Supporting Information for "Real-Time Flood Inundation Modeling With Flow Resistance Parameter Learning"

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Introduction

The present supporting information shows how binary inundation observations are obtained from aerial videography made available by the emergency personnel ("Vigili del Fuoco" Fire Department of Modena) involved during the flood inundation event that has affected the flood plain of the Secchia River in the period from 19 to 21 January 2014. Numerous (58) frames are extracted from the aerial videography taken on 20 January 2014, from about 11:30 AM to 12:00 PM (Figures S1, S2, S4, S5, S7, ..., S117). The first frame is reported in Figure S1 and zommed in Figure S2. The second frame is reported in Figure S4 and zommed in Figure S5. From these 58 frames, 580 wet points and 331 dry points are identified visually. Wet and dry points are then mapped on the orthoimages so that they can be georeferenced (Figures S3, S6, S8, ..., S118). Wet and dry points are selected among those points lying close to landmarks such as crossroads, building corners, trees, channels, crops edges and corners, as these points can be easily mapped

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and georeferenced in orthoimages. The errors made in mapping and georeferencing each of these point are estimated to be less than 5 m.

Movie S1. The movie taken by the emergency personnel ("Vigili del Fuoco" Fire Department of Modena, Italy) is uploaded and provided as attachment.

Figure S1.   Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.
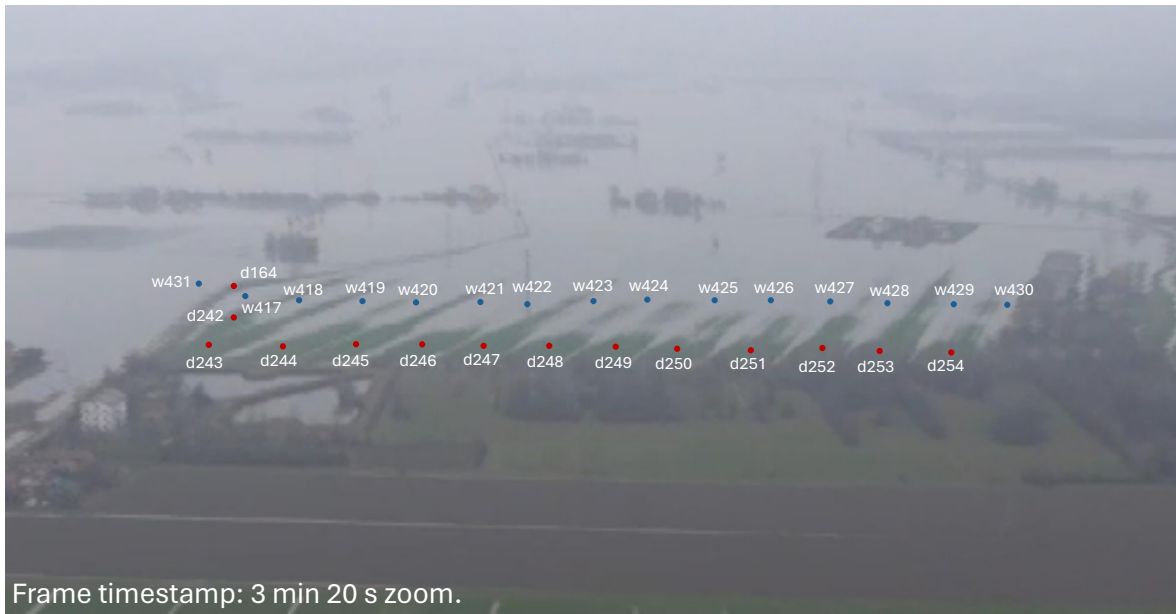
Figure S2. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.
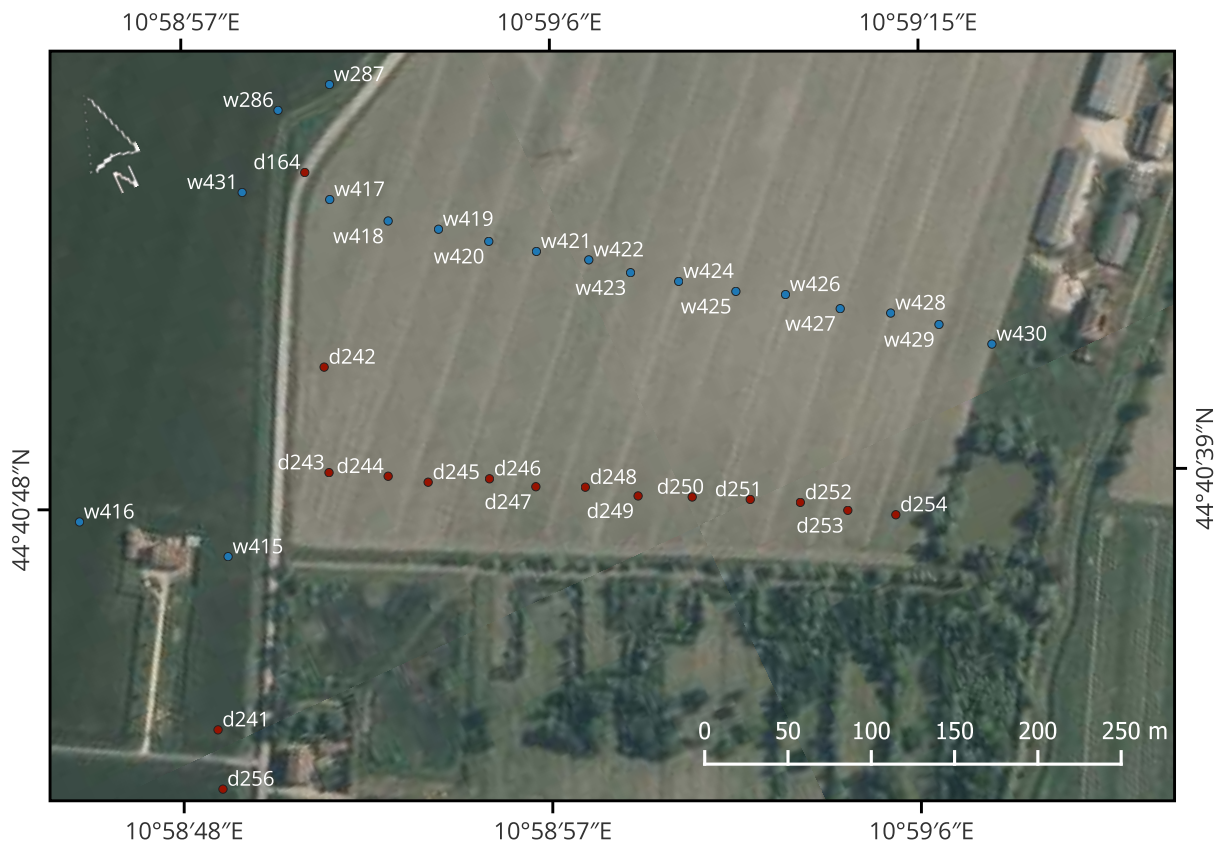

