

Role of advection for the ecosystem-atmosphere carbon dioxide exchange of alpine grasslands

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Background

Estimates of net ecosystem CO₂ exchange (NEE) have been attracting a lot of attention because of the important role of CO₂ in global climate change. The contribution of advection to CO₂ flux measurements is often ignored in the estimation of NEE, even though some studies reported that more realistic estimates of night-time and daily total NEE could be gathered if horizontal and vertical advection was accounted for.

Objectives

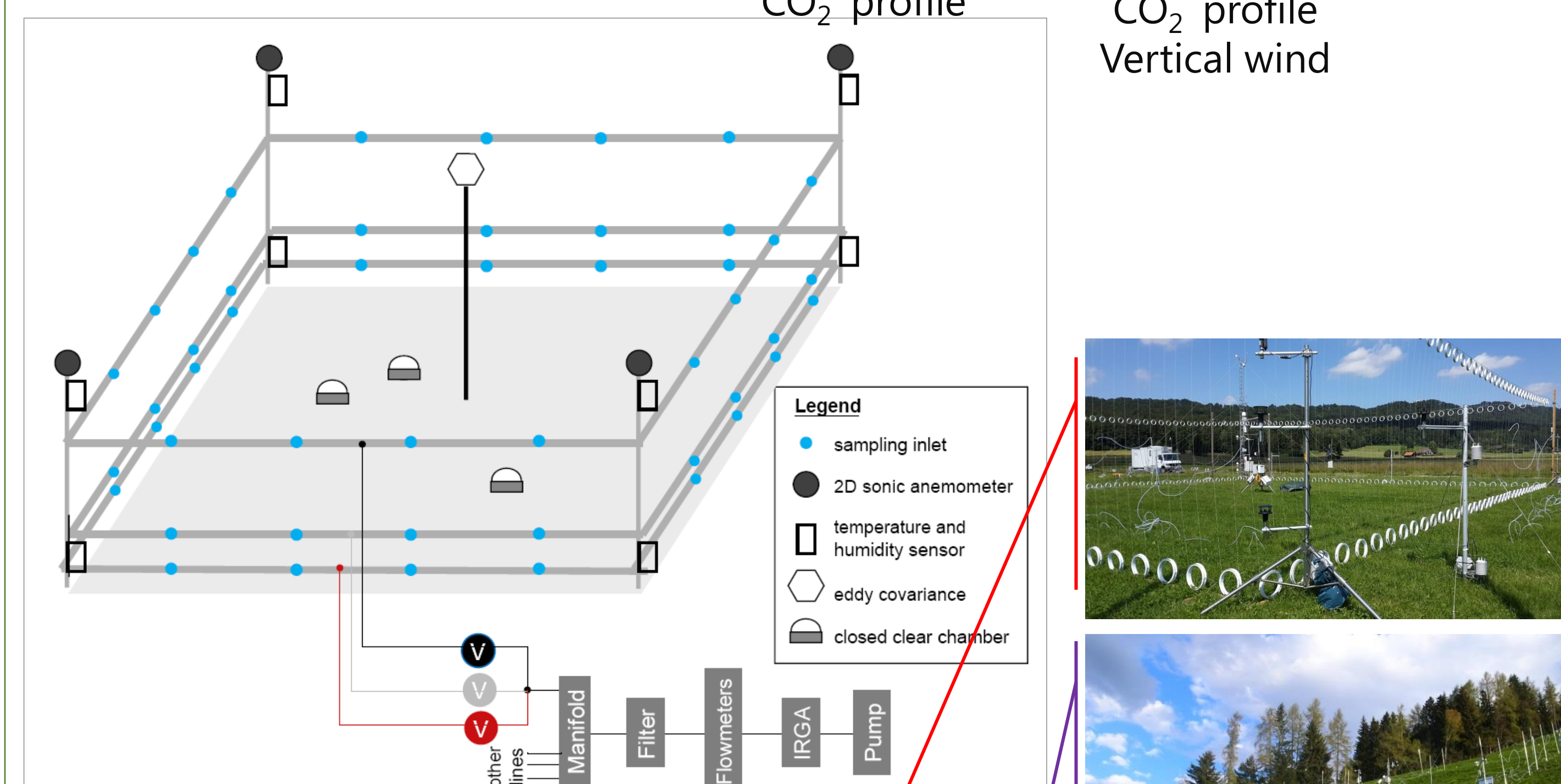
- To quantify the contribution of advection to NEE at grasslands.
- To study the advection flux terms in differently complex terrain types in the Alps.

