work on an aircraft campaign. It implied a lot of preparatory work, getting the instruments calibrated —very interesting. And then I used the data for my Ph.D. along with the development of radiative models. It was a very good and unique experiment because it was like a physics laboratory experiment. We measured the input data for radiative transfer models and measured the output parameters from the models too. So, it was like an experiment in a laboratory, except that we were outside, way out over the North Atlantic.

During that time I learned also to deal with experimental data. I learned to understand, which was very important to me, that good data are difficult to get. Later, visiting Madison and seeing Professor Suomi, I really soaked up as guidance a few of his proverbs. And one I remember from Professor Vern Suomi is: “There are three types of data: good data, bad data, and no data” [they laugh]. Suomi said, “No data is always better than bad data.” And certainly, that I had learned during the experiment.

PHILLIPS: Okay. Any other mentors that you wanted to— [talk about]?

SCHMETZ: Yes. After that I moved to the Max Planck Institute in Hamburg. There I worked on cloud and radiation problems in climate and the effect 3-D clouds. I also teamed up with a colleague and we put cloud-radiation interaction into his three-dimensional numerical boundary layer model. That was probably one of the first studies of that type. I remember we got a letter from Professor K. Kondratyev congratulating us upon our publications.

Then I moved to join the European Space Agency. And that was the point when I started working in satellite meteorology, using the expertise I had acquired in my previous work.

PHILLIPS: So, this would have been in the early '70s? Mid-'70s?

SCHMETZ: No, not quite, I started University in the early ‘70s. Got my Ph.D. in early 1981. I left Max Planck [at the] end of '84, and then started at the European Space Operations Center of the European space Agency (ESA) working in the Meteosat program. And that was quite a challenge. I had a wonderful boss, Mr. Johannes (Han) de Waard. He is an engineer with very broad international experience. Actually, Han and I still meet about five to six times a year over lunch and talk about many things and, of course, the good old times. We enjoy good food and talk, it just feels great. Han de Waard was a great boss because he gave me a lot of latitude to do what I thought is necessary. The first work I did at ESA was to calibrate Meteosat spectral channels. Tomorrow in my talk I will highlight that. When I started at ESA, the Meteosat satellites basically took images. And everybody liked the images on TV, the movie loops, all this, however, it was NOT calibrated. So, the quantitative use was extremely limited. In fact, Professor Hartmut Grassl, who later became the Director of the World Climate Research Program, said publicly in meetings: Meteosat is a UFO, an uncalibrated flying object [laughter]. He is the source of the usage of UFO in that context.

A few people felt a bit criticized. I thought he was right because it was not calibrated. I had to devise methods to calibrate the two thermal infrared channels. The visible channel was calibrated vicariously with aircraft campaigns. That was ok because the visible is relatively stable, degradation was monitored looking at stable desert targets. However, for the water vapor (WV) and the infrared window channel (IR), calibration varies substantially for technical reasons I will not go into. Therefore, we had to calibrate regularly, daily, or better several times per day. How could one do that? I thought, I can calculate the radiances from good data that are available. So, I used for the thermal IR temperature and humidity profiles ECMWF [European Centre for Medium-Range Weather Forecasts] short-term forecasts. And that works quite well because radiances reaching the satellite in clear-sky conditions are dominated by the temperature and humidity structure of the lower atmosphere and the surface temperature. We used clear-sky areas over the ocean as calibration targets. Sea surface temperature was taken from an operational NOAA [National Oceanic and Atmospheric Administration] product. That was the input I put into a very fast radiation model which I developed. Computer run time was a very critical issue in the operational system.

For the water vapor channel, it was tricky because ECMWF profiles for the upper troposphere were, at that time not realistic, rather from a ‘different planet’. ECMWF knew that, they couldn't even give me advice on which radiosonde is good and which radiosonde is bad. In order to succeed we had to develop our own quality control for radiosonde upper tropospheric humidity, it was very tedious work. Later, with my colleague Leo van de Berg, we accomplished an adequate quality control. And that way we could calibrate both satellites channels, not perfectly, but well enough to obtain, for instance, the height of winds from tracking semi-transparent clouds reasonably well. We did well enough such that Dr. Tony Hollingsworth, Head of

Research at ECMWF at that time, was quite pleased with the quality of Meteosat winds. That was toward the end of '87. It was around then when he said “Now the Meteosat winds are the best.” Nice compliment from ECMWF we thought.

