**Supplementary Material**

# Non-growing season carbon emissions in a northern peatland are projected to increase under global warming

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# Supplementary Material

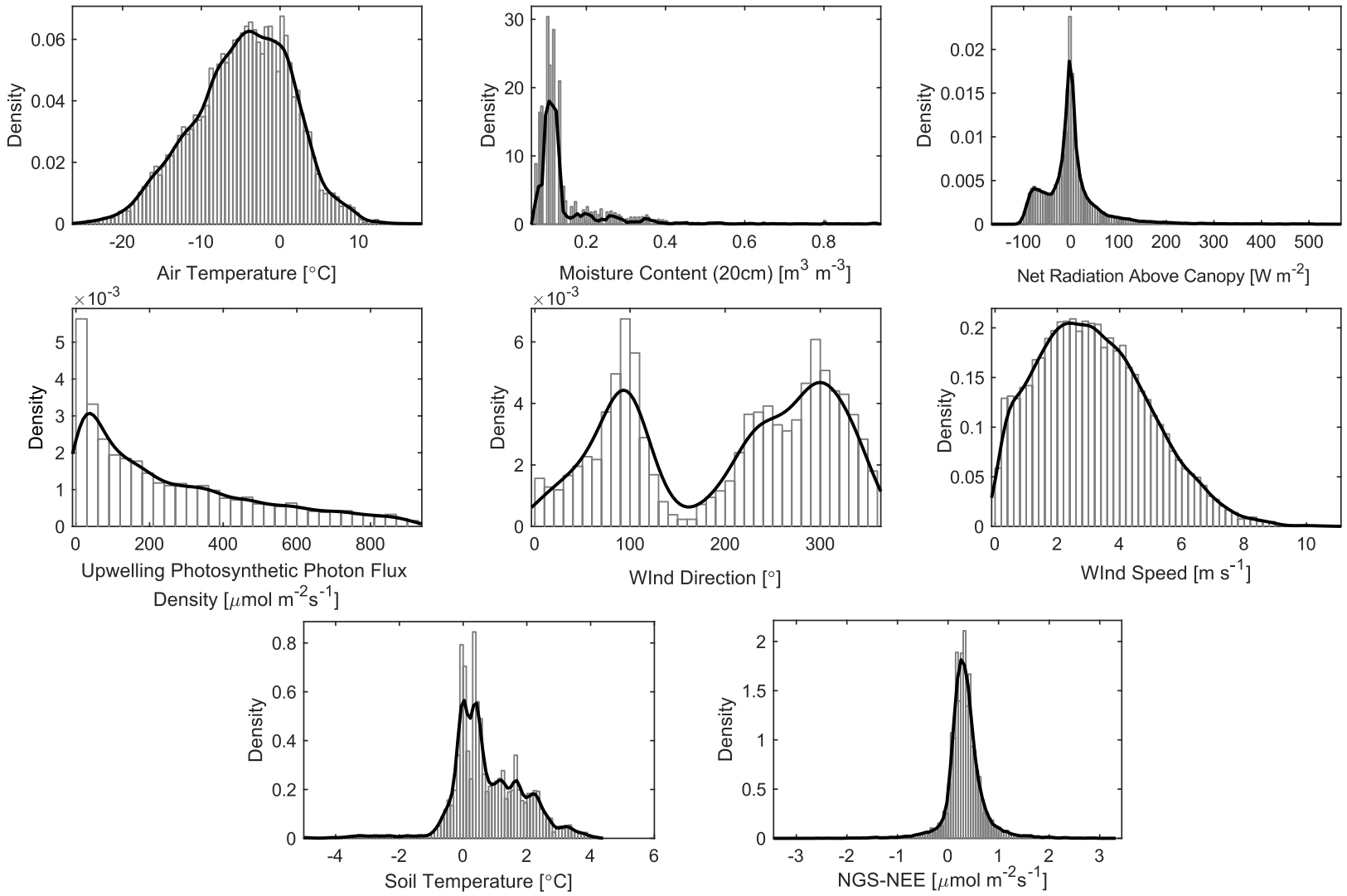


**Figure S1.** Distributions of model variables. Solid black lines represent non-parametric (normal kernel) fits to the distributions.