Methods

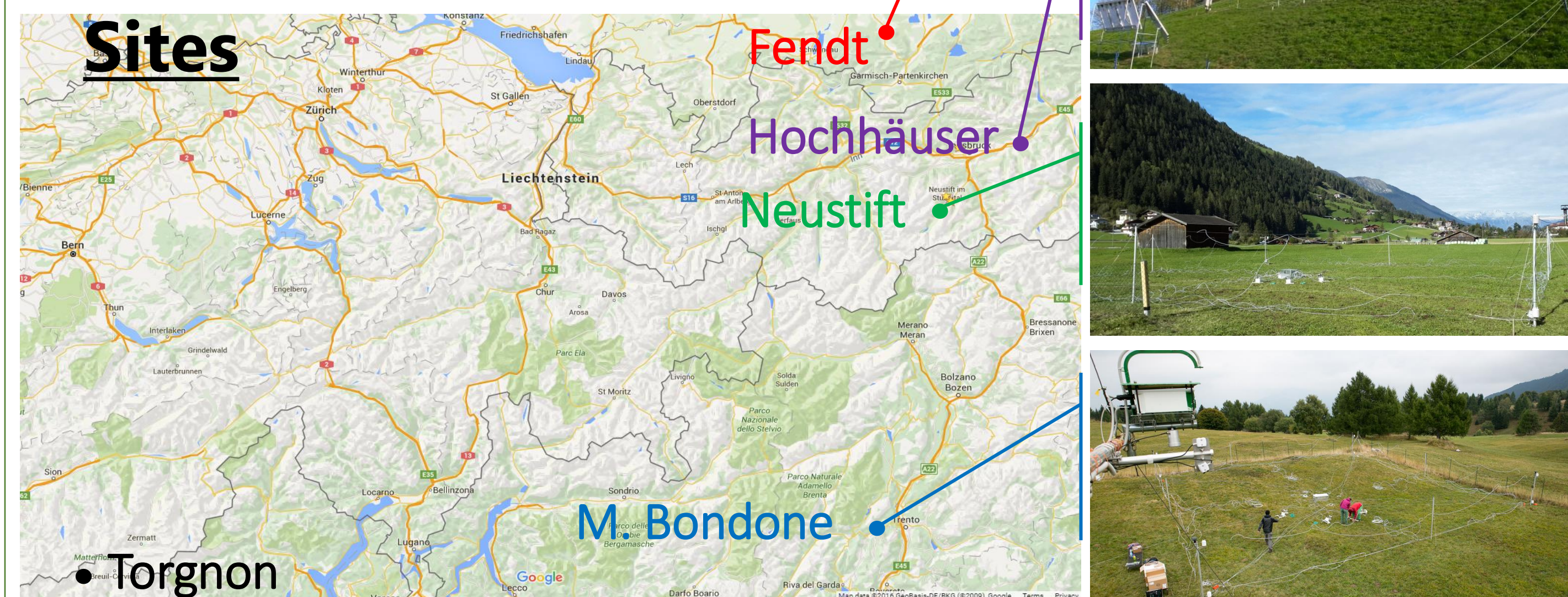
$$\bar{F}_c \approx \bar{F}_{c,s} + \bar{F}_{c,h} + \bar{F}_{c,v} + \bar{F}_{c,t}$$

