ATS Special Seminar

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from Colby College

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ATS 101 and Zoom

The Emergence of Atmospheric Science Cutting the Gordian Knot of Meteorology

Atmospheric researchers have long attempted to untie the Gordian Knot of meteorology — that intractable and intertwined tangle of observational imprecision, theoretical uncertainties, and non-linear influences — that, if unravelled, would provide perfect prevision of the weather for ten days, of seasonal conditions for next year, and of climatic conditions for a decade, a century, a millennium, or longer. This big picture history examines the first six decades of the twentieth century, from the dawn of applied fluid dynamics to the emergence, by 1960, of the interdisciplinary atmospheric sciences. Using newly available archival sources, it documents the work of three interconnected generations of scientists. Vilhelm Bjerknes initiated a neo-Laplacian program — to measure atmospheric conditions with sufficient accuracy and to calculate the future state of the weather with sufficient precision using the equations of hydrodynamics and thermodynamics. Falling short of analytic solutions to the non-linear equations of atmospheric motion, he founded the Bergen school of meteorology, where graphical methods prevailed. His protégé, Carl-Gustaf Rossby, established the graduate schools of meteorology at M.I.T., Chicago, and Stockholm that focused on upper-air dynamics and, after 1947, on atmospheric environmental issues. Rossby identified upper-air planetary waves as the keys to long-range forecasting, treating them as idealized cases suitable for computation by digital computers. Rossby's student Harry Wexler, head of research at the U.S. Weather Bureau, and his close associates prepared the foundations for the emergence of the interdisciplinary atmospheric sciences and introduced a number of transformative technologies into meteorology including radar, nuclear tracers, digital computers, sounding rockets, and weather satellites, that helped cut into, if not through, the Gordian Knot. In 1960, using a simple computer and a simple, but profound, non-linear model, MIT professor Edward Lorenz introduced chaos theory into meteorology and identified a new "chaotic knot," that might never be untied, at least not by mortals.