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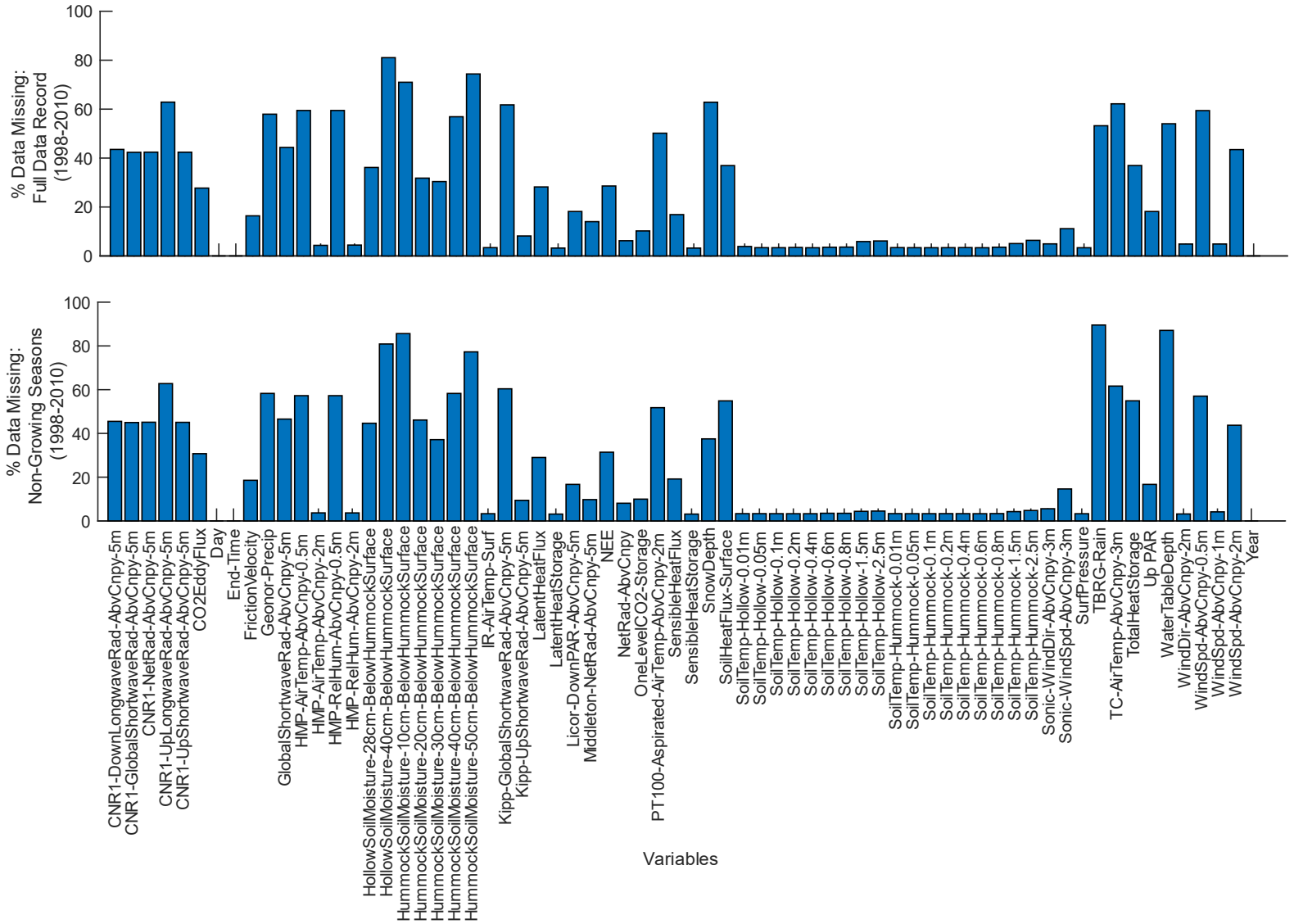


**Figure S2.** Percentage of missing observations across (a) the entire Mer Bleue dataset (1998-2010) and (b) the non-growing seasons.

