Universidad de Granada

UGR research calls current methods of studying photosynthesis into question

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Research news

New theory developed by Prof. Andrew Kowalski, which records non-diffusive gas transport, key to calculating water use efficiency and CO2 concentrations in plants

The current scientific assumption that the transport of gases between the surface and atmosphere is produced exclusively through diffusion is mistaken, according to research conducted by Prof. Andrew Kowalski of the UGR’s Department of Applied Physics. His groundbreaking research describes how the flow of water vapour (which is not 100% diffusive), accounts for the greatest exchange of gases between the surface and the atmosphere, propelling a stream of air which originates in the surface. This discovery has important implications for fields such as biology and micrometeorology.

The new theory, which accounts for non-diffusive gas transport, is essential for calculating the water use efficiency of plants and the CO2 concentrations in their interior — a fundamental parameter when it comes to analysing photosynthesis. In the field of biology, research data related to the process of photosynthesis are altered by these variables. As Prof. Kowalski explains: “When we assume that the transport of all CO2 during photosynthesis is diffusive, we do not take into account the transport produced by the stream of air which is propelled by the water vapour emitted by plants. Therefore, photosynthesis is not being studied properly.”

This discovery also affects micrometeorology, since some theories within this field, such as the Monin-Obukhov similarity theory, which links gas flow to concentration gradients, must be reviewed in order to take non-diffusive flows into account.

Prof. Andrew Kowalski’s recently published his research findings in a paper entitled “The boundary condition for vertical velocity and its interdependence with surface gas exchange” in the prestigious international journal Atmospheric Chemistry and Physics.

Bibliographical reference:

Kowalski, A. S.: The boundary condition for vertical velocity and its interdependence with surface gas exchange, Atmospheric Chemistry and Physics, 17, 8177-8187, https://doi.org/10.5194/acp-17-8177-2017, 2017.

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