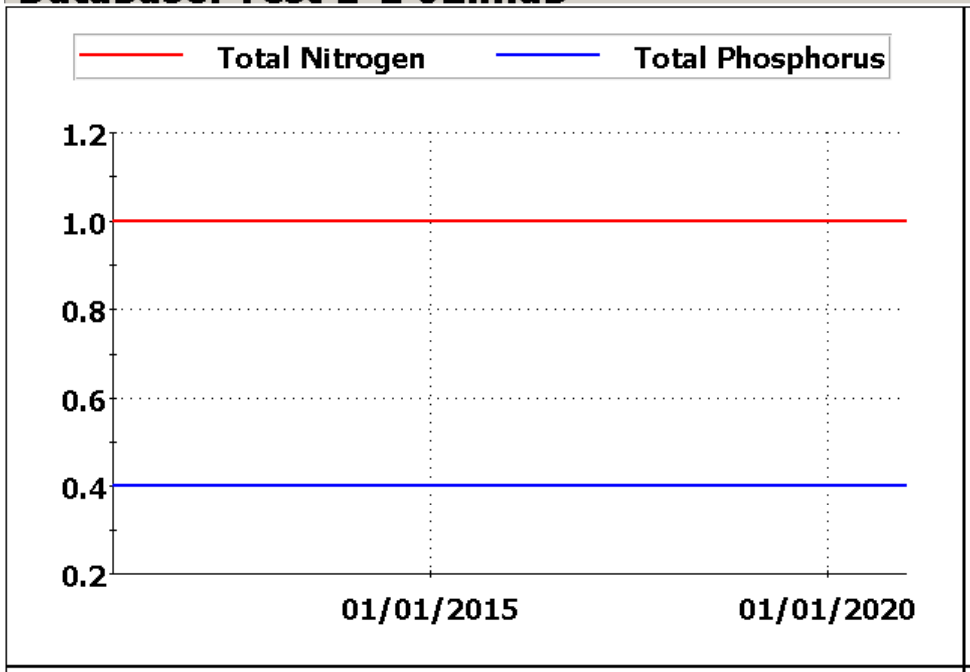
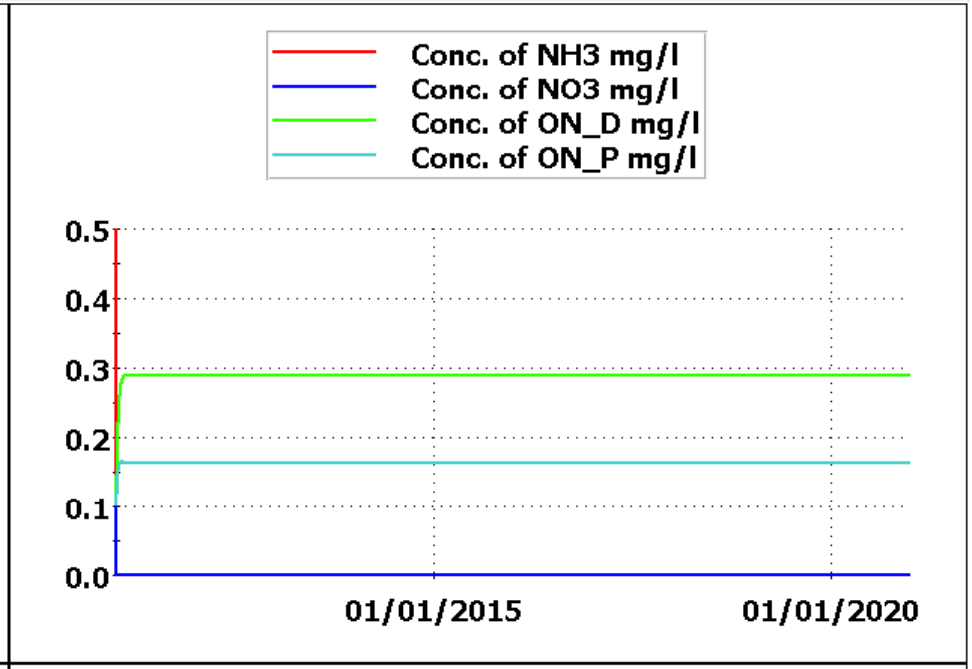
Appendix L. GEMSS Code Testing

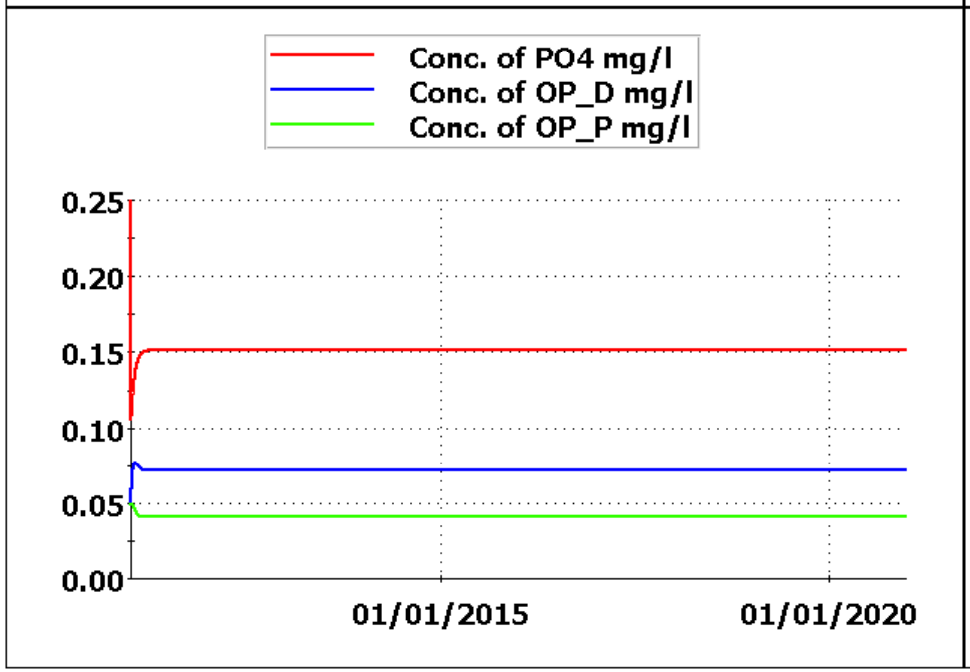
Case	Test	Comments
1.1	TN = 1.0 mg/l; TP = 0.4 mg/l	Done
1.2	TN = 1.0 mg/l; TP = 0.4 mg/l	Done
1.3	TN = 0.2 mg/l; TP = 0.05 mg/l; CBOD_f = 0.133 mg/l; CBOD_s = 1.2 mg/l	Done
1.4a	TC = 1.0 mg/l; TIOC = 0.82 mg/l; OC_P_R = 0.18 mg/l	Done
1.4b	TC = 1.0 mg/l; TIOC = 1.0 mg/l	Done
1.5	TN = 0.19 mg/l; TP = 0.05 mg/l; TC = 0.95 mg/l	Done

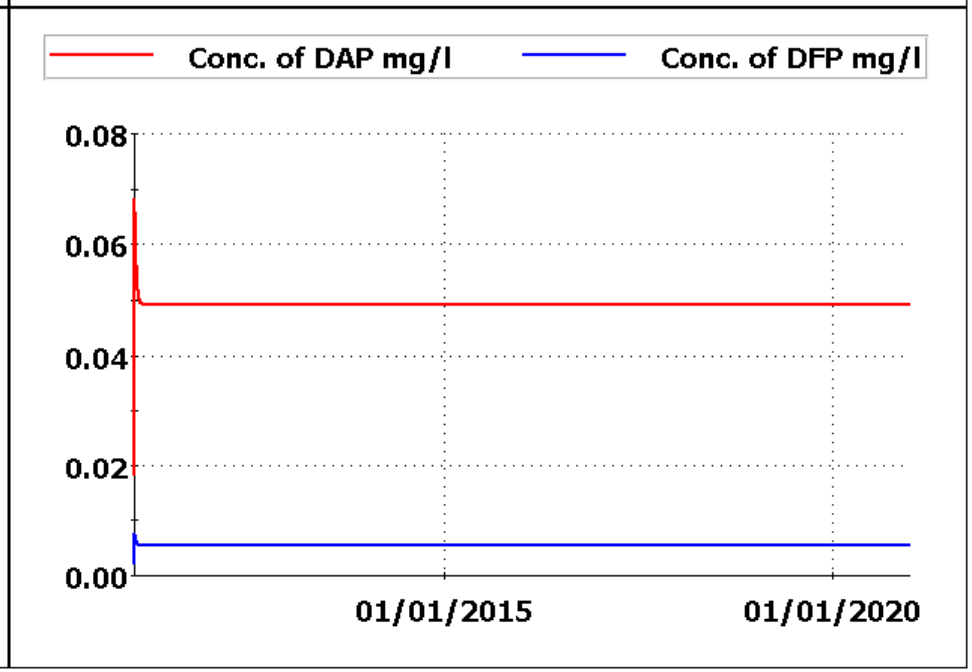
Test 1.1 – Total Nutrient Concentration in CSTR with No Flow

Database: Test 1-1 02.mdb



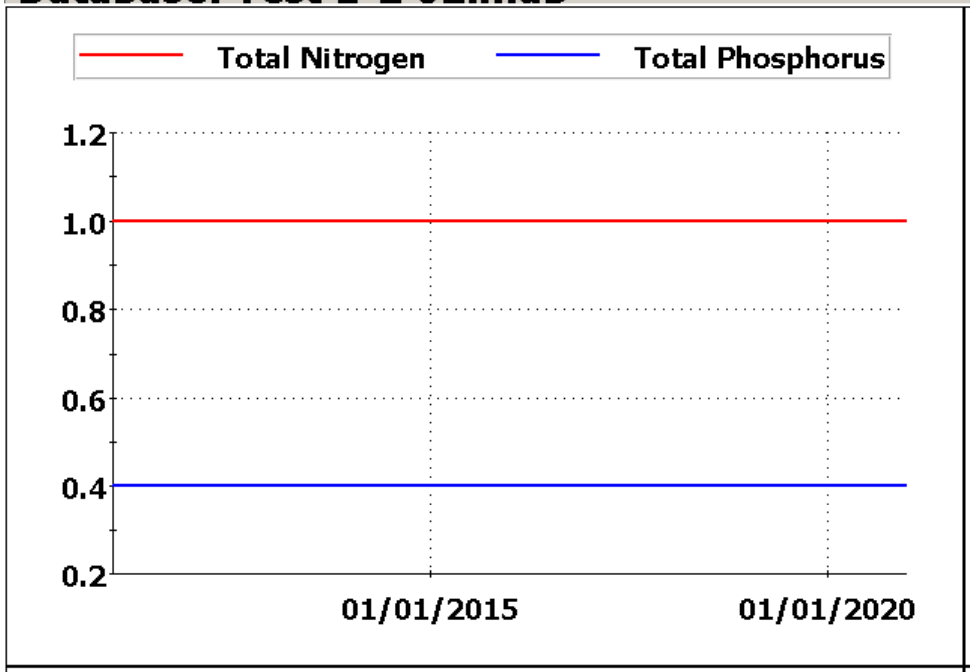


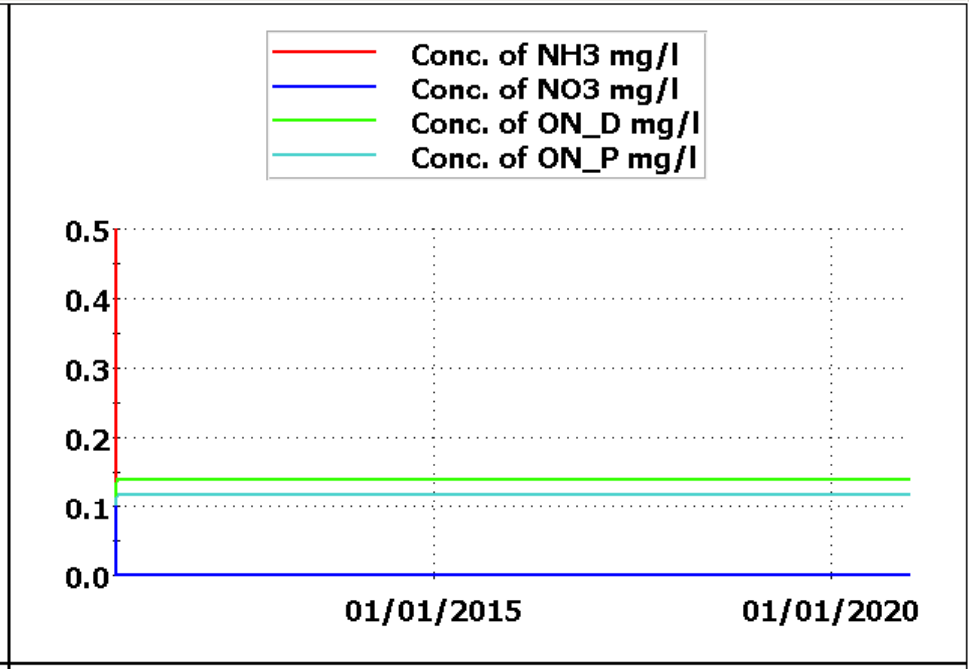


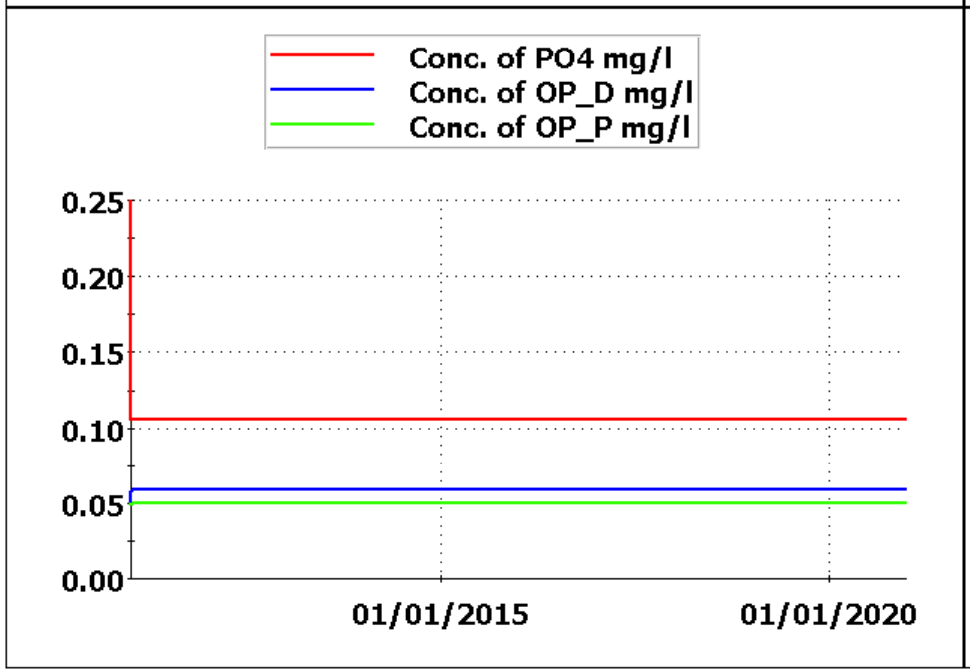


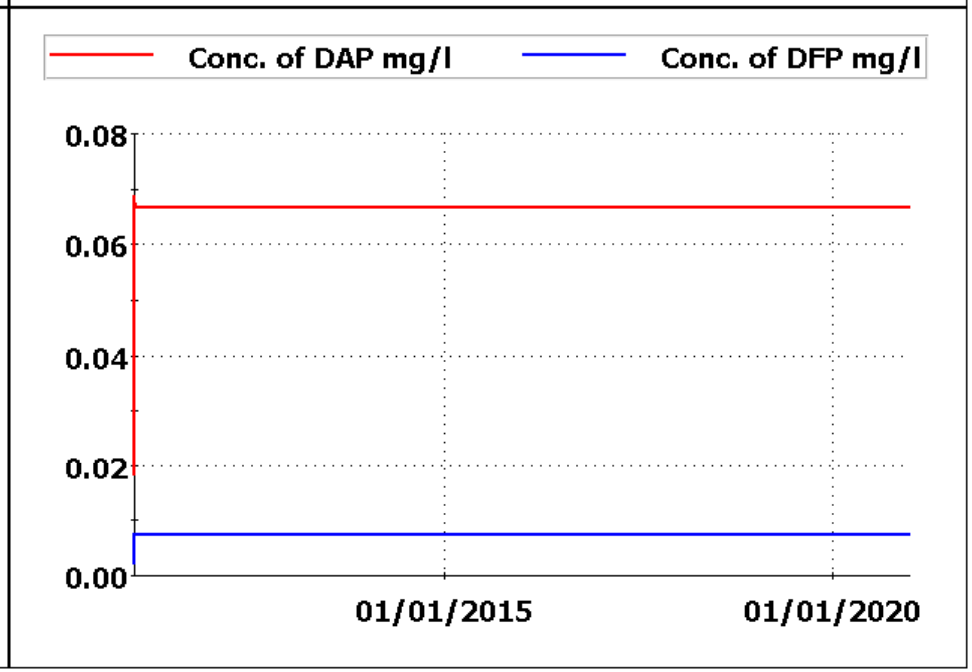
Test 1.2 – Total Nutrient Concentration in CSTR with Flow