Figure S3. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.
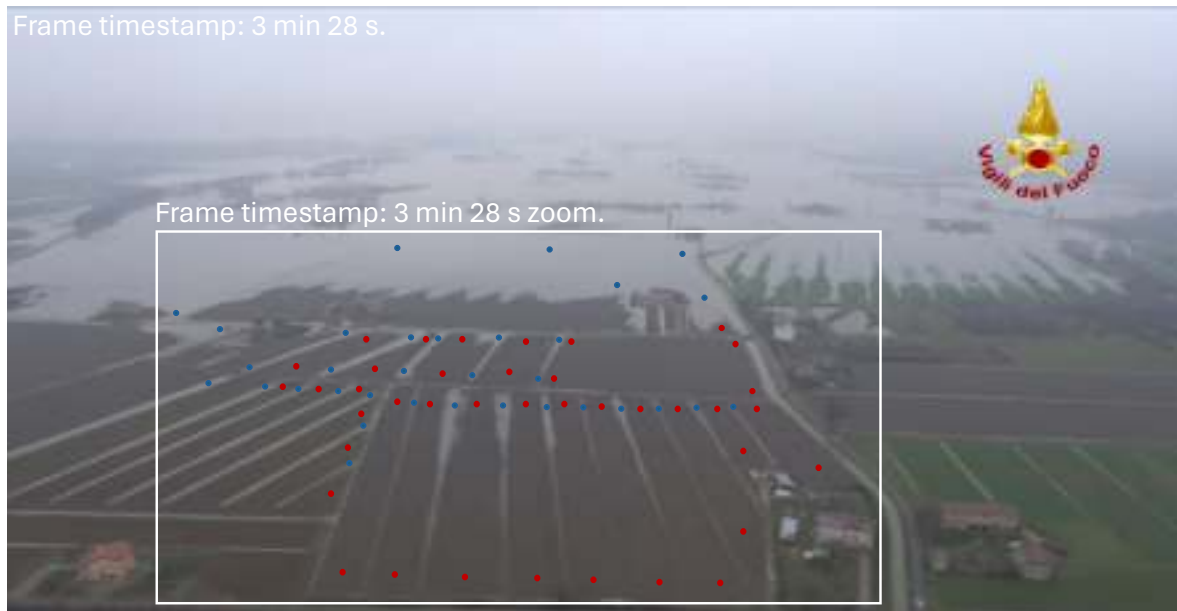
Figure S4. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S5.   Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.
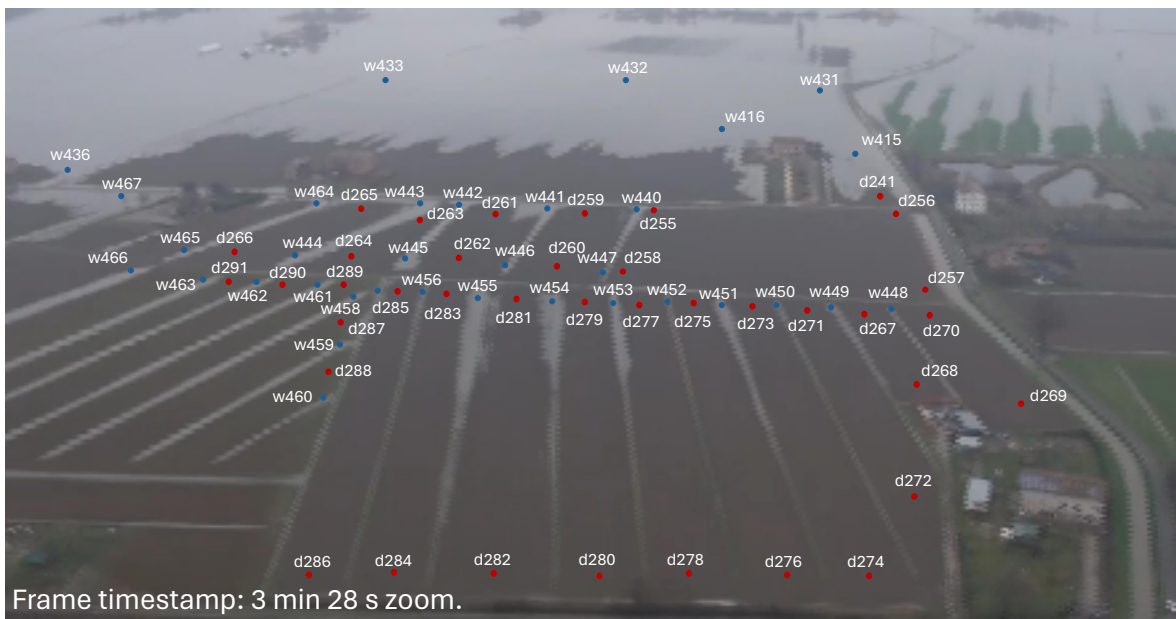

Figure S6.   Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S7. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.
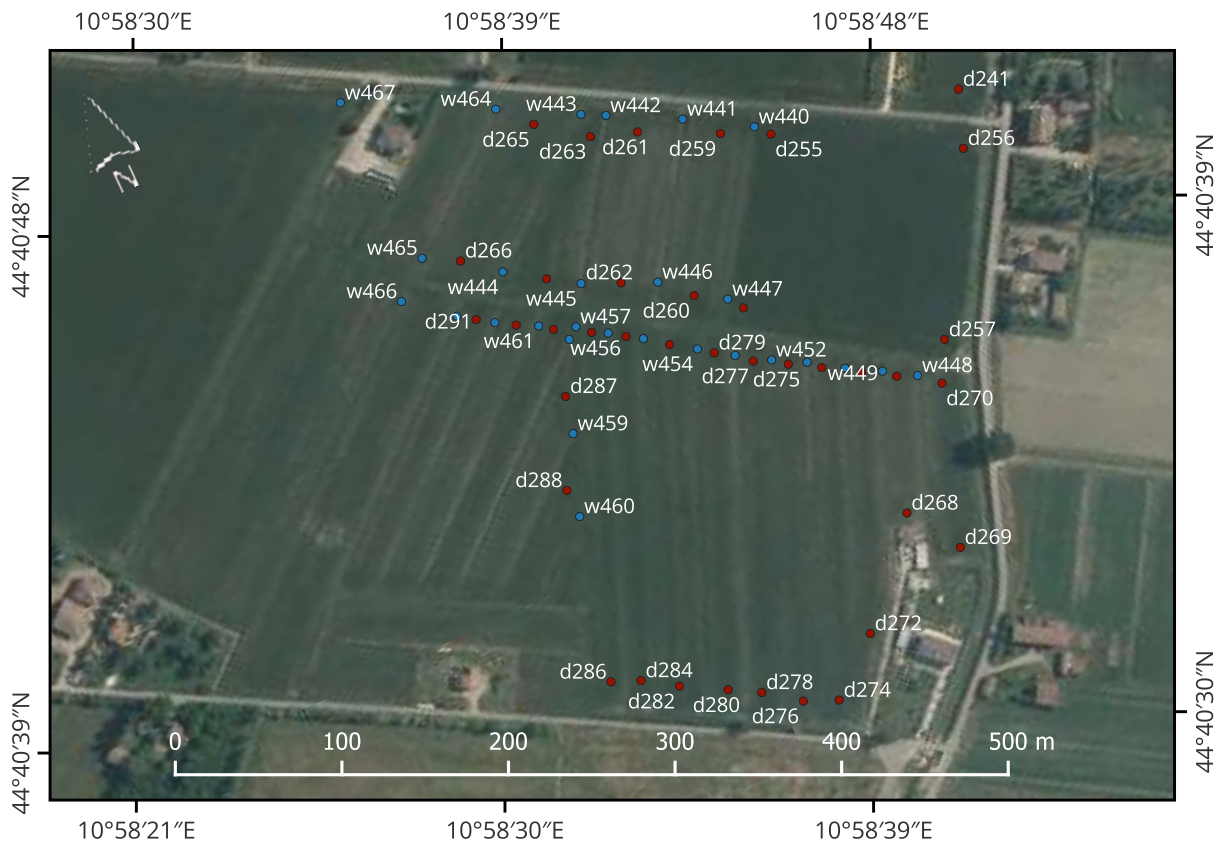

