Supporting Information

Temperature-induced diurnal redox potential in soil

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Figure S1 Image of the soil monolith (20 × 20 × 5 cm; h × w × d) inserted in a climate chamber and of Pt electrodes installed in depths of 2.5, 7.5, 12.5, and 17.5 cm. The reference electrode (Ag–AgCl, 3 M KCl L⁻¹ internal electrolyte) is identical to the ones employed for the other field and lab experiments. The climate chamber was programmed with a daily temperature amplitude that ranged from 15 to 35 °C with an anticyclical pattern, i.e., the highest soil temperatures occurred during the nighttime. The soil was excavated from study site Speicherkoog and the soil properties are equal to the data found in Table S1 for “Lab E”.

| Time (UT) | Temperature (°C) |
|-----------|------------------|
| 0         | 33               |
| 1         | 33               |
| 2         | 35               |
| 3         | 35               |
| 4         | 33               |
| 5         | 33               |
| 6         | 28               |
| 7         | 25               |
| 8         | 22               |
| 9         | 19               |
| 10        | 18               |
| 11        | 17               |
| 12        | 16               |
| 13        | 15               |
| 14        | 15               |
| 15        | 15               |
| 16        | 15               |
| 17        | 16               |
| 18        | 17               |
| 19        | 18               |
| 20        | 19               |
| 21        | 22               |
| 22        | 25               |
| 23        | 28               |
**Figure S2** Only quasi-stationary redox potentials ($E_H$) were employed for the statistical analysis, which resemble the red boxes in the example above for an electrode in 60 cm depth at Polder Speicherkoog (A). The selection for these stable phases served to delineate spatiotemporal trends in $\Delta E_H$ (e.g., as shown in B).
Figure S3 Boxplot diagram of data from redox potentials ($E_H$) under quasi-stationary conditions for all electrodes (triplicate per depth) for the sites Lavesum (A), Speicherkoog (B), and Kottenforst (C). The data was used to calculate daily $\Delta E_H$. The close-up for the distinct soil depth reflects a 7-d period in September (2006, D; 2010, E; 2014, F), and highlights the presence of diel $E_H$ pattern for each site. Note the variable scaling of the y-axis.
Figure S4 Depth-dependent delta redox potential (ΔE₉; calculated as the difference between daily E₉-max – E₉-min value) for the study sites Lavesum, Speicherkoog and Kottenforst. The data accounts for the mean with the standard error of the mean for electrodes in triplicate per depth.
Figure S5 Data density distribution visualized by ridgeline plots of delta air temperature (ΔAT; A). Spearman coefficients for variables shown in Figure 3C to G are plotted within a correlation matrix (B). Only the p < 0.05 coefficients have a background color.
**Figure S6** Image of a reference electrode installed at site Speicherkoog embedded within a salt bridge to close the electrical circuit with the soil. Please note, the salt bridge was removed from the soil on the right image for maintenance.
| Depth (cm) | Reference (DOI) | pH  | OC§ (g kg\(^{-1}\)) | Sand (g kg\(^{-1}\)) | Silt (g kg\(^{-1}\)) | Clay (g kg\(^{-1}\)) |
|-----------|-----------------|-----|---------------------|----------------------|----------------------|---------------------|
| Lavesum   | 10.2134/jeq2012.0225 | 4.7 | 73.9                | 22                   | 58                   | 20                  |
|           |                  | 5.5 | 15.7                | 21                   | 58                   | 21                  |
|           |                  | 6.2 | 22.3                | 42                   | 39                   | 19                  |
|           |                  | 4.7 | 1.7                 | 54                   | 30                   | 16                  |
|           |                  | 4.7 | 1.7                 | 94                   | 4                    | 2                   |
| Speicherkoog | 10.1002/jpln.2018000960 | 7.1 | 28.6                | 230                  | 520                  | 250                 |
|           |                  | 7.3 | 17.5                | 131                  | 669                  | 210                 |
|           |                  | 7.4 | 9.7                 | 192                  | 603                  | 220                 |
|           |                  | 7.4 | 4.6                 | 520                  | 360                  | 110                 |
|           |                  | 7.6 | 2.6                 | 721                  | 224                  | 60                  |
|           |                  | 7.6 | 2.0                 | 773                  | 187                  | 50                  |
| Kottenforst | 10.1016/j.catena.2020.104528 | 4.5 | 3.8                 | 68                   | 809                  | 122                 |
|           | 65+90           | 4.9 | 2.2                 | 50                   | 675                  | 276                 |
|           | 120             | 5.1 | 1.8                 | 148                  | 570                  | 283                 |
| Lab A†    | 10.1007/s11368-017-1812-3 | 5.8 | 85.3                | 415                  | 435                  | 150                 |
| Lab B‡    |                  | 7.5 | 1.98                | 20                   | 780                  | 200                 |
| Lab C‡    | 10.1111/eqss.12717 | 7.2 | 5.61                | 880                  | 77                   | 43                  |
| Lab D‡    |                  | 6.7 | 27.1                | 223                  | 557                  | 217                 |
| Lab E‡    |                  | 7.6 | 2.0                 | 773                  | 187                  | 50                  |

† Disturbed sample
‡ Undisturbed sample
§ Organic carbon