Database: Test 1-2 02.mdb



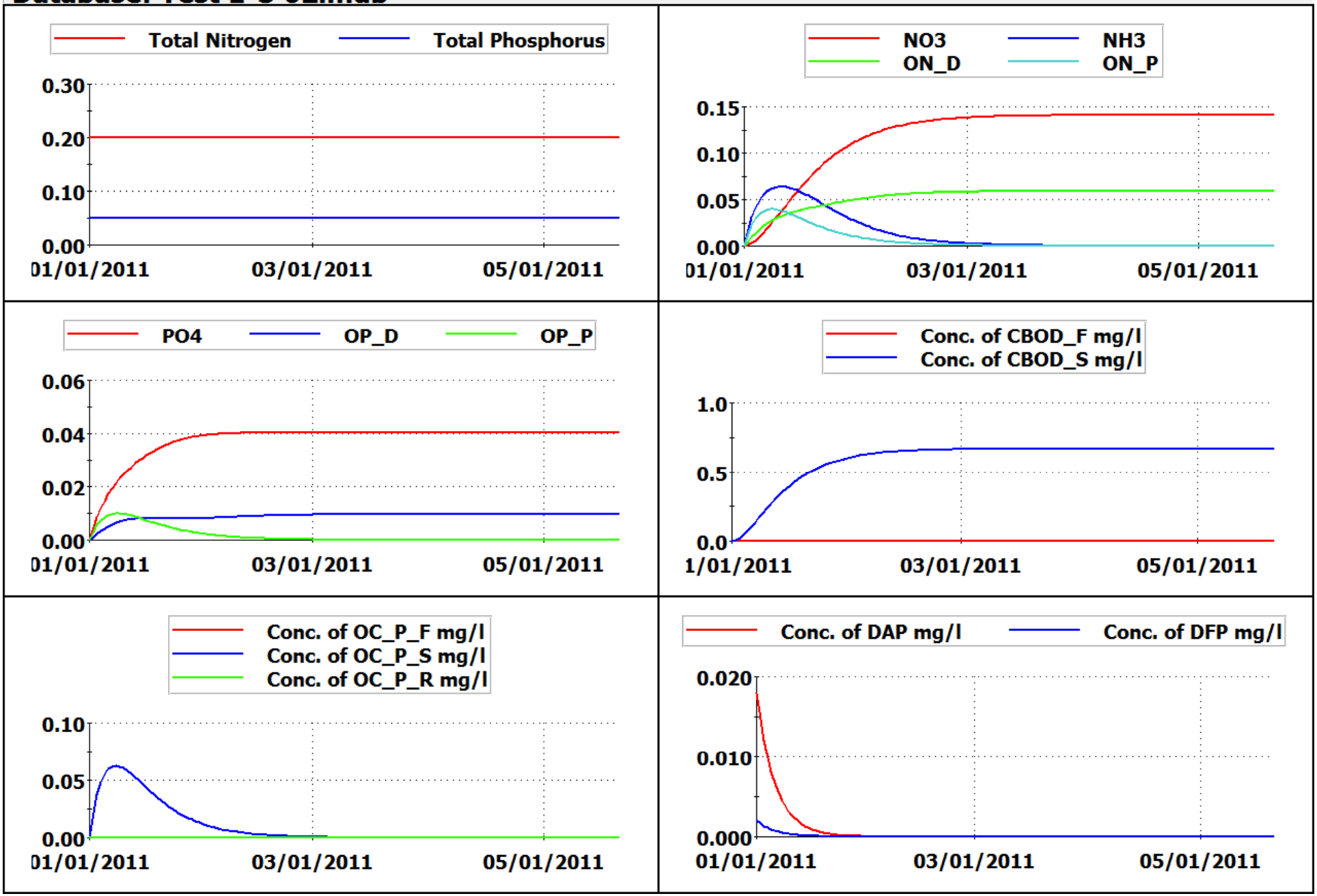






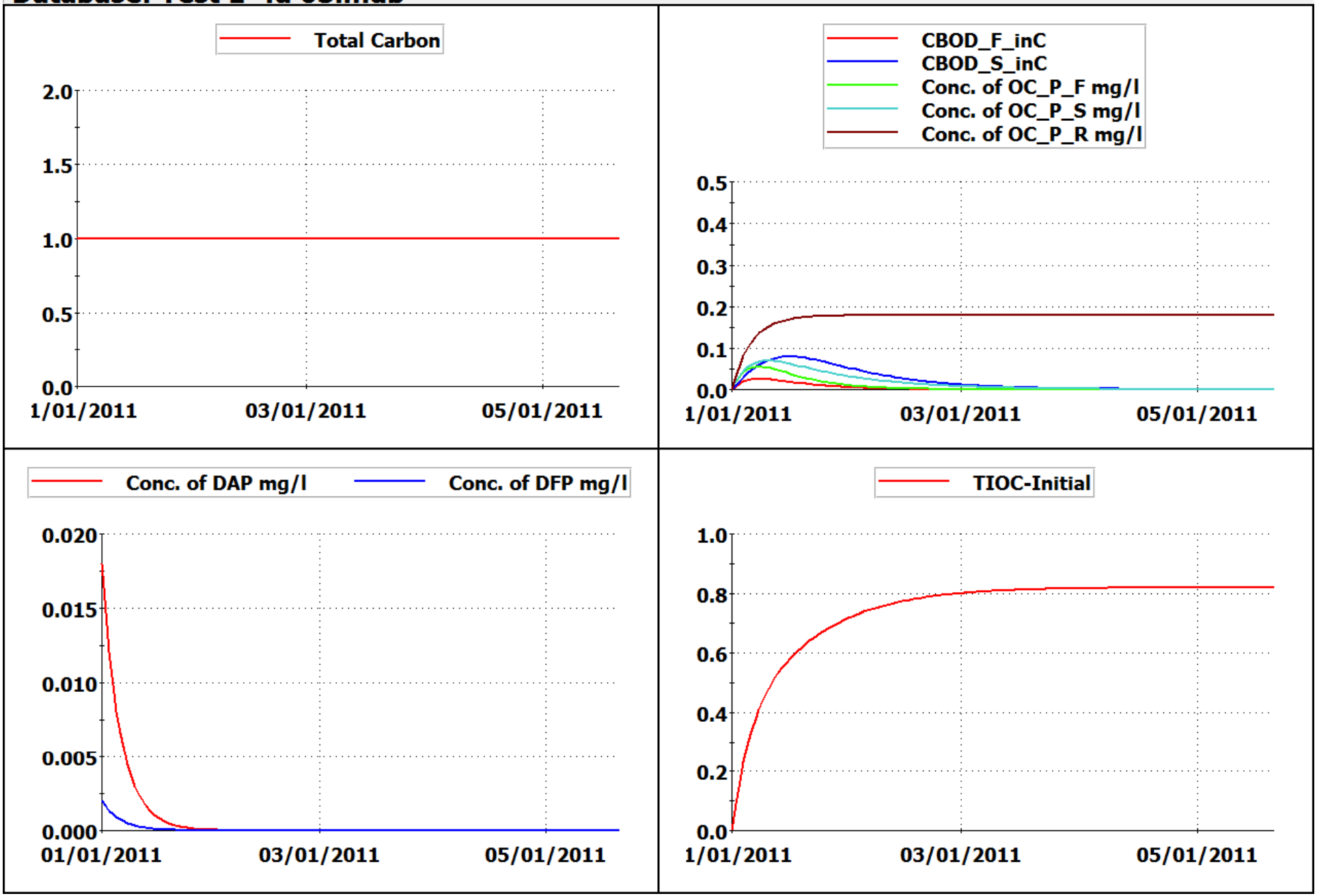
Test 1.3 – Phytoplankton to Inorganic Nutrient Pathway in CSTR with No Flow