Figure S8. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.
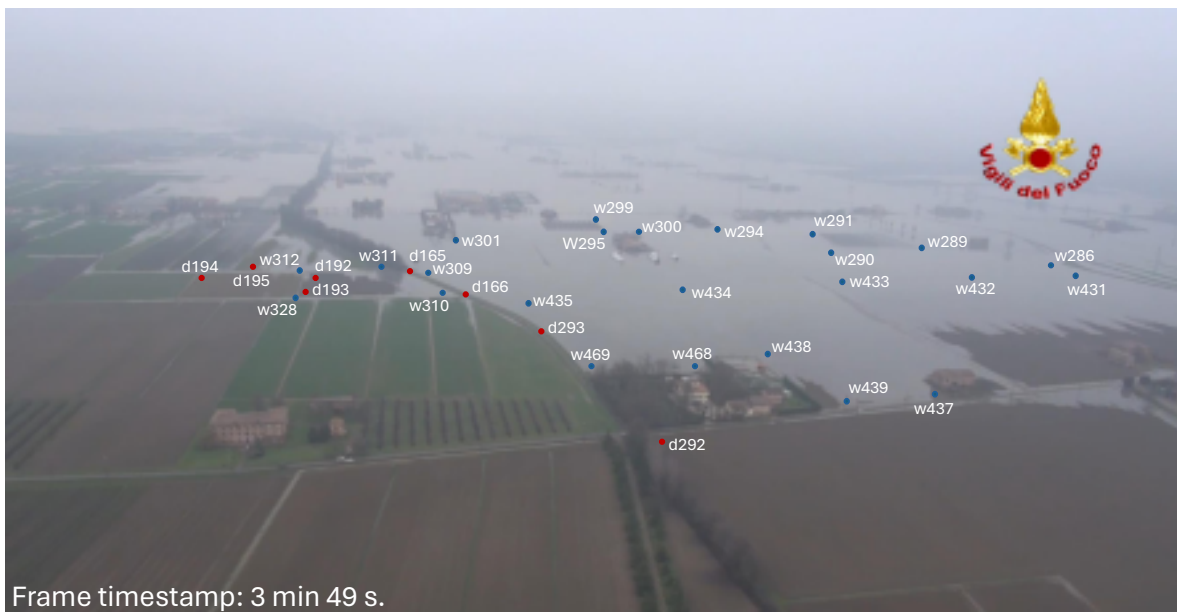
Figure S9.   Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.
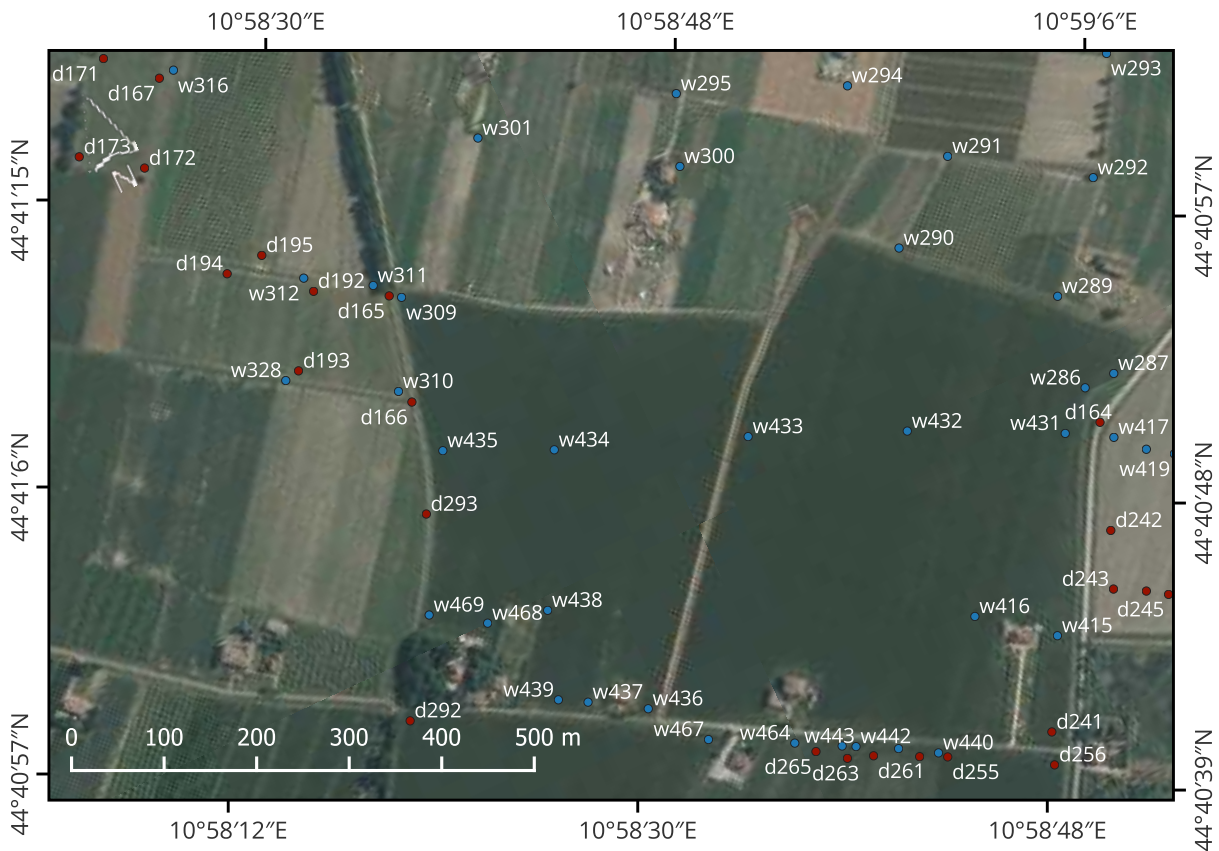

Figure S10.   Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S11. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S12. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S13. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S14. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S15. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S16. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S17. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S18. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S19. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S20. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S21. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S22. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Frame timestamp: 7 min 17 s.

