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Herd position habits can bias net CO_2 ecosystem exchange estimates in free range grazed pastures.

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The eddy covariance (EC) technique has been widely used to quantify the net CO_2 ecosystem exchange (NEE) of grasslands, which is an important component of grassland carbon and greenhouse gas budgets. In free range grazed pastures, NEE estimations are supposed to also include cattle respiration. However, cattle respiration measurement by an EC system is challenging as animals act as moving points emitting CO_2 that are more or less captured by the EC tower depending on their presence in the footprint. Often it is supposed that, over the long term, cattle distribution in the pasture is homogeneous so that fluctuations due to moving sources are averaged and NEE estimates are reasonably representative of cattle respiration. In this study, we test this hypothesis by comparing daily cow respiration rate per livestock unit (LU) estimated by postulating a homogeneous cow repartition over the whole pasture with three other estimates based on animal localization data, animal scale carbon budget and confinement experiments. We applied these methods to an intensively managed free range grassland and showed that the NEE estimate based on a homogeneous cow repartition was systematically lower than the three other estimates. Consequently, in order to allow estimating the validity of this hypothesis but also to improve inter site comparisons, we advocate to compute separately pasture NEE and grazer's respiration. In the presentation, we will propose a method based on cattle presence detection using CH4 fluxes, elimination of data with cattle and gap filling on the basis of data without cattle. For the second we propose three independent methods (animal localization with GPS, animal scale carbon budget, confinement experiments) to estimate the cattle respiration rate and discuss their use depending on site specificities.