Chamber measurement CO₂ profile
Horizontal wind Eddy covariance

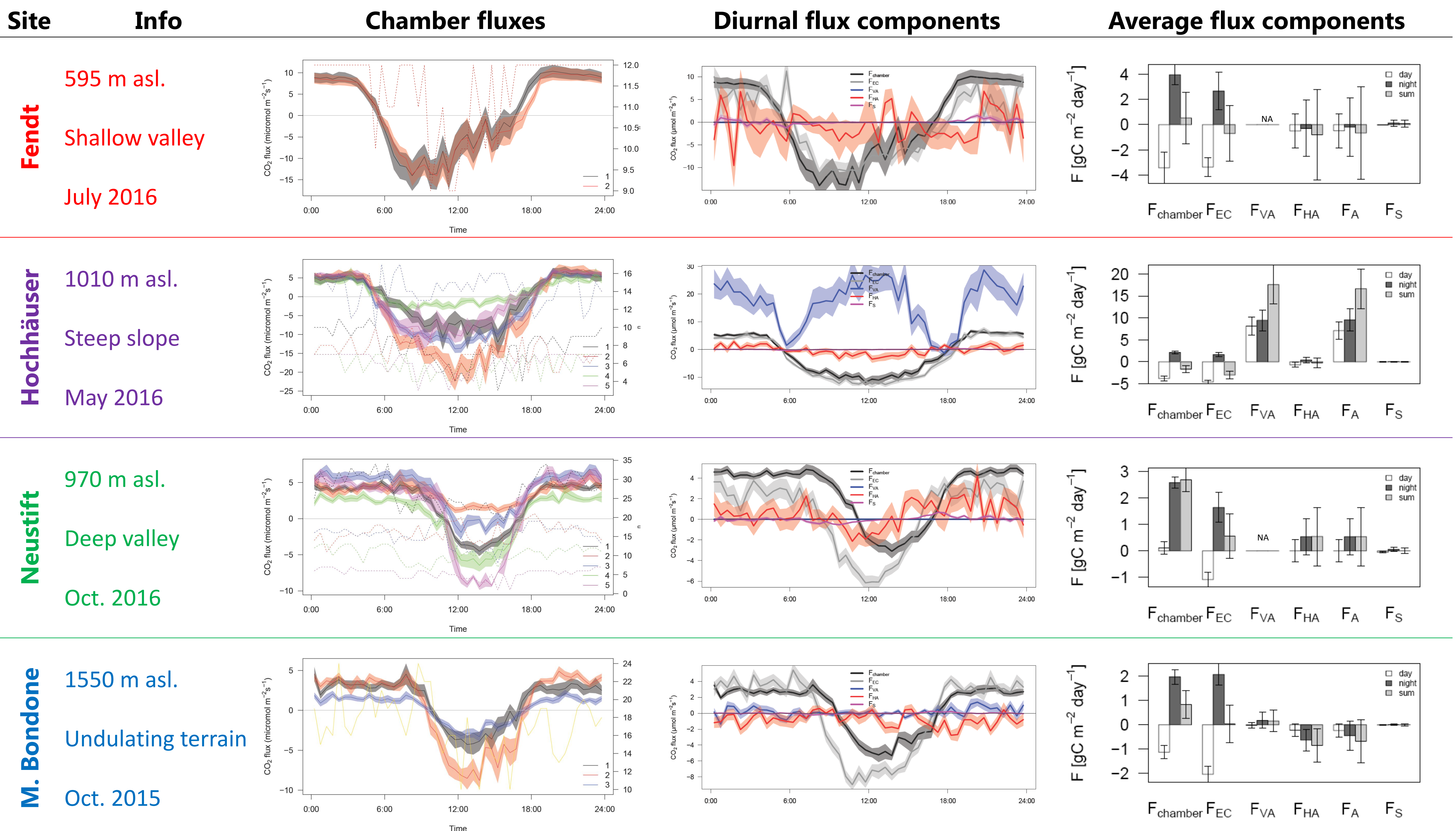
CO₂ profile
Vertical wind



Sites



Results



Conclusions

- Both the horizontal and vertical advection contributed more significantly to the CO₂ flux at night time than at daytime at most sites.
- At the flatter sites, horizontal advection played a more important role than the vertical advection, and vice versa at the steep site.
- The above-canopy advection contributed more to the CO₂ flux than within-canopy advection due to short canopy heights.
- Large variability of NEE measured by the three chambers indicates the challenge of comparing chamber and micrometeorological fluxes resulting from the heterogeneity of the grassland surface.

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