Supplement of Atmos. Meas. Tech., 14, 5987–6003, 2021 https://doi.org/10.5194/amt-14-5987-2021-supplement © Author(s) 2021. CC BY 4.0 License.





## Supplement of

## Mobile atmospheric measurements and local-scale inverse estimation of the location and rates of brief $CH_4$ and $CO_2$ releases from point sources

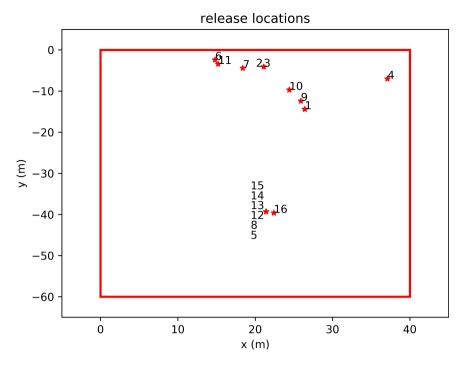
Pramod Kumar et al.

Correspondence to: Pramod Kumar (pramod.kumar@lsce.ipsl.fr)

The copyright of individual parts of the supplement might differ from the article licence.

## **List of Figures**

	<b>S</b> 1	Release locations (red stars) in the ATEX zone. Different releases can have identical locations. Isolated loca-	
		tions (5, 8, 12-16) correspond to the highest release rates	2
	S2	Contour plots of (a) $J_p$ , (b) $J_w$ , and (c) $J$ when fixing the release rate to its inverted value $Q_e$ for release no.	
5		1. Red and white stars respectively show the actual and inverted source locations	3
	<b>S</b> 3	Contour plots of (a) $J_p$ , (b) $J_w$ , and (c) $J$ when fixing the release rate to its inverted value $Q_e$ for release no.	
		2. Red and white stars respectively show the actual and inverted source locations	3
	<b>S</b> 4	Contour plots of (a) $J_p$ , (b) $J_w$ , and (c) $J$ when fixing the release rate to its inverted value $Q_e$ for release no.	
		3. Red and white stars respectively show the actual and inverted source locations	3
10	<b>S</b> 5	Contour plots of (a) $J_p$ , (b) $J_w$ , and (c) $J$ when fixing the release rate to its inverted value $Q_e$ for release no.	
		4. Red and white stars respectively show the actual and inverted source locations	4
	<b>S</b> 6	Contour plots of (a) $J_p$ , (b) $J_w$ , and (c) $J$ when fixing the release rate to its inverted value $Q_e$ for release no.	
		5. Red and white stars respectively show the actual and inverted source locations	4
	<b>S</b> 7	Contour plots of (a) $J_p$ , (b) $J_w$ , and (c) $J$ when fixing the release rate to its inverted value $Q_e$ for release no.	-
15	~ .	6. Red and white stars respectively show the actual and inverted source locations	4
	S8	Contour plots of (a) $J_p$ , (b) $J_w$ , and (c) $J$ when fixing the release rate to its inverted value $Q_e$ for release no.	•
	50	7. Red and white stars respectively show the actual and inverted source locations. $\dots \dots \dots \dots$	5
	<b>S</b> 9	Contour plots of (a) $J_p$ , (b) $J_w$ , and (c) $J$ when fixing the release rate to its inverted value $Q_e$ for release no.	
	5)	8. Red and white stars respectively show the actual and inverted source locations. $\dots \dots \dots \dots$	5
20	S10		
	510	9. Red and white stars respectively show the actual and inverted source locations. $\dots \dots \dots \dots$	5
	S11	Contour plots of (a) $J_p$ , (b) $J_w$ , and (c) $J$ when fixing the release rate to its inverted value $Q_e$ for release no.	J
	511	10. Red and white stars respectively show the actual and inverted source locations. $\dots \dots \dots \dots$	6
	S12	Contour plots of (a) $J_p$ , (b) $J_w$ , and (c) $J$ when fixing the release rate to its inverted value $Q_e$ for release no.	Ü
25	512	11. Red and white stars respectively show the actual and inverted source locations	6
20	S13	Contour plots of (a) $J_p$ , (b) $J_w$ , and (c) $J$ when fixing the release rate to its inverted value $Q_e$ for release no.	O
	515	12. Red and white stars respectively show the actual and inverted source locations. $\dots$	6
	\$14	Contour plots of (a) $J_p$ , (b) $J_w$ , and (c) $J$ when fixing the release rate to its inverted value $Q_e$ for release no.	O
	511	13. Red and white stars respectively show the actual and inverted source locations. $\dots \dots \dots \dots$	7
30	\$15	Contour plots of (a) $J_p$ , (b) $J_w$ , and (c) $J$ when fixing the release rate to its inverted value $Q_e$ for release no.	,
00	013	14. Red and white stars respectively show the actual and inverted source locations. $\dots \dots \dots \dots$	7
	\$16	Contour plots of (a) $J_p$ , (b) $J_w$ , and (c) $J$ when fixing the release rate to its inverted value $Q_e$ for release no.	,
	510	15. Red and white stars respectively show the actual and inverted source locations. $\dots \dots \dots \dots$	7
	\$17	Contour plots of (a) $J_p$ , (b) $J_w$ , and (c) $J$ when fixing the release rate to its inverted value $Q_e$ for release no.	,
35	517	16. Red and white stars respectively show the actual and inverted source locations. $\dots \dots \dots \dots$	8
33	C10		9
		Average errors for all (a) CH <sub>4</sub> and (b) CO <sub>2</sub> releases with respect to $\lambda$ in the cost function $J = J_p + \lambda J_w$	9
	S19	Average errors for all (a) CH <sub>4</sub> and (b) CO <sub>2</sub> releases with respect to $\lambda$ in the cost function $J^{log} = J_p^{log} + \lambda J_w$ .	9
	S20		
40		release no. 2 and when using $\lambda = 1.6\%$ . Red and white stars respectively show the actual and inverted source	10
40	001		10
	521	Contour plots of (a) $J_p^{log}$ (b) $\lambda J_w$ , and (c) $J_p^{log} = J_p^{log} + \lambda J_w$ when fixing the release rate to its inverted value	
		$Q_e$ for release no. 2 and when using $\lambda = 0.8\%$ . Red and white stars respectively show the actual and inverted	1.0
		source locations.	10



