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Drinking Water Engineering and Science Discussions

Interactive comment on "Modelling water quality in drinking water distribution networks from real-time direction data" *by* S. Nazarovs et al.

Anonymous Referee #1

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General comments

This paper describes an approach that uses an understanding of the real time direction of flow in selected pipes within a distribution network in order to generate information about the spread of contaminated water. The aims are to determine the optimal number of deployed flow direction sensors required to provide enough flow direction information to identify which parts of a network might be affected by polluting material, and where the material might have originated; without the use of demand driven hydraulic modelling methods that require accurate demand data to be of operational use; and to strike a balance between sensor installation cost and method sensitivity.

All references cited in the manuscript are present in the reference section.

The work presented is a scaled up version of previous work and, as such, is not novel in its own right. However, it does show how the previous work can be scaled for use on a large multi-source distribution network so is novel in its application.

The paper begins by stating that modelling contamination spread, and locating the source of the contamination is important – but not why it is important, or what could be done if these things were known. It would be helpful to readers if the reasons for doing this work, and the quantified benefits of doing it, were mentioned in the abstract, and clearly described in the manuscript body.

The availability of "real time data" is a key component of this approach. It would be helpful to understand the frequency of flow direction measurement, and the time lapse before this data is made available to the user, and how varying these affect application, and the usefulness of the results in terms of operational reaction / action.

The network in this study is "mainly supplied" by three sources. An explanation of what "mainly supplied" means, and why this network is operated as an open system rather than having a specific isolated network for each source water, would be useful background.

The DMAs created appear to be "virtual", the boundaries of each being defined only by the location of flow sensors (as opposed to sluice valves). It is important to make this clear because, for some readers, "DMA" will mean a hydraulically isolated area of a network monitored by a flow meter. Where this is the case, the entire DMA could be monitored by a single sensor at the inlet. Clarification of DMA creation used in this approach, and how that relates to the network as a whole, would be useful information for the reader.

The manuscript in its current form does not provide an easy to understand description of what is being done, why it is being approached this way, or what quantifiable benefits are to be gained by using it.

Specific comments

A lot of work on hydraulic, water quality and contamination modelling in distribution networks has been published since 2005; more of this recent work should be reviewed and referenced.

What is the definition of real time data as used in this case study? Is it real time data presented for use at some time interval after the measurements were actually taken, or is it data that is immediately available for processing with virtually no time lapse between data measurement and use?

What is the specification of the flow direction sensors? How sensitive / robust are they? Hydraulic models are often calibrated to 15 min frequency flow and pressure data; indeed this is the industry standard in some countries. Hydraulic model build techniques have become significantly automated and the cost of producing a model has fallen in recent years. Do these hydraulic modelling developments start to erode the need for the matrix method?

If the flow condition in the network changes because public health notices are issued, how are these notices disseminated to the consumers? How do the network operators know who to contact if the network is open to three (or more) water sources and the hydraulics are driven by demand – but there is no access to demand data?

It would be nice to see the scenario results presented in tabular format, to aid result comparison.

The first statement in the conclusions is about advances in communications technologies. However, this is not mentioned in the manuscript.

Suggestions

I would like to suggest the paper is re-composed to provide a clearer explanation of the original work by Davidson et al, each component of the work of the authors presented here, and in the precise order it was undertaken, so that the reader is presented with

a clear understanding of the "story" i.e. exactly what motivated the work, how the work was undertaken, the results, a discussion of what the results mean, and the benefits that might be obtained by applying this methodology rather than any of the other possible approaches.

As a reader one of the questions I would ask is "would it be possible / practicable to create a number of isolated network areas, each supplied by one of the different water treatment plants?" This way, water from each treatment plant would supply a clearly defined area of the network, and it could be assumed that, in the worst case scenario, all pipes in the network area supplied by a contaminated plant will be affected. If this is not possible or practicable, it would be helpful to understand why. The manuscript does not address the cause of the problem. Again, as a reader, I would ask whether it would be more effective to invest in treatment plant performance and network infrastructure to negate the need for public health notices in the first place. Some background information as to why the polluted water enters the network and why this particular approach is necessary, would be helpful.

Technical corrections

Any specific technical corrections required can be identified once the paper is restructured.

Interactive comment on Drink. Water Eng. Sci. Discuss., 5, 31, 2012.