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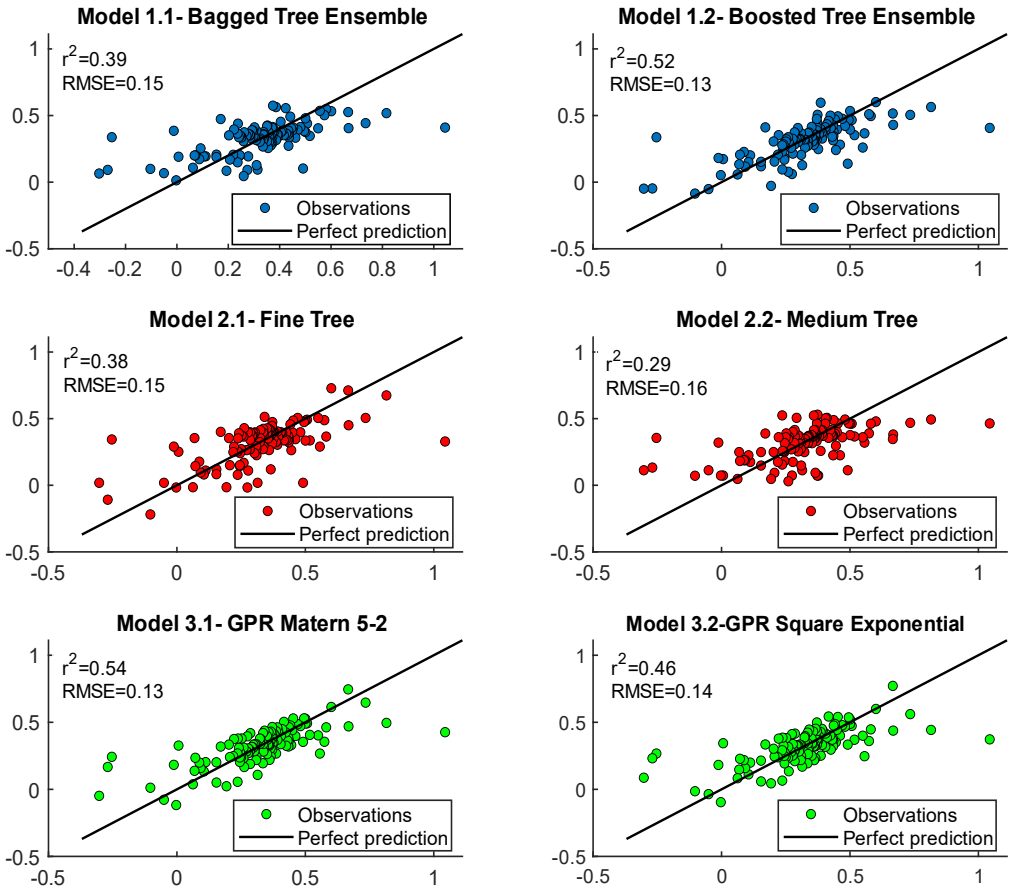


**Figure S3**. Comparison of 6 models trained prior to selection of the ε-SVM model. These models had inferior performance when compared to the ε-SVM model and were therefore not selected for further consideration in this study.

