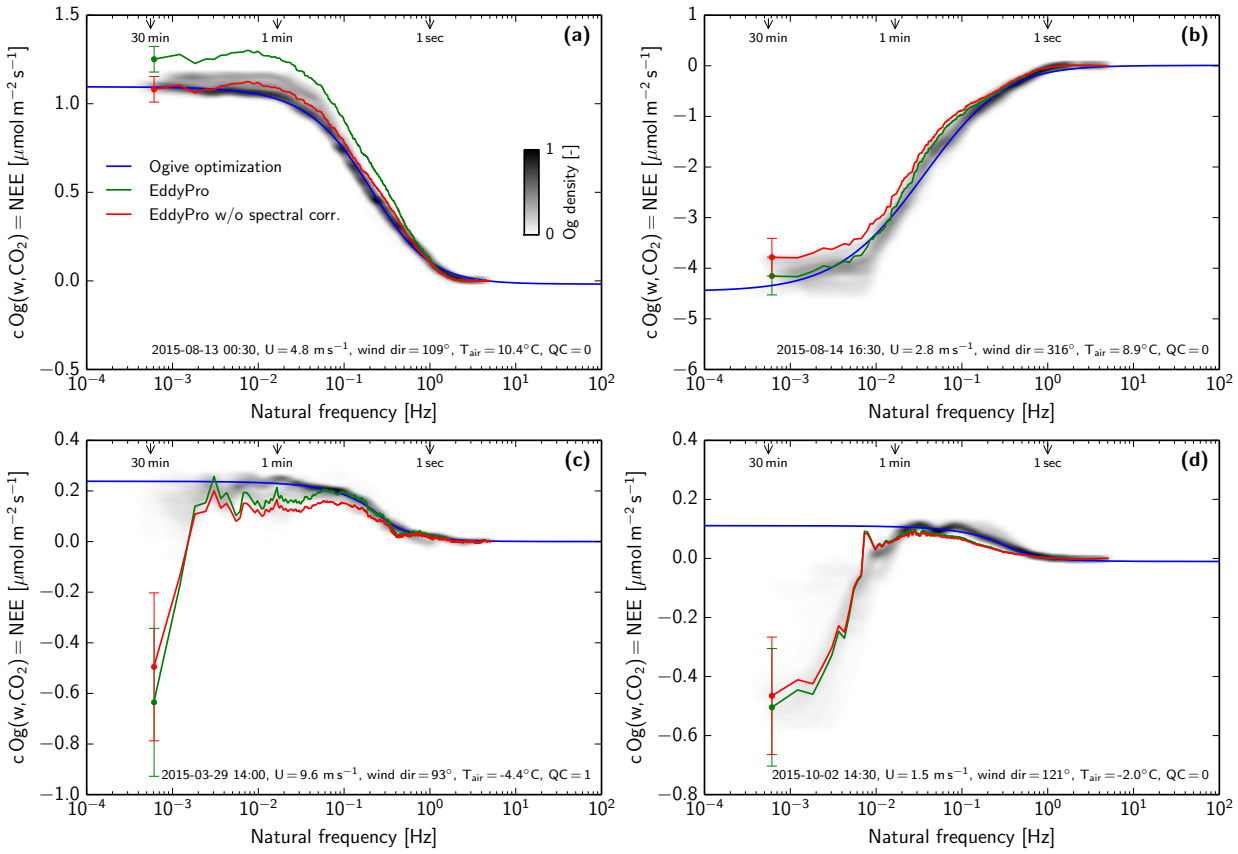

Figure S1: Additional examples of the flux estimation by ogive optimization and EddyPro (with and without spectral corrections after *Moncrieff et al.* (1997, 2004)). Local time, average horizontal wind speed (U), wind direction, air temperature (T_{air}) and quality flag (QC) are given in the lower right of each panel. a: Nighttime release during the growing season showing acceptable agreement between the methods. b: Growing season uptake when both methods agree. c: Small release during strong wind in wintertime. After stabilization of the ogives in the mid frequency range, contributions of the lowest frequencies implausibly suggest CO_2 uptake in conventional flux estimates. d: Similar situation during calm conditions in October.