**Figure S1.** Release locations (red stars) in the ATEX zone. Different releases can have identical locations. Isolated locations (5, 8, 12-16) correspond to the highest release rates.

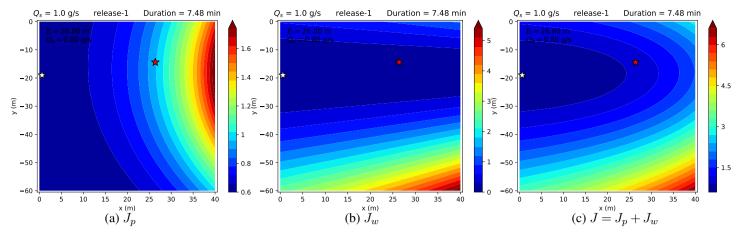


Figure S2. Contour plots of (a)  $J_p$ , (b)  $J_w$ , and (c) J when fixing the release rate to its inverted value  $Q_e$  for release no. 1. Red and white stars respectively show the actual and inverted source locations.

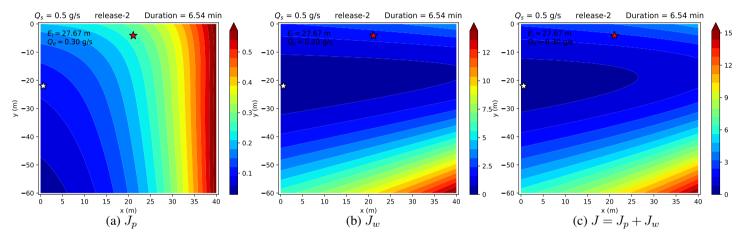


Figure S3. Contour plots of (a)  $J_p$ , (b)  $J_w$ , and (c) J when fixing the release rate to its inverted value  $Q_e$  for release no. 2. Red and white stars respectively show the actual and inverted source locations.

