OBITUARY

Joanne Simpson (1923–2010)

Meteorologist who brought the study of clouds to the forefront of Earth science.

Before Joanne Simpson got into meteorology, neither women nor clouds were taken very seriously in the emerging field of atmospheric science. She liked to tell the story of a pre-eminent professor advising her that clouds would be "a good subject for a little girl" because they were just passive phenomena determined by the larger dynamics of the atmosphere. That little girl went on to show that clouds are essential interactive elements of the atmosphere — critical not only to the physics of major storms, but also to the general circulation and climate of the whole atmosphere.

Simpson, who died on 4 March, was an explorer. She undertook treks in the Himalayas, undersea diving and long sailing expeditions. But most of all, she explored clouds — first by aircraft and later by satellite. She focused her life's work on cumulus and cumulonimbus clouds because she wanted most to understand the clouds that carry energy from the warm tropical oceans to the upper atmosphere.


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Simpson's early work at the Woods Hole Oceanographic Institution in Massachusetts and at the University of California, Los Angeles, in the 1950s and 1960s took her over the ocean in crude airplanes to observe how the smallest tropical cumulus clouds carried energy up from the sea. Further astute observations of tropical cloud forms led her to postulate how these clouds become diluted by drawing air into themselves from the uncloudy environment. Her work inspired some of the first numerical cloud modelling, which she later promoted in her laboratories at the National Oceanic and Atmospheric Administration (NOAA), the University of Virginia in Charlottesville and, finally, NASA's Goddard Space Flight Center in Greenbelt, Maryland. Indeed, at NASA, she and her colleagues developed one of the most respected cloud-modelling research centres in the world today.

Simpson's most famous work is her 'hot tower' hypothesis, posited with her colleague Herbert Riehl in 1958. Around this time, meteorologists were mystified by the observation that warmer, high-energy air in the upper atmosphere of the tropics seemed to be separated from the warm ocean by a region of low energy in the middle levels of the atmosphere. From their knowledge of the buoyant nature of the air inside cumulus and cumulonimbus clouds, Simpson and Riehl suggested that it was the cumulonimbus clouds that penetrated the low-energy region and carried energy to upper levels. Although the details of the mechanism by which this happens are still debated, the basic hot-tower energy-transport idea has become key to understanding the global climate.

Less widely recognized, but just as important, is Simpson's recognition that the hot towers reaching the upper atmosphere needed the 'protection' of larger, 'mesoscale' cloud systems. When weather satellites started to be used, researchers realized that these mesoscale systems were the extensive bright areas that dominated the satellite pictures taken over tropical oceans. Much later in her career, in 1992, Simpson led a flight into a mesoscale system that was evolving into a tropical storm, and so began to reveal how the larger mesoscale systems are involved in the early stages of a hurricane.

In the mid-1960s to 1970s, while head of a NOAA laboratory in Coral Gables, Florida, Simpson focused on whether clouds could be artificially modified by seeding them with silver iodide. This stimulates water drops to freeze and thus release energy. Although cloud seeding has never proved feasible, Simpson's studies led to improved cloud modelling and to an understanding of how smaller clouds merge with each other to form mesoscale systems.

During this time, she collaborated with Robert Simpson, then the director of the National Hurricane Center in Miami, Florida, who would become her husband of 45 years. Together, they designed an experiment called Project Stormfury, to explore whether cloud seeding could be used to mitigate the strength of hurricanes. The technology did not prove effective, but, like the Florida cumulus work, these field experiments led to new understanding — in particular, that it is difficult to reduce the strength of hurricanes by artificially seeding hurricane clouds because they are naturally filled with ice particles.

Mesoscale cloud systems remained a focus for Simpson during and after the Florida years; to study them, she helped lead expeditions to the equatorial Atlantic, the Asian monsoon and the South Pacific. By the 1990s, though, Simpson had arrived at NASA and was moving away from the piecemeal study of clouds, through observations from aircraft, to the comprehensive study of tropical clouds by satellite. She became project scientist for the Tropical Rainfall Measuring Mission (TRMM) satellite, which put the first meteorological radar into space in 1997.

This satellite still orbits the tropical latitudes today. It observes critical details of the entire population of clouds that release energy into the tropical atmosphere and drive the global climate. The satellite has been revolutionary — spawning global studies of rainfall and a host of other factors crucial for understanding the global climate, such as how the hot towers and other clouds of the tropics distribute energy, how monsoon rains occur, how the Himalayas and Andes affect the distribution of tropical clouds, and how anthropogenic effects are influencing weather. Simpson considered the TRMM her greatest achievement.

She received numerous formal accolades and awards throughout her working life, including the *Los Angeles Times* Woman of the Year and the American Meteorological Society's 1983 Carl-Gustaf Rossby Research Medal — the highest award in atmospheric sciences, named for the very professor who told her clouds were not all that important. But she is also remembered for pushing atmospheric sciences forward by the great force of her personality and her charisma. Whether in a broad-brimmed hat or flight suit and sunglasses, Joanne Simpson at the height of her career, walking into a crowd and aligning the group towards the mission of the day — that will not be forgotten. Her powerful combination of intellect, determination, leadership and drive will be missed.

Robert A. Houze Jr
Robert A. Houze Jr is in the Department of Atmospheric Sciences, University of Washington, Seattle, Washington 98195, USA.
e-mail: houze@washington.edu