Eddy Covariance Measurements of CO_2 and Energy Fluxes above Mountain Grasslands in the Austrian Alps: Challenges and Results

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Background Eddy covariance (EC) flux measurements in mountainous terrain are challenging because many of the basic assumptions inherent to the method may be violated resulting in biased flux estimates. Here we report on CO_2, H_2O and energy flux measurements made over the past couple of years at several grassland sites in the complex topography of the Austrian Alps.

Results Appropriate quality control provided (not shown), EC measurements above mountain grasslands in complex terrain yielded CO_2 fluxes which reasonably corresponded with independent chamber measurements (Fig. 2). The energy balance closure (or lack thereof) was of the same order as at many supposedly more ideal sites (Fig. 3) – if we accept closure gaps of 20-30% at flat sites we also have to do so at complex sites. As shown in Fig. 4, cospectral peaks were consistently located at lower frequencies (in particular during stable conditions) as compared to the reference cospectra by Kaimal & Finnigan (1994). As a consequence, our EC flux measurements require less corrections for low-pass filtering.

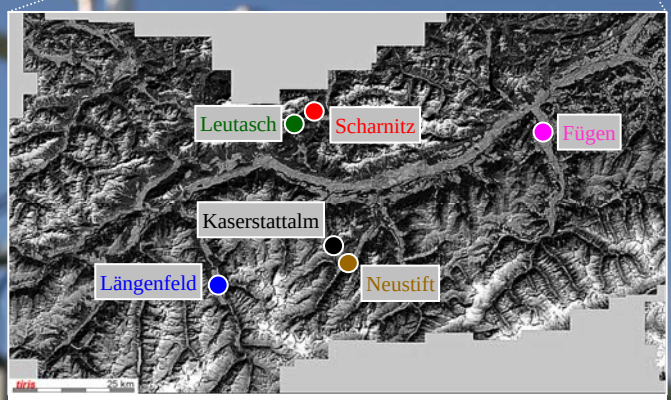

Figure 1 Location of mountain grassland study sites in Tyrol, Austria.

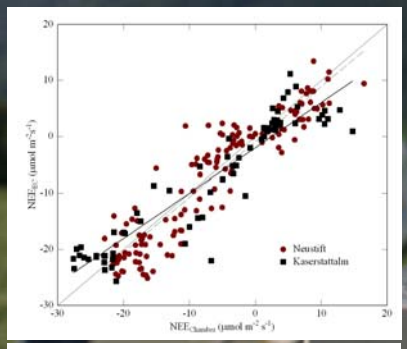

Fig. 2 EC *vs.* chamber-based NEE.

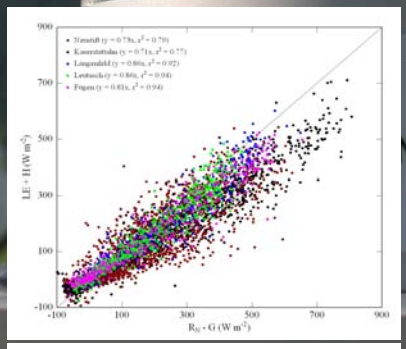

Fig. 3 Energy balance closure.

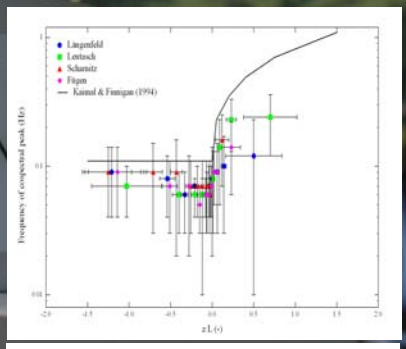

Fig. 4 Cospectral shape *vs.* stability.

Conclusions At least over short grassland vegetation, our measurements indicate that defensible EC flux measurements are possible even in complex mountainous terrain.

Funding