

Professor Sergei A. Kitaigorodskii in Memoriam

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Professor Sergei A. Kitaigorodskii, one of the pioneers of air-sea interaction studies, passed away on 4th December 2014 in Helsinki, at the age of 80. He had a clear vision of the fundamental problems of the physics of the marine boundary layer. The bold ideas he had already more than half a century ago opened new paths then, and they continue to stimulate active research.

Kitaigorodskii was born in Moscow on September 13, 1934. His father, Professor Alexander Kitaigorodskii, was a well-known physicist. Sergei Kitaigorodskii completed his undergraduate studies at Moscow State University in 1956, and he continued his postgraduate studies on the theory of turbulent mixing at the Academy of Sciences, Moscow, where he was awarded his Ph.D. from the Institute of Physics of the Atmosphere in 1960.

As a post-doctoral fellow at the Institute of Oceanology of the Academy of Sciences he in 1961 formulated the Kitaigorodskii similarity hypothesis for the wind-generated wave spectrum. He later recounted how he, as a young student, had been impressed by the simple and at the same time fundamental results of O. M. Phillips, and he had wanted to follow that path by combining it with the Russian tradition, the Kolmogorov similarity hypothesis of turbulence. The Kitaigorodskii hypothesis immediately showed its value when W.J. Pierson Jr. and L. Moskowitz were able in 1964 to collapse their empirical data into a single dimensionless curve, and to formulate the Pierson-Moskowitz spectrum for the fully developed sea. At the same Kitaigorodskii continued his studies of the atmospheric side and showed how swell could influence the marine boundary layer, a topic where his ideas are still important.

In 1962 Kitaigorodskii became Senior Scientist and turned his main interest back to the turbulence of the mixed layer of the ocean. Here he again made fundamental contributions. These, combined with his earlier studies of waves and the air-sea boundary layer, were summarized in his thesis for the Russian degree of Doctor of Science in 1968. This work was the basis of a monograph "*Physics of air-sea interaction*" in 1970, which was translated into English in 1973, and was widely used as a textbook. In the same year, 1973, he received the Rosenstiel gold medal, and in 1978 the Liege University Award.

Between 1968 and 1977 Kitaigorodskii was the head of the Laboratory of the Physics of Ocean-Atmosphere Interaction in the Institute of Oceanology

In the 1970's Kitaigorodskii established contacts with the Finnish geophysics community. His Finnish wife had completed her term as a press correspondent in Moscow, and she returned to Helsinki with their twin daughters. The Soviet system allowed Kitaigorodskii to visit his family every other year, and he used this opportunity to lecture and to do research at several Finnish institutes.

Sylvain Joffre describes these lectures in Helsinki:

"Sergei's trademark was his ability to boil down issues and problems encountered during the research process to the core physical processes and questions. Sergei's lectures were also always a source of inspiration. They were like a Hollywood movie, alternating drama and comedy, and climaxing suddenly with a simple, beautiful, and enlightening physical explanation. The resulting blackboard, full of equations and graphs spreading in all directions and into every corner, was in itself an artistic collage. Sergei was not a practical person in everyday life, and though he was aware of it, it did not bother him. Nor did it have a negative impact on the way others looked at him; on the contrary, this perhaps contributed to creating his legend, and we all looked up to him as a genuinely great scientist, with an image that perfectly suited that role."

My own introduction to air-sea interaction was mainly through these lectures. I therefore took it as self-evident that Sergei's ideas, while not all yet proven, were how things most likely are. Just how visionary his ideas were was revealed to me later in my studies, when I found that there were alternative views as well, and only decades later empirical evidence has shown that in many cases things indeed were very close to what Sergei had envisioned.

In 1978 Kitaigorodskii moved abroad. He was first a visiting professor at the Max Planck Institute for Meteorology, the Johns Hopkins University, and Cornell University; then a lecturer at the University of Copenhagen in 1979 – 1985. In 1980 – 1992 he was Professor of Oceanography at the Johns Hopkins University. During this period he collaborated with John Lumley at Cornell University, Kristina Katsaros at the University of Washington, and in particular with the research group led by Mark Donelan at the Canada Centre for Inland Waters. Donelan's comprehensively instrumented field experiments in Lake Ontario, which included new instruments specifically developed for this campaign, demonstrated the important role of breaking waves for the subsurface turbulence; an issue that Sergei had emphasized already in his 1974 lectures in Helsinki.

In 1992 Sergei returned to Europe. He was first a visiting professor at the Finnish Meteorological Institute and the Finnish Institute of Marine Research; from 1994 to 2001 he was at the Institute of Oceanology of the Russian Academy of Science. For his last years he lived in Helsinki, near his family.

Sergei was active to the very end. He completed the book that he had been working on for decades, “*Five discoveries by Harald Sverdrup. An introduction to physical oceanography*”. He gave seminars, and he wrote papers, mostly summaries of his previous work. But when chess championship matches were going on, everything else was postponed. Sergei loved chess, and he was an excellent player. In his youth he had been too good in the opinion of his father, who considered “sports” such as chess a waste of time for a scientist.

On December 2 in 2014, Sergei told me that after he had heard from his doctor we could settle the date of his next seminar. That seminar was never given: he passed away two days later in the evening of December 4.