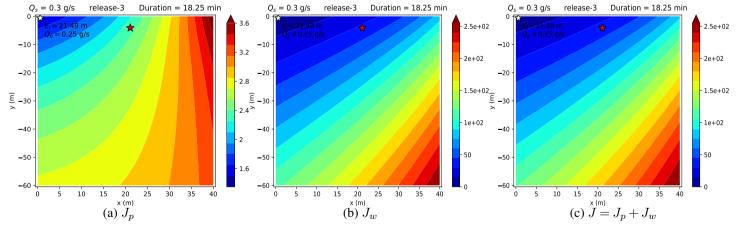


Figure S4. Contour plots of (a)  $J_p$ , (b)  $J_w$ , and (c) J when fixing the release rate to its inverted value  $Q_e$  for release no. 3. Red and white stars respectively show the actual and inverted source locations.

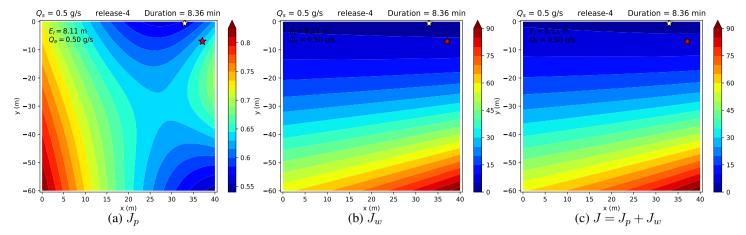


Figure S5. Contour plots of (a)  $J_p$ , (b)  $J_w$ , and (c) J when fixing the release rate to its inverted value  $Q_e$  for release no. 4. Red and white stars respectively show the actual and inverted source locations.

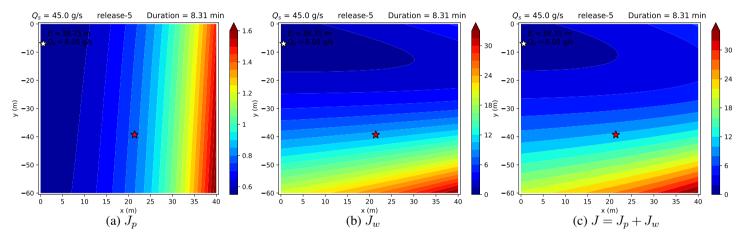


Figure S6. Contour plots of (a)  $J_p$ , (b)  $J_w$ , and (c) J when fixing the release rate to its inverted value  $Q_e$  for release no. 5. Red and white stars respectively show the actual and inverted source locations.

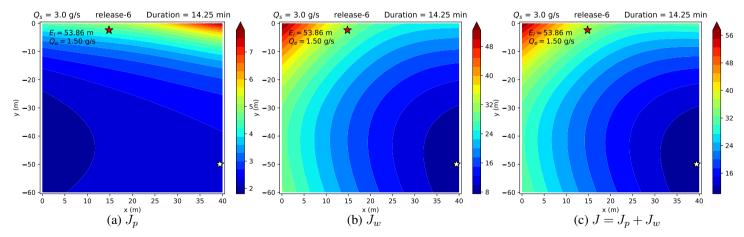


Figure S7. Contour plots of (a)  $J_p$ , (b)  $J_w$ , and (c) J when fixing the release rate to its inverted value  $Q_e$  for release no. 6. Red and white stars respectively show the actual and inverted source locations.