Database: Test 1-3 02.mdb



Test 1.4a – WQCBM Phytoplankton to Inorganic Carbon Pathway in CSTR with No Flow

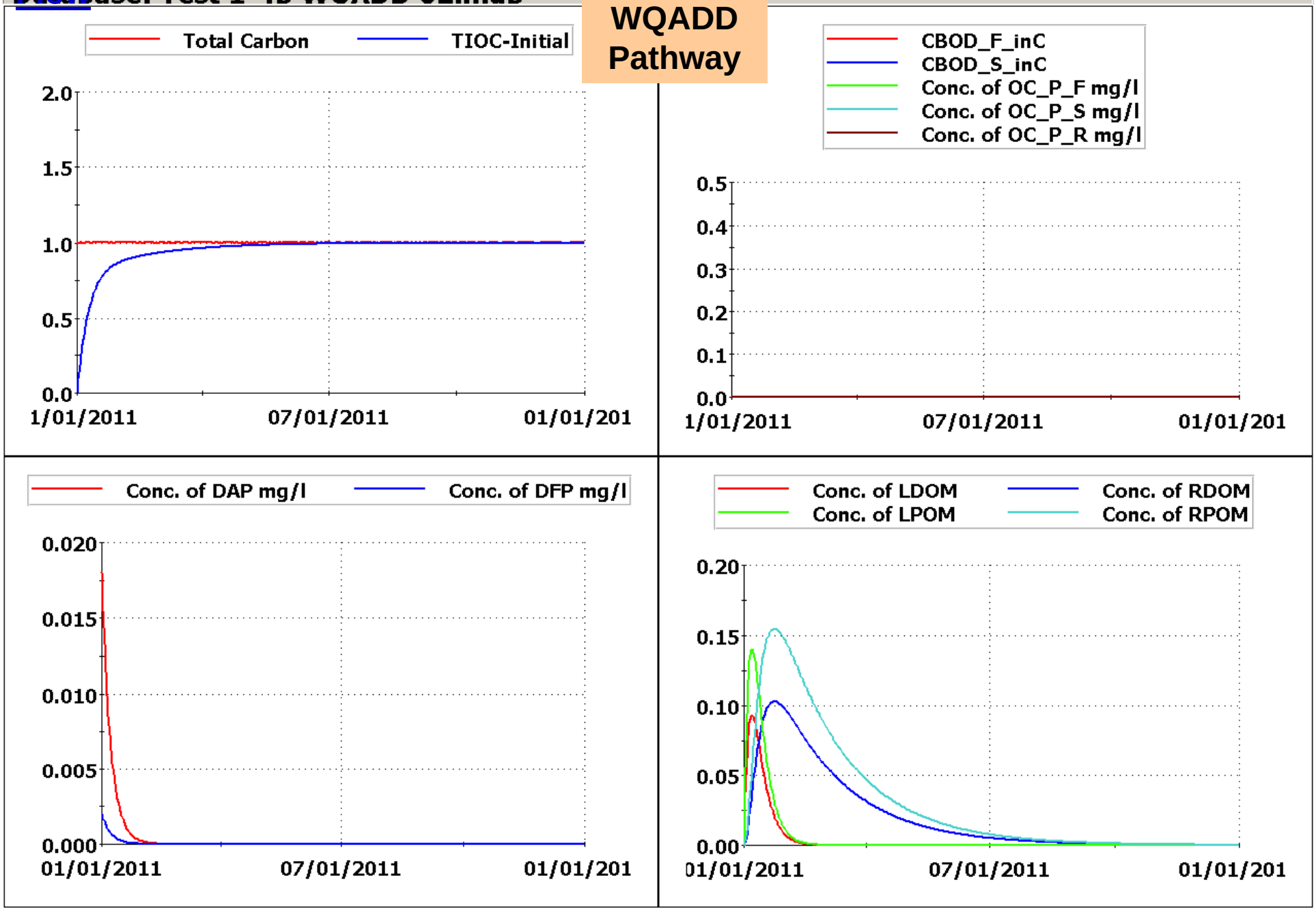
Database: Test 1-4a 03.mdb



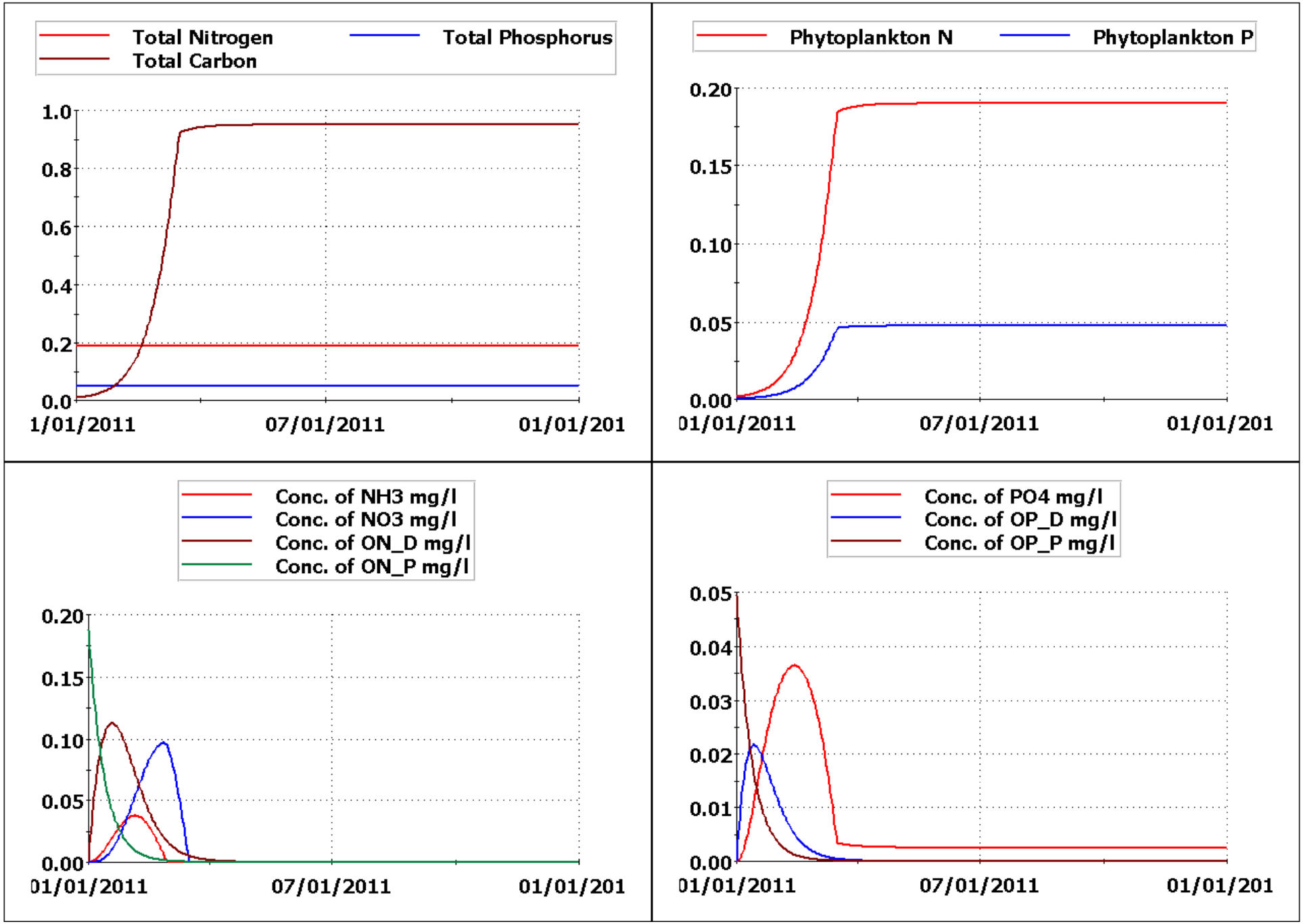
Test 1.4b – WQADD Phytoplankton to Inorganic Carbon Pathway in CSTR with No Flow

Database: Test 1-4b WOADD 02.mdb

WQADD Pathway

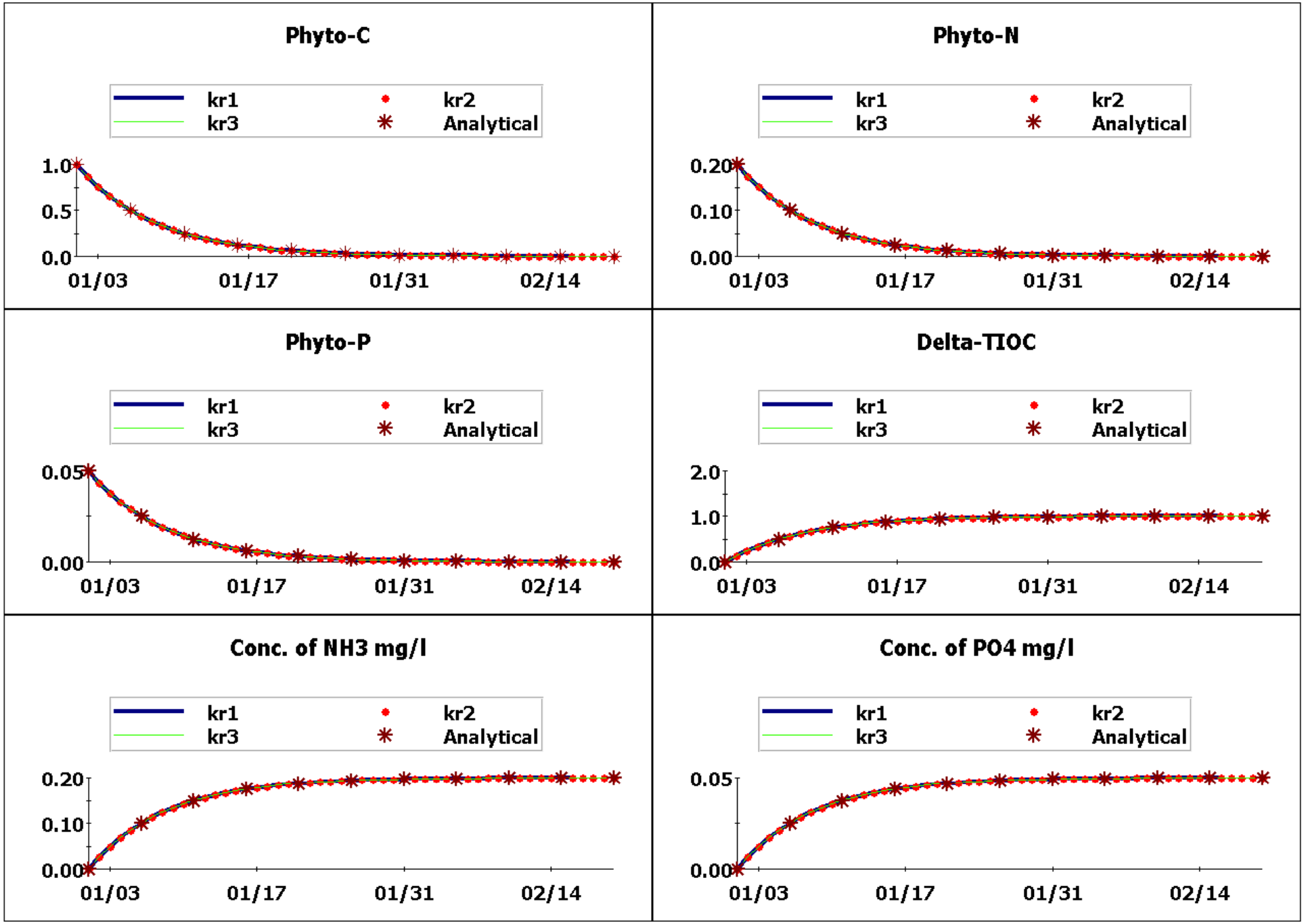


Test 1.5 – Detritus to Phytoplankton Nutrient Pathway in CSTR with No Flow

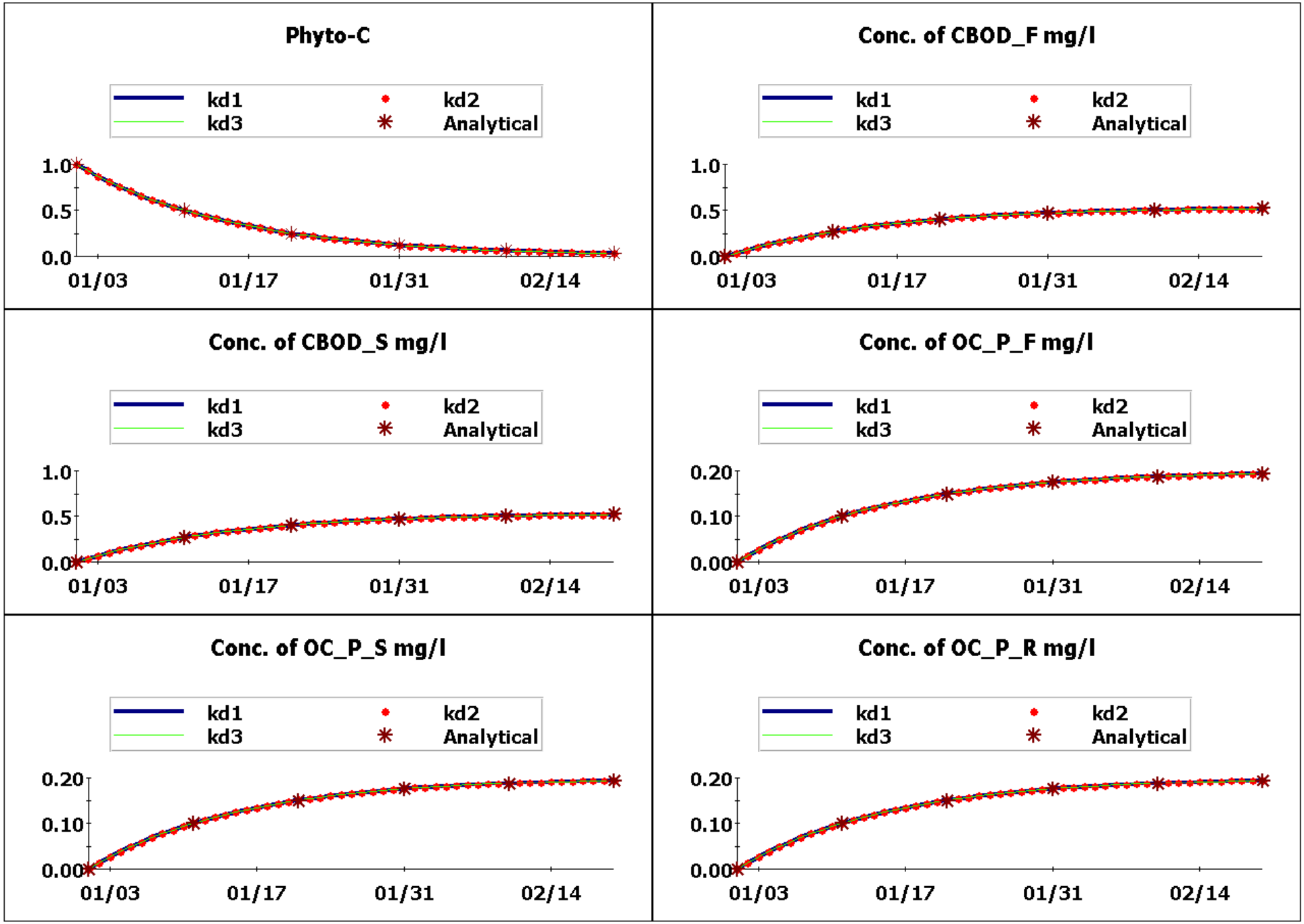


Number	Scenario	Completed
1	Test 2.1	✓
2	Test 2.2a	✓
3	Test 2.2b	✓
4	Test 2.3	✓
5	Test 2.4a	✓
6	Test 2.4b	✓
7	Test 2.4c	✓
8	Test 2.5a	✓
9	Test 2.5b	✓
10	Test 2.6a	✓
11	Test 2.6b	✓
12	Test 2.7a	✓
13	Test 2.7b	✓
14	Test 2.7c	✓
15	Test 2.7d	✓
16	Test 2.8a	✓
17	Test 2.8b	✓
18	Test 2.8c	✓
19	Test 2.8d	✓
20	Test 2.8e	✓

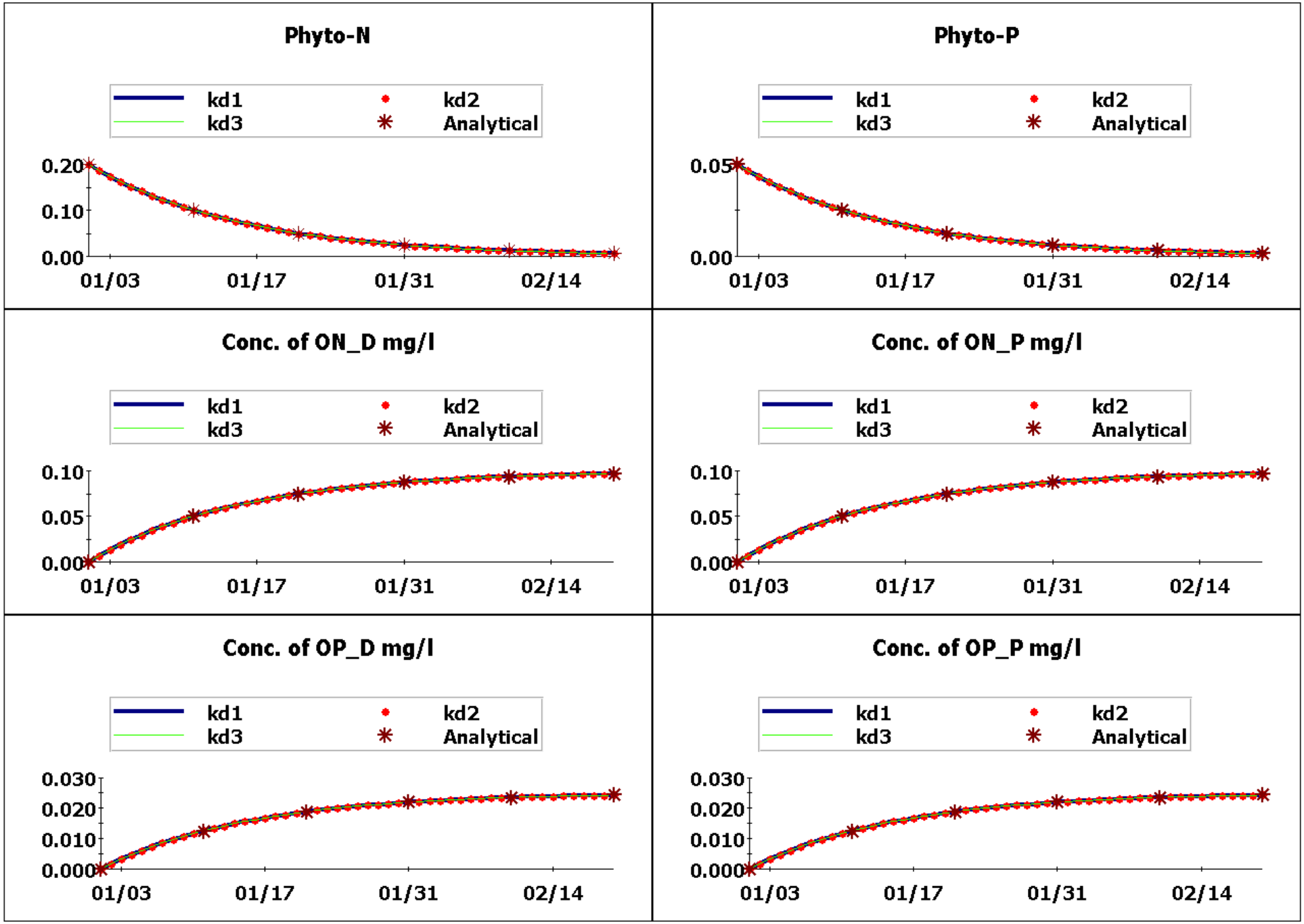
Test 2.1


Phyto-C
kr1
kr2
kr3
Analytical
1.0
0.5
0.0
01/03
01/17
01/31
02/14
Phyto-N
kr1
kr2
kr3
Analytical
0.20
0.10
0.00
01/03
01/17
01/31
02/14
Phyto-P
kr1
kr2
kr3
Analytical
0.05
0.00
01/03
01/17
01/31
02/14
Delta-TIOC
kr1
kr2
kr3
Analytical
2.0
1.0
0.0
01/03
01/17
01/31
02/14
Conc. of NH3 mg/l
kr1
kr2
kr3
Analytical
0.20
0.10
0.00
01/03
01/17
01/31
02/14
Conc. of PO4 mg/l
kr1
kr2
kr3
Analytical
0.05
0.00
01/03
01/17
01/31
02/14

