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The many meanings of gross photosynthesis and their implication for photosynthesis research from leaf to globe

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Gross photosynthesis is a key term and concept in carbon cycle science. It however turns out that this term has been and is used with different meanings by different communities – either with (historically referred to as apparent photosynthesis) or without (historically referred to as true photosynthesis) including photorespiration – which has been and still is causing confusion. Here we review the history of these terms and the underlying theory to clarify the terminology and make recommendations about a consistent use of terms. We further show that eddy covariance CO_2 flux partitioning, due to an overestimation of daytime mitochondrial respiration and our inability to estimate photorespiration, yields estimates which are quantitatively closer to the definition of true photosynthesis (i.e. carboxylation only) despite aiming at estimating apparent photosynthesis (i.e. carboxylation minus photorespiration). The implications of this finding are discussed.