Figure S23. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S24. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S25. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S26. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S27. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S28. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S29. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S30. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S31.   Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S32.   Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S33. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S34. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S35. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S36. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S37.   Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.
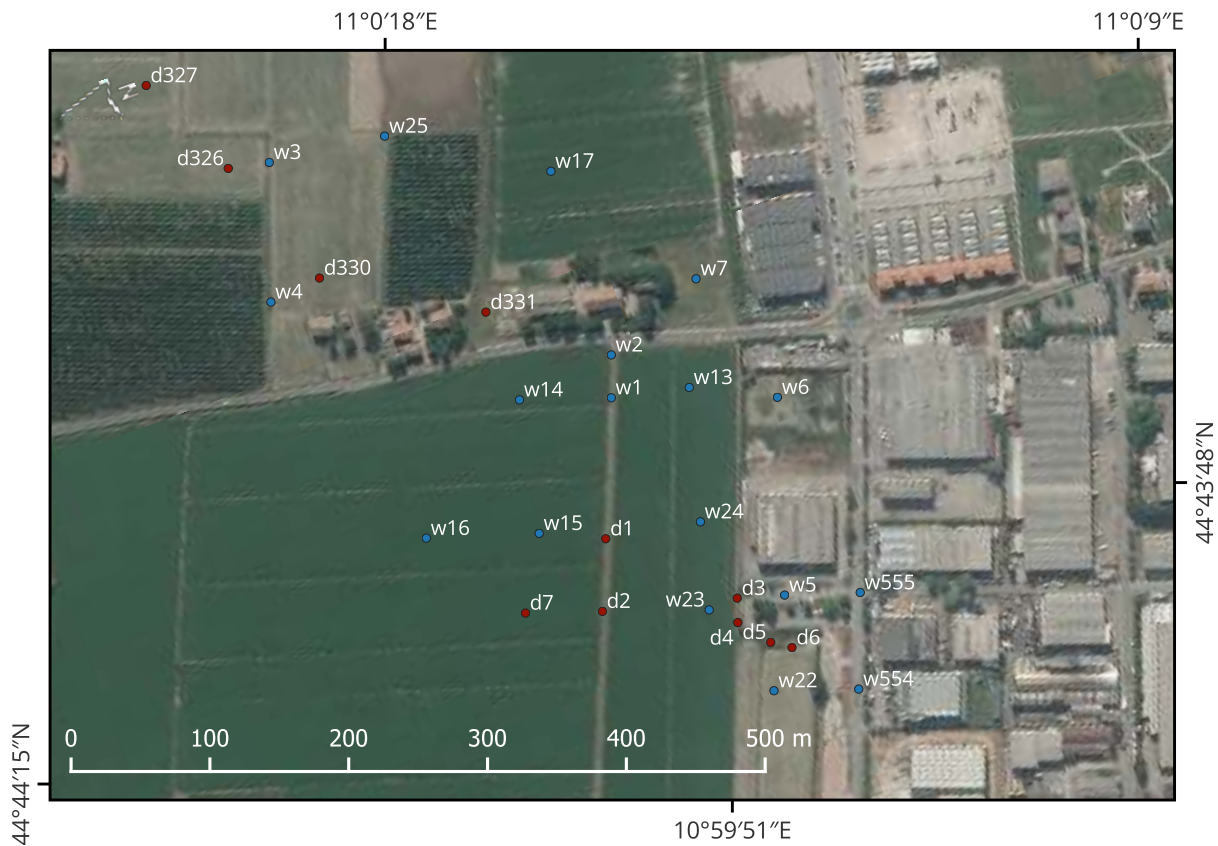

Figure S38.   Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S39. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S40. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.
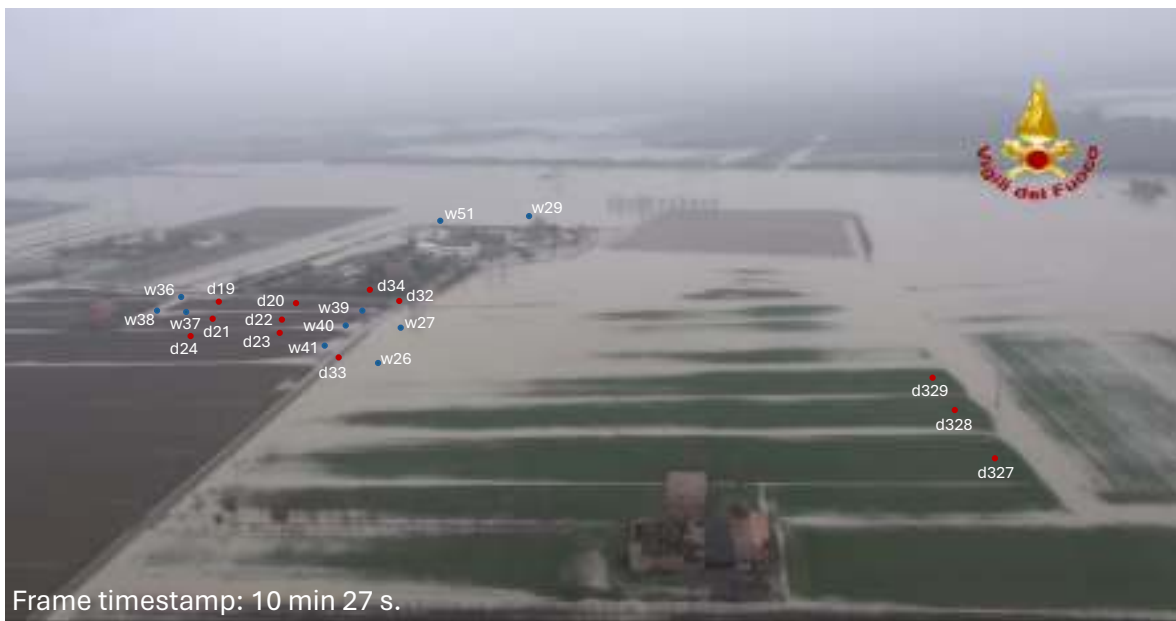
Figure S41.   Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S42.   Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.
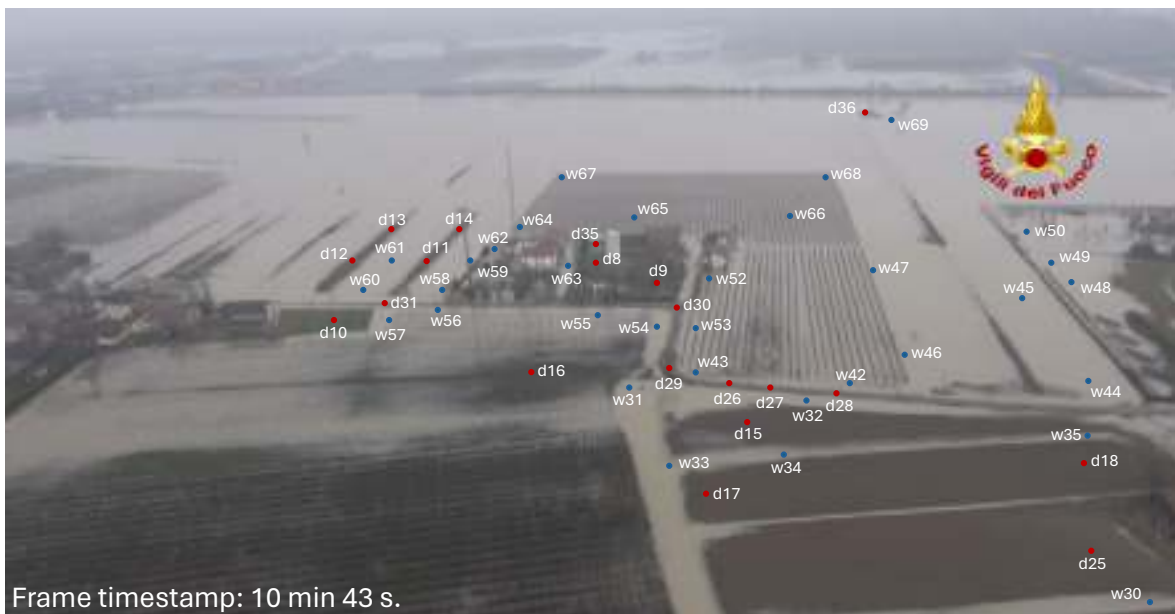
Figure S43. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S44. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S45. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S46. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S47. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.
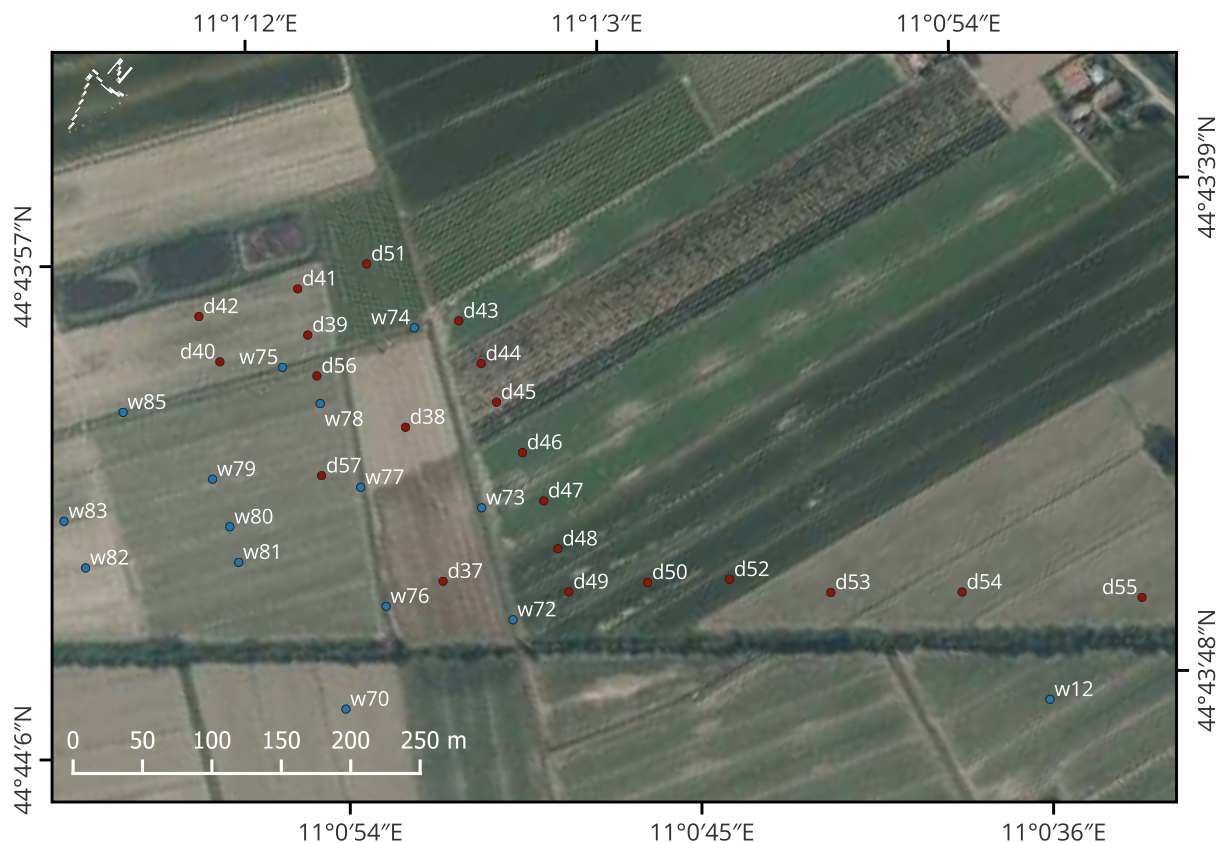