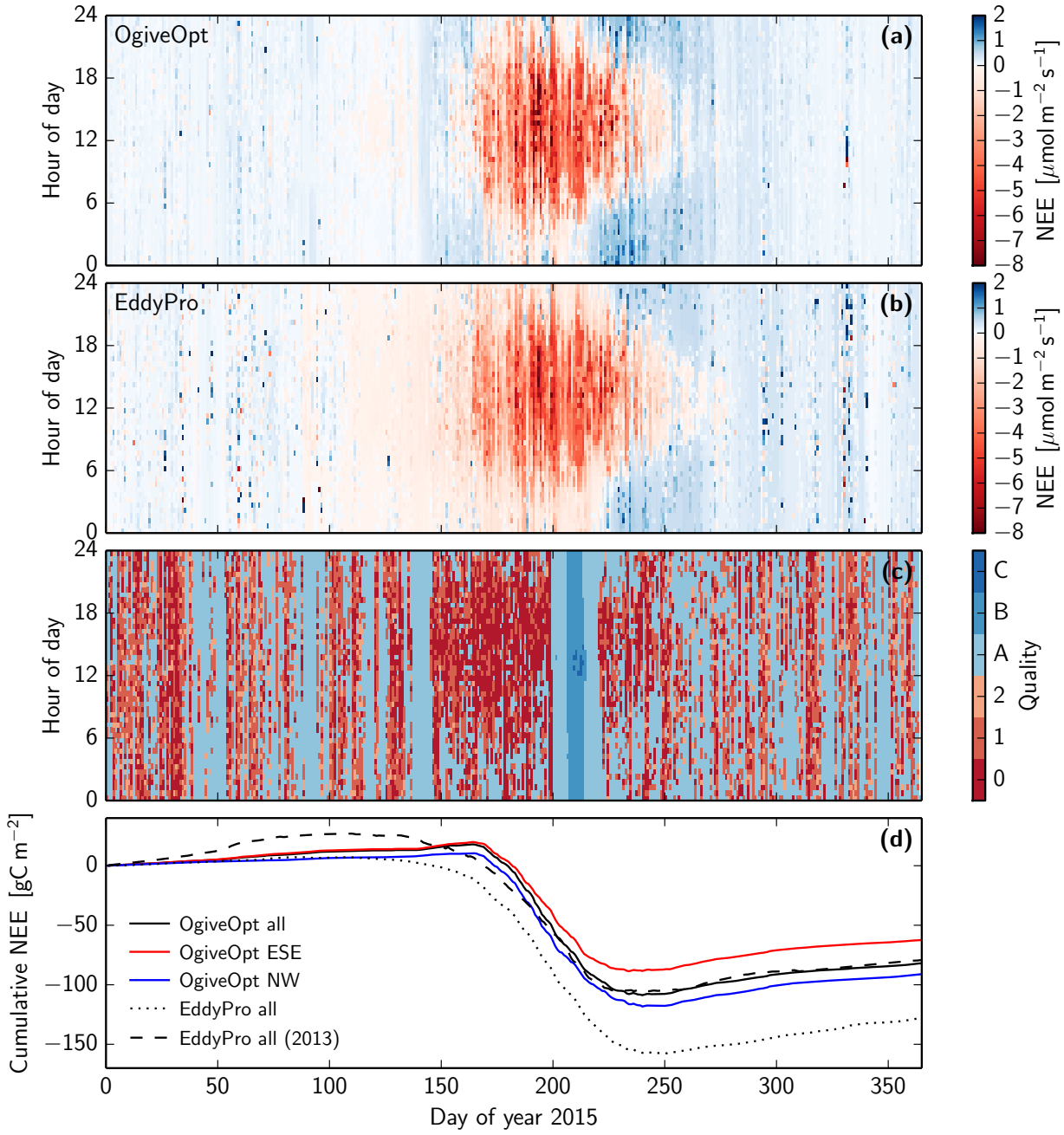

Figure S2: Gap-filled NEE fluxes and quality flags. a: Fingerprint plot of ogive optimization results of 2015. b: Corresponding EddyPro results. c: Corresponding quality flags based on *Foken and Wichura* (1996) and *Reichstein et al.* (2005). d: Cumulative sums based on all measurements, and separately gap-filled for the two footprints. The EddyPro results from 2013 are based on raw CO_2 measurements as wet molar densities, which renders them less certain than the 2015 data and prevented flux calculations using ogive optimization.

