Supplemental Information

Section S1. Gas leak site

Figure S1. Image of gas leak site works taken on 12th June 2023.

Figure S2. Image of dead vegetation (circled in red) at gas leak site taken on 12th June 2023.

Figure S3. Google Earth Image (Airbus 2023) of the gas leak site taken in June 2023 (Google and Airbus, 2023), showing works being done on the west site of the railway line.
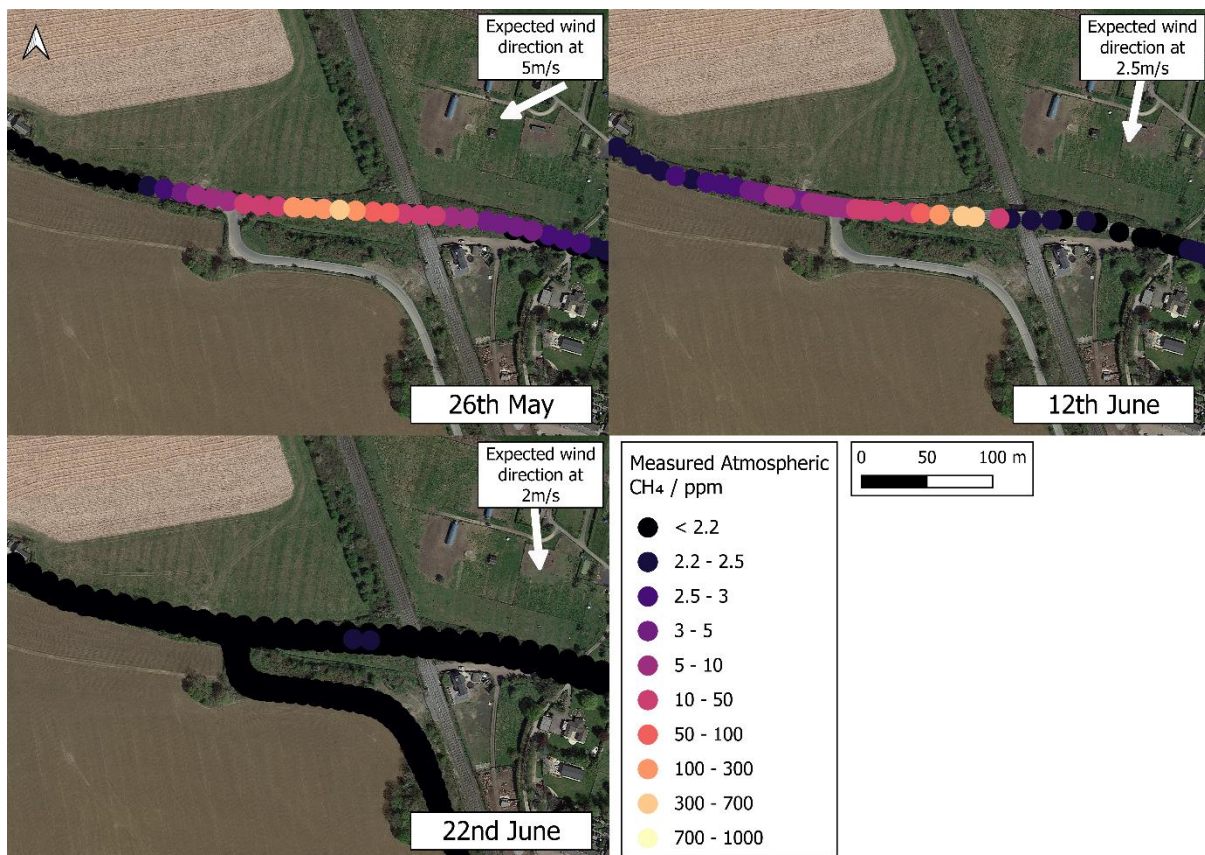
Section S2. Mobile Survey

Figure S4. Median observed concentrations (ppb) during the ground-based mobile surveys. © 2023 Google

Section S3. NAME Plume Modelling

We tested different plume criteria for scaling NAME to estimate the flux of the leak from the satellite. Here are the different flux estimates from the different plume criteria.

Table S1. Comparison between the mobile survey- and GHGSat-derived fluxes (kg h^{-1}) against the equivalent fluxes derived in NAME (kg h^{-1}) with the release location moved by ~10m in N/S/E/W directions. The NAME-derived fluxes are shown with the estimation bounds in brackets.