That somehow triggered NOAA in Madison—it was Kit Hayden, Paul Menzel, and also Vern Suomi, because he was interested in the water vapor channel on Meteosat—to invite us to come to Madison. That was the beginning of a long cooperation that's still going on. I remember that, when I visited the second time, Paul invited me to present the Meteosat winds to a NOAA Winds Product Oversight Panel in Washington D.C. I presented what we had done, and then we started working together. Paul and Chris Velden, obviously, knew exactly how to take advantage of those topics and moved on further.

PHILLIPS: Well, Chris Velden also worked with Suomi on winds early on, and brought that to the mix.

SCHMETZ: Right. So, people in Madison were our counterparts for winds, they knew at least as much as we did. We told them what we did, and they told us what they did. We showed one another scientific code. We called it, at some point, friendly competition, which implied a constant sharing of new insight and progress. The big difference was that at ESA we did both, the development and the implementation of the software into the operational system.

PHILLIPS: So how has that friendly competition evolved over time? What other areas have you collaborated with that wouldn't have had the result they did had you not shared data, collaborated?

SCHMETZ: Various topics: upper tropospheric humidity, cloud products, and, a prominent one, was satellite calibration. I told the story that at ESA (European Space Agency) we developed a vicarious calibration based on a real-time fast radiative transfer model. Therefore, calibration was always on our mind. And the GOES [Geostationary Operational Environmental Satellite] satellite had a better calibration system than we did with Meteosat, so when Paul Menzel visited in, I think it was either '92 or '93, he came with the idea: let's do an intercalibration. We took Meteosat and GOES data, and we intercompared the radiances in the overlapping area, correcting for viewing angle. That was the start and we kept on doing that. Paul was, for a couple of months, in Darmstadt at ESA as a visiting scientist. There was no perfect agreement between the two satellite calibrations as we expected. We were off by more than 2 K, so we had a job to do. Another interesting step was: we felt that the intercalibration was so interesting that we brought it to the Coordination Group for Meteorological Satellites (CGMS). We presented papers at the annual CGMS meetings and informed other satellite operators about our activity. Meanwhile I joined EUMETSAT in 1995. Then in '97, that was during the 25th CGMS meeting in St. Petersburg in Russia, the time was mature to place a recommendation/action on other CGMS members operating geostationary satellites to perform satellite intercalibrations. The practical approach was to intercompare the AVHRR [Advanced Very High Resolution Radiometer] measurements from NOAA`s polar-orbiting satellites with the IR window channel of geostationary satellites looking at the same scene. That was probably a major step. It continued and satellite intercalibration became a regular activity of CGMS. Eventually, in 2006, it became the formal activity known as the Global Space-based Intercalibration System (GSICS).

The first GSICS chair was Mitch Goldberg of NOAA who led it into a successful broad activity.

PHILLIPS: Well, and that sort of leads me to my next topic, [which] is this idea of cooperation among agencies and sharing data among agencies seems to be such a good example of coexistence that maybe could be used in other areas of our lives and political sphere. But talk about that because Paul is a huge proponent of data sharing, and you are, and—talk about that and its value.

SCHMETZ: Well, I think working together brings us forward—I mean individuals and societies. When more people work on the same topic in collaboration, you create the potential to obtain more ideas. And when you have a common goal, then the probability that you achieve something useful toward that goal becomes higher. Simply there are more good brains working in the same direction. Of course, a prerequisite is the willingness of participants to share the achievement while the work is in progress, and that's what we did. And we did that also with other partners. We even shared scientific prototype code, which I think is useful because then partners see how a scientific idea is actually realized; it provides more and complementary information to a scientific publication. I should add that we could NOT share operational code when that was written by industry because then intellectual property rights apply.

PHILLIPS: It's proprietary.

SCHMETZ: It's proprietary information. But we could share the science ideas and their realization in terms of prototype software. And in the end, I think, it creates a win-win situation.

PHILLIPS: I always think of, and have referred to, you and Paul as sort of ambassadors for this area of science. And we need that kind of vision and leadership and cooperation, as you said, in order to have better ideas and improve.

SCHMETZ: In the beginning of such a cooperation it might not be a balanced exchange of ideas. Probably NOAA and EUMETSAT gave more to the new partners, new emerging spacefaring agencies than they received back. But to me, that doesn't detract from the idea because it is investing into future cooperation. And, of course, I like also the idea—what you, Jean, alluded to—I like the idea that it's for the better of mankind when we work together for a good cause. And we make friend and we become friends by working together, which is wonderful.

PHILLIPS: And it's best.

SCHMETZ: Yes, absolutely.

PHILLIPS: Talk a little about the time that one of our— one of the U.S. satellites, I don't remember which GOES satellite it was, failed, and EUMETSAT moved Meteosat into position so that it could cover both Europe and the U.S., right?

