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## Obituary and Tribute: J. E. (Eamonn) Nash (1927–2000)

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On the 17<sup>th</sup> of April, 2000, Professor J. E. (Eamonn) Nash died peacefully in Galway, Ireland, surrounded by his loving family. His international career in hydrology spanned more than four decades and his work has had a profound influence on the development of modern scientific hydrology. He will be forever enshrined in the literature as the originator of the 'Nash Cascade' (of linear reservoirs) but will also be remembered for his deep intellectual honesty, his sense of humour, and his genuine concern for others.

Eamonn Nash was born in Sligo, a provincial town about 170 km north of Galway on the West Coast of Ireland. He began his university studies in 1945 as a civil engineering student at University College Galway. He graduated in 1948 with a first class honours degree, and, after a brief period as an engineer in local government, joined the Irish Electricity Supply Board, where his immediate superior was Jim Dooge (later Professor J. C. I. Dooge). This marked the beginning of a life-long professional association and a close friendship which Eamonn valued greatly, even though they often disagreed—sometimes vigorously and in public. In 1950, Eamonn joined the Irish Government's Office of Public Works, in Dublin, which had just embarked on a national programme of arterial drainage to reduce the flooding of agricultural land. This stimulated a life-long interest in modelling the relationship between rainfall and runoff; for his early research in this field, Eamonn was awarded an M.E. degree by his Alma Mater in 1955.

In 1956, Eamonn took up a Senior Research Fellowship at the Hydraulics Research Station (HRS) in Wallingford, a position which allowed him to give full expression to his creativity. He regarded his work at Wallingford over the period 1956–59 as being the best of his career, and his achievement in developing the Nash Cascade model was recognised through the award of the Telford Prize by the Institution of Civil Engineers, London in 1958.

Eamonn's involvement with the problems of developing countries began in 1960 through a secondment to Nigeria as Assistant Director (Hydrology) of the Federal Department of Inland Waterways. This provided him with an appreciation of the important role of hydrology in developing the water resources of a third world country, an issue which was to play a central role in the latter part of his career.

When Eamonn returned to Wallingford in 1962, the importance of hydrology as a discipline in its own right was becoming recognised in the UK, and a unit was set up to investigate the water requirements of different land covers

in upland catchment areas. Eamonn was the Head of the Hydrological Research Unit (HRU), based in the first instance at HRS at Wallingford. Although established under the wing of the HRS, it was foreseen that the new Unit would separate from its parent body, and Eamonn was given the task of planning a series of catchment area experiments involving changes in land use, as envisaged by the Department of Scientific and Industrial Research's Committee on Hydrological Research as the work of the new Unit for the first few years of its existence. However, a position of senior lecturer in hydraulics became available at Galway and, wishing to return to Ireland to raise his young family, Eamonn moved to Galway in 1962 to begin his university career.

At Wallingford, Eamonn was succeeded by Dr J. S. G. (Jim) McCulloch as Head of the embryonic HRU, which developed in 1968 into the Institute of Hydrology with much wider terms of reference. An unlikely long-term professional association and friendship was forged between the two, since, as a physicist, Jim had very different research interests to Eamonn, and a different vision for the Institute of Hydrology. However, Jim recognised the future importance of mathematical modelling and engineering hydrology and Eamonn returned to Wallingford for many years as a consultant to provide advice and guidance in these fields. This link was also to provide valuable career opportunities for a number of Eamonn's postgraduate students.

Back in Galway, Eamonn's research interests centred mainly on rainfall-runoff modelling, unit hydrograph theory, flood routing, hydrological frequency analyses and the application of systems engineering in applied hydrology. Following the award of his DSc degree in 1970, he was appointed Professor of Engineering Hydrology. In 1976, he became head of the newly created Department of Engineering Hydrology, the only department of its kind in the Irish University system; this provided a platform for new developments in postgraduate teaching and research, while continuing to provide service courses in fluid mechanics, hydraulics and hydrology to undergraduate engineering students.

Eamonn's idea of applying Bayesian probabilities in a hydrological context and was one of the earliest papers of its kind. While Eamonn is almost universally remembered for his contribution to deterministic, systems hydrology, he also had a deep interest in probabilistic concepts and in the

theory of extreme values. Few realise that one of the first papers on the use of simulation methods in flood frequency research was published by him, jointly with Jim Amorocho, in *Water Resources Research* in 1965. Also, in the same year, in a paper published jointly with B. Lewis. Shaw, he showed that a mean annual flood estimate obtained from a regression relationship with catchment characteristics was no better than that obtainable from a single year of hydrometric data.

With regard to computer modelling, Eamonn felt strongly that most conceptual models were overparameterized and that a measure of the sampling variance of parameter estimates, derived from the properties of the response surface, would be valuable in identifying insensitive or redundant parameters. His 1970 *Journal of Hydrology* paper with John Sutcliffe set forth modelling principles which are valid more than 30 years later: he emphasised the need for parsimony, while the Nash-Sutcliffe mode efficiency measure  $R^2$  is still in widespread use today. However, although over-parameterization of conceptual models has since been the subject of a great deal of research, fundamental difficulties remain, as indeed foreseen by Eamonn.

