General comments

The authors compare a traditional deterministic "top-down"(TD) approach for allocating water demands in a pipe network against a stochastic "bottom-up" (BU) scheme. Daily tracer tests were conducted for nearly seven weeks at Zandvoort, a beach-front Dutch town with 1000 homes and three hotels. Tracer concentrations and travel times measured at four locations in the DMA network provided a benchmark against which to judge the relative accuracy of water age simulated by the hydraulic engine EPANET using both the TD and BU approaches. The authors conclude that the BU approach can provide good predictions of water age in a DMA network without the need for pre-measuring water demand patterns. While the BU approach has a firm logical basis, these conclusions may be overly optimistic as explained in the specific comments that follow. In any event, the seven-week field study is quite impressive and the resulting data set is a tremendous resource for the research community.

Specific Comments

Page 2 line 25 – coagulation, flocculation, sedimentation are unit processes at the water treatment plant (WTP). Since the WTP precedes the network, these unit processes are not directly affected by water age in the distribution system.

Page 3 lines 5 through 15 – There are brief references to autocorrelation (line 6) and spatial correlation (line 11), but no explanation about how, when or why correlation is important in demand modeling. It would be helpful to make this connection.

Page 4 line 10 – Cite a reference about very low leakage in Dutch water networks. The pipes at the study site are nearly 60 years old….can the authors be sure that leakage is zero, as assumed?

Page 5 line 1 – Point out that the tracer dosing schedule (3 h on and 20 h off) shifted the start time forward by 1 hour each day. Hence, during the seven week field study, each hour of the day was used twice as the starting time for a tracer test. This allowed for some replication of starting run conditions.

Page 5 line 10 – Give the Weibull distribution.

Page 5 lines 17 through 21 – Figure 3 is a "result" and so it might be best presented later in Section 3.2. More importantly, what is the "weighted mean travel time" in Figure 3 and how is it computed? The conventional way to estimate travel times with tracer data (i.e., C –vs– t, as shown in Fig 3) is to compute the centroids of the upstream and downstream tracer cloud (say τ_1 and τ_2, respectively) and then get travel time as $\tau_2 - \tau_1$.

Page 6 line 3 – Please list these "correction factors" in Table 2.

Page 6 lines 8 through 12 – Explain why the $DMP_{booster}$ values for the TD model were also used to represent the BU demand patterns (for beach club and the hotels).

Page 6 (and Table 2) – Mention somewhere that nearly 33% of the $Model_{BU}$ demands are exactly the same as the $Model_{TU}$ demands, based on use of the $DMP_{booster}$ pattern for beach clubs and hotels.

Page 6 line 23 – Did the 5 minute time step for $Model_{BU}$ also apply to the beach club and hotel demands? If so, explain how this was accomplished.

Page 7 line 3 – Why were 10 runs made? Why not 5 or 500?

Page 7 lines 17-18 – "…the modeled value closest to the measured value was used to determine the statistical measurements." Please justify this methodology. I am not aware of any valid scientific studies where researchers are allowed to selectively pick the most favorable outcomes when comparing model predictions against field observations. This would introduce a misleading and serious bias into the findings and invalidate the entire analysis. I hope I have misunderstood the procedure. Please clarify the process described in lines 17-18. Perhaps an example would clear up the confusion.

Page 8 line 20 – Clear evidence of spreading (axial dispersion) is also present in the EC cloud at Location 4. What flow regimes occur between the booster and Location 4?

Page 9 line 9 – "…except for location 1 where the $Model_{TD}$ significantly underestimates the measured water age." In Table 4, location 1 has the best performance for $Model_{TD}$. Please clarify.

Page 10 line 15 – "…of the pipes in a greater flow velocity,…" Please clarify….Greater flow velocity than what?

Table 1 – Add another column showing the volume of pipes in the Zandvoort network. For example, using 75 mm as the typical size for pipes <100 mm, gives the following volumes for the five pipe diameters: 61.9, 149.2, 795.2, 10.2, 39.8 for a total of 1056 m^3. With a mean daily demand of 24 m^3/h (stated on page 4 line 9) this gives an overall mean residence time of 1056/24 = 44 hours in the Zandvoort network.

Table 2 – column 3 does not sum to 24 as indicated in the bottom row. Suggest that a new column be added (as product of columns 2 and 3) to show a sum to 24.

Table 3 – Indicate the average number of residents per household.

Table 4 – Provide the sample size for each of the listed statistics. Define what is meant by "good comparisons". The R^2 value for Loc 3 with $Model_{BU}$ is 100%. Is this correct? Is there really a perfect fit between measured and modeled water age at Location 3? This is not evident in Fig 8.

Figure 1 – Include a scale; represent locations 1,2,3,4 as "dots" on the appropriate network pipes with labels that identify each dot.

Figure 3 – Show the weighted mean travel time in this figure. Is it 2:30 h? If so, how was it computed? Explain why centroids were not used to estimate travel times.

Figure 4 – Show which line is for $Model_{TD}$ and which is for $Model_{BU}$ (see caption).

Figure 5 – Remind the reader that 1/3 of Q_{sim} is identical to $Q_{booster}$ obtained from the DMP_{TD} approach. The other 2/3 of Q_{sim} is average of 10 runs from DMP_{BU} approach.

Figure 6 – See comments for Figure 5; the intrinsic value of this figure is not clear. What is the main point represented in this Figure?

Figure 8 – It is interesting to note that none of the water ages (even those at Location 4) exceed the mean residence time (44 h) for the Zandvoort DMA. This means there must be many other locations in this network where the travel time (water age) approaches and or exceeds 3 days. Can this be confirmed with EPANET runs? If yes, it should be stated in the paper. If not, this could suggest that leaks are not insignificant at this DMA.

Summary – The seven week field test is quite interesting. However, the good agreement between $Model_{BU}$ and field measurements may be misleading for two reasons:
[1] Up to 1/3 of $Model_{BU}$ is based on booster measurements.
[2] Selecting the best fit data from 10 BU runs will bias the comparison with field data.

Editorial Notes
Page 3 line 20 – Methodes should be Methods
Page 10 line 16 – change "…12% if the pipes…" to "…12% of the pipes…"

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