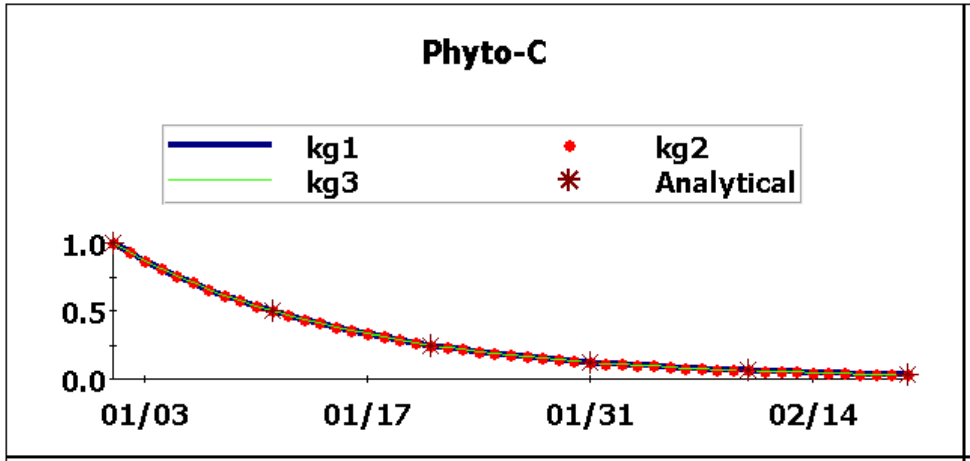
Test 2.2a

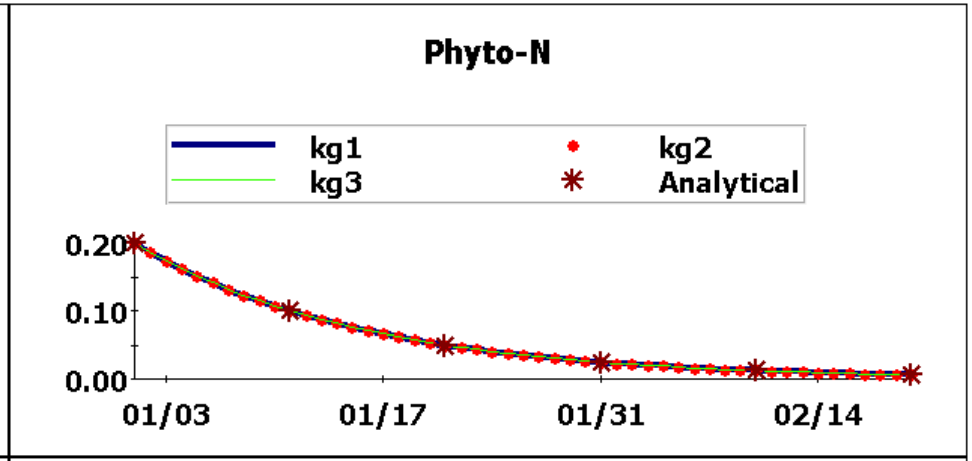

Phyto-C
kd1
kd2
kd3
Analytical
1.0
0.5
0.0
01/03
01/17
01/31
02/14
Conc. of CBOD_F mg/l
kd1
kd2
kd3
Analytical
1.0
0.5
0.0
01/03
01/17
01/31
02/14
Conc. of CBOD_S mg/l
kd1
kd2
kd3
Analytical
1.0
0.5
0.0
01/03
01/17
01/31
02/14
Conc. of OC_P_F mg/l
kd1
kd2
kd3
Analytical
0.20
0.10
0.00
01/03
01/17
01/31
02/14
Conc. of OC_P_S mg/l
kd1
kd2
kd3
Analytical
0.20
0.10
0.00
01/03
01/17
01/31
02/14
Conc. of OC_P_R mg/l
kd1
kd2
kd3
Analytical
0.20
0.10
0.00
01/03
01/17
01/31
02/14

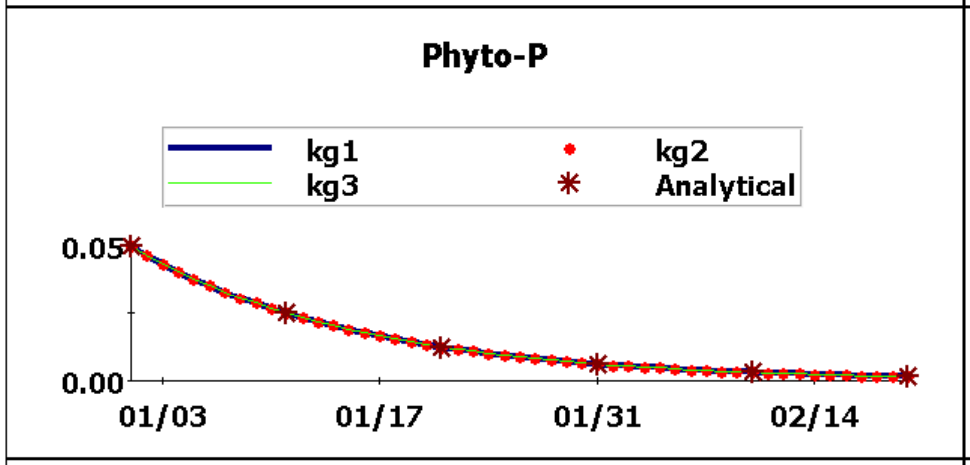
Test 2.2b

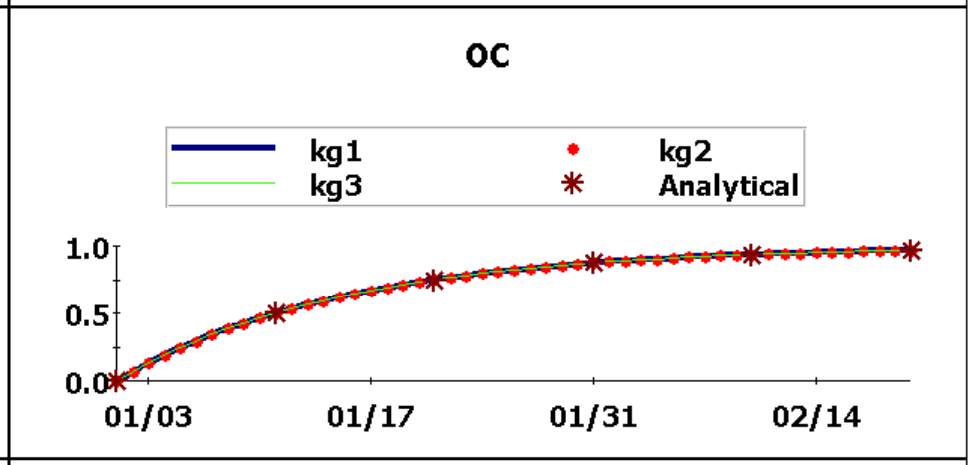

Phyto-N
kd1
kd2
kd3
Analytical
0.20
0.10
0.00
01/03
01/17
01/31
02/14
Phyto-P
kd1
kd2
kd3
Analytical
0.05
0.00
01/03
01/17
01/31
02/14
Conc. of ON_D mg/l
kd1
kd2
kd3
Analytical
0.10
0.05
0.00
01/03
01/17
01/31
02/14
Conc. of ON_P mg/l
kd1
kd2
kd3
Analytical
0.10
0.05
0.00
01/03
01/17
01/31
02/14
Conc. of OP_D mg/l
kd1
kd2
kd3
Analytical
0.030
0.020
0.010
0.000
01/03
01/17
01/31
02/14
Conc. of OP_P mg/l
kd1
kd2
kd3
Analytical
0.030
0.020
0.010
0.000
01/03
01/17
01/31
02/14