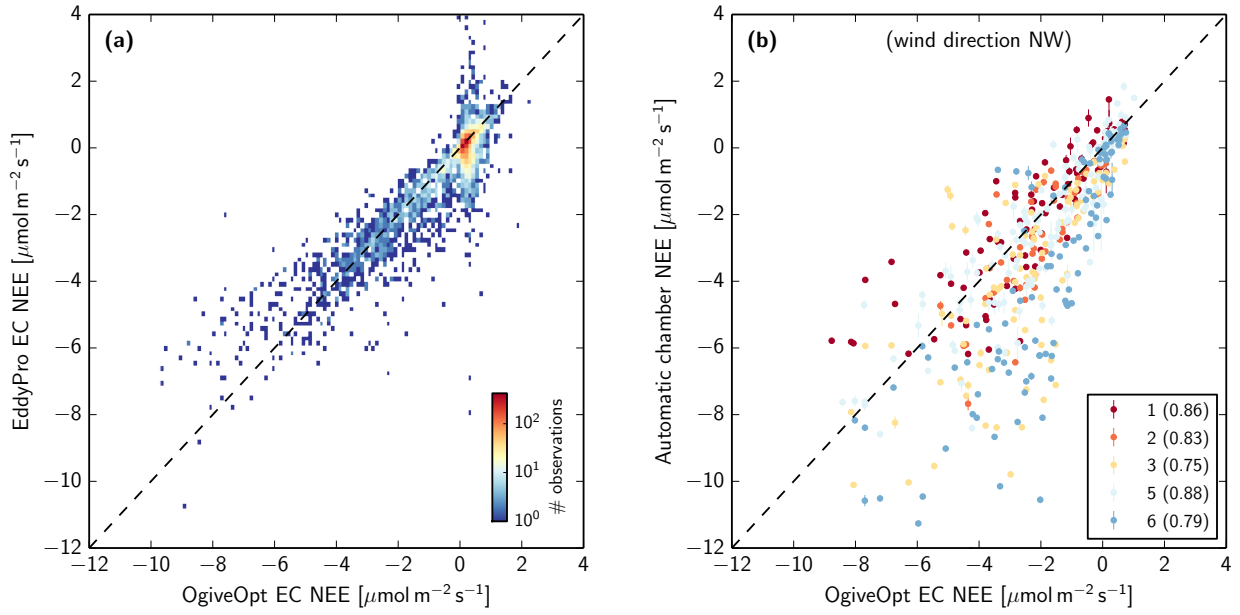

Figure S3: Comparison of ogive optimization fluxes to other methods. a: Histogram of conventional EC fluxes calculated by EddyPro (correlation r=0.88). b: Five individual automatic flux chambers located in the NW footprint (chamber 4 was not operational). Numbers in parentheses denote correlation coefficients. Corresponding p-values are all smaller than 10^{-12}.

