



Supplement of

Snow–vegetation–atmosphere interactions in alpine tundra

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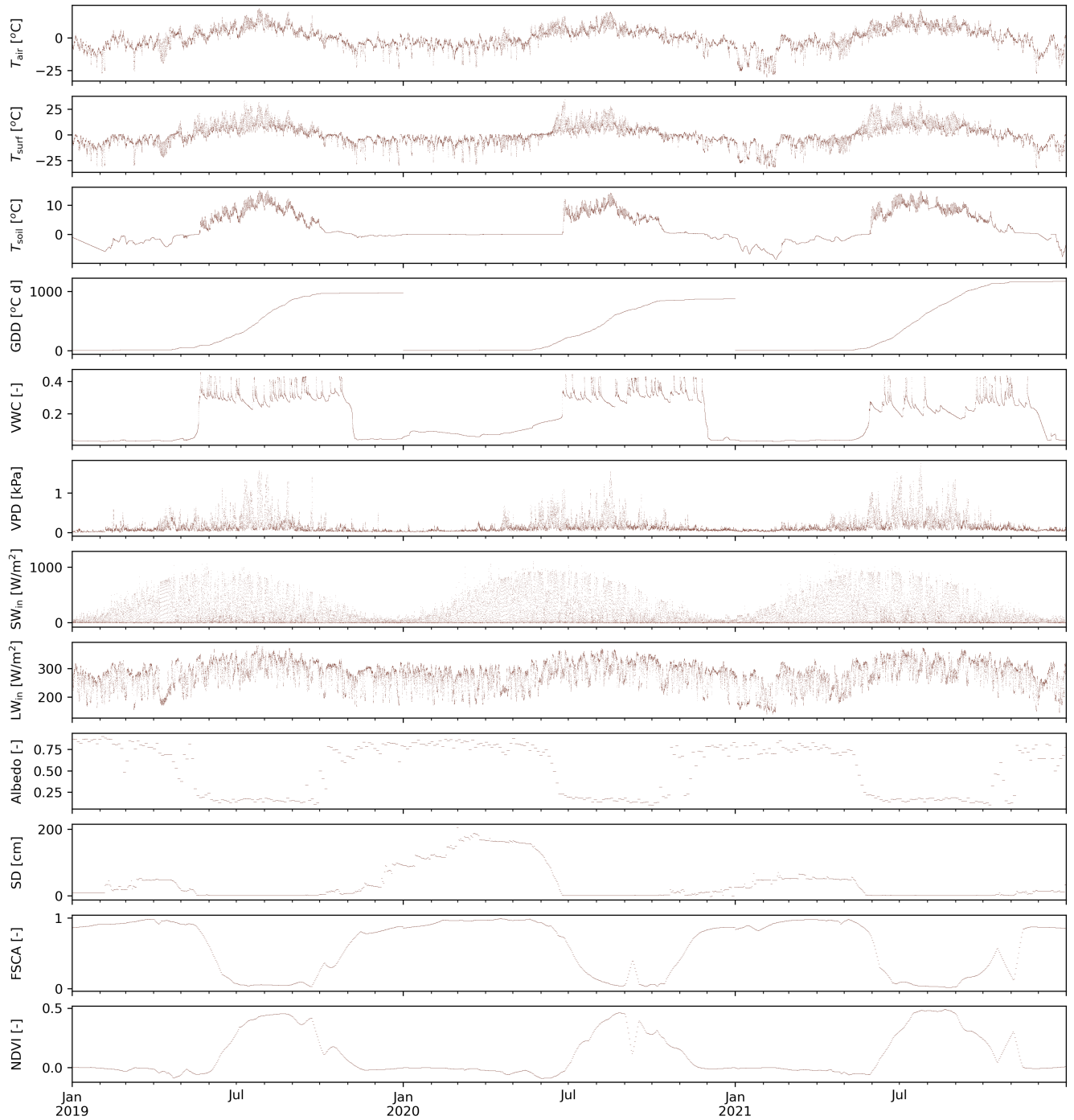


Figure S1. Time series of 30-minute estimates for the 12 predictors. Variable name denotes, from top to bottom, air temperature (T_{air} [°C]), surface temperature (T_{surf} [°C]), soil temperature (T_{soil} [°C]), growing degree days (GDD [°C d]), soil volumetric water content (VWC [-]), vapour pressure deficit (VPD [kPa]), incoming shortwave radiation (SW_{in} [W m^{-2}]), incoming longwave radiation (LW_{in} [W m^{-2}]), surface albedo (albedo [-]), snow depth (SD [cm]), fractional snow-covered area (FSCA [-]), normalised difference vegetation index (NDVI [-])

Table S1. Fractions of weighted contributions from different nature types for both footprints separately as well as combined. Statistics represent averages over all valid CO₂ flux measurements from 2019-2021.

