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Supporting Information for

**Detecting Hot Spots of Methane Flux using Footprint-Weighted Flux Maps**

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Figures S1 to S10

**Introduction**

The following supporting information includes 10 figures that support some of the statements/findings included throughout the main text.

Chart, diagram

Description automatically generated

**Figure S1**. Differences in the cospectra of methane concentration and vertical wind velocity between 30 min and 15 min fluxes for the August release encompassing 10 days of data used in the validation.

Diagram

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**Figure S2.** Sonic-anemometer wind profiles during neutral conditions at US-Bi1 where the methane release experiment was conducted. Roughness length was graphically calculated from the 22 profiles under neutral stability conditions.

Chart

Description automatically generated

**Figure S3.** Wind shear variations between the top and bottom sonic anemometers in response to friction velocity ()



**Figure S4**. Histogram of the CH4 fluxes measured by the eddy-covariance tower measured during the release experiment and used in the validation.

Diagram

Description automatically generated

**Figure S5.** Example 50-80% contour footprints for the tower at 3.9 m height during the release experiment for different cases of atmospheric stability. a) unstable case for 08-16 15:00, b) Neutral case for 08-18 07:00, c) Stable case for 08-22 01:45. It can be appreciated that the KL model has slightly wider footprints at the base, and that the neutral footprints of the KL tend to be much shorter.

Chart, scatter chart

Description automatically generated

**Figure S6.** Results of the validation as in Figure 3 but using 30 min integration instead of 15 minutes.

Graphical user interface, application, PowerPoint

Description automatically generated

**Figure S7.** Daytime hotspot of methane emissions for the Sherman Wetland site for Day of Year 155-185, 2019. Plots a) shows the cumulative footprint and plot b) shows the corresponding footprint-weighted flux map for methane flux.

Graphical user interface, application

Description automatically generated

**Figure S8.**Footprint-weighted flux maps in Mayberry from DOY 076-096 for daytime and nighttime condition. Plots a) and c) show the cumulative footprints for daytime and nighttime values, respectively. Plots b) and e) show the corresponding footprint-weighted flux map for methane flux. In this location, high methane fluxes arise from the vegetation edge, at the intersection between the land and the open water, where the water level is very close to the surface. Visits to the field and analysis of satellite imagery corroborated the existence of this hot spot of methane flux. However, no actual chamber measurements were performed at this site. By estimating the hot spot area and applying Eq. 13 to this site, we calculate that the flux from this hot spot is potentially 1546 nmol m-2 s-1 during the daytime and 6859 nmol m-2 s-1 during the nighttime, however we could not corroborate these estimations.



**Figure S9**. Daytime comparison of model error (modeled – observed) against friction velocity (u\*), standard deviation of the vertical velocity component (), and wind direction.



**Figure S10**. Nighttime comparison of model error (modeled – observed) against friction velocity (u\*), standard deviation of the vertical velocity component (), and wind direction.