Figure S48. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S49. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.
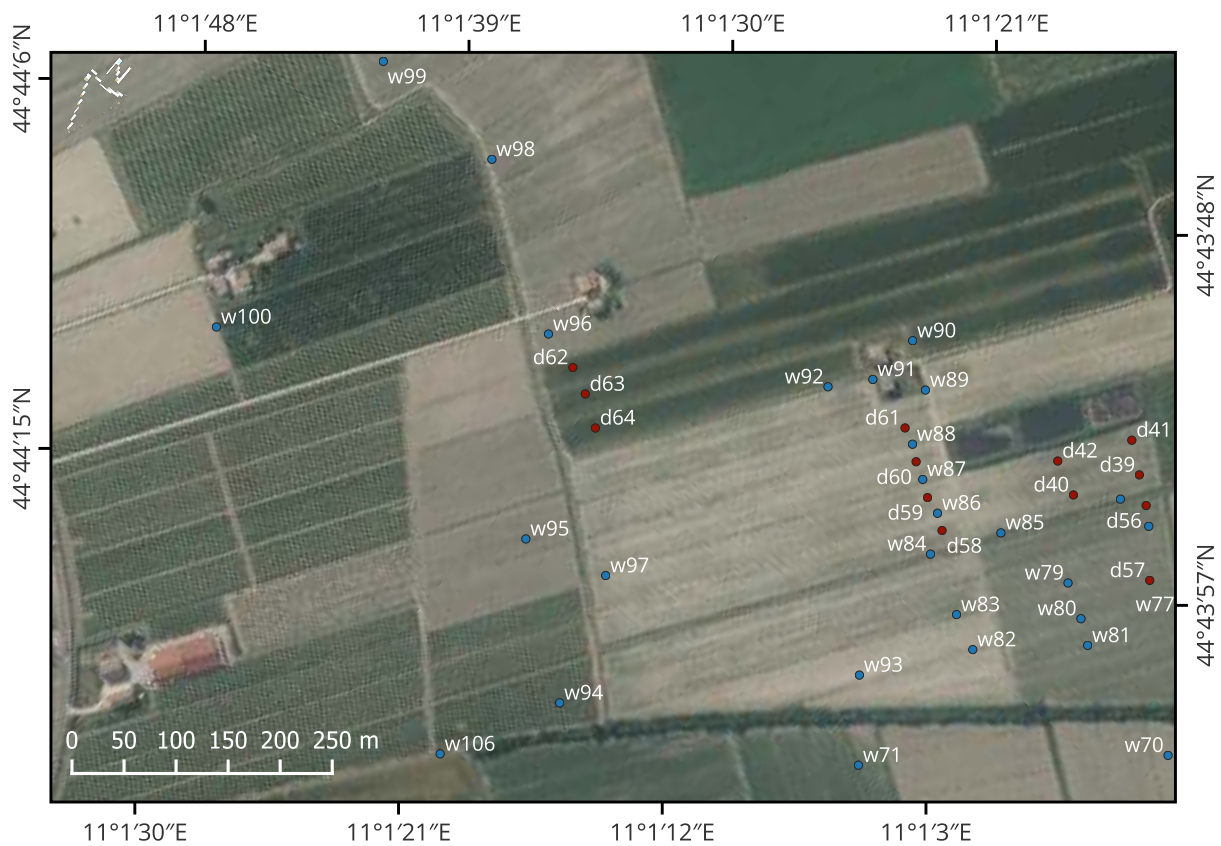

Figure S50. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S51. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S52. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S53.   Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S54.   Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S55. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S56. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S57. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S58. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S59. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S60. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S61.   Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S62.   Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S63.   Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S64.   Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S65.   Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S66.   Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S67. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S68. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S69.   Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S70.   Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Frame timestamp: 14 min 9 s.