| | Combined | East | West |
|---------------------|----------|------|------|
| Water | 0.25 | 0.32 | 0.20 |
| Other | 0.02 | 0.00 | 0.04 |
| Mountain heathlands | 0.11 | 0.08 | 0.14 |
| Lichen heathlands | 0.18 | 0.18 | 0.18 |
| Moderate snow beds | 0.21 | 0.13 | 0.26 |
| Late snow beds | 0.09 | 0.19 | 0.01 |
| Flood plains | 0.03 | 0.03 | 0.03 |
| Fens | 0.11 | 0.07 | 0.14 |

Table S2. Mean evaluation statistics for 10 random forest regression models using different random subsets of data for training (80%) and testing (20%). Root mean square error (RMSE) values are given in the respective flux units, i.e. $\mu\text{mol m}^{-2} \text{s}^{-1}$ for NEE and $\text{mmol m}^{-2} \text{s}^{-1}$ for ET.

| Footprint | | # of estimates | RMSE | | | R^2 | | |
|-----------|------|----------------|----------|-------|-------|----------|-------|-------|
| | | | Training | Test | All | Training | Test | All |
| NEE | East | 10270 | 0.008 | 0.055 | 0.017 | 0.982 | 0.868 | 0.960 |
| | West | 13806 | 0.014 | 0.098 | 0.031 | 0.992 | 0.945 | 0.983 |
| ET | East | 10031 | 0.002 | 0.015 | 0.005 | 0.979 | 0.849 | 0.954 |
| | West | 12677 | 0.005 | 0.039 | 0.012 | 0.985 | 0.886 | 0.965 |

Table S3. Growing season statistics based on gap-filled NEE and ET fluxes of both footprints for the three years with flux measurements.

| | Year | Footprint West | Footprint East |
|---|------|----------------|----------------|
| Start date | 2019 | 25 June | 18 June |
| | 2020 | 30 July | 18 July |
| | 2021 | 25 June | 20 June |
| End date | 2019 | 08 September | 21 September |
| | 2020 | 26 September | 19 September |
| | 2021 | 05 September | 05 September |
| Carbon balance [gC m^{-2}] | 2019 | 61.9 | 43.7 |
| | 2020 | 28.4 | 16.6 |
| | 2021 | 81.4 | 67.7 |
| ET loss [mm] | 2019 | 73.0 | 47.7 |
| | 2020 | 34.4 | 20.9 |
| | 2021 | 69.0 | 51.8 |
| Water use efficiency [$\mu\text{mol-CO}_2 \text{ mmol-H}_2\text{O}^{-1}$] | 2019 | 1.27 | 1.37 |
| | 2020 | 1.24 | 1.20 |
| | 2021 | 1.77 | 1.96 |

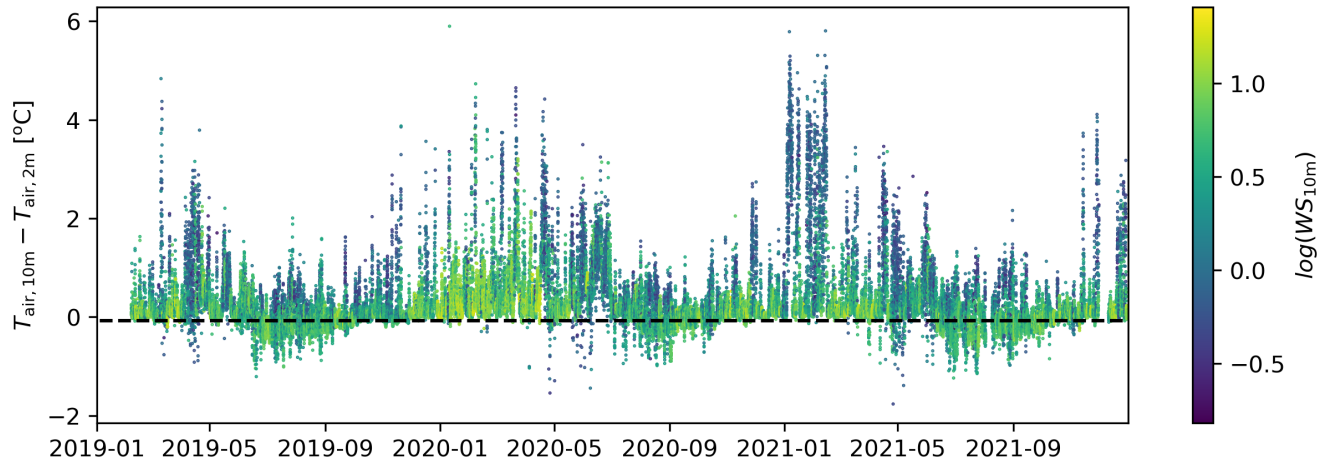


Figure S2. Time series of 30-minute estimates of air temperature differences between 10 and 2 m a.g.l. Colors indicate horizontal wind speeds at 10 m a.g.l. on a logarithmic scale. The stipulated line indicates neutral stratification.