Throughout his career, Eamonn lived up to an endearing reputation of absent-mindedness. Once, Eamonn was having coffee in the university staff room, when he suddenly remembered that he was already late for his lecture to the final year engineering students, on the *Method of Characteristics for Unsteady Flow in Open Channels*. Dashing to the Engineering Building, he rushed into the lecture hall, relieved to find that the students had waited for their lecturer. In the corridor afterwards, still waving the envelope on which his lecture had been outlined, a jubilant Eamonn pronounced "I think that's one of the best lectures I have ever given! For once, it all came out just right!" Only later did he realise that his pearls of wisdom had been delivered to a stunned and bewildered first year engineering class which had waited in vain for their lecturer in mathematics.

In 1976, Eamonn's long-held ambition to provide a postgraduate training programme relevant to the needs of developing countries was realised when he established, in collaboration with one of the present authors (Kieran O'Connor), the International Postgraduate Hydrology (MSc and Diploma) Courses, funded by Irish Government Aid. This programme became widely recognised as a major success, both in terms of the quality of the students it attracted and the training it provided. To date, 360 students from 56 countries have registered on these courses in Galway. Postgraduate research also flourished as a significant number of M.Sc graduates went on to take PhD degrees. In collaboration with UNESCO/ANSTI and also funded by Irish Aid, Eamonn was instrumental in establishing a similar programme of postgraduate courses in water resources engineering at the University of Dar es Salaam in Tanzania, which is the most successful of its kind in Africa today.

In 1985, again as an Irish Aid Programme, shorter (three month) international advanced courses/workshops in Galway were set up by Eamonn with Professor Jim Dooze and two of the present authors (Con Cunnane and Kieran O'Connor). Between 1985 and 1997, 117 senior hydrologists (practitioners, researchers and academics) from 25 countries participated in a total of seven advanced courses/workshops held on River Flow Forecasting. These tested the rainfall runoff models developed in Galway on data from all over the world.

Over his long career, Eamonn Nash lectured, by invitation, at many universities throughout the world. His special relation with China dates back to 1978 when he was one of the first western hydrologists to lecture there after the Cultural Revolution. In 1986, he was appointed an Honorary Professor of Ho-Hai University of Water Resources in Nanjing. He also acted as a consultant to many national and international agencies, including UNESCO and WMO. Other notable distinctions include the award, in 1989, of the International Hydrology Prize of the International Association of Hydrological Sciences (IAHS) in recognition of his contribution to the development of analytical methods in deterministic catchment modelling. In 1999, he received the Ven Te Chow Award in Hydrology of the American Society of Civil Engineers

Eamonn's publications date from 1955, when he published his first paper on flood routing to his last paper, co-authored with Assad Shamseldin, published in this journal [*HESS* 2(1), 1-8, March 2000] As an Editor of the *Journal of Hydrology* over the period 1969-1995, he set and enforced demanding standards, but his help and guidance was highly appreciated by many authors, particularly those whose first language was not English. He will also be remembered for his role as Chairman of the IAHS/UNESCO Panel on Hydrological education which produced the radical report on "The Education of Hydrologists", in 1990. The WMP Bulletin Interview of Eamonn, by Dr H. Taba, published in 1994, provides a revealing insight into his personality, his background and the motivation for his work.

When he retired, late in 1992, Eamonn took time out to pursue his other intellectual interests, such as Theology, Mathematics, Astronomy, Persian Art, Eastern Cultures and Poetry. The West of Ireland weather ensured that he still maintained a considerable involvement with hydrology: on wet days, he would come to his office in the University, while on dry days, he could frequently be found taking long walks in his beloved Burren (the karstic region of Co. Clare), often accompanied by his grandchildren.

Following Eamonn's death, the deluge of condolences, arriving in Galway by e-mail, fax and letter, was a great comfort to this wife Deirdre and their three children, Paul, Carol and David. Many of those who wrote recalled how some action by Eamonn had radically changed their lives for the better so that they had benefited greatly from his influence and advice. Although Eamonn's contribution to

the development of the science of hydrology is widely acknowledged by his peers, and rightly so, the most telling measure of a man is the positive influence he exerts throughout his life on the lives of others. The condolences sent to Galway after his death testify to Eamonn's very considerable success in this regard. He will be sorely missed.

Although we have worked closely with Eamonn during the intervening 25 years, it is the early memories and his incisive intellectual qualities that remain with us most strikingly. To this wonderful mentor, colleague and friend, we say "slán agus beannacht" – safe journey."

Kieren O'Connor and Con Cunnane, National University of Ireland, Galway, Ireland

P. Enda O'Connell, University of Newcastle upon Tyne, UK

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