SCHMETZ: Yes. That was the launch of GOES-8 [Geostationary Operational Environmental Satellite-8], that was the first one in the new series, which unfortunately had failed. The fortunate thing was that EUMETSAT—at that time it was already EUMETSAT, but the operations were done still conducted by ESA —agreed to move Meteosat-3, a spare satellite so to speak, to the Western Atlantic in support of NOAA. Then the United States had again a two-satellite system which is needed to cover the huge area of the United States plus the area of interest, which is the Atlantic, for hurricanes primarily, but also the Pacific, for the storms coming from the West. Meteosat-3 then covered the Atlantic.

It was a coincidence that Meteosat-3 had just arrived in that West Atlantic position when hurricane Andrew hit Florida. So, the European satellite was immediately helpful to the USA. The satellite move was a big technical thing realized by NOAA engineers and ESA engineers, under the lead of Johannes (Han) de Waard from ESA/ESOC. The principle, help your neighbor, is nowadays explicitly spelled out by CGMS. There are agreements with partners: if someone has a significant failure and a neighbor has redundancy, mutual support is planned for.

PHILLIPS: That's good. Where do you see the global observing needs heading in the future? What do we need that we don't have or—

SCHMETZ: That's a difficult question which probably I will most likely not answer satisfactorily because depending on who is working in which area, they have different lists of priority. But let's take NWP [Numerical Weather Prediction] as a main customer of our satellite data. These days satellite data are the main data source for global numerical weather prediction, together with conventional data such as radiosondes or other in situ data, aircraft measurements etc. We need to improve the measurements both in terms of quality and quantity. For instance, the Europeans, the European Space Agency, has put a wind lidar successfully into orbit. And the data seem to be very useful and give positive results in NWP. Once we have more of those measurement will presumably be a big step for numerical forecasting. And now, as it has been demonstrated, I think that's one thing one should follow up.

An interesting story related to that is from the very first International Winds Workshop, which was hosted by NOAA in 1991. There was one talk on a proposal for a wind LiDAR in space. And the vein of the talk was also that atmospheric motion vectors or the satellite cloud track winds would become a sort of second-class wind information. In principle, that was not incorrect. However, it took nearly three decades until the wind lidar in space was realized. So, the message from that is: harvest the low-hanging fruit first, do what you can with what you have. However, don't forget to go into new territories and develop new and better things.

PHILLIPS: In terms of future Meteosat, Europe will have a hyperspectral sounder. I know that that imager sounder is also under discussion for the U.S. From your perspective, where do you see that going?

SCHMETZ: From my perspective, what has happened in Europe benefitted from our partnership. I will say it again tomorrow in my talk. The idea for a geostationary hyperspectral sounder comes from the U.S., the scientific champions of the idea are Professor Bill Smith, Dr. Hank Revercomb, Dr. Paul Menzel and others. They developed it. EUMETSAT will fly a hyperspectral sounder in a geostationary orbit on Meteosat Third Generation (MTG). Interestingly, China has realized it already. They have the GIIRS instrument in geostationary orbit, they took the idea and made it happen. I think the data will be extremely useful, in particular for short-range NWP, because the instrument provides changes and gradients both in space and time, which can be assimilated into models. Having said that, I am pretty confident that the U.S. will follow.

PHILLIPS: Well, it's another example of the sharing of ideas and technologies.

[. . .]

SCHMETZ: Yes, I'm pretty confident that the U.S. will follow and have their own geostationary hyperspectral sounder. It was interesting, yesterday Dr. Louis Uccellini had it in his talk listed as a fairly high priority. And I also heard from people from U.S. industry, Harris for instance, they're pretty confident that it can be done in an adequate way.

PHILLIPS: For the next generation.

SCHMETZ: For the next generation. Yes, it cannot be bolted onto what exists. There's little risk, so to speak, engineering-wise. Whereas, what I earlier described, the development of wind LiDAR was, in terms of technology, risky because one stepped into territory which was not completely known.

PHILLIPS: What do you— As you look back on your career, what do you see as the highlights?

SCHMETZ: Highlights? That's difficult. Actually, it was all very good. I liked going to work every morning. Sometimes it was a bit too much. I probably detracted too much time from my family and need to apologize and be thankful to them. Important was that I had good bosses lending support when needed. There is one nice example I could quote: At EUMETSAT the Meteorological Division which I headed and built up was initially very small, literally a handful of people. Demands were high. The majority were engineers and they often asked: "Can you do this? Can you do that?" On one occasion my boss Alain Ratier, he was the Director of the Technical Department, helped me by saying to my engineering friends, "Look, capability is not a synonym for availability." That saved us [laughs]. We could not possibly do it all."