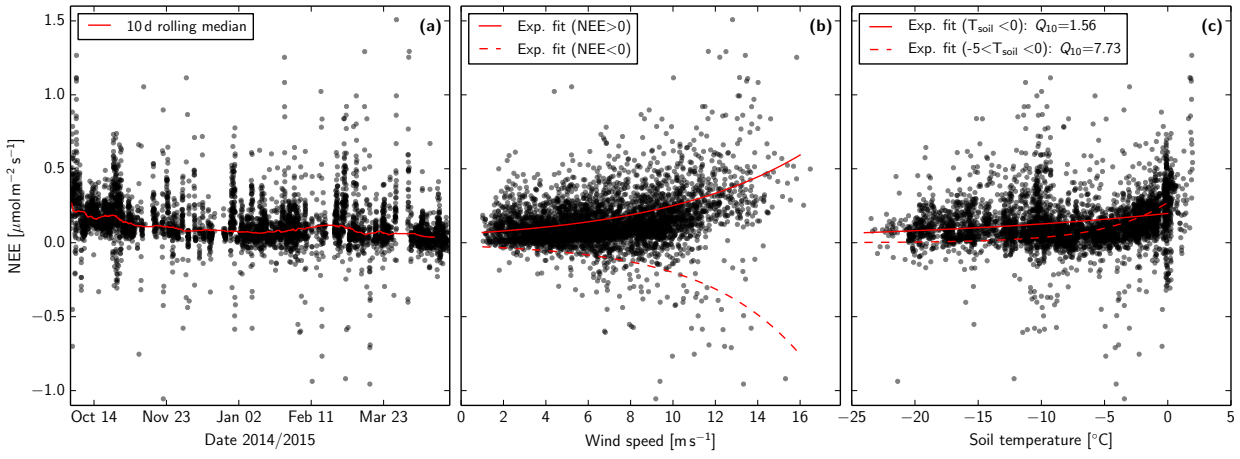

Figure S4: NEE results of ogive optimization between 1 October 2014 and 1 May 2015. a: Time series. b: Relation with wind speed. c: Relation with soil temperature (10 cm depth).

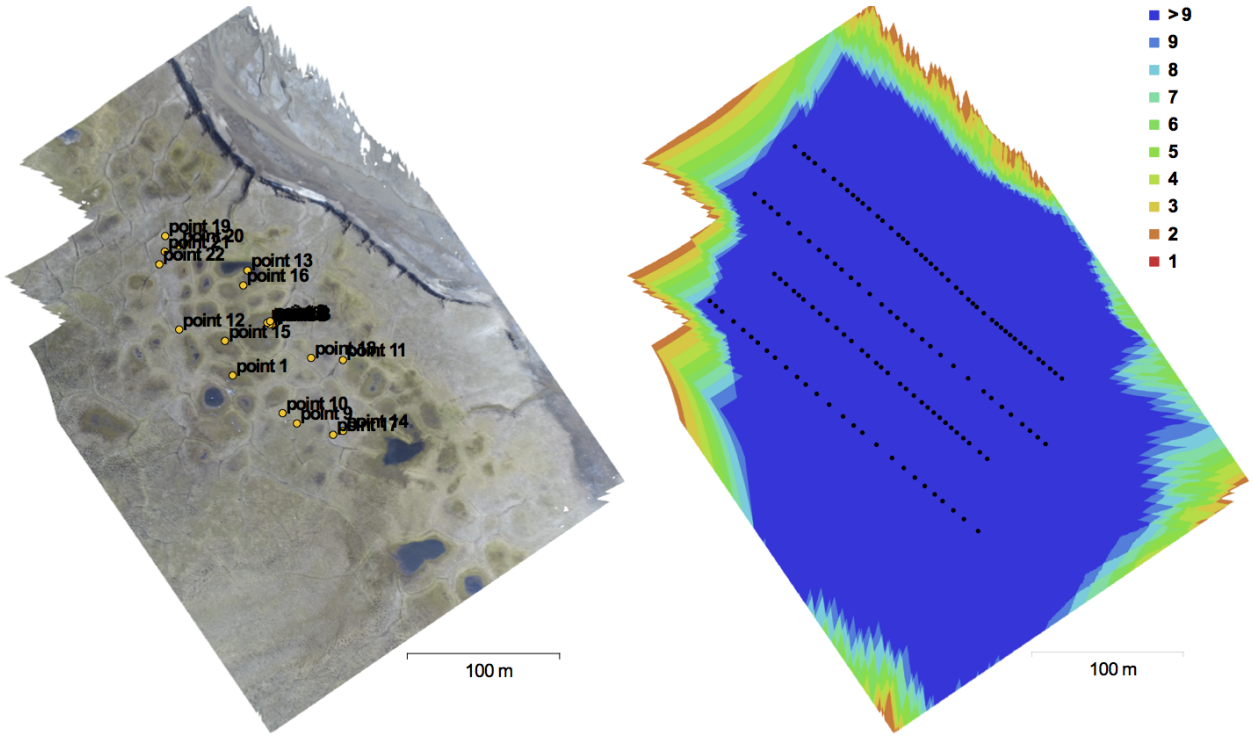

Figure S5: Details of the topographical survey. Left: Ground control points. Right: Camera locations and image overlap.

Figure S6: Photos of the environment and instrumentation on 19 August 2013 (left) and 7 October 2015 (right).

