# Introduction to E2DISP

- Examples

## Example 5.1

A bottle opened to reaeration and filled with polluted water has the following characteristics:

$\ell_0 = 17.98$ mg/L  $c_0 = 6.681$ mg/L  $c_s = 8.418$ mg/L

$\beta = 0.97$ d$^{-1}$  $\alpha = 0.40$ d$^{-1}$

Find $\ell(t)$ and $c(t)$ after

(a) $1/3 \times 10^4$ s; (b) $5/3 \times 10^4$ s; (c) $1/3 \times 10^5$ s.

Also, find the critical time $t_c$, critical DO deficit $D_c$ and critical DO $c_c$.

## Example 5.1 – Analytical Solution

(a) After 86400 s

$$\ell = 17.98 \times \exp\left(\frac{-0.4 \times 8.64 \times 10^4}{86400}\right) = 12.05 \text{ mg/L}$$

$$D_1 = 1.737 \times \exp\left(\frac{-0.97 \times 8.64 \times 10^4}{86400}\right) = 0.658 \text{ mg/L}$$

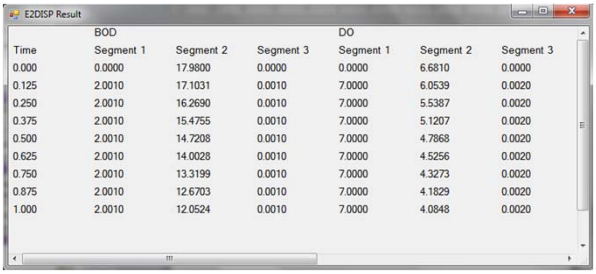
$$D_2 = 17.98 \times \left(\frac{0.4}{0.57}\right) \times \left[\exp\left(\frac{-0.4 \times 8.64 \times 10^4}{86400}\right) - \exp\left(\frac{-0.97 \times 8.64 \times 10^4}{86400}\right)\right]$$

$= 3.67$ mg/L

$\therefore\ D = D_1 + D_2 = 0.658 + 3.67 = 4.33$ mg/L

and $c = 8.418 - 4.33 = 4.085$ mg/L

## Example 5.1 – E2DISP




| | BOD | | | DO | | |
|---|---|---|---|---|---|---|
| Time | Segment 1 | Segment 2 | Segment 3 | Segment 1 | Segment 2 | Segment 3 |
| 0.000 | 0.0000 | 17.9800 | 0.0000 | 0.0000 | 6.6810 | 0.0000 |
| 0.125 | 2.0010 | 17.1031 | 0.0010 | 7.0000 | 6.0539 | 0.0020 |
| 0.250 | 2.0010 | 16.2690 | 0.0010 | 7.0000 | 5.5387 | 0.0020 |
| 0.375 | 2.0010 | 15.4755 | 0.0010 | 7.0000 | 5.1207 | 0.0020 |
| 0.500 | 2.0010 | 14.7208 | 0.0010 | 7.0000 | 4.7868 | 0.0020 |
| 0.625 | 2.0010 | 14.0028 | 0.0010 | 7.0000 | 4.5256 | 0.0020 |
| 0.750 | 2.0010 | 13.3199 | 0.0010 | 7.0000 | 4.3273 | 0.0020 |
| 0.875 | 2.0010 | 12.6703 | 0.0010 | 7.0000 | 4.1829 | 0.0020 |
| 1.000 | 2.0010 | 12.0524 | 0.0010 | 7.0000 | 4.0848 | 0.0020 |

## River Example

Simulate BOD-DO of a river receiving BOD waste from a factory at the rate of $Q_e$ = 0.5 m$^3$/s with $\ell_e$ = 50 mg/L and $c_e$ = 5 mg/L

This river has the following characteristics:

$Q = 1.5$ m$^3$/s  $c = 7$ mg/L  $\beta = 0.97$ d$^{-1}$

$\ell = 2$ mg/L  $c_s = 8.42$ mg/L  $\alpha = 0.4$ d$^{-1}$

$v = 0.1$ ms$^{-1}$

## River Example

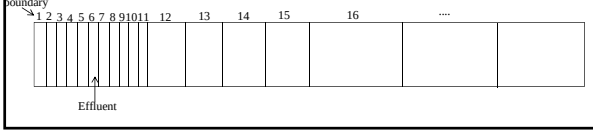
Effluent:

$Q_e = 0.5$ m$^3$/s  $c_e = 5$ mg/L  $\ell_e = 50$ mg/L

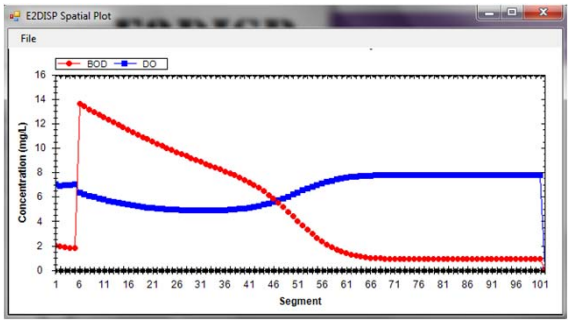
River: $v = 0.1$ ms$^{-1}$

$Q = 1.5$ m$^3$/s  $c = 7$ mg/L  $\beta = 0.97$ d$^{-1}$

$\ell = 2$ mg/L  $c_s = 8.42$ mg/L  $\alpha = 0.4$ d$^{-1}$



## River Example – E2DISP Solution




## Thank you

Presented by
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