John Lennox Monteith, who has died aged 82, pioneered the application of physical principles in the study of how plants and animals interact with their immediate environment, or microclimate. In a career spanning over half a century, he is perhaps best known for the Penman-Monteith equation that has become the basis for guidelines for estimating irrigation water requirements used by the FAO (Food and Agriculture Organization of the United Nations). He became one of the youngest ever Fellows of the Royal Society of London in 1971, and was made a Fellow of the Royal Society of Edinburgh in 1972. In addition he was a Fellow (1951) and Honorary Fellow (1997) of the Royal Meteorological Society, Fellow (1966) of the Institute of Physics, Fellow (1976) of the Institute of Biology, and served as president of the Royal Meteorological Society from 1978 to 1980. In 1989 he was awarded an honorary DSc by the University of Edinburgh. During his career he served on many national and international scientific committees and on the editorial boards of prominent scientific publications. He also served as Fellowship Secretary to this Society from 1997-1999.

Born in September 1929 in Fairlie, Ayrshire, John was the only child of the Reverend John and Margaret Lennox Monteith and began his schooling at Paisley Grammar School before the family moved to Edinburgh when he was eleven. His father, who had suffered from multiple sclerosis, died shortly afterwards. From a very early age John showed innate scientific curiosity, encouraged by family friends who supplied him with electricity and chemistry sets. He was fond of practical jokes and experimenting with hazardous chemicals acquired from a local scientific supply shop. A strong all-rounder at George Heriots School, Edinburgh, and keen on amateur dramatics and music, he was nevertheless propelled towards a future in either physics or chemistry – biology being out of the question given his perceived inability to draw specimens. On leaving he studied Physics at Edinburgh University and particularly enjoyed lectures by the distinguished meteorologist, James Paton. Graduating with First Class honours, he sought opportunities in agricultural aspects of meteorology, recognising the chance to contribute to the major societal challenges of sustainable food production, while also escaping the confines of a laboratory.

Embarking on postgraduate research at Imperial College, Howard Penman, from the Rothamsted Experimental Station in Harpenden, encouraged him to focus on the science of dew formation. Dew had been identified as a potentially important precursor for plant fungal infections, but it remained unclear what weather conditions were necessary for dew to form, and hence it was difficult anticipate when damage was most likely to occur. His investigations required the development of novel and highly sensitive micrometeorological instruments for the measurement of dew fall, humidity and energy fluxes. Using a method of analysis that would characterise many of his future papers, he recognized that the balance of incoming and outgoing energy at ground level determined the source of the dew (i.e. soil or atmosphere) and the amount that could be formed.

In 1954 he moved to Rothamsted as a Scientific Officer and began working under Penman who was concerned how variation in weather affected soil moisture. Penman had developed a method to predict the rate of evaporation from wet surfaces, but it did not take into account the
complicating effects that vegetation imposed on water loss. By harnessing the analogy of electrical resistance, John showed how to account for surface conductance of water, and produced the Penman-Monteith equation that more correctly accounted for wind and surface effects. The approach was subsequently adapted to model the behaviour of any natural system involving mass or energy exchange in fields ranging from animal energetics to pollutant deposition. While at Rothamsted, John also made, in collaboration with Geza Szeicz, some of the world’s first measurements of carbon dioxide exchange (CO₂) between the land surface and the atmosphere.

In 1967 John was appointed to the newly-created Chair of Environmental Physics at the School of Agriculture, Sutton Bonington, a faculty of the University of Nottingham. Although he had not considered teaching, he took very naturally to the task. Many students, as well as colleagues, would find their careers shaped and altered by their associations with him, and several now hold important positions in organisations across the world. The discipline of Environmental Physics as a defined field of study really became established with the publication of “Principles of Environmental Physics” in 1973, later editions of which were written in collaboration with his colleague Mike Unsworth. With funding from the Oversees Development Agency, his growing team established a unique set of large, microclimatologically controlled greenhouses which allowed realistic field-scale assessments of the growth of crops from the semi-arid tropics under different environmental conditions. John became increasingly interested in the factors determining crop growth and yield, and eventually spent a six month sabbatical at NASA in Maryland, USA, developing approaches to assess crop production from space using Remote Sensing. The Nottingham group continued to develop micrometeorological instruments for measuring physical attributes of the environment, collaborating with two major suppliers of state-of-the-art environmental research instrumentation for Britain and Europe, Delta-T Devices, and Campbell Scientific Ltd, for whom John was a co-founder. In 1987 he became Director of the Resource Management Program at the International Crops Research Institute for Semi-Arid Tropics in Hyderabad, India, where he served until 1991. On his return to Edinburgh, he was invited to become Senior Visiting Fellow at the Institute of Terrestrial Ecology at Penicuik.

John had a multi-faceted personality and a wide range of interests. He was an accomplished organist, and for many years served the communities of Sutton Bonington Methodist Church and Mayfield Salisbury Church, Edinburgh, in this capacity. He had a deep love of the countryside, and of wilderness areas, particularly the Scottish Highlands where he enjoyed hill-walking. He was also a keen photographer, and gardener.

A devoted husband, father and grandfather, John is survived by his wife, Elsa, his five children, David, Graham, Donald, Alison and Andrew, and by eleven grandchildren.

Submitted and prepared by the Monteith Family, with contributions from John's colleagues, including Dr Dr Gaylon Campbell. This obituary also appeared in The Scotsman on 8 August 2012.