Figure S71. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S72. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S73. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S74. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S75. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S76. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S77. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S78. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S79. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S80. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.
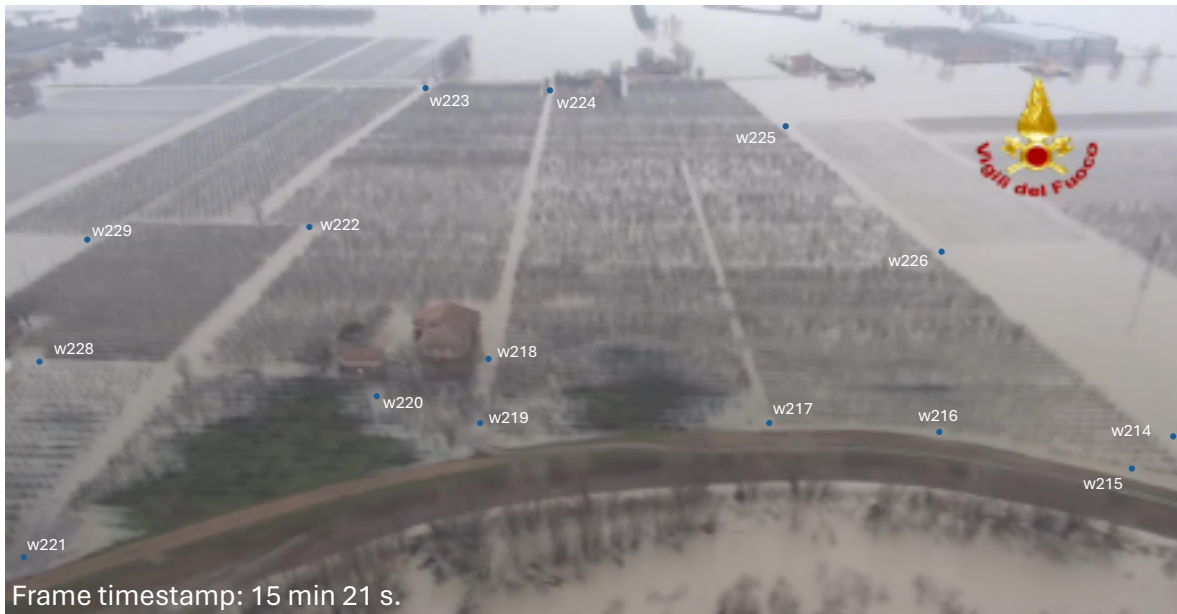
Figure S81. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S82. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S83. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S84. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S85.   Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S86.   Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S87. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S88. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S89. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S90. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S91. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S92. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S93. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S94. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S95.   Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.
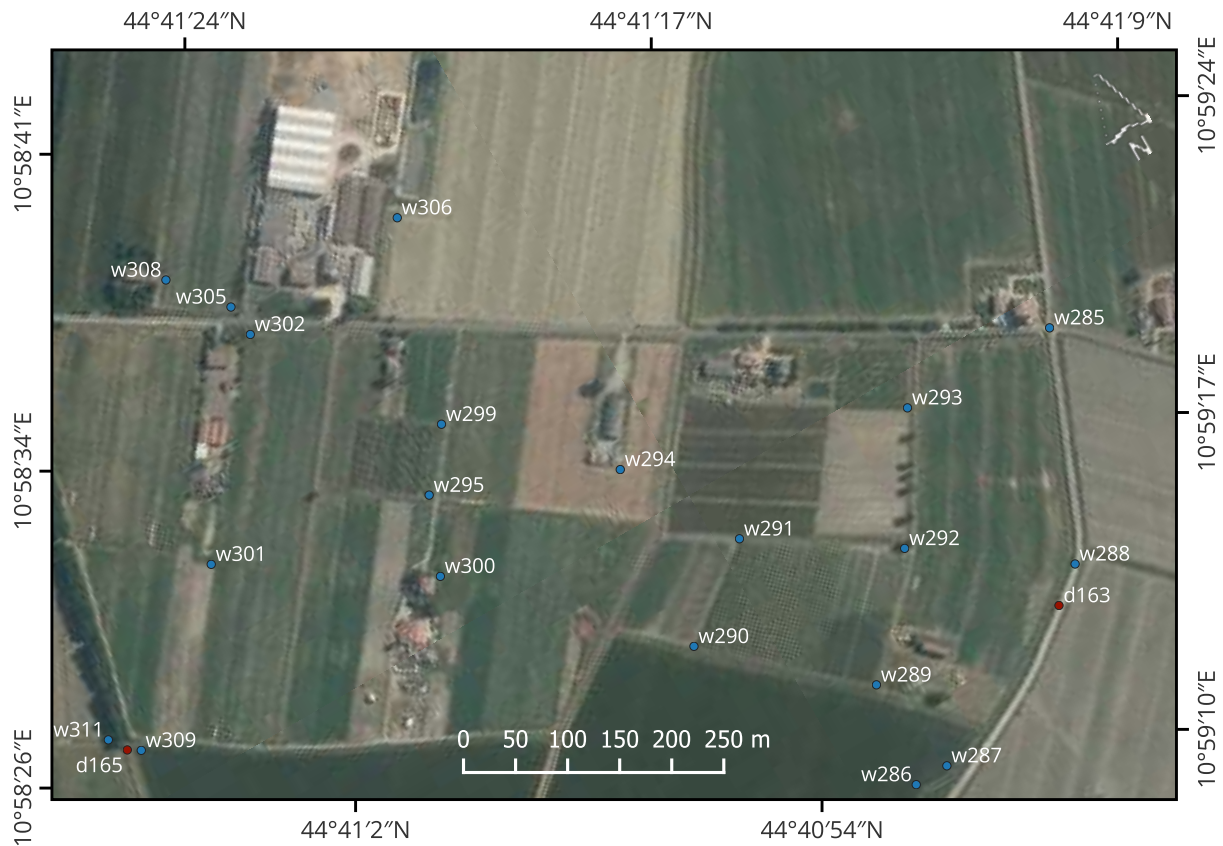

Figure S96.   Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S97.   Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S98.   Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S99. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.
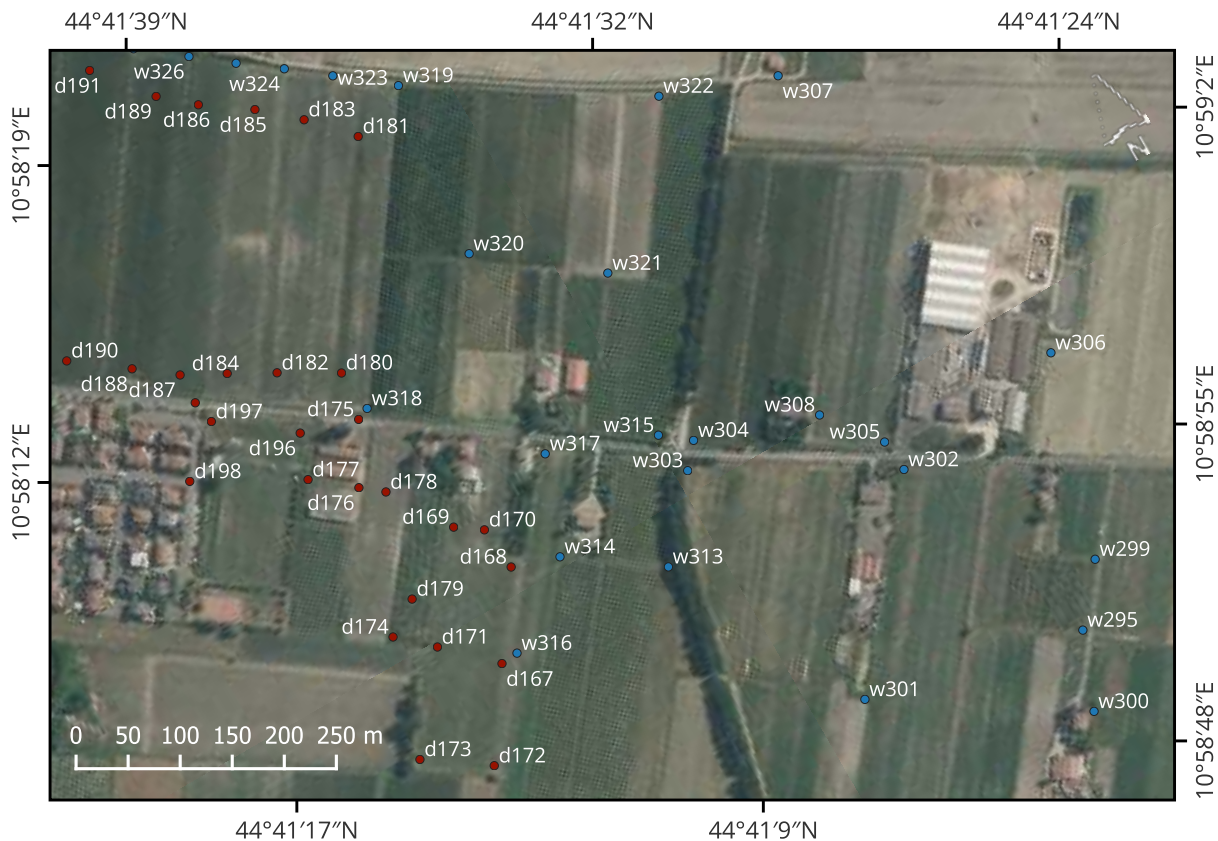