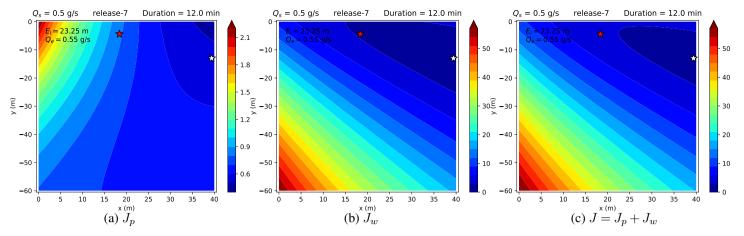


Figure S8. Contour plots of (a)  $J_p$ , (b)  $J_w$ , and (c) J when fixing the release rate to its inverted value  $Q_e$  for release no. 7. Red and white stars respectively show the actual and inverted source locations.

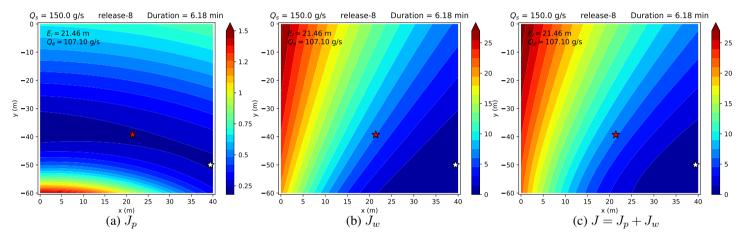


Figure S9. Contour plots of (a)  $J_p$ , (b)  $J_w$ , and (c) J when fixing the release rate to its inverted value  $Q_e$  for release no. 8. Red and white stars respectively show the actual and inverted source locations.

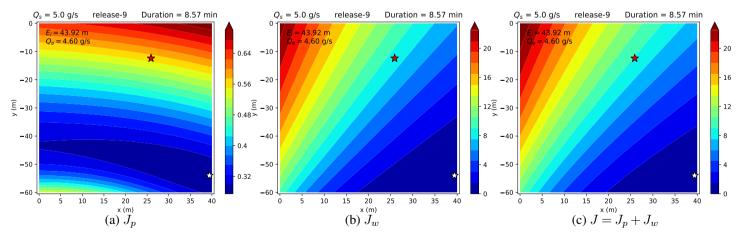


Figure S10. Contour plots of (a)  $J_p$ , (b)  $J_w$ , and (c) J when fixing the release rate to its inverted value  $Q_e$  for release no. 9. Red and white stars respectively show the actual and inverted source locations.

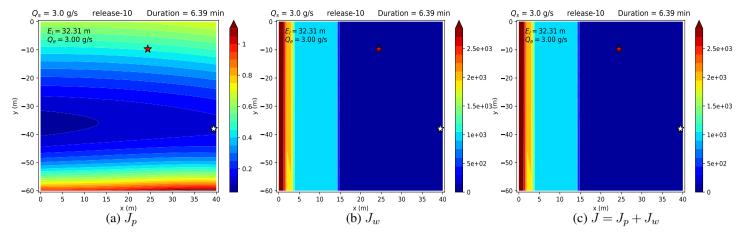


Figure S11. Contour plots of (a)  $J_p$ , (b)  $J_w$ , and (c) J when fixing the release rate to its inverted value  $Q_e$  for release no. 10. Red and white stars respectively show the actual and inverted source locations.

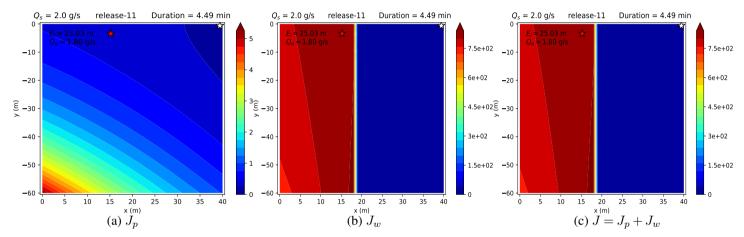


Figure S12. Contour plots of (a)  $J_p$ , (b)  $J_w$ , and (c) J when fixing the release rate to its inverted value  $Q_e$  for release no. 11. Red and white stars respectively show the actual and inverted source locations.