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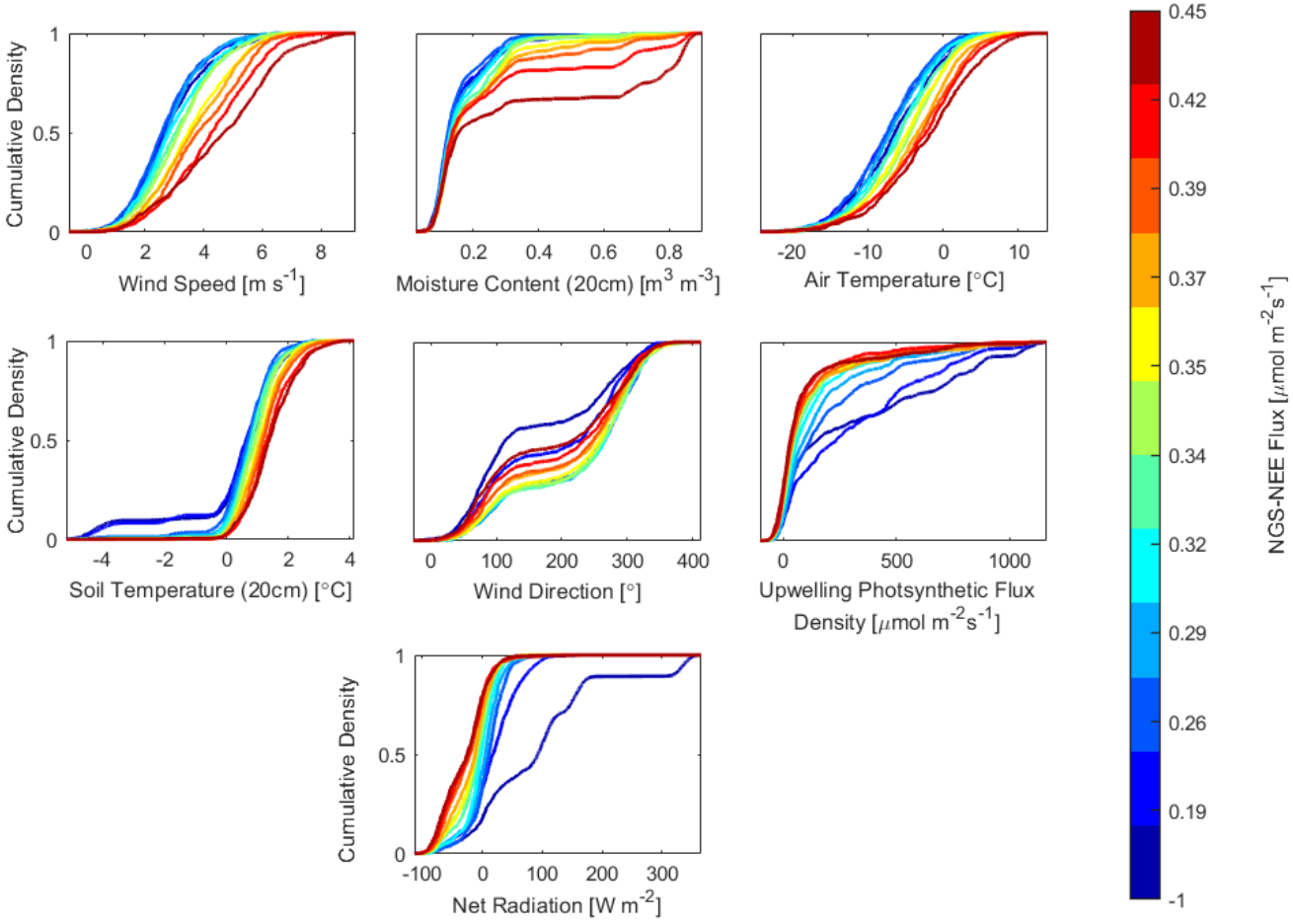


**Figure S4.** Regional sensitivity analysis of predictor variables shown by the empirically derived Cumulative Density Functions (CDFs) for 12 distinct regions of predicted NGS NEE values.

# Supplementary Material

**Table S1.** Non-Growing Season Phenology at Mer Bleue

| Non-Growing Season* | | |
|---|---|---|
| **Start (YYYY-MM-DD)** | **End (YYYY-MM-DD)** | **Length [days]** |
| 1998-12-20 | 1999-04-06 | 107 |
| 1999-12-15 | 2000-03-05 | 81 |
| 2000-11-21 | 2001-04-12 | 142 |
| 2001-12-15 | 2002-04-05 | 111 |
| 2002-11-05 | 2003-03-27 | 142 |
| 2003-11-30 | 2004-03-05 | 96 |
| 2004-12-02 | 2005-03-29 | 117 |
| 2005-11-24 | 2006-03-28 | 124 |
| 2006-12-02 | 2007-03-26 | 114 |
| 2007-11-21 | 2008-04-12 | 143 |
| 2008-11-25 | 2009-03-11 | 106 |
| 2009-12-10 | 2010-03-12 | 92 |

*Defined as the period between the first of three consecutive days of snow on ground and the first day of three consecutive days with no snow on ground. Days during the winter in which no snow was present on the ground were not considered as feasible end dates for the non-growing season