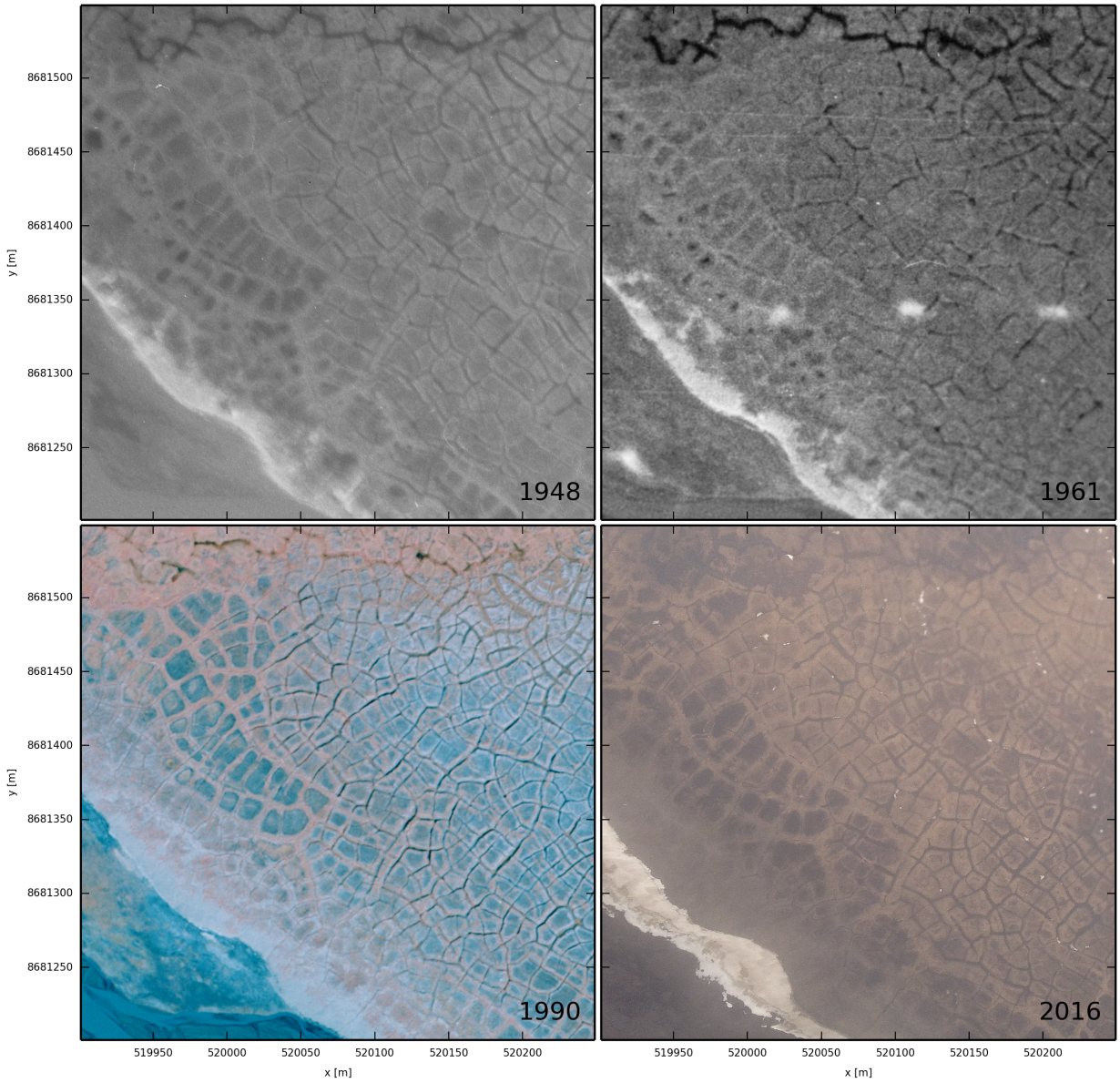

Figure S7: Time series of aerial images from the northern side of Adventdalen, 2.4 km away from the measurement site. Both low-centered and high-centered polygons show little signs of differential ground subsidence, which would indicate ice-wedge degradation. Historical photographs were provided by the Norwegian Polar Institute (reference numbers S48-5181, S61-3301 and S90-5273). The images from 1948 and 1961 were taken on panchromatic films, and the image from 1990 is a near infra-red (false color) photography.

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Moncrieff, J., R. Clement, J. Finnigan, and T. Meyers (2004), Averaging, detrending, and filtering of eddy covariance time series, in *Handbook of micrometeorology*, pp. 7–31, Springer.

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