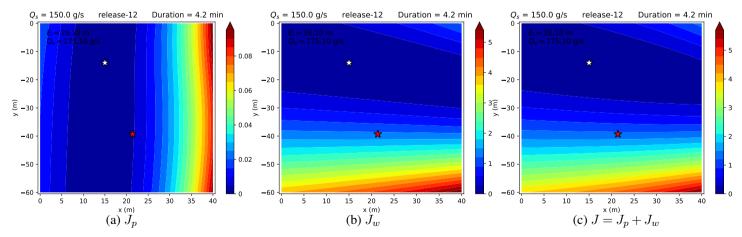


Figure S13. Contour plots of (a)  $J_p$ , (b)  $J_w$ , and (c) J when fixing the release rate to its inverted value  $Q_e$  for release no. 12. Red and white stars respectively show the actual and inverted source locations.

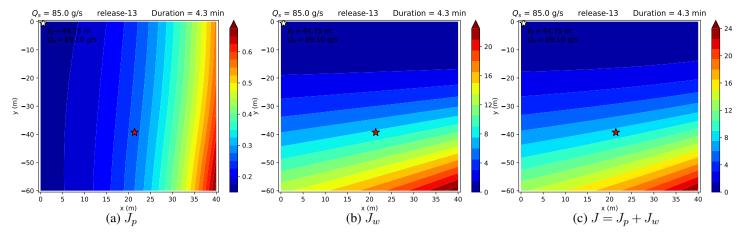
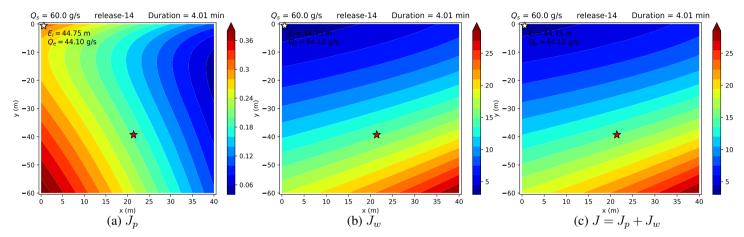


Figure S14. Contour plots of (a)  $J_p$ , (b)  $J_w$ , and (c) J when fixing the release rate to its inverted value  $Q_e$  for release no. 13. Red and white stars respectively show the actual and inverted source locations.



**Figure S15.** Contour plots of (a)  $J_p$ , (b)  $J_w$ , and (c) J when fixing the release rate to its inverted value  $Q_e$  for release no. 14. Red and white stars respectively show the actual and inverted source locations.

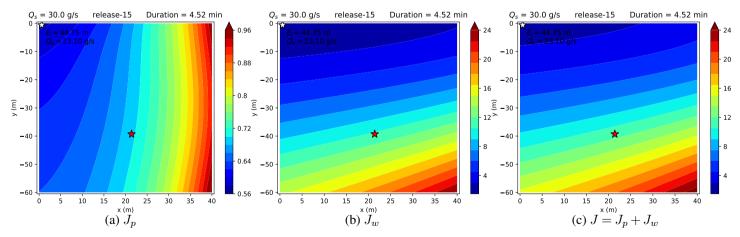
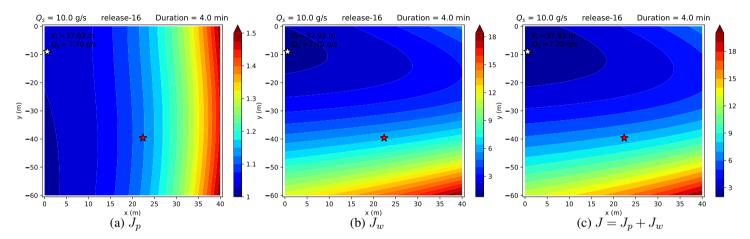


Figure S16. Contour plots of (a)  $J_p$ , (b)  $J_w$ , and (c) J when fixing the release rate to its inverted value  $Q_e$  for release no. 15. Red and white stars respectively show the actual and inverted source locations.