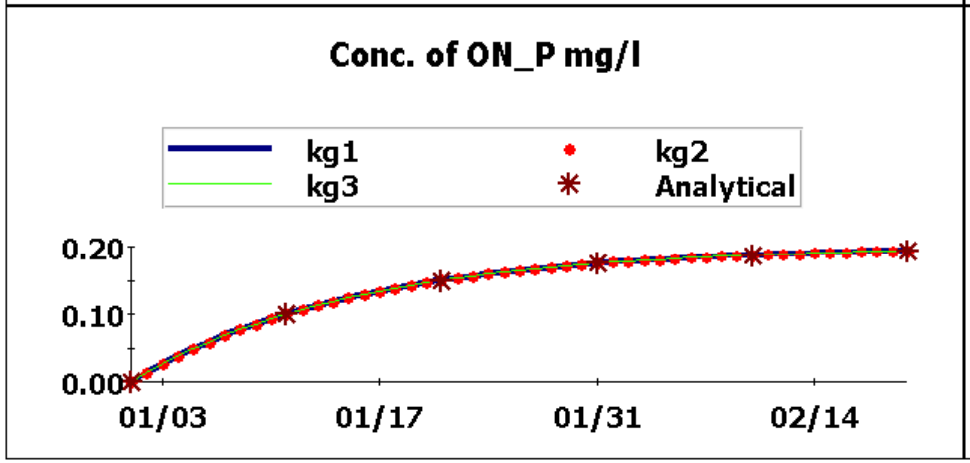
Test 2.3

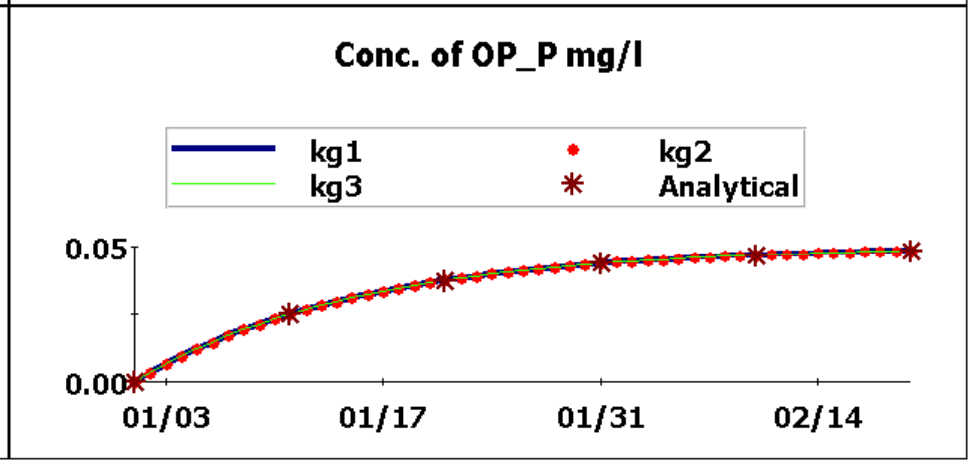

Phyto-C
kg1
kg2
kg3
Analytical
1.0
0.5
0.0
01/03
01/17
01/31
02/14


Phyto-N
kg1
kg2
kg3
Analytical
0.20
0.10
0.00
01/03
01/17
01/31
02/14

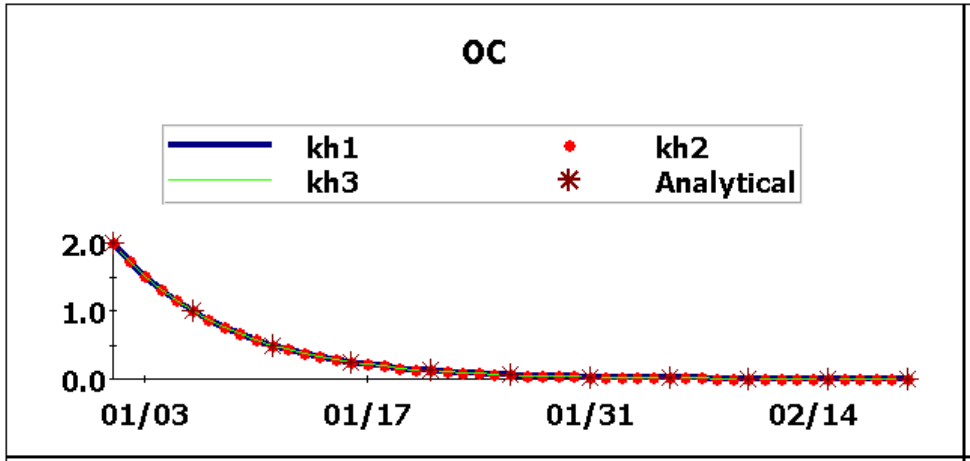

Phyto-P
kg1
kg2
kg3
Analytical
0.05
0.00
01/03
01/17
01/31
02/14

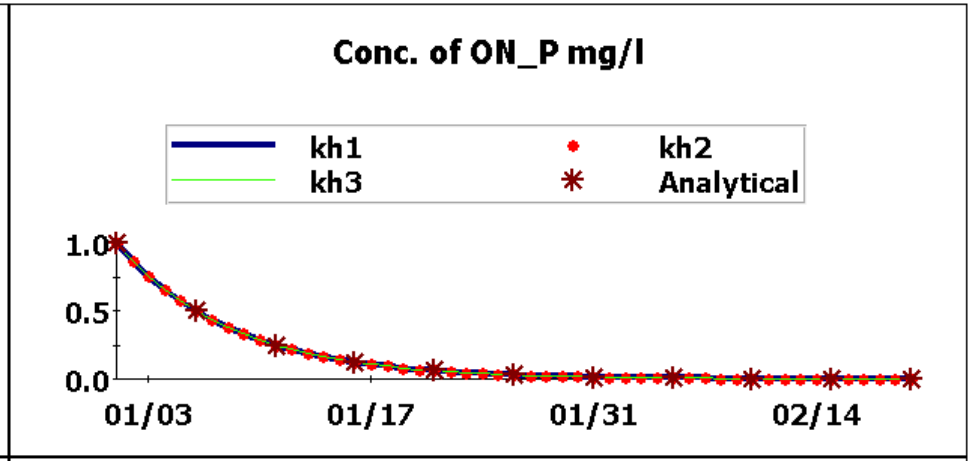

OC
kg1
kg2
kg3
Analytical
1.0
0.5
0.0
01/03
01/17
01/31
02/14

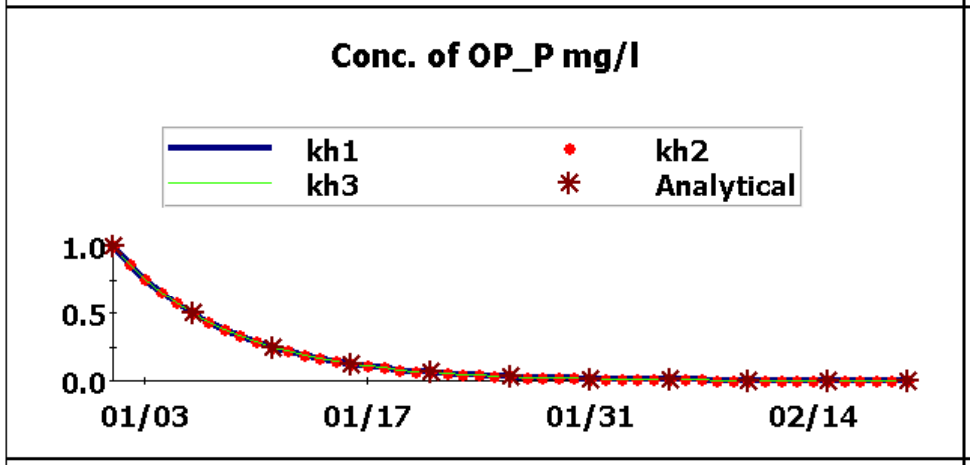

Conc. of ON_P mg/l
kg1
kg2
kg3
Analytical
0.20
0.10
0.00
01/03
01/17
01/31
02/14

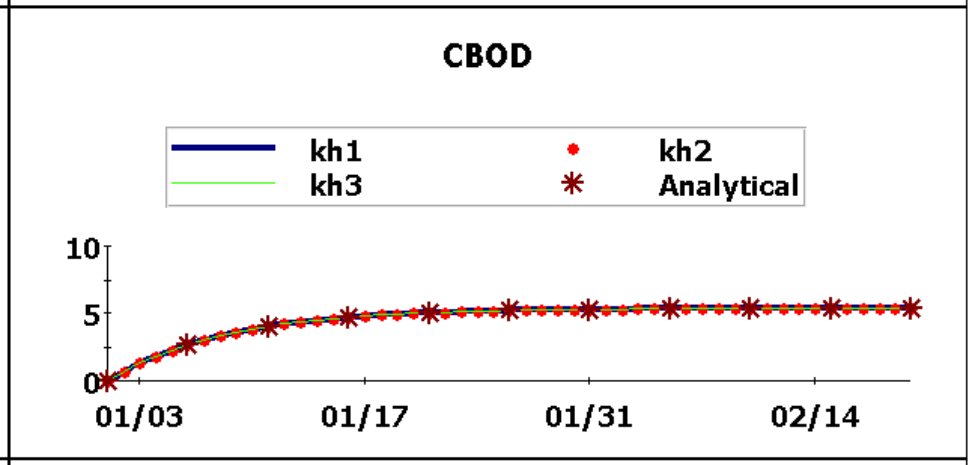

Conc. of OP_P mg/l
kg1
kg2
kg3
Analytical
0.05
0.00
01/03
01/17
01/31
02/14

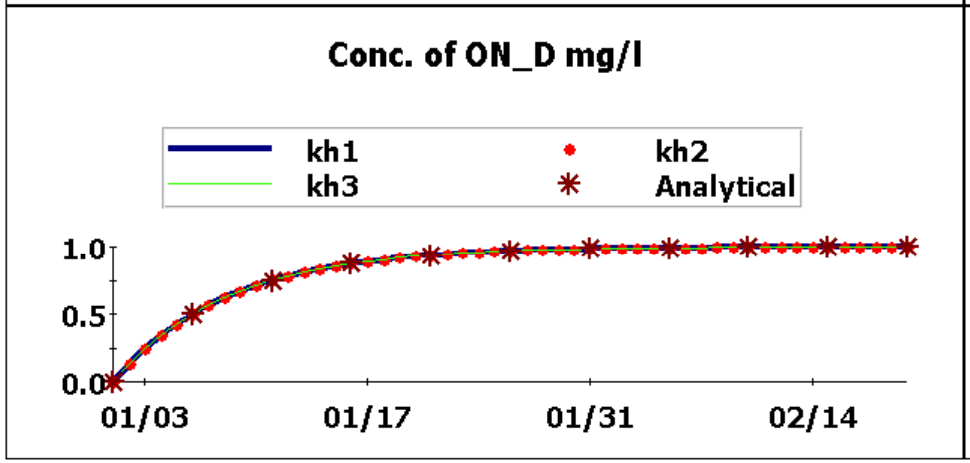
Test 2.4a

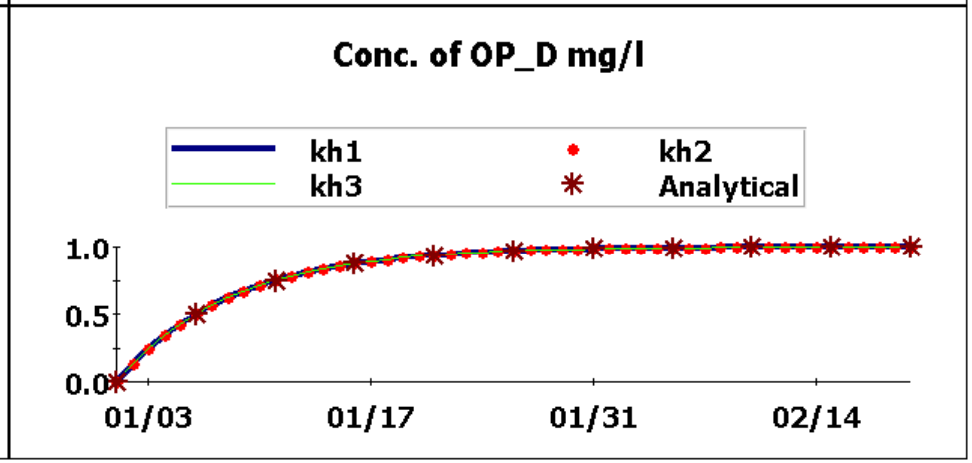

OC
kh1
kh2
kh3
Analytical
2.0
1.0
0.0
01/03
01/17
01/31
02/14


Conc. of ON_P mg/l
kh1
kh2
kh3
Analytical
1.0
0.5
0.0
01/03
01/17
01/31
02/14

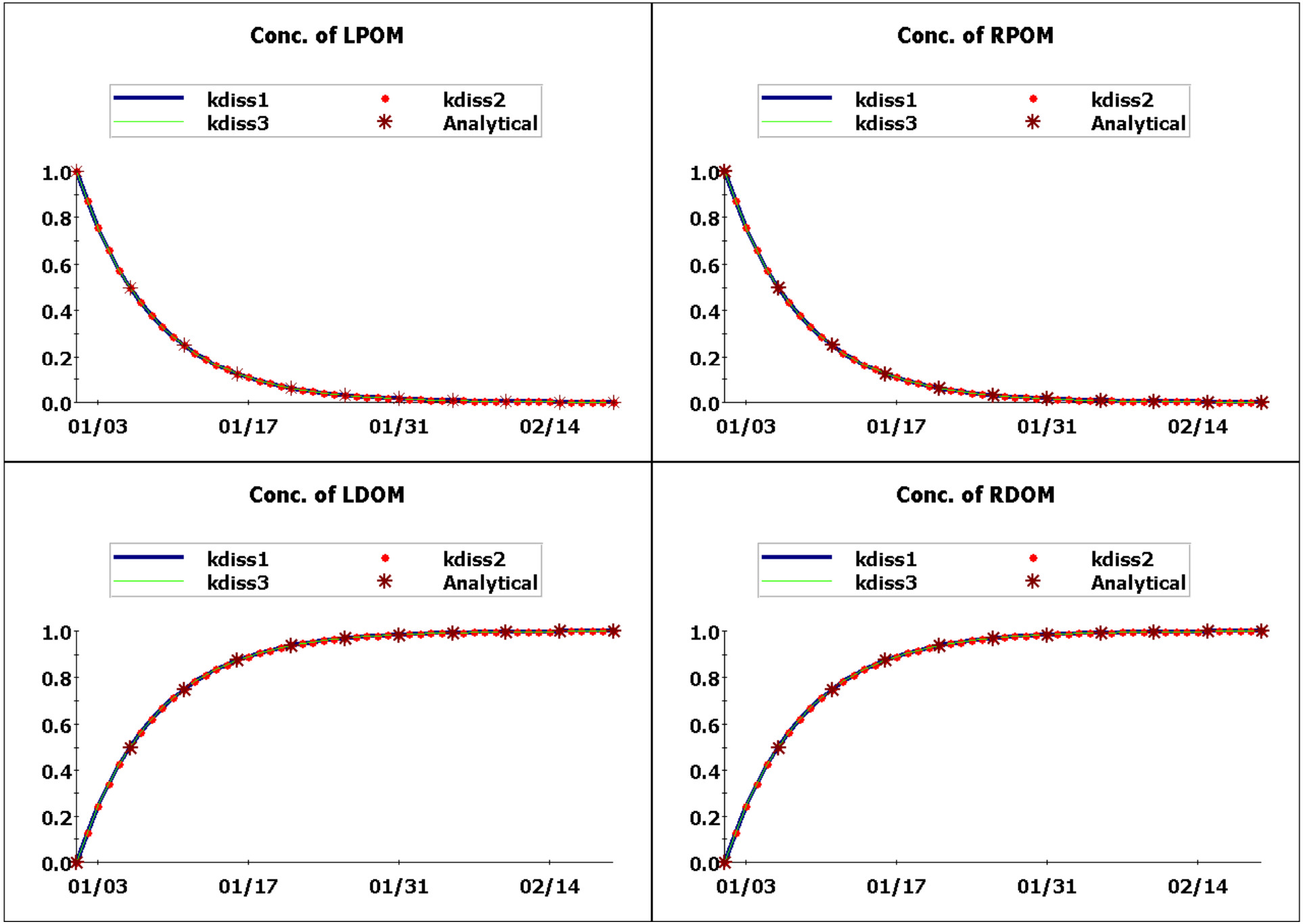

Conc. of OP_P mg/l
kh1
kh2
kh3
Analytical
1.0
0.5
0.0
01/03
01/17
01/31
02/14


CBOD
kh1
kh2
kh3
Analytical
10
5
0
01/03
01/17
01/31
02/14

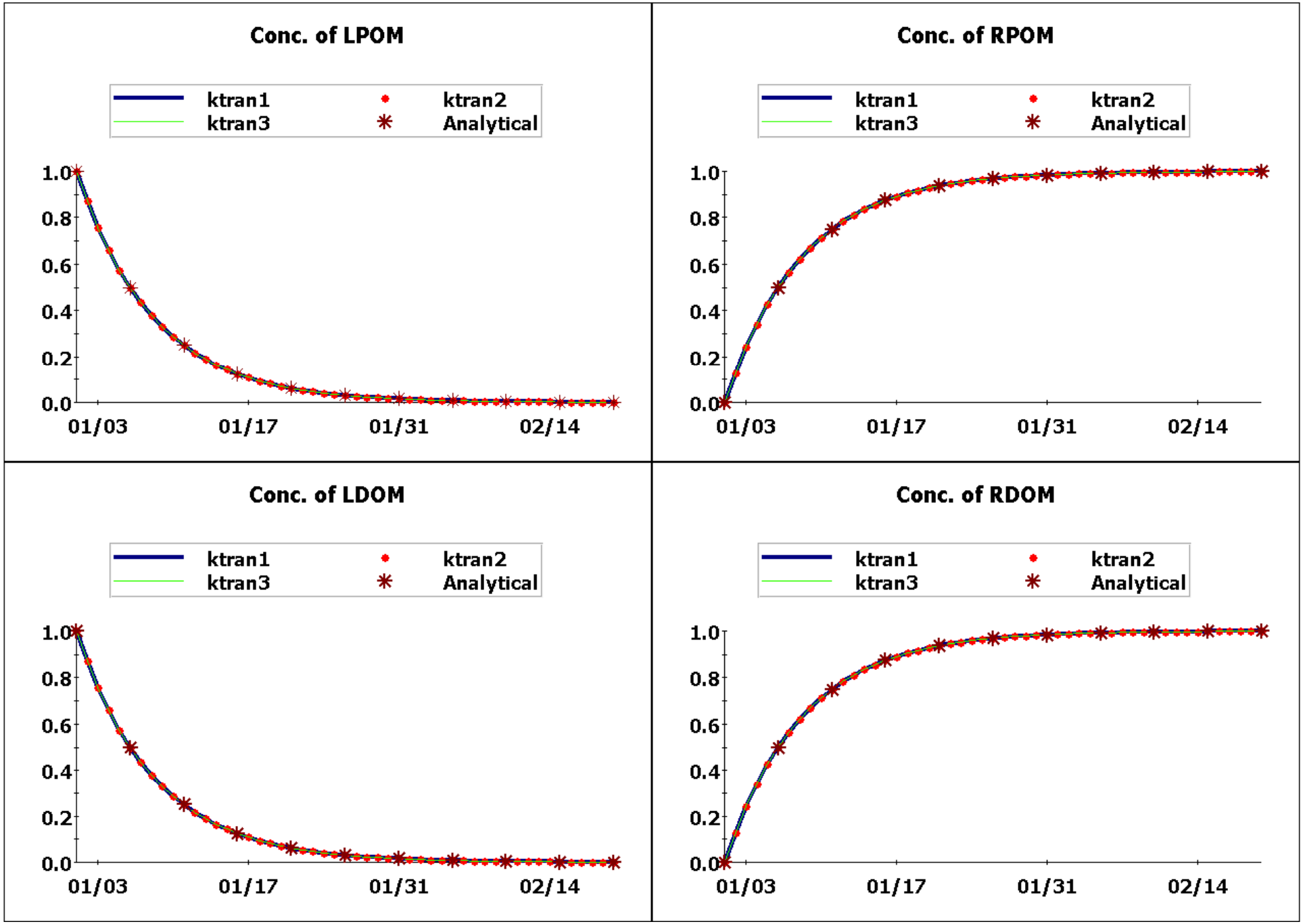

Conc. of ON_D mg/l
kh1
kh2
kh3
Analytical
1.0
0.5
0.0
01/03
01/17
01/31
02/14


Conc. of OP_D mg/l
kh1
kh2
kh3
Analytical
1.0
0.5
0.0
01/03
01/17
01/31
02/14

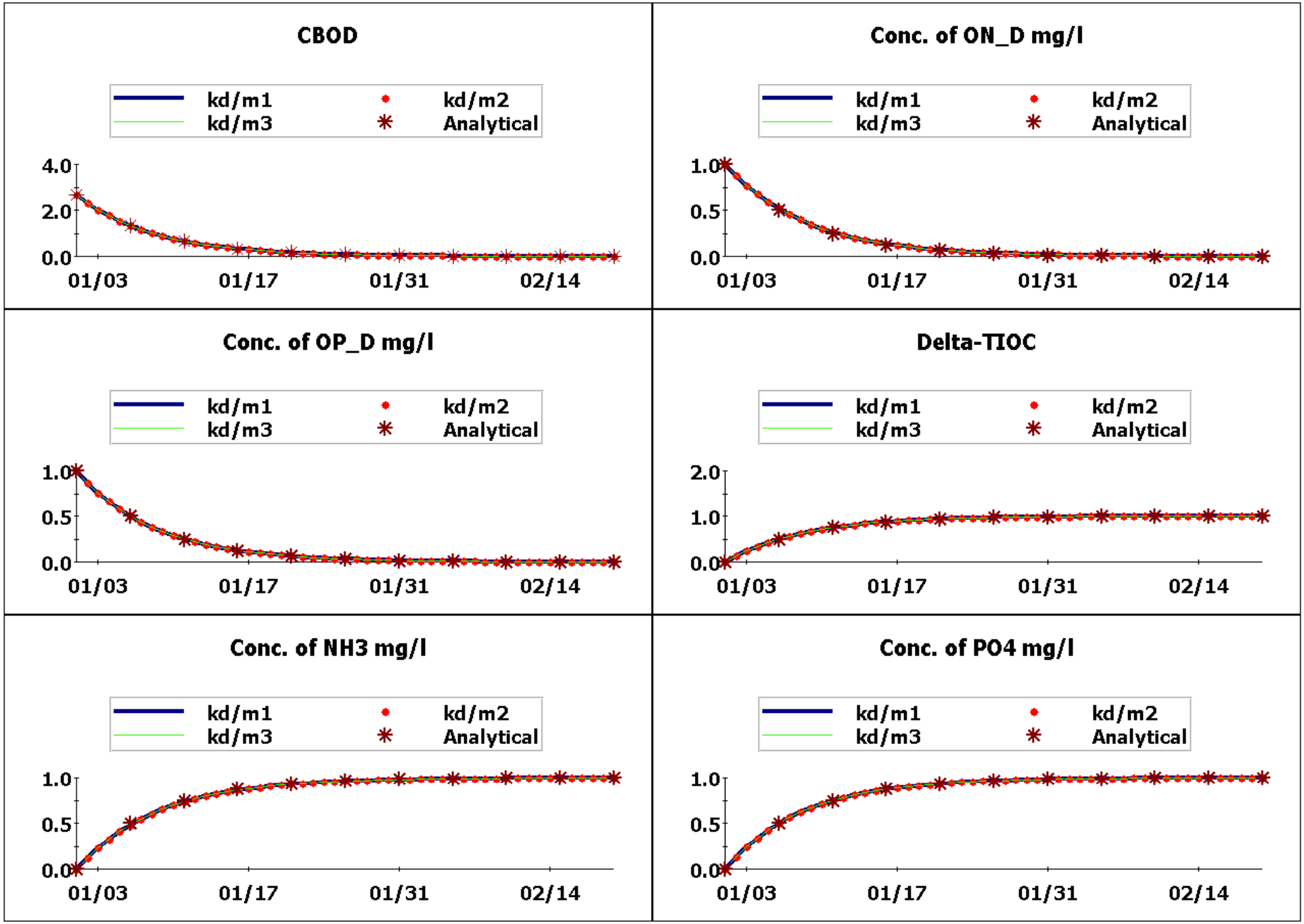
Test 2.4b


Conc. of LPOM
kdiss1
kdiss2