Date	GHGSat Flux (kg h^{-1})	NAME Derived Flux (kg h^{-1})	NAME Flux North (kg h^{-1})	NAME Flux South (kg h^{-1})	NAME Flux East (kg h^{-1})	NAME Flux West (kg h^{-1})
27/03/2023	236 ± 157	181 [133, 322]	199 [132,294]	206 [132,296]	202 [134,314]	208 [132,290]
20/04/2023	1071 ± 310	745 [539, 1376]	732 [650,1808]	769 [559,1813]	724 [559,1782]	776 [560,1868]
20/05/2023	1375 ± 481	1243 [931, 2322]	1462 [977,3128]	1498 [973,3128]	1455 [971,3018]	1444 [979,3123]
22/05/2023	438 ± 215	384 [173, 292]	398 [177,395]	432 [177, 397]	392 [177,396]	432 [177,403]
07/06/2023	290 ± 131	204 [77, 244]	212 [77,231]	210 [76,226]	211 [75,208]	229 [76,228]

Table S2. Wind speeds (ms^{-1}) used in flux estimations.

Date	GEOS FP Wind Speed (ms^{-1})	UKV Wind Speed (ms^{-1})
27/03/2023	0.8	3.8
20/04/2023	7.3	12.0
20/05/2023	4.9	7.3
22/05/2023	5.3	8.6
26/05/2023	-	4.4
07/06/2023	3.7	5.8
12/06/2023	-	3.1

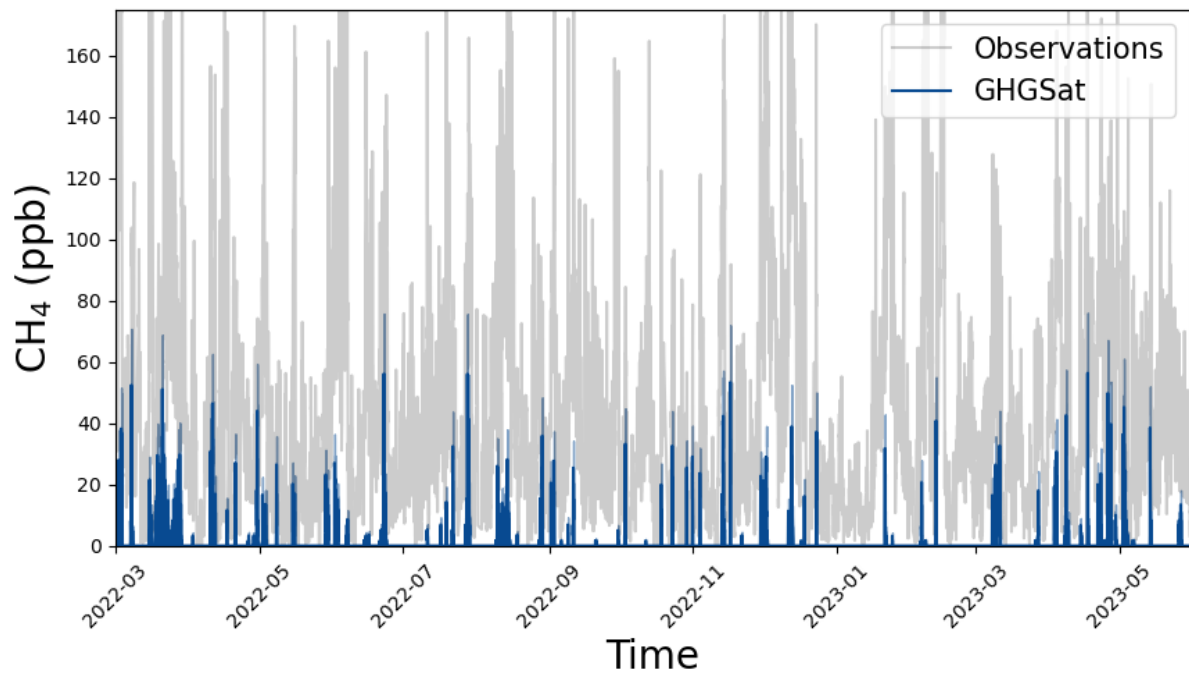## Section S3. Modelled Concentrations at Ridge Hill

Figure S5. The NAME_long modelled concentrations at Ridge Hill from GHGSat derived flux rates (ppb, blue) and above-background concentrations at RGL (ppb, grey).