# Supplementary Material

**Table S2.** Mer Bleue site: Measured energy, soil, and meteorological variables.

| Variable Name | Units | Variable ID (Figure 6) | Description (Sensor Height) | Variable Name | Units | Variable ID (Figure 6) | Description (Sensor Height) |
|---|---|---|---|---|---|---|---|
| Year | [n/a] | 1 | - | SoilTemp_Hummock_0.8m | [°C] | 35 | Hummock Soil Temperature- 0.8m depth |
| Day | [n/a] | 2 | - | SoilTemp_Hummock_1.5m | [°C] | 36 | Hummock Soil Temperature- 1.5m depth |
| End_Time | [UTC] | 3 | - | SoilTemp_Hummock_2.5m | [°C] | 37 | Hummock Soil Temperature- 2.5m depth |
| CNR1_NetRadiation_AbvCnpy_5m | [W $m^{-2}$] | 4 | Net Radiation Balance (+5.4m) | WindSpd_AbvCnpy_0.5m | [m $s^{-1}$] | 38 | Wind Speed (+0.6m) |
| GlobalShortwaveRad_AbvCnpy_5m | [W $m^{-2}$] | 5 | Downwelling Shortwave Radiation (+5.4m) | WindSpd_AbvCnpy_1m | [m $s^{-1}$] | 39 | Wind Speed (+1m) |
| CNR1_GlobalShortwaveRad_AbvCnpy_5m | [W $m^{-2}$] | 6 | Downwelling Shortwave Radiation (+5.4m) | WindSpd_AbvCnpy_2m | [m $s^{-1}$] | 40 | Wind Speed (+2m) |
| CNR1_UpShortwaveRad_AbvCnpy_5m | [W $m^{-2}$] | 7 | Outgoing Shortwave Radiation (+5.4m) | Sonic_WindSpd_AbvCnpy_3m | [m $s^{-1}$] | 41 | Wind Speed (+3m) |
| CNR1_DownLongwaveRad_AbvCnpy_5m | [W $m^{-2}$] | 8 | Incoming Longwave Radiation (+5.4m) | WindDir_AbvCnpy_2m | [°] | 42 | Unit Vector Mean Wind Direction (+2m) |
| CNR1_UpLongwaveRad | [W $m^{-2}$] | 9 | Upwelling Longwave Radiation (+5.4m) | Sonic_WindDir_AbvCnpy_3m | [°] | 43 | Wind Direction (+5.4m) |
| Middleton_NetRad_AbvCnpy_5m | [W $m^{-2}$] | 10 | Net Radiation (+5.4m) | TBRG_Rain | [mm] | 44 | Event Rainfall |
| Kipp_GlobalShortwaveRad_AbvCnpy_5m | [W $m^{-2}$] | 11 | Downwelling Shortwave Radiation (+5m, +2m) | SnowDepth | [m] | 45 | Depth of Snow |
| Kipp_UpShortwaveRad_AbvCnpy_5m | [W $m^{-2}$] | 12 | Upwelling Shortwave Radiation (+5m) | WaterTableDepth | [m] | 46 | Depth below hummock surface |
| Licor_DownPAR_AbvCnpy_5m | [µmol $m^{-2}s^{-1}$] | 13 | Downwelling Photosynthetic Flux Density (+5m) | SurfPressure | [kPa] | 47 | Barometric Pressure (+1m) |
| HMP_RelHum_AbvCnpy_0.5m | [%] | 14 | Relative Humidity (+0.5m) | PT100_Aspirated_AirTemp_AbvCnpy_2m | [°C] | 48 | Air Temperature (+2m) |
| HMP_RelHum_AbvCnpy_2m | [%] | 15 | Relative Humidity (+2m) | Geonor_Precip | [mm] | 49 | Event Precipitation |
| HMP_AirTemp_AbvCnpy_0.5m | [°C] | 16 | Air Temperature (+0.5m) | HummockSoilMoisture_10cm_BelowHummockSurface | [$m^3$ $m^{-3}$] | 50 | Hummock Volumetric Soil Moisture- 10cm depth |
| HMP_AirTemp_AbvCnpy_2m | [°C] | 17 | Air Temperature (+2m) | HummockSoilMoisture_20cm_BelowHummockSurface | [$m^3$ $m^{-3}$] | 51 | Hummock Volumetric Soil Moisture- 20cm depth |