Figure S100. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S101. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.
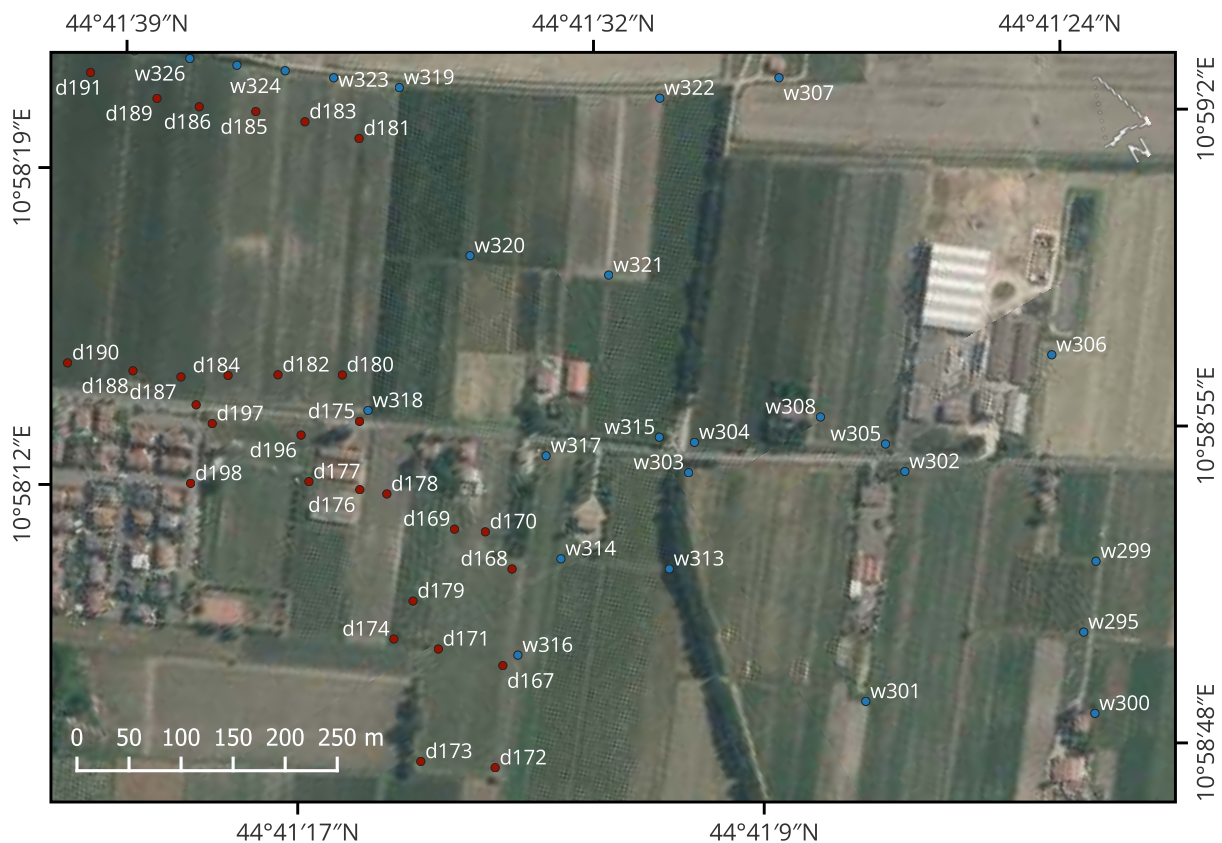

Figure S102. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S103. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S104. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S105. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S106. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.
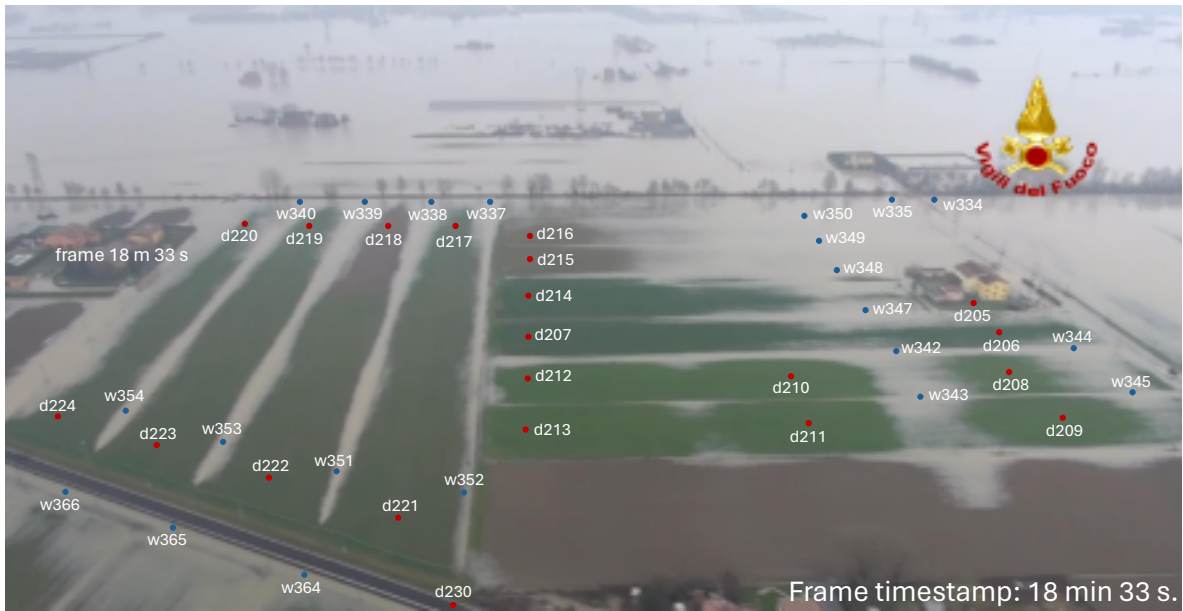
Figure S107. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S108. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S109. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S110. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S111.   Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S112.   Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S113.   Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S114.   Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.
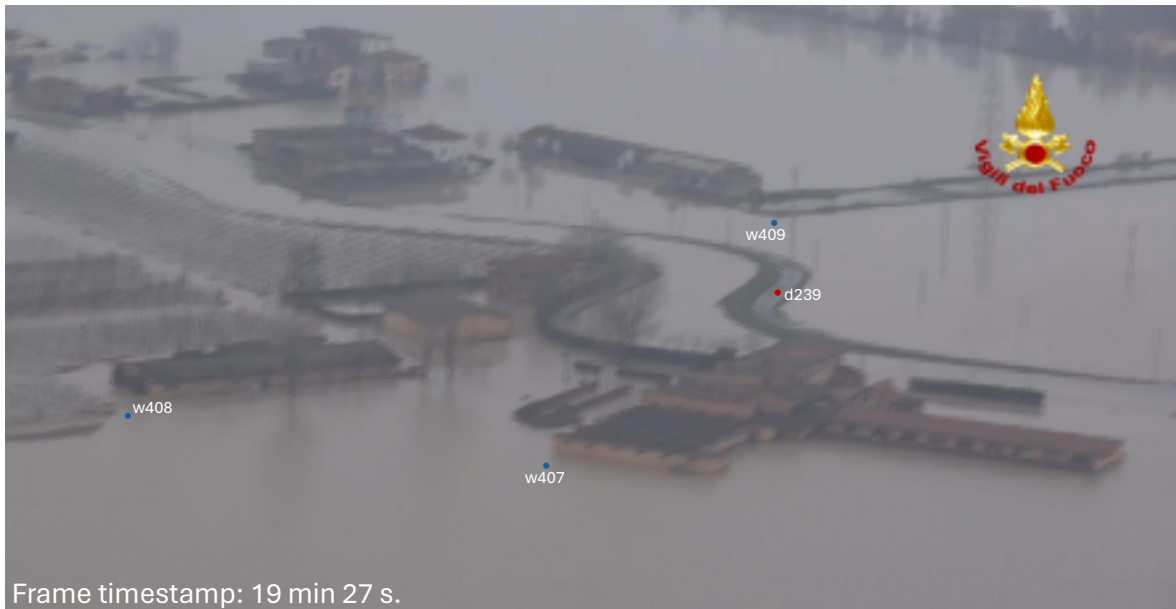
Figure S115. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S116. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.