**Figure S17.** Contour plots of (a)  $J_p$ , (b)  $J_w$ , and (c) J when fixing the release rate to its inverted value  $Q_e$  for release no. 16. Red and white stars respectively show the actual and inverted source locations.

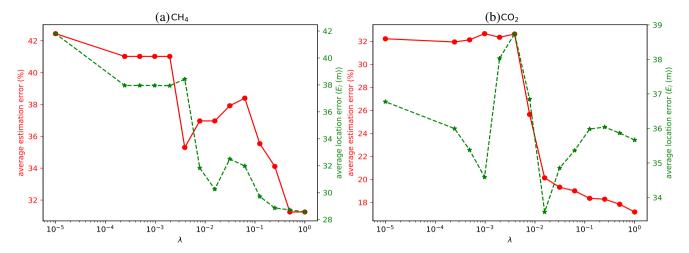


Figure S18. Average errors for all (a) CH<sub>4</sub> and (b) CO<sub>2</sub> releases with respect to  $\lambda$  in the cost function  $J = J_p + \lambda J_w$ .

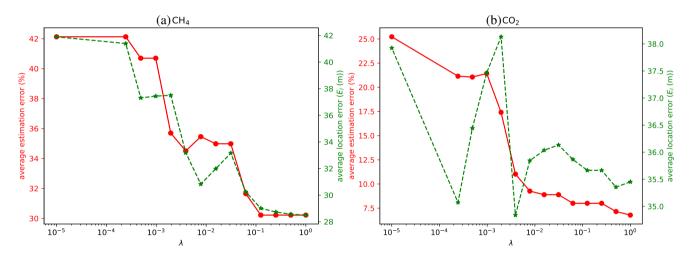


Figure S19. Average errors for all (a) CH<sub>4</sub> and (b) CO<sub>2</sub> releases with respect to  $\lambda$  in the cost function  $J^{log} = J_p^{log} + \lambda J_w$ .

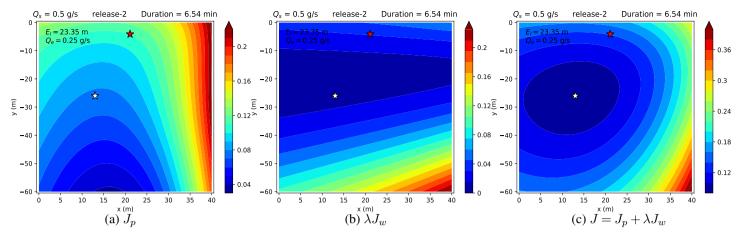
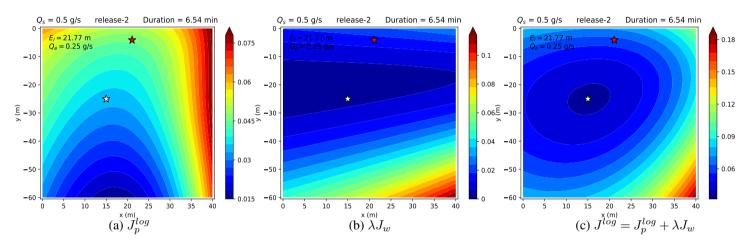


Figure S20. Contour plots of (a)  $J_p$  (b)  $\lambda J_w$ , and (c)  $J = J_p + \lambda J_w$  when fixing the release rate to its inverted value  $Q_e$  for release no. 2 and when using  $\lambda = 1.6\%$ . Red and white stars respectively show the actual and inverted source locations.



**Figure S21.** Contour plots of (a)  $J_p^{log}$  (b)  $\lambda J_w$ , and (c)  $J^{log} = J_p^{log} + \lambda J_w$  when fixing the release rate to its inverted value  $Q_e$  for release no. 2 and when using  $\lambda = 0.8\%$ . Red and white stars respectively show the actual and inverted source locations.