kdiss3
Analytical
1.0
0.8
0.6
0.4
0.2
0.0
01/03
01/17
01/31
02/14
Conc. of RPOM
kdiss1
kdiss2
kdiss3
Analytical
1.0
0.8
0.6
0.4
0.2
0.0
01/03
01/17
01/31
02/14
Conc. of LDOM
kdiss1
kdiss2
kdiss3
Analytical
1.0
0.8
0.6
0.4
0.2
0.0
01/03
01/17
01/31
02/14
Conc. of RDOM
kdiss1
kdiss2
kdiss3
Analytical
1.0
0.8
0.6
0.4
0.2
0.0
01/03
01/17
01/31
02/14

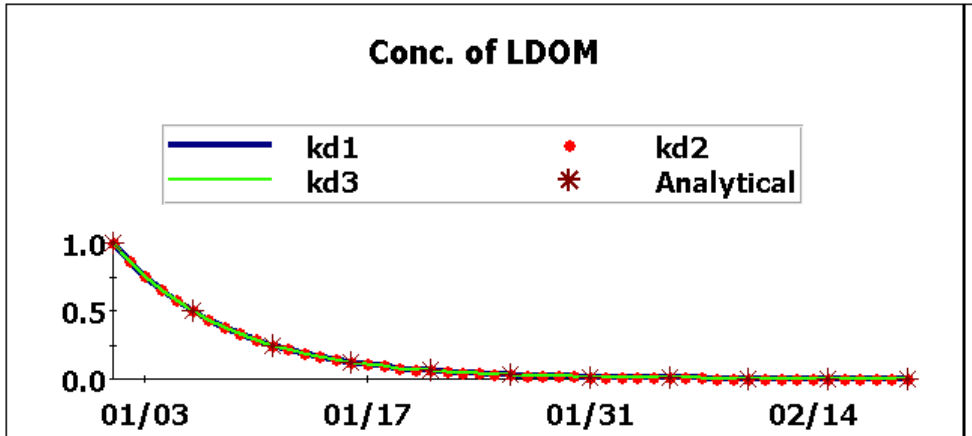
Test 2.4c

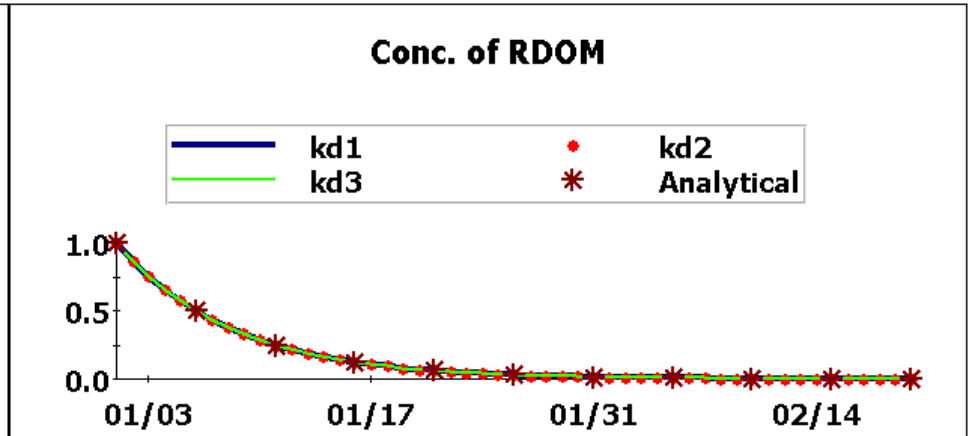

Conc. of LPOM
ktran1
ktran2
ktran3
Analytical
1.0
0.8
0.6
0.4
0.2
0.0
01/03
01/17
01/31
02/14
Conc. of RPOM
ktran1
ktran2
ktran3
Analytical
1.0
0.8
0.6
0.4
0.2
0.0
01/03
01/17
01/31
02/14
Conc. of LDOM
ktran1
ktran2
ktran3
Analytical
1.0
0.8
0.6
0.4
0.2
0.0
01/03
01/17
01/31
02/14
Conc. of RDOM
ktran1
ktran2
ktran3
Analytical
1.0
0.8
0.6
0.4
0.2
0.0
01/03
01/17
01/31
02/14

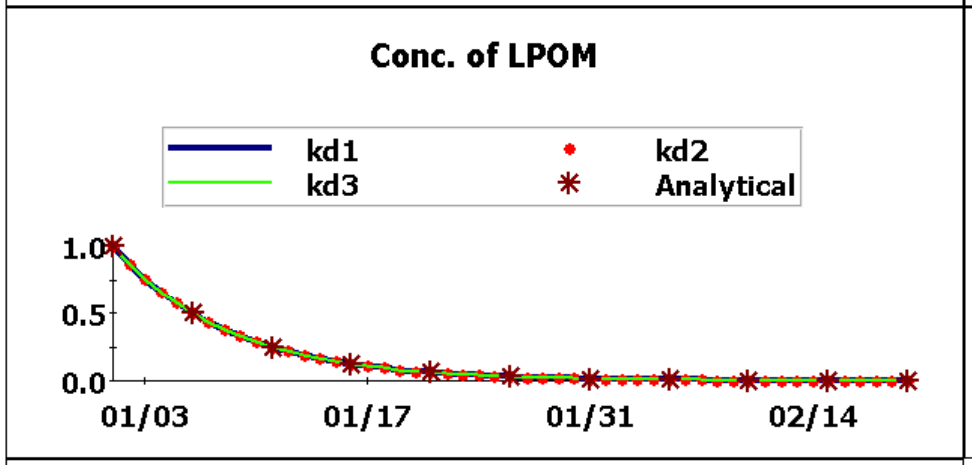
Test 2.5a

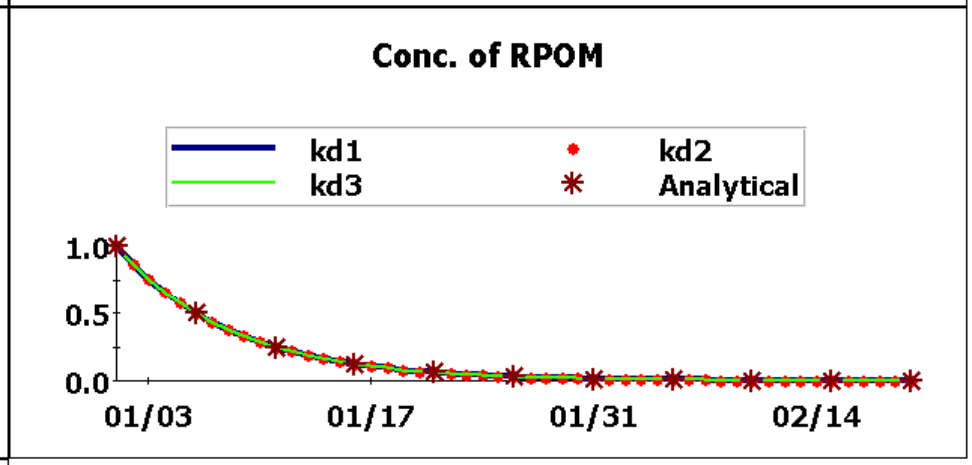

CBOD
kd/m1
kd/m2
kd/m3
Analytical
4.0
2.0
0.0
01/03
01/17
01/31
02/14
Conc. of ON_D mg/l
kd/m1
kd/m2
kd/m3
Analytical
1.0
0.5
0.0
01/03
01/17
01/31
02/14
Conc. of OP_D mg/l
kd/m1
kd/m2
kd/m3
Analytical
1.0
0.5
0.0
01/03
01/17
01/31
02/14
Delta-TIOC
kd/m1
kd/m2
kd/m3
Analytical
2.0
1.0
0.0
01/03
01/17
01/31
02/14
Conc. of NH3 mg/l
kd/m1
kd/m2
kd/m3
Analytical
1.0
0.5
0.0
01/03
01/17
01/31
02/14
Conc. of PO4 mg/l
kd/m1
kd/m2
kd/m3
Analytical
1.0
0.5
0.0
01/03
01/17
01/31
02/14

