

Michael Raupach (1950–2015)

Builder of the global carbon budget.

Will Steffen

Mike Raupach is best known around the world for his leading role in advancing our knowledge of the global carbon cycle, a crucial step in addressing the climate change challenge. Mike was a founding co-chair of the Global Carbon Project (GCP), a network of the world's leading carbon cycle researchers, which aims to understand the role of humanity in changing the dynamics of the carbon cycle and to provide the insights needed to reduce our perturbation of the cycle.

Under Mike's leadership the GCP flourished. The annual carbon budget, which tracks changes in emissions of CO₂, atmospheric concentration of CO₂, and the strength of the marine and land carbon sinks, has become a landmark product of the GCP. It is backed up by a large body of state-of-the-art research in both the natural and social sciences, ranging from studies of the processes that control natural carbon sinks to exploring the institutional and technical constraints slowing the transition towards decarbonized economies. Importantly, the GCP has analysed possible options for implementing a global carbon budget based on a blend of equity principles and achievability.

Born in South Australia, Mike received his PhD in 1976 from Flinders University, Adelaide, in the area of micrometeorology. A postdoctoral position with the well-known micrometeorologist Alistair Thom at the University of Edinburgh followed. Mike returned to Australia in 1979 to take up a position with the CSIRO (Commonwealth Scientific and Industrial Research Organization) Division of Environmental Mechanics, in Canberra.

Mike's early career was focused on challenges much smaller than the global scale. He made major contributions to the study of the flow and transport of matter and energy through and above plant canopies. In particular, his work was part of the transition from using simple gradient-diffusion theory to describe canopy transport processes to embracing the physically more realistic turbulent transport of energy and matter. This required related research, to which Mike also made significant contributions, aimed at understanding turbulence as a coherent and organized process. This period



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in his career included quantification of CO₂ transport through and above plant canopies, a forerunner of his later research interests, albeit at much smaller scales.

The transition to focusing on larger scales, up to the global, came in the 1990s when Mike was appointed to the scientific steering committee of the Biospheric Aspects of the Hydrological Cycle core project of the IGBP (International Geosphere-Biosphere Programme). One of the most fundamental and important questions that the project addressed was: does the land-surface matter in climate and weather? Mike's research greatly contributed to addressing that question, through his work on turbulent fluxes near the land surface, boundary-layer budgeting and quantifying the water balance at broader scales.

His excellence in scientific research is not the only skill that enabled Mike to build such a brilliant career. He always had a warm and thoughtful way of collaborating with his colleagues. He showed respect and humility in interacting not only with them, but also with the policy world and the public. Mike's communications skills were legendary. He could distil the most complex ideas into crisp, understandable stories. His words were carefully chosen, and his spoken sentences often carried the grace and power of expertly crafted written prose. His touchstone, however, was always the science, and in that he was unfailingly rigorous and insightful.

Later in his career, this combination of skills — research excellence, communicating effectively to all audiences, and ability to assemble and gently steer groups of strong-minded scientists — put him in leadership positions in some very challenging projects. But in an Australian context, Mike was also very active in tackling some of the wicked problems that link the biophysical world with human societies, and was keenly interested in efforts to unify perspectives and research approaches from the natural sciences, social sciences and the humanities.

He chaired the steering committee of the 'Australia 2050' project of the Australian Academy of Science (AAS). In 2009–2010 he chaired the Expert Working Group on Challenges at the Intersection of Carbon, Energy and Water, reporting to the Prime Minister's Science, Engineering and Innovation Council and the Office of the Chief Scientist of Australia. Just before his death, Mike co-chaired the working group drafting the AAS booklet *The Science of Climate Change: Questions and Answers*.

His skills and achievements were widely recognized. He was elected a Fellow of the AAS, the Australian Academy of Technological Sciences and Engineering and the American Geophysical Union. He was also appointed to a CSIRO Fellowship.

I worked with Mike for nearly 35 years, from the early days in CSIRO to February 2014, when he succeeded me as the executive director of the Climate Change Institute at the Australian National University. What I remember most about Mike was his uncanny ability to cut through the most complex of problems and distil them to their essence in understandable yet profoundly insightful ways, leaving one wondering "why couldn't I think of that?". Above all, he was a wonderful human being and will be sorely missed by the Earth System research community and by all those who knew him and worked with him.

Mike passed away peacefully on 10 February 2015 after a short illness. He is survived by his wife, Hilary Talbot, and their three children, Tim, Anna and Alex. □

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