JOSEPH SMAGORINSKY
1924–2005

Joseph Smagorinsky, the "inventor" of the third leg of physical science—numerical simulation based upon the dynamical, mass continuity, and thermodynamical equations of classical physics—died in September 2005 following an extended struggle with diabetes and Parkinson's disease. Our loss of Joe was magnified because he died very shortly after the September symposium honoring the 50th Anniversary of NOAA's Geophysical Fluid Dynamics Laboratory, which he pioneered in 1955, and where he served as its director for 28 years.

Smagorinsky was born in 1924 in New York City, a son of Jewish immigrants from the western region of the former Soviet Union. He showed an impressive early interest in engineering and science, with a particular interest in naval architecture. He later was fascinated by weather, so he enrolled in the Department of Meteorology at New York University (NYU) in 1941, the year in which the attack on Pearl Harbor pushed the United States into full-scale participation in World War II.

In the middle of his sophomore year at NYU, he entered the air force and joined an elite group of cadet recruits, chosen for their talents in mathematics and physics. Those talents led Smagorinsky to be selected for the air force meteorology program. He and other recruits were then sent to Brown University to study mathematics and physics for six months. He was then sent to the Massachusetts Institute of Technology to learn dynamical meteorology. His instructor was Ed Lorenz, who later became "the world's pioneer" of the mathematical theory of deterministic chaos. I find it personally inspiring that these two brilliant minds, in the pursuit of understanding dynamical meteorology on a quantitative basis, literally changed the still-challenging field of "classical" mathematical physics as well.

In the early-to-mid 1960s, when I was a graduate student in atmospheric sciences at Colorado State University, there were essentially only two ways to pursue understanding of how the atmosphere works: theory (invariably linear) and observations. In 1962, Smagorinsky's famous paper using the "primitive equations" of atmospheric dynamics to simulate the atmosphere's circulation literally changed the "world" of physical science. The unstable "two-legged" stool of (mostly) linear theory and observation expanded to a stable "three-legged" stool of theory, observation, and mathematical simulation. Intriguingly, Lorenz's ground-breaking discovery of "deterministic chaos" was published just a year later.

To my still-continued amazement, Smagorinsky was never elected to become a member of the National Academy of Sciences, while all of his peers of major international status have been so elected, and many from his generation with far lesser pioneering achievements also have. I, and many of my peers, have long hoped that the National Academy of Sciences, and now the National Academies of the twenty-first century, will finally acknowledge this glaring error of judgment and elect Smagorinsky posthumously.

After World War II, where Joe had spent most of his time as a weather forecaster, he was awarded his M.S. and Ph.D degrees from NYU, where he was working on the diagnostic analysis of vertical velocity in the atmosphere. A very important outcome of his work there was when he met a graduate student in statistics whose name was Margaret, and who was affiliated with the U.S. Weather Bureau. She and Joe were married there in 1948.

At that time, Jule Charney came to the Weather Bureau to give a seminar that inspired Charney and Smagorinsky to examine the degree of predictability of large-scale motions in the middle troposphere. Upon Charney's invitation, Joe and Margaret went to the Princeton Institute for Advanced Study to work on Charney's attempt to use the Institute's ENIAC "supercomputer" (the only computer in existence) to launch the primeval attempt to produce the world's first numerical weather forecast. During that time, Margaret was programming the barotropic model code for that first numerical forecasting attempt, remarkably, in 1950, well over a half-century ago.

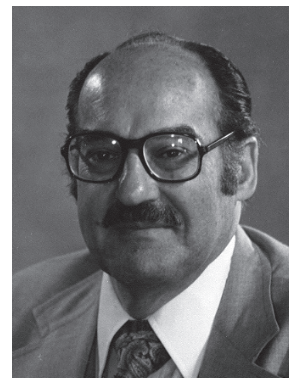
While at Princeton, Smagorinsky commuted to complete his Ph.D. dissertation at NYU, but still under the demanding guidance of Charney. That interaction led to his now-classic paper on the thermodynamic forcing of quasi-stationary disturbances in the midlatitudes. Intriguingly, he had moved toward a challenge that still confronts us today. Bert Bolin was, at the time (1950), working on the effect of mountains in guiding the anomalies in the midlatitude westerly flow. Although Joe's dissertation was not as well recognized at the time as Bolin's work, it did pioneer what might today be described as the El Niño/La Niña problem. Thermal anomalies in the Eastern Pacific Ocean act to alter the paths of the midlatitude westerlies and their associated transient cyclones. This still defines a major part of predicting the monthly anomalies in the midlatitude westerlies today, albeit with far more physically complete models. Now, we characterize this work as the "monthly/seasonal" extended forecast problem.