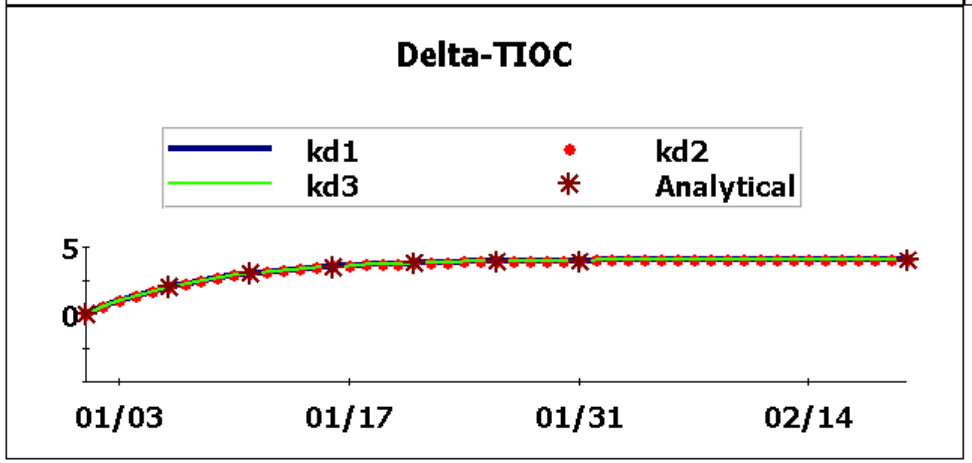
Test 2.5b


Conc. of LDOM
kd1
kd2
kd3
Analytical
1.0
0.5
0.0
01/03
01/17
01/31
02/14

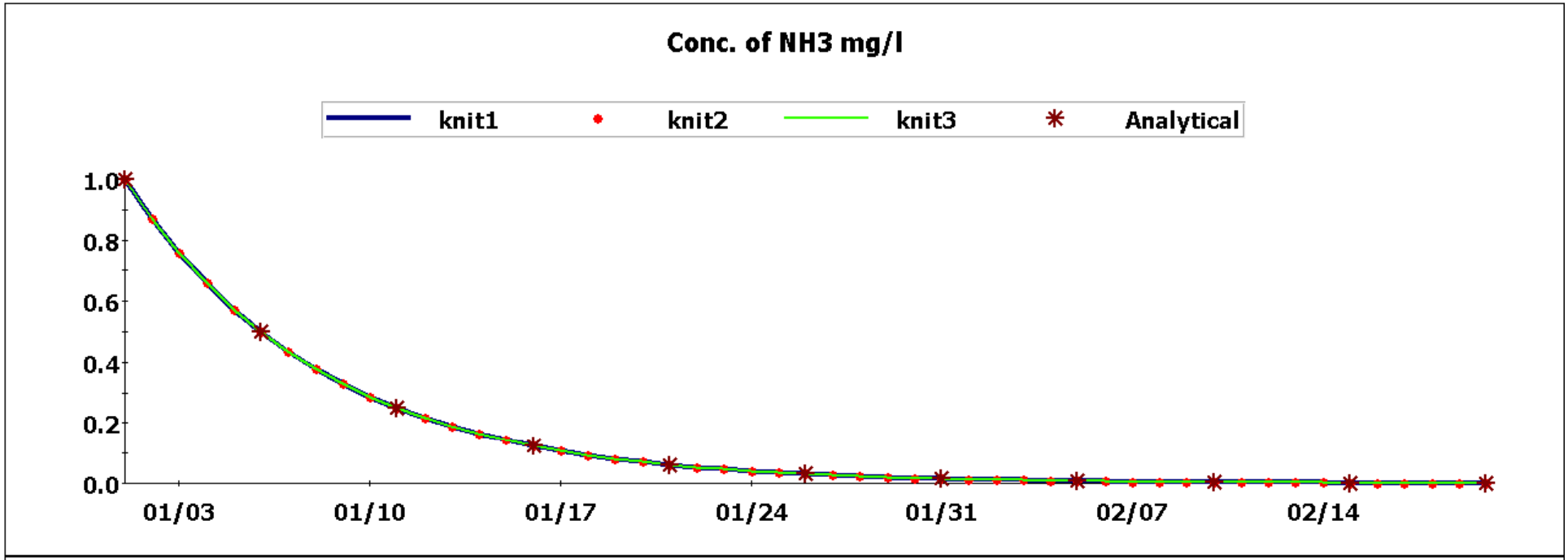

Conc. of RDOM
kd1
kd2
kd3
Analytical
1.0
0.5
0.0
01/03
01/17
01/31
02/14

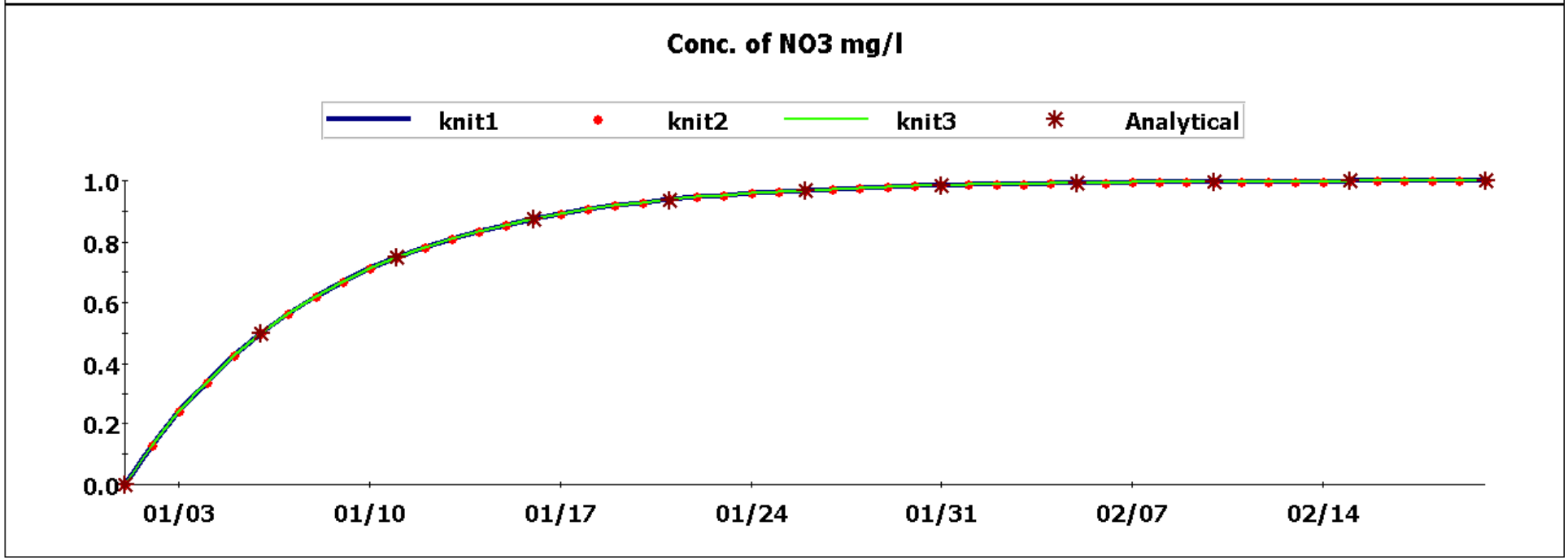

Conc. of LPOM
kd1
kd2
kd3
Analytical
1.0
0.5
0.0
01/03
01/17
01/31
02/14


Conc. of RPOM
kd1
kd2
kd3
Analytical
1.0
0.5
0.0
01/03
01/17
01/31
02/14

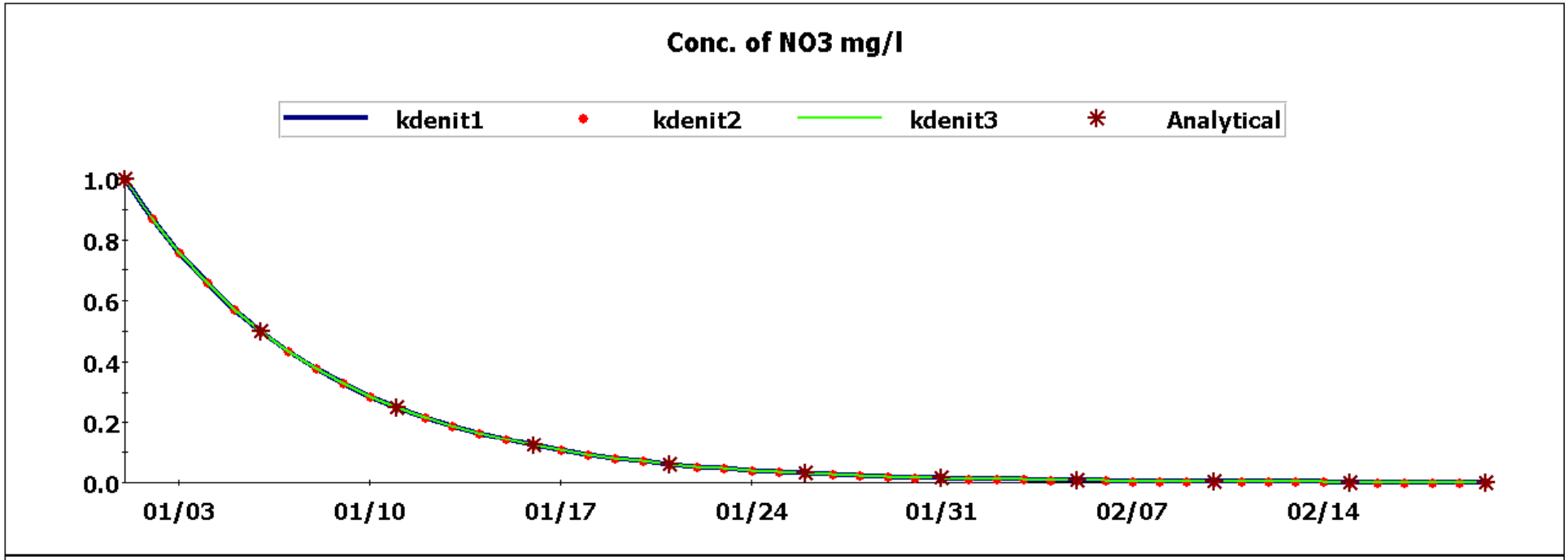

Delta-TIOC
kd1
kd2
kd3
Analytical
5
0
01/03
01/17
01/31
02/14

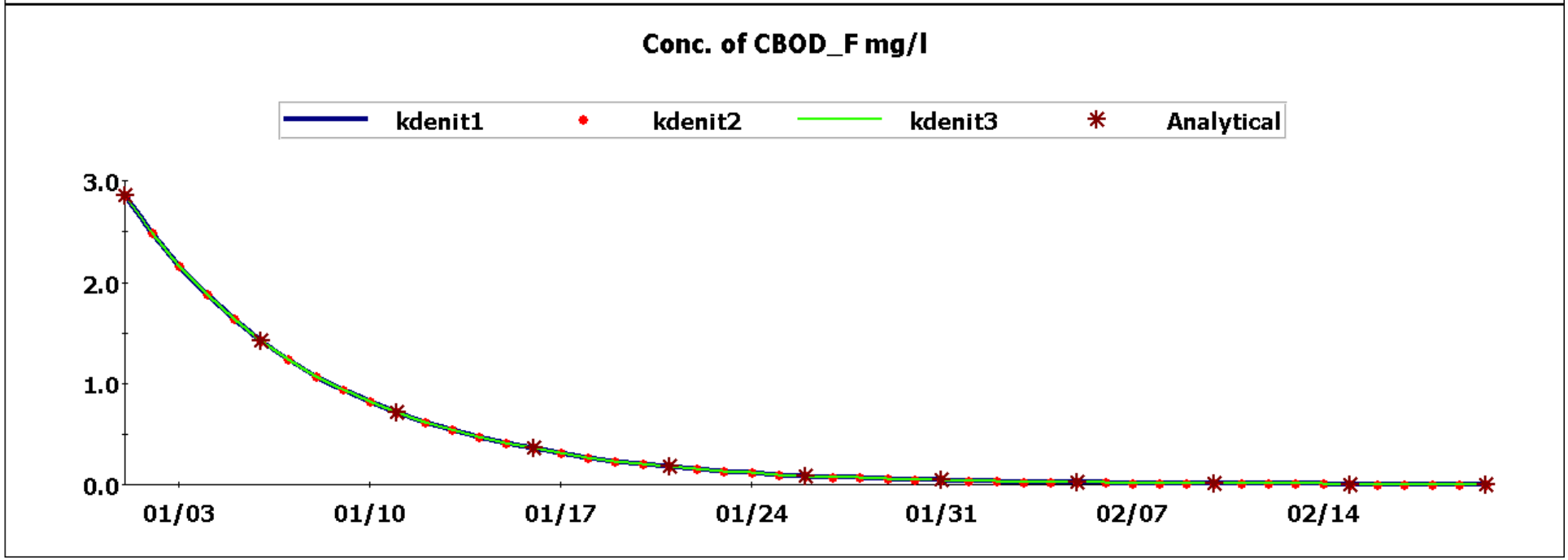
Test 2.6a


Conc. of NH3 mg/l
knit1
knit2
knit3
Analytical
1.0
0.8
0.6
0.4
0.2
0.0
01/03
01/10
01/17
01/24
01/31
02/07
02/14

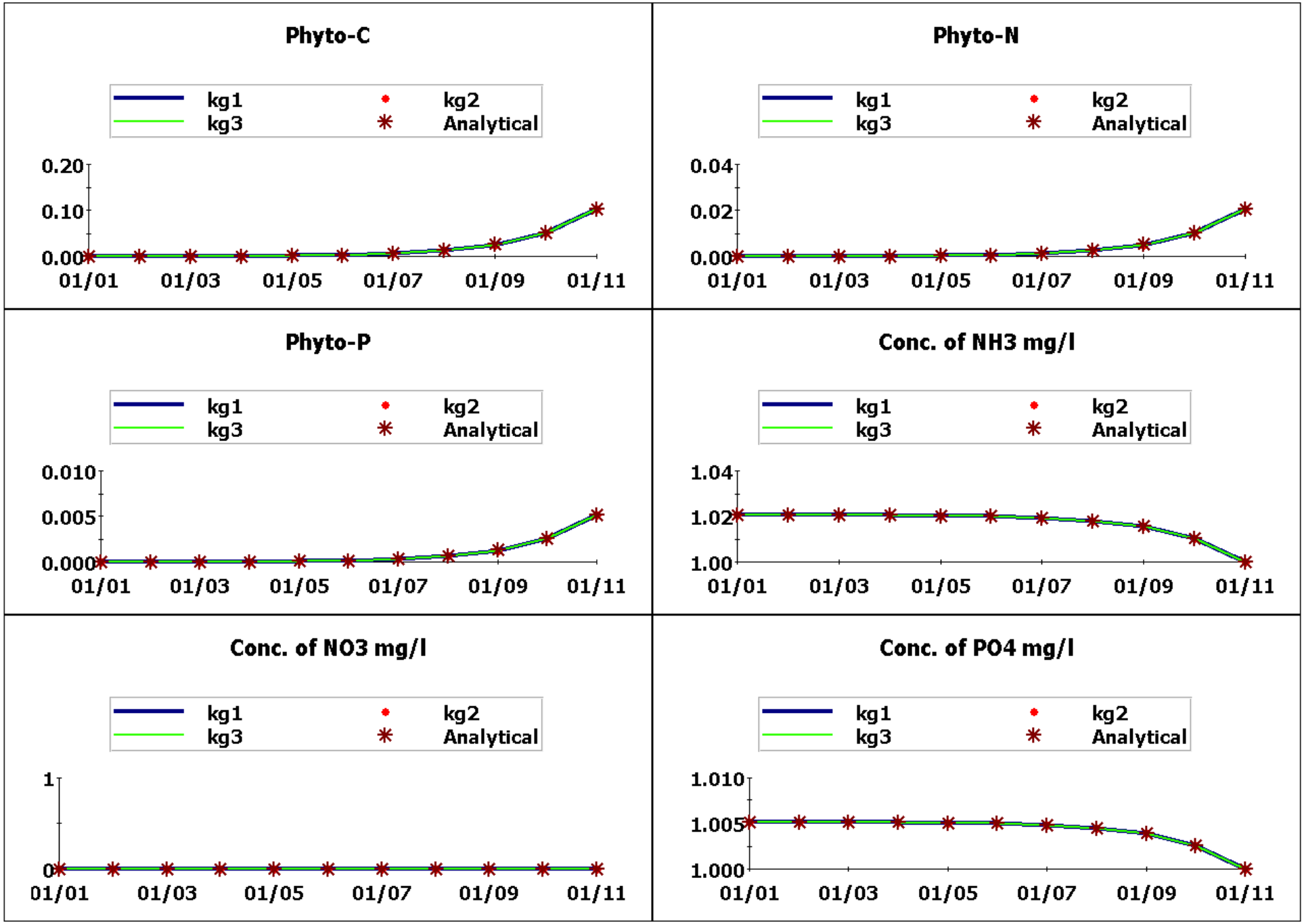

Conc. of NO3 mg/l
knit1
knit2
knit3
Analytical
1.0
0.8
0.6
0.4
0.2
0.0
01/03
01/10
01/17
01/24
01/31
02/07
02/14

Test 2.6b

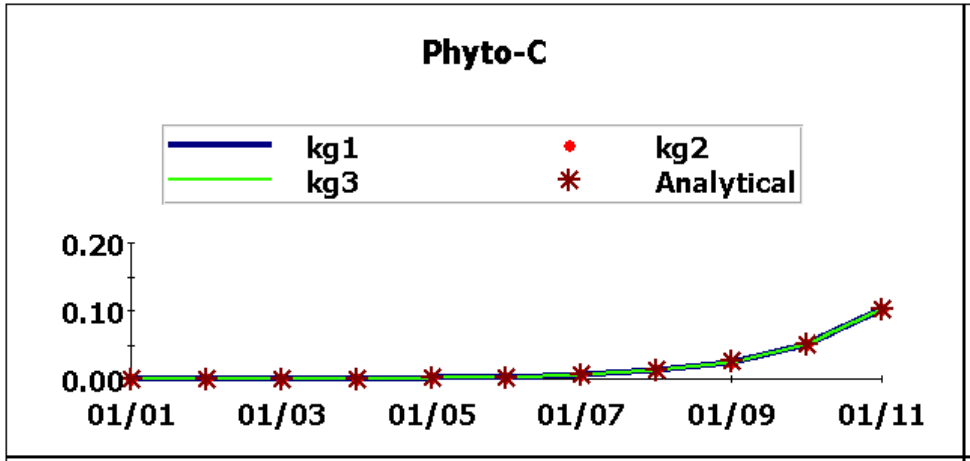

Conc. of NO3 mg/l
kdenit1
kdenit2
kdenit3
Analytical
1.0
0.8
0.6
0.4
0.2
0.0
01/03
01/10
01/17
01/24
01/31
02/07
02/14

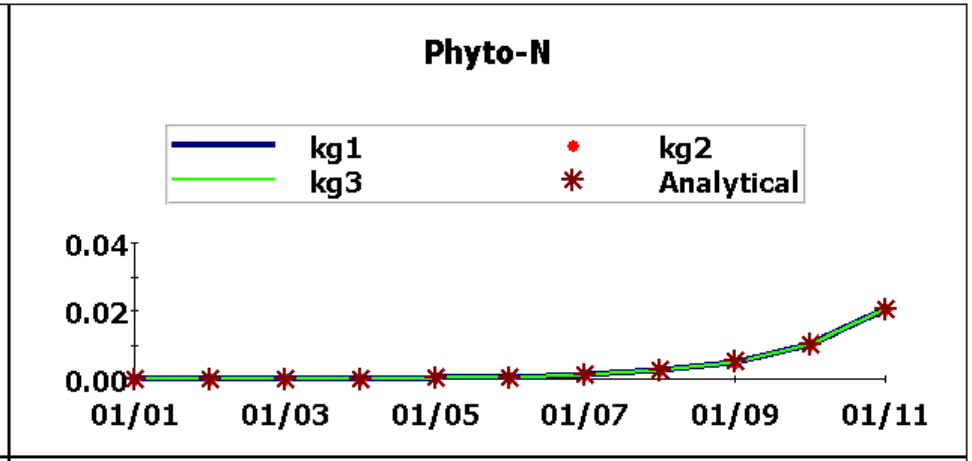

Conc. of CBOD_F mg/l
kdenit1
kdenit2
kdenit3
Analytical
3.0
2.0
1.0
0.0
01/03
01/10
01/17
01/24
01/31
02/07
02/14