Figure S117. Frame of the aerial videography taken by the "Vigili del Fuoco" Fire Department of Modena. Wet points are highlighted in blue and dry points are highlighted in red. The time reported in the frame is counted from the beginning of the aerial videography occurred on 20 January 2014 at about 11:30 AM.

Figure S118. Orthoimage associated to the previous aerial videography frame, where georeferenced wet points are highlightd in blue and georeferenced dry points are highlighted in red.
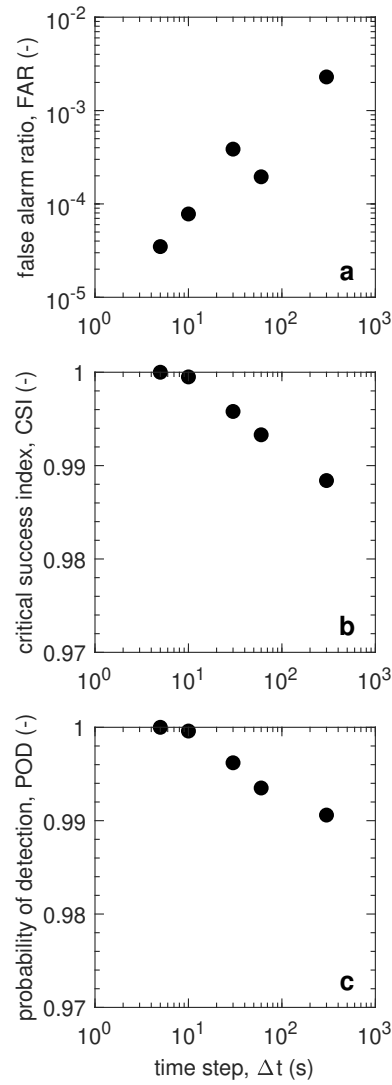
Figure S119. False alarm ratio (FAR), critical success index (CSI), and probability of detection (POD) for different time step sizes.
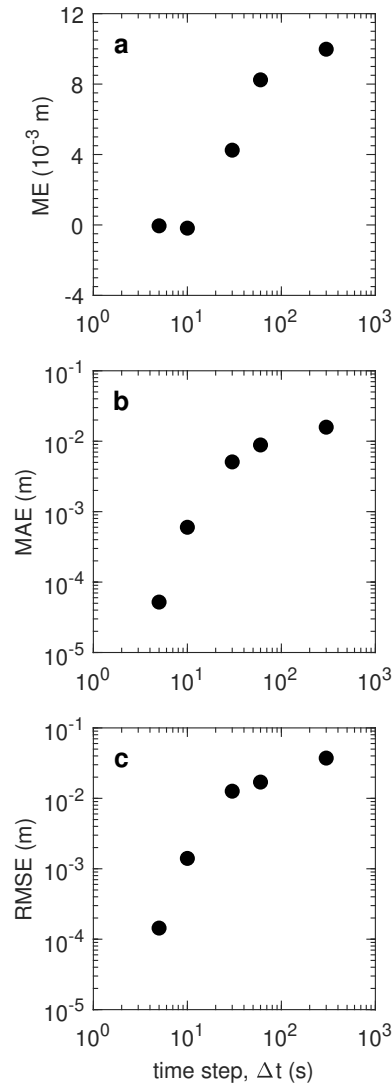
Figure S120.   Mean error (ME), mean absolute error (MAE), root mean square error (RMSE) for different time step sizes.
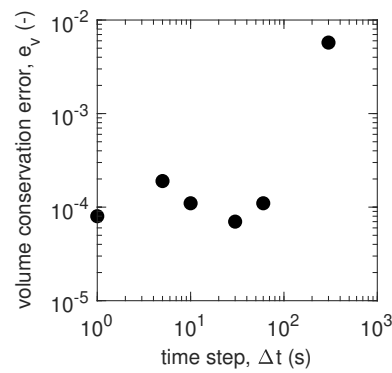

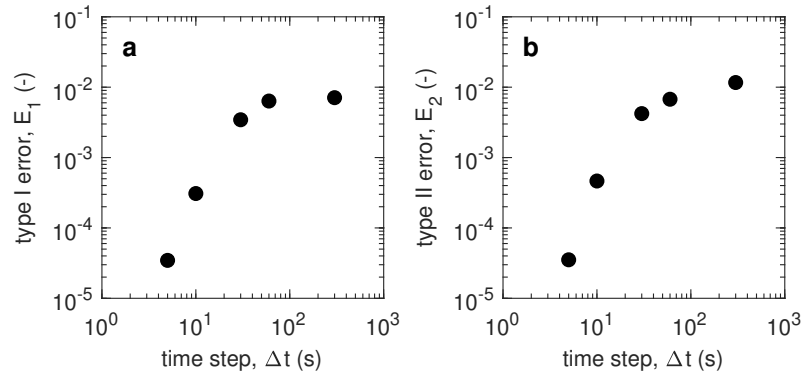**Figure S121.**   Volume conservation errors for different time step sizes.

Figure S122.   Type I and type II errors for different time step sizes.

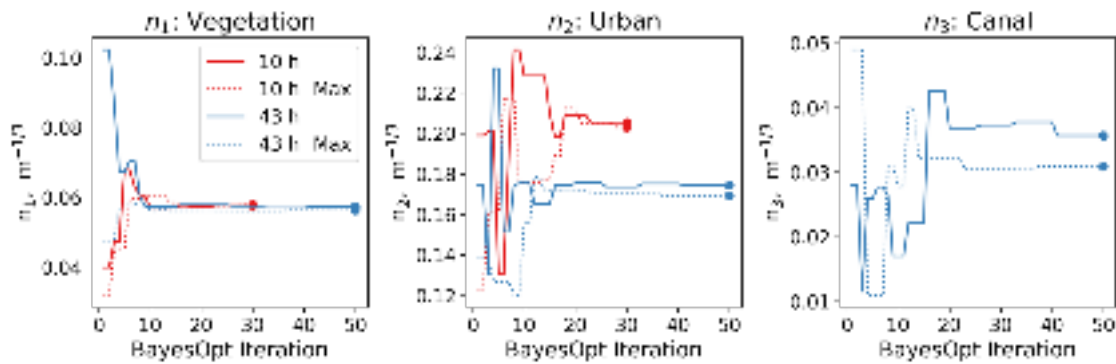**Figure S123.**   Bayesian optimization convergence plots for each Manning's n in the 10-h, 10-h Max, 43-h, and 43-h Max experiments.