After Joe completed his Ph.D. at NYU in 1953, he took a position at the U.S. Weather Bureau's Joint Numerical Weather Prediction Unit. In 1954, he assumed the leadership of the newly formed General Circulation Research Section. In a conversation that Joe later had with Robert White, they agreed that the most appropriate (and impressive) name for the facility would be the Geophysical Fluid Dynamics Laboratory. GFDL was thus born in a small building in downtown Washington, D.C.

During that time in 1955, Smagorinsky was given considerable freedom to choose his staff members. His first hires were Douglas Lilly, Syukuro Manabe, Leith Holloway, Kikuro Miyakoda, Kirk Bryan, Gareth Williams, and Isidoro Orlanski. All of them added impressively to our understanding of the atmosphere and the ocean. Perhaps even more impressively, they played instrumental roles in empowering Joe's teamwork approach to solving megaproblems with a decadal-scale focus. The GFDL of Joe's plan was thus formed.

Around 1968, Smagorinsky had arranged for GFDL to be associated with a prestigious university. Due to the dedicated support from George Mellor, Princeton University was judged to be the most appropriate university "host" for GFDL, and the move of GFDL to Princeton had begun, corresponding with Joe's move "back home" to Princeton. Two of Joe's achievements at Princeton were the formation of a very successful Visiting Scientist Program and a cooperative part-time teaching of Princeton graduate and undergraduate students.

By the time that I had accepted Joe's offer in 1970 to fill a research scientist position at GFDL, the move to Princeton and GFDL had essentially been completed. This move fundamentally changed my scientific life. At the outset, I was then quite awestruck by Joe's deep and broad intellectual power, as well as by the scientific talent that had joined GFDL to work with Joe considerably earlier. I was assigned, as agreed earlier, to work with Manabe on the problem of modeling the dynamical and chemical behavior of the stratosphere, a problem that still confronts us today. By the mid-1970s, Joe gave me the responsibility (and the supercomputer resources, one of Joe's special talents) to add new quality scientists to my research group. Most notably, he added Steven Fels and Hiram Levy II, as well as some very talented support scientists. This investment by Smagorinsky for my research group made me see something powerful about Joe: He had no real interest in the "university scientific culture" that still has a tendency to count scientific publications, rather than scientific achievements, as its measure of faculty success. Joe would have none of that. He wanted junior scientists such as us to focus on solving difficult scientific challenges of major relevance to NOAA, the United States, and the world.



Joseph Smagorinsky

If Smagorinsky were here today, he would still be focused on the "grand challenges" of societal relevance, in the United States and globally, and still challenging GFDL and the U.S. scientific community to retain a fundamental scientific ethic, but with an intrinsically global focus on the mega-challenges that still confront us. Without Joe's support and encouragement, would Manabe have written the first paper on the science of global warming in 1967? Would Bryan have produced the world's first ocean model in 1970? Would Manabe and Bryan have produced the world's first coupled atmosphere–ocean model in 1972? Would I have produced the first comprehensive stratospheric dynamical/chemical model? Would Miyakoda have pioneered extended-range weather forecasting? For my research, the answer is: almost certainly not. Without the level of scientific and computational support provided by Joe, these achievements would have required at least another decade of development to achieve success.

Upon Joe's retirement in 1983, to my personal surprise, I became his successor as director of GFDL—a high honor, and a very challenging act to follow. I served as GFDL's director for 16 years. Joe and I always acknowledged that our strengths and weaknesses were very different, but we remained very similarly oriented on what is required to achieve, and sustain, success in scientific leadership. I fondly recall a conversation the two of us had during the period after his retirement announcement, but before I became GFDL's director. I asked Joe what he would consider to be my most significant weakness in such an important position. It was the first time that I ever left him speechless. After collecting his thoughts, he said, "Jerry, I worry that you might be too nice a guy for the job." A year or so later, when NOAA's budget was under stress and I had to fight the system to avoid serious programmatic loss, Joe said, "Jerry, I am no longer worried that you are too nice a guy for this job." My interpretation was that Joe was saying that he was now convinced that I would stand up for what is right. I later realized that fighting for what is right is far less challenging than allowing ourselves to capitulate to that which is clearly wrong. Without the inspiration of Joseph Smagorinsky, I might have taken far longer to understand that.

—Jerry Mahlman