

Publication

A new mass conservation approach to the study of CO₂ advection in an alpine forest**JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)****ID** 157820**Author(s)** Montagnani, L.; Manca, G.; Canepa, E.; Georgieva, E.; Acosta, M.; Feigenwinter, C.; Janous, D.; Kerschbaumer, G.; Lindroth, A.; Minach, L.; Minerbi, S.; Mölder, M.; Pavelka, M.; Seufert, G.; Zeri, M.; Ziegler, W.**Author(s) at UniBasel** [Feigenwinter, Christian](#) ;**Year** 2009**Title** A new mass conservation approach to the study of CO₂ advection in an alpine forest**Journal** Journal of geophysical research. D, Atmospheres**Volume** 114**Pages / Article-Number** 25

A new method is proposed for the computation of CO₂ Net Ecosystem Exchange (NEE) and its components in a forest ecosystem. Advective flux is estimated by taking into account the air mass conservation principle. For this purpose, wind and dry air density values on the surface of the control volume are first corrected and then the advective flux is estimated on the surface of the control volume. Turbulent flux is also computed along the surface of the control volume while storage flux is computed inside the volume. Additional characteristics of this method are that incompressibility of the mean flow is not assumed a priori, and that vertical and horizontal advective fluxes are not treated separately, but their sum is estimated directly. The methodology is applied to experimental data collected with a three-dimensional scheme at the alpine site of Renon during the Advex project (July 2005). The advection flux was found to be prevailing positive at night and negative during the day, as was found in previous studies on advection for the same site, but showed a lower scatter in half-hour calculated values. We tested the effect of its summation on turbulent and storage fluxes to produce half-hourly values of NEE. Nighttime NEE values were used in functional relations with soil temperature, daytime values with PPFD. The effect of addition of the advection component was an increase in the values of parameters indicating ecosystem respiration, quantum yield, and photosynthetic capacity. The coefficient of correlation between NEE and environmental drivers increased.

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