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| Variable Name | Units | Variable ID (Figure 2) | Description (Sensor Height) | Variable Name | Units | Variable ID (Figure 2) | Description (Sensor Height) |
|---|---|---|---|---|---|---|---|
| TC_AirTemp_AbvCnpy_3m | [°C] | 18 | Air Temperature (3m) | HummockSoilMoisture_30cm_BelowHummockSurface | [$m^3$ $m^{-3}$] | 52 | Hummock Volumetric Soil Moisture- 30cm depth |
| IR_AirTemp_Surf | [°C] | 19 | Bog Surface Temperature | HummockSoilMoisture_40cm_BelowHummockSurface | [$m^3$ $m^{-3}$] | 53 | Hummock Volumetric Soil Moisture- 40cm depth |
| SoilTemp_Hollow_0.01m | [°C] | 20 | Hollow Soil Temperature- 0.01m depth | HummockSoilMoisture_50cm_BelowHummockSurface | [$m^3$ $m^{-3}$] | 54 | Hummock Volumetric Soil Moisture- 50cm depth |
| SoilTemp_Hollow_0.05m | [°C] | 21 | Hollow Soil Temperature- 0.05m depth | HollowSoilMoisture_28cm_BelowHummockSurface | [$m^3$ $m^{-3}$] | 55 | Hollow Volumetric Soil Moisture- 28cm depth |
| SoilTemp_Hollow_0.1m | [°C] | 22 | Hollow Soil Temperature- 0.1m depth | HollowSoilMoisture_40cm_BelowHummockSurface | [$m^3$ $m^{-3}$] | 56 | Hollow Volumetric Soil Moisture- 40cm depth |
| SoilTemp_Hollow_0.2m | [°C] | 23 | Hollow Soil Temperature- 0.2m depth | NetRad_AbvCnpy | [W $m^{-2}$] | 57 | Net Radiation (+5.4m) |
| SoilTemp_Hollow_0.4m | [°C] | 24 | Hollow Soil Temperature- 0.4m depth | LatentHeatFlux | [W $m^{-2}$] | 58 | Latent Heat Flux (+3m) |
| SoilTemp_Hollow_0.6m | [°C] | 25 | Hollow Soil Temperature- 0.6m depth | SensibleHeatFlux | [W $m^{-2}$] | 59 | Sensible Heat Flux (+3m) |
| SoilTemp_Hollow_0.8m | [°C] | 26 | Hollow Soil Temperature- 0.8m depth | FrictionVelocity | [m $s^{-1}$] | 60 | Friction (Shear) velocity |
| SoilTemp_Hollow_1.5m | [°C] | 27 | Hollow Soil Temperature- 1.5m depth | OneLevel$CO_2$ Storage | [µmol $m^{-2}s^{-1}$] | 61 | Change in $CO_2$ Concentration in air column below EC instrumentation |
| SoilTemp_Hollow_2.5m | [°C] | 28 | Hollow Soil Temperature- 2.5m depth | $CO_2$EddyFlux | [µmol $m^{-2}s^{-1}$] | 62 | $CO_2$ Flux above hummock surface (+3m) |
| SoilTemp_Hummock_0.01m | [°C] | 29 | Hummock Soil Temperature- 0.01m depth | LatentHeatStorage | [W $m^{-2}$] | 63 | Change in Latent Heat in air column below EC instrumentation |
| SoilTemp_Hummock_0.05m | [°C] | 30 | Hummock Soil Temperature- 0.05m depth | SensibleHeatStorage | [W $m^{-2}$] | 64 | Change in Sensible Heat in air column below EC instrumentation |
| SoilTemp_Hummock_0.1m | [°C] | 31 | Hummock Soil Temperature- 0.1m depth | SoilHeatFlux_Surface | [W $m^{-2}$] | 65 | Heat Flux through Bog Surface |
| SoilTemp_Hummock_0.2m | [°C] | 32 | Hummock Soil Temperature- 0.2m depth | TotalHeatStorage | [W $m^{-2}$] | 66 | Combined Energy Storage Budget |
| SoilTemp_Hummock_0.4m | [°C] | 33 | Hummock Soil Temperature- 0.4m depth | NEE | [µmol $m^{-2}s^{-1}$] | 67 | Net Ecosystem Exchange |
| SoilTemp_Hummock_0.6m | [°C] | 34 | Hummock Soil Temperature- 0.6m depth | Licor_UpPAR_AbvCnpy_5m | [µmol $m^{-2}s^{-1}$] | 68 | Upwelling Photosynthetic Flux Density (+5m) |

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**Table S3.** Mer Bleue site: Computed Random Forest Importance Metrics.

| Variable | Importance Metric ($I_j$) |
|---|---|
| Sonic_WindSpd_AbvCnpy_3m | 0.186 |
| WindDir_AbvCnpy_2m | 0.135 |
| Up PAR | 0.729 |
| HMP_AirTemp_AbvCnpy_2m | 0.422 |
| NetRad_AbvCnpy | 0.517 |
| HummockSoilMoisture_20cm_BelowHummockSurface | 0.397 |
| SoilTemp_Hummock_0.2m | 0.474 |