Authors response to:

Interactive comment on “Efficient Online Source Identification Algorithm for Integration within Contamination Event Management System”

by
Jochen Deuerlein et al.
Anonymous Referee #2

Authors:

We thank the reviewer for the time spent to review the paper and the invaluable comments. We tried to improve the paper by consideration of all the issues raised by the reviewer. Details of our response are given below.

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Dear Editor the paper proposes an algorithm for the identification of the source of a contamination and its integration within a real-time management system. The paper deals with a hot topic in the field of water distribution system and so it is interesting for operators, also because it presents a novel software that can be very useful for the water utilities. However, the paper is not clear in some parts, but it can be improved and so published

if the Authors will take into account some major and minor revisions.

Major Comments:

1) Introduction is poorly written with a limited state of art about the topic of water distribution system protection from contamination. More than half of the abstract is devoted to the developed software. It is important to describe better the state of the art (both in terms of contamination risk and in terms of methodology to face the problem) and previous papers that deal with the problem of source identification. The following works can be related to the paper topic (in which several other papers can be found in the references):

a) Chang, N.-B., Pongsanone, N.P., Ernest, A. (2011). Comparisons between a rule-based expert system and optimization models for sensor deployment in a small drinking water network Expert Systems with Applications, 38 (8), pp. 10685-10695.

b) Hall, J., Zaffiro, A.D., Marx, R.B., Kefauver, P.C., Radha Krishnan, E., Haught, R.C.,Herrmann, J.G. (2007). On-line water quality parameters as indicators of distribution system contamination Journal / American Water Works Association, 99 (1), pp. 66-77.

c) Di Nardo, A., Di Natale, M., Musmarra, D., Santonastaso, G.F., Tzatchkov, V., Alcocer-Yamanaka, V.H. (2015). Dual-use value of network partitioning for water system management and protection from malicious contamination, Journal of Hydroinformatics, 17 (3), pp. 361-376.

Authors response:

The Introduction has been completely revised. A brief description of the state of the art that focuses on the development of Source Identification algorithms has been added. To give a comprehensive overview of the different topics related to water distribution network security is impossible due to the limited space.

2) The description of the methodology and the model are confused (maybe because too "compressed") and some parameters are not explained – page 2, equation 1a (e.g.ct and cx). Are they refuse? Please check to make paper consistent and more clear. I suggest to use a flow chart to improve the methodology description.

Authors response:
The explanation of the parameters has been added. In addition, we have tried to improve the presentation of the methodology by adding a flow chart.

3) Page 4, line 24: "based on a worst case assumption of a unique source location is selected ....", taking into account the different hypothesis and the simplified model used, is realistic to focus on a unique source location or it will be better to identify an area on which focus on the attention?

Authors response:
We agree with the reviewer. It is better to focus on areas instead of a single source. Therefore, the whole area with the source candidates is marked with red color by the software. The single source with the worst case assumption is required only for the estimation of current and future spread of contaminant by forward calculation.
The following revised text is now in the paper on page 5:

"Based on a worst case assumption a unique source location is selected that serves as input for a simplified look-ahead transport calculation that gives an estimation over the future spread of contamination. As worst case the node with the biggest outflow volume is chosen. This second step is necessary since the backtracking algorithm in general does not give unique results. The region of possible source locations can be quite large depending on the efficiency of the sensor network."

4) Page 5, line 9: "In the following section the SI algorithm is demonstrated using the example of the test network in Zurich (Fig. 1).". It should be interesting to provide some information about this water distribution network, and above all, it should be more attractive to test the algorithm on a real system.

The following description of the network has been added.
"The total pipe length of the network is about 160 m. The system consists of transparent PVC pipes (diameter 100 mm) and has three major outlets that allow the operation with adjustable demands. In addition to flow and pressure measurements at the system inlet there are four additional flow measurements installed within the pipe network. The measurement devices are connected to a central OPC server. The hydraulic online simulation is connected with the OPC server through a bidirectional interface provided by the online OPC client SirOPC. The hydraulic simulation runs every five seconds with updated boundary values from the OPC server. The calculation results, namely the flow velocities are stored in a native binary data format from where they can be accessed by the SI-Plugin and transferred to the transport solvers. Water quality sensors are installed at five locations. Four sensors are distributed over the network (orange circles) and one is located directly downstream the contamination source (red circle) in order to control the entrance water quality for the injection scenarios."

Additionally, a photography of the system is included.

In the conclusion we mention that the software was tested also for real existing networks. However, publication of details is prohibited due to security reasons.

Minor revision:
1) Page 1, line 2: “Whilst a number of algorithms have been published on the algorithmic development...
”, please change.

Authors response:
The sentence has been replaced by:
“Many publications deal with the algorithmic development, however, only few information exists about the integration within a comprehensive real-time Event Detection and Management System”.

2) Page 1: please pay attention to the sequence of tenses.

Authors response:

We tried to do our best to improve the quality of the text.

3) Pay attention to reference format in the text, (e.g. page 2, line 8 – “.... software tools can be found in [7]”, while at page 3, line 10 “... page 6, line 12 “... of possible source candidates (see for comparison De Sanctis et. al., 2010)”.

Authors response:

The references in the text and the references list at the end of the paper haven been changed by using the MS-Word reference tool.

4) Pay attention to reference in the text; at page 2, line 8 is reported the seventh reference, where are the previous six? Please check. Furthermore, the references at the end of paper are not numbered.

Authors response:

The references in the text and the references list at the end of the paper haven been changed by using the MS-Word reference tool.

5) Page 3, line 10: Shang et al, (2002), is not reported in the references list.

Authors response:

The reference has been added

6) I suggest improving the English language.

Authors response:

We did our best to improve the English language

7) I suggest improving the quality of figures.

Authors response:

The figures have been changed.

8) Figures are very large; if the authors reduce their dimensions they can save space for better explain the methodology and the results

Authors response:

The figures have been changed in order to get more space for the explanations. Now the paper has 10 pages which was the maximum allowed by the editor.