

Instructions for DO Parameter Estimation Program 3.0.3* (DOPar3)

By

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This program performs a non-steady state analysis of re-aeration data in accordance with the required procedures of the ASCE/EWRI Standard 2006-2. This program is not part of the Standard but serves as a reference and demonstration program of the method. It can also be used to validate other programs. This program supersedes two earlier programs previously distributed with earlier versions of the Standard. This is also the next version of the ASCE DOPar 3.0.1 with some bug fixes and plotting improvements.

The program uses Excel with the built VBasic.net in a Workbook. It requires no set up or installation and can be executed from the Windows Explorer prompt. The size is 10.7 Mbytes and can be sent via email. DOPar 3 will analyze six probes simultaneously and can handle a maximum of 493 observations per probe. It also converts the test results to standard conditions in the final output, plots the data and the residuals. It can perform the analysis in the most often used sets of British and metric units.

The Workbook is composed of 4 main sheets as follows:

- Input - used for inputting the DO versus Time data, specifying the truncation level and test conditions
- Interface –used for calibrating to standard conditions. It also shows the progress of the program for every iteration.
- Output – shows a summary of the calculated DO parameters, the associated RMSE, blower related parameters and test conditions.
- Plot – Graphically shows the fit of the calculated DO to the observed DO and the residuals for the data set.

It also consists of 2 hidden sheets:

- Calculations – used by the program for intermediate calculations and should never be changed or modified by the user
- Scratch – Calculates and stores some background values that the program uses.

The re-aeration data should be prepared in an Excel spreadsheet or similar program so that it can be pasted into DOPar3. The data should be prepared in tabular columns with the time column on the left and up to six DO concentrations in parallel columns. The time column for each probe must be the same if you want to perform the analysis simultaneously; otherwise perform the

analysis with one probe per file, by first saving the file using a different name and using the “Clear DO data” option. The user should be careful as to not have any gaps due to missing data.

The sheet “Input” is designed to accept user-entered data values and the sheet “Interface” calculates the parameters based on them.

On the “**Input**” Sheet:

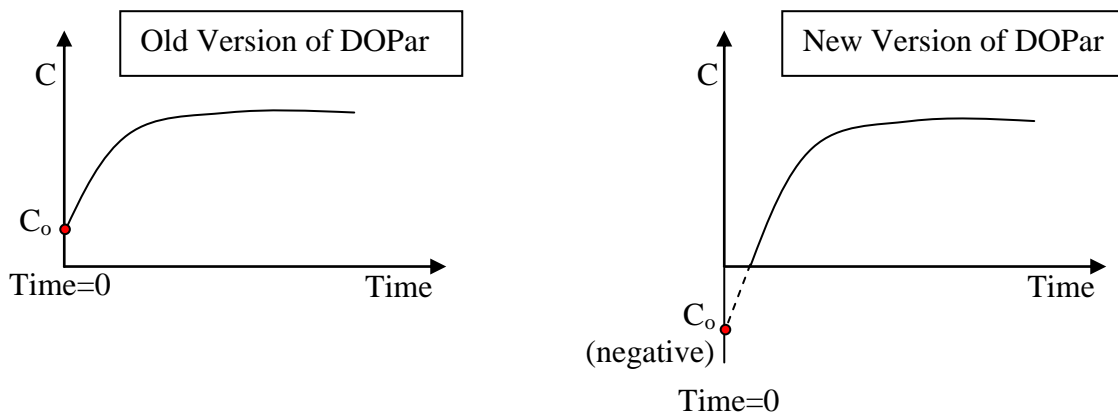
- As indicated, clear all data first by clicking “Clear all data”.
- The test conditions must also be supplied, either in British or in metric units, as follows:

Parameter	British Unit	Metric Unit
Test Temperature	°C	°C
Volume of test tank	ft ³	m ³
Volumetric Airflow rate	SCFM	Standard m ³ /min
Barometric pressure at site	in. Hg	kPa
Elevation of site	ft	m
Barometric pressure at site from elevation	in. Hg	kPa
Power input	hp	kW
TDS during test	mg/L	mg/L

- Select the truncation level by entering the desired percentage of truncation (percent of C^*_{∞} , allowable up to 20%) in the cell indicated on the sheet.
- Copy and paste or manually enter DO probe data in the columns provided in the correct format.
- Click “**Proceed**” to move to the “**Interface**” sheet.
- Click “**Calculate parameters**” and you will see the spreadsheet perform each calculation. Observe the error and the residuals in the Plot sheet.
- Different truncation levels can be evaluated by observing the variation of residuals over time. The residuals should add up to approximately zero for a good truncation level. Additionally they should not be biased, meaning that they should appear random without a pattern.
- The final summary is contained in sheet “**Output**” and can be either printed or copied and pasted into different software.
- The plots for residuals over time and the fit between the calculated DO values and the observed DO values are contained in the sheet “**Plots**”. Individual plots can be printed in

the “portrait” page layout by selecting the particular plot and giving the print command. If you give a print command for the entire sheet, it will print scratch values and blank sheets also. This sheet also contains values for residuals over time for plotting purposes only. These values are for the programmer’s reference and use only.

- The initial DO concentration C_o may be negative but this is not an error or problem. C_o can be negative depending on when the time axis starts and the level of truncation. See the two figures below. Older version of this program truncated the data as shown on the left, so that the value of C_o was always positive. The new version of the program truncated the data as shown on the right, and can produce a negative C_o . A negative C_o has no impact on the estimates of K_{la} , C^*_{∞} , SOTE, SOTR and SAE.



- The final indicator of a good fit between the parameter estimation program and the re-aeration data is a set of mean zero, unbiased residuals. If you see that the plot of residuals is not mean zero (more values on the positive or negative side of the zero line) or biased (e.g., more residuals on one side of the zero line at low values of time and more on the opposite side of the line and high values of time), it suggests one or more problems with the re-aeration data set. A common error is to mistype one of the values, which becomes a large residual and biases the remaining residuals.

*Although extreme effort and care have been spent in debugging this program, we make no guarantees or warranties. Please use with caution at your own risk. We are interested in your feedback on the utility of this program, and you can contact us by email knaik@ucla.edu or stenstro@seas.ucla.edu. A description of the optimization technique used to fit the parameters is provided in Stenstrom, M.K., L.C. Brown and H.J. Hwang, “Oxygen Transfer Parameter Estimation,” *J. Env. Engr., ASCE*, **107**(2), pp 379-397, 1981*