PHILLIPS: And you progressed. You became later the Chief Scientist.

SCHMETZ: Right, at the end, that was a very pleasant step. I had built up the meteorological division pretty much from scratch. Then, in 2012, EUMETSAT went into a reorganization and the Director General decided it would be good to have a chief scientist working closer to himself an doing specific things and also with the head of strategy and international relations, Paul Counet. That's why the position of chief scientist was created. I was immediately very interested because I had done my job, which I loved. When asked I said to the Director-General, Alain Ratier, "I'm quite happy to take out one unknown in your equations for the new jobs. I'm very happy to take the job of a chief scientist." And that's what happened.

I prepared and conducted various projects. A highlight the Climate Symposium 2014 which EUMETSAT hosted in Darmstadt. Several hundred people attended and we had top-notch scientists. To prepare the science part of that meeting together with Dr. Ghassem Asrar was a wonderful challenge and the Symposium was very successful.

PHILLIPS: So both you and Paul Menzel are students of history, and you have written about the history of meteorological satellites and programs. And I think the interview that you have there is based on the article that you and he wrote for an AMS journal, *Weather, Climate and Society,* I think?

SCHMETZ: Yes, partly.

PHILLIPS: Yes. So since we're at an AMS meeting, just talk a little about how that article came together and why you decided to do it and, you know, [the] response that you've gotten to it.

SCHMETZ: Well Paul and I, we had always talked about how we see the future: what is difficult, what are the low-hanging fruits, what should be a priority. We had both our experiences with how satellite programs were done, and what lessons one could draw from how it was done, what could have been done better. At one point I asked Paul whether he would be interested to write such a paper. It took quite a while to write it. We both started writing contributions to the paper, bits and pieces, long before it was submitted.

And why did we write it? As we say in the introduction of the paper, "We've lived through that." We started both as hands-on scientists working in satellite meteorology, and we made it up to what you would call medium-level management, not top level. We always worked for the top level and we had close interactions with top level, which means top level talked to us continuously, they asked us. We thought we write down a few salient messages. Of course, we put emphasis on the positive things. Things that could have been better we mention too. Actually, already the response we got from three anonymous reviewers was extremely positive.

And then we also wanted to write down a few ideas which could be quite far-reaching. One is a paradigm shift about considering the planning of future global observation system for meteorological satellites from the outset. Right now, we do very well in terms of coordinating our satellites, in particular via CGMS, WMO, CEOS. EUMETSAT, for instance, covers the mid-morning polar orbit and NOAA the early afternoon orbit and so on. China promised to fill the open early morning orbit. And we have a ring of satellites in the geostationary orbit from different nations and agencies, so it's all complimentary in a very nice and effective way. Paul and I, we dare to take it one step further, asking the question: could we do the planning from the outset? The simple picture we had in mind was: All come with their plans into a big room, and then the tasks or satellite missions are distributed. For instance, one could build as many hyperspectral infrared sounders as globally required, and then the instruments would be operated by the respective nation or agency. The same for other instruments. Clearly big savings could be made on economies of scale because the most expensive satellite is always the first one. With the same amount of money available, one could achieve a lot more. But, of course, we are not naive. We know there are obstacles which are huge. For instance, industrial policy. However, if nobody spells it out, it will never happen. And then, is it totally unrealistic? We do not think so. We have already an example: For the initial Joint Polar System, EUMETSAT and NOAA exchanged instruments. On METOP-A, -B, -C, EUMETSAT flies the US AVHRR imagers, and the AMSU-

A [Advanced Microwave Sounding Unit-A] microwave sounder, and on METOP-A and -B there are also the HIRS instrument. And in return, the microwave humidity sounder (MHS) came from EUMETSAT to NOAA for NOAA-18 and -19. We think those are nice example about an exchange of instruments. An avenue one could consider in cooperations in the future.

PHILLIPS: Are there any other areas that you would like to talk about, or stories that you'd like to share that we didn't touch on? I'm sure there are many.

SCHMETZ: Well, nothing comes to my mind, nothing I can add to round it off.

PHILLIPS: Okay. I want to thank you so much for sitting for this interview.

NATHANS: Thank you.

SCHMETZ: Thank you, it was a pleasure. Let me end by saying I feel extremely grateful to all my friends and colleagues I met and worked with during my career. Thanks to everybody.

[END OF INTERVIEW.]

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