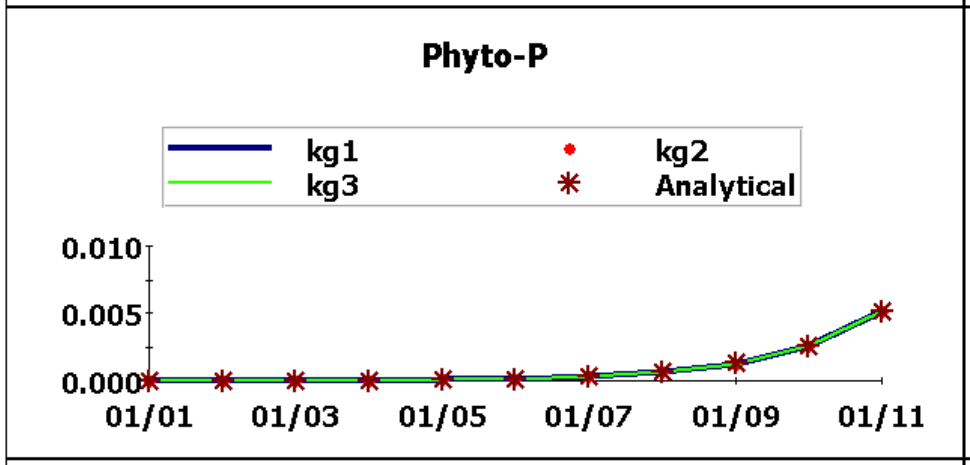
Test 2.7a: NH3

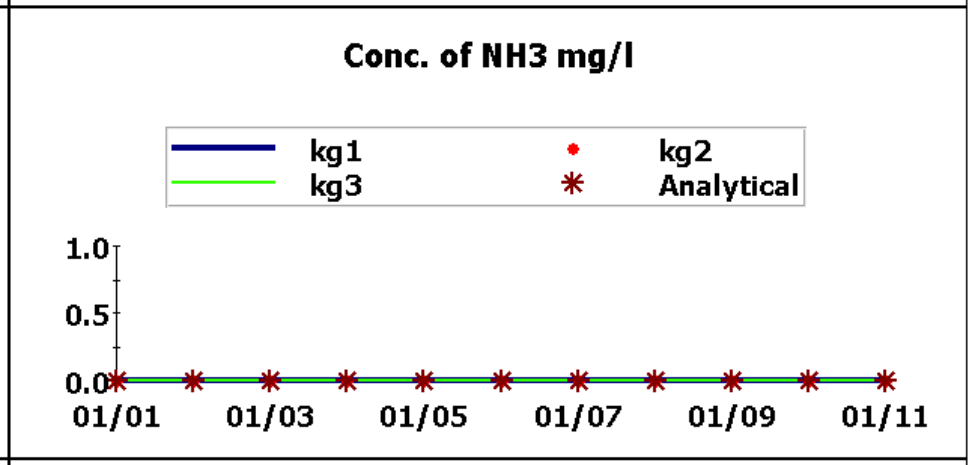

Phyto-C
kg1
kg2
kg3
Analytical
0.20
0.10
0.00
01/01
01/03
01/05
01/07
01/09
01/11
Phyto-N
kg1
kg2
kg3
Analytical
0.04
0.02
0.00
01/01
01/03
01/05
01/07
01/09
01/11
Phyto-P
kg1
kg2
kg3
Analytical
0.010
0.005
0.000
01/01
01/03
01/05
01/07
01/09
01/11
Conc. of NH3 mg/l
kg1
kg2
kg3
Analytical
1.04
1.02
1.00
01/01
01/03
01/05
01/07
01/09
01/11
Conc. of NO3 mg/l
kg1
kg2
kg3
Analytical
1
0
01/01
01/03
01/05
01/07
01/09
01/11
Conc. of PO4 mg/l
kg1
kg2
kg3
Analytical
1.010
1.005
1.000
01/01
01/03
01/05
01/07
01/09
01/11

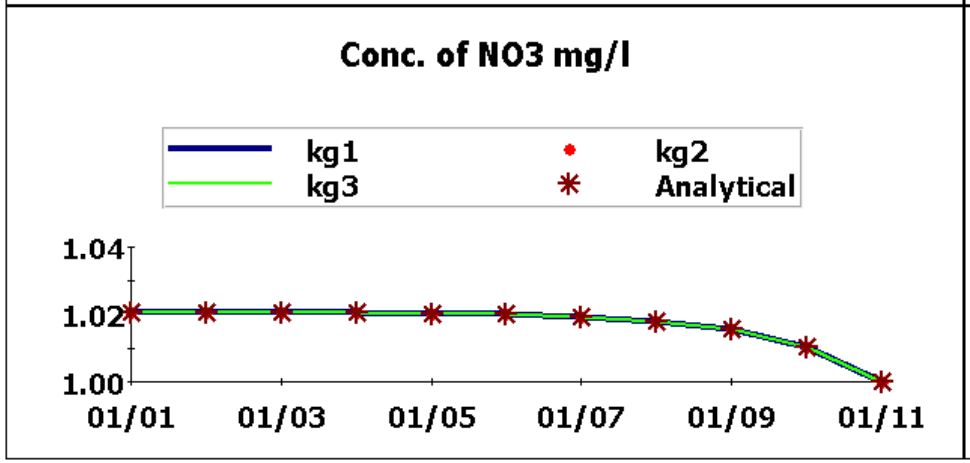
Test 2.7a : NO3

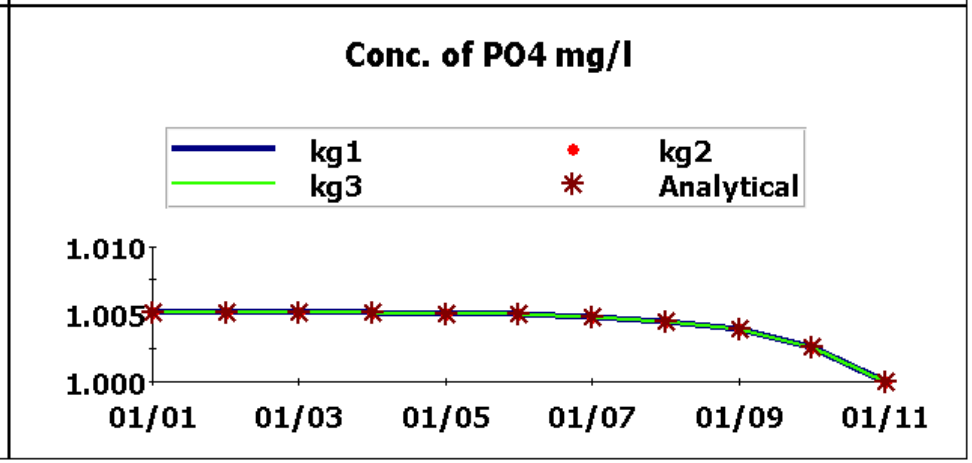

Phyto-C
kg1
kg2
kg3
Analytical
0.20
0.10
0.00
01/01
01/03
01/05
01/07
01/09
01/11


Phyto-N
kg1
kg2
kg3
Analytical
0.04
0.02
0.00
01/01
01/03
01/05
01/07
01/09
01/11

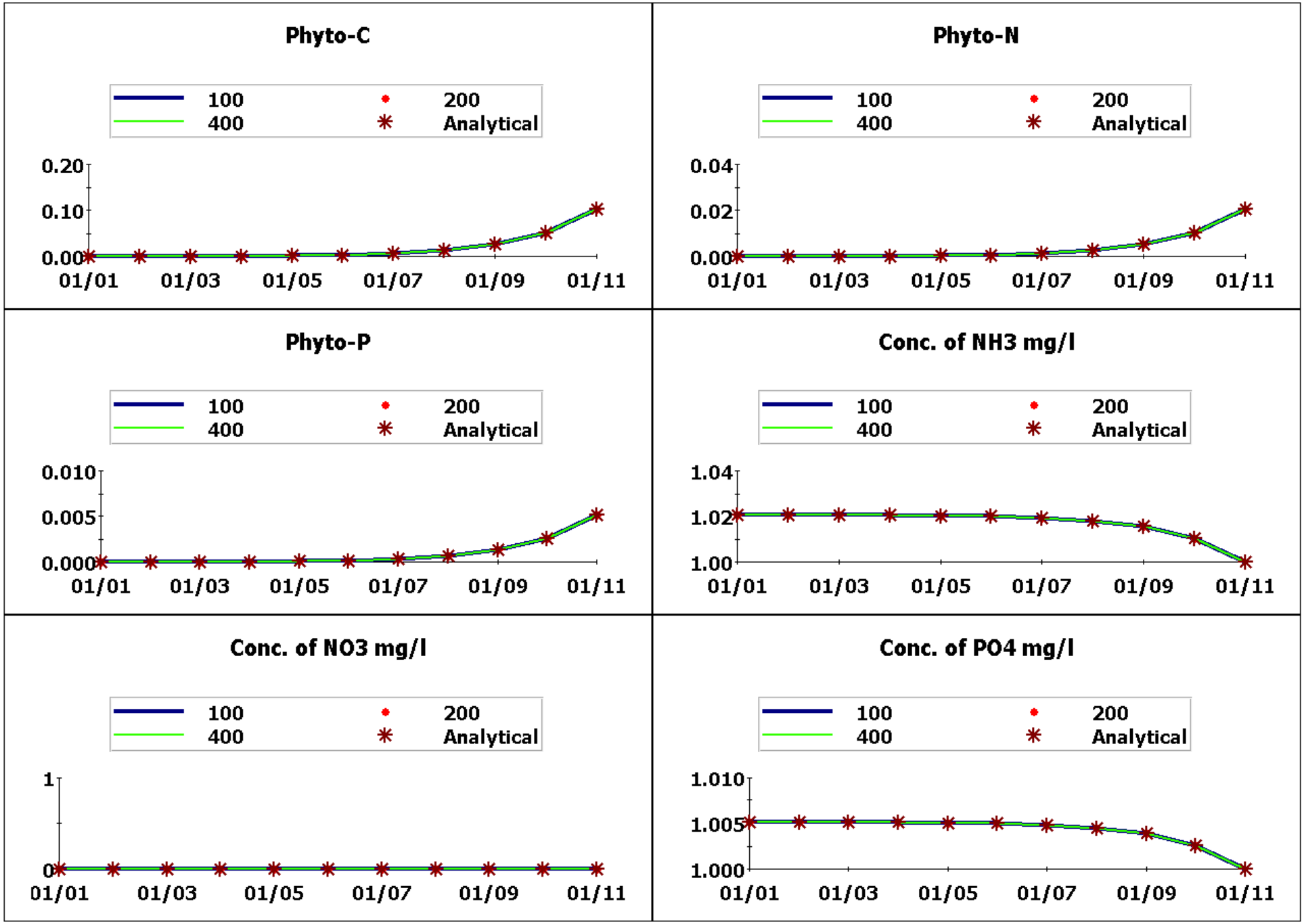

Phyto-P
kg1
kg2
kg3
Analytical
0.010
0.005
0.000
01/01
01/03
01/05
01/07
01/09
01/11


Conc. of NH3 mg/l
kg1
kg2
kg3
Analytical
1.0
0.5
0.0
01/01
01/03
01/05
01/07
01/09
01/11

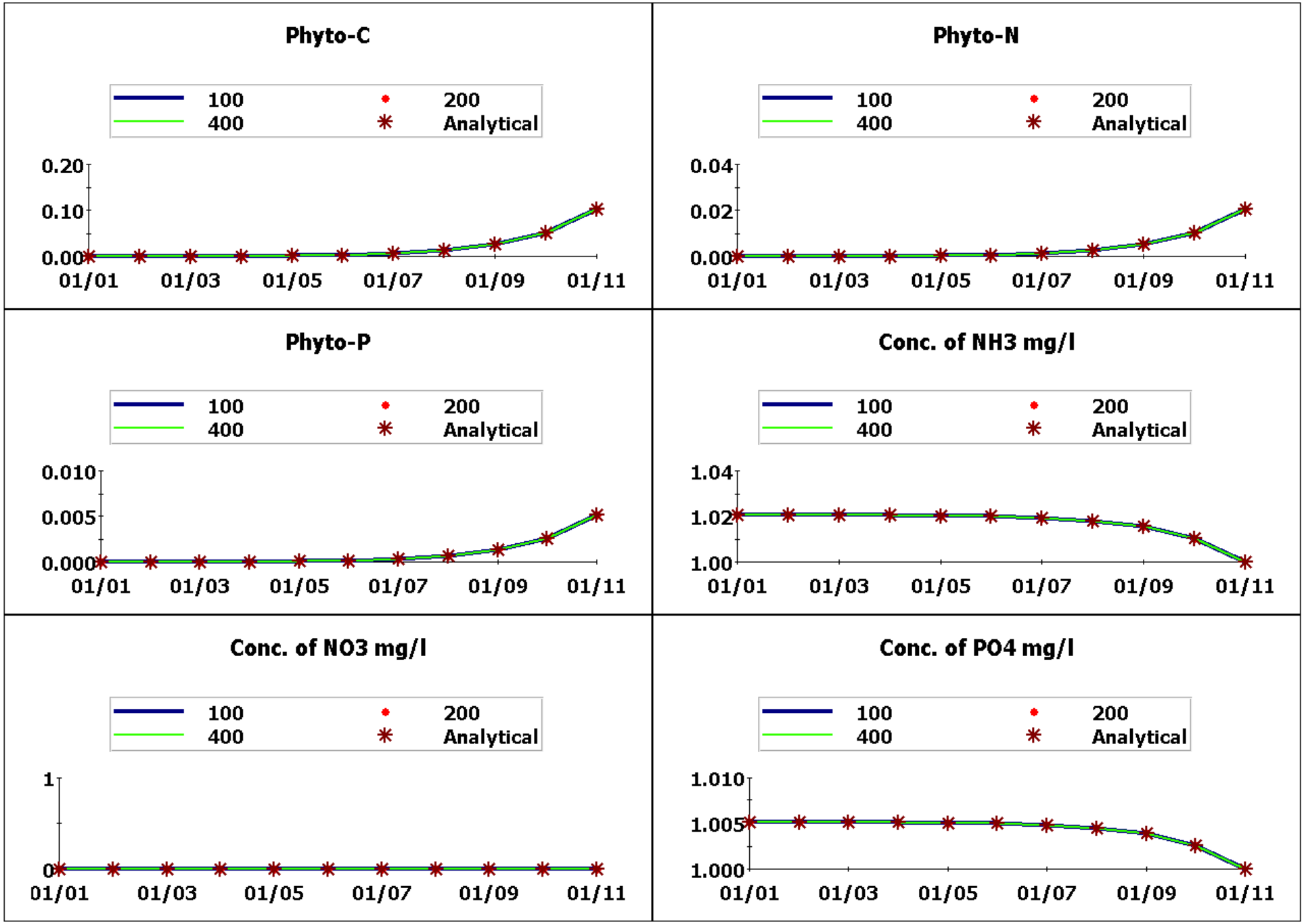

Conc. of NO3 mg/l
kg1
kg2
kg3
Analytical
1.04
1.02
1.00
01/01
01/03
01/05
01/07
01/09
01/11


Conc. of PO4 mg/l
kg1
kg2
kg3
Analytical
1.010
1.005
1.000
01/01
01/03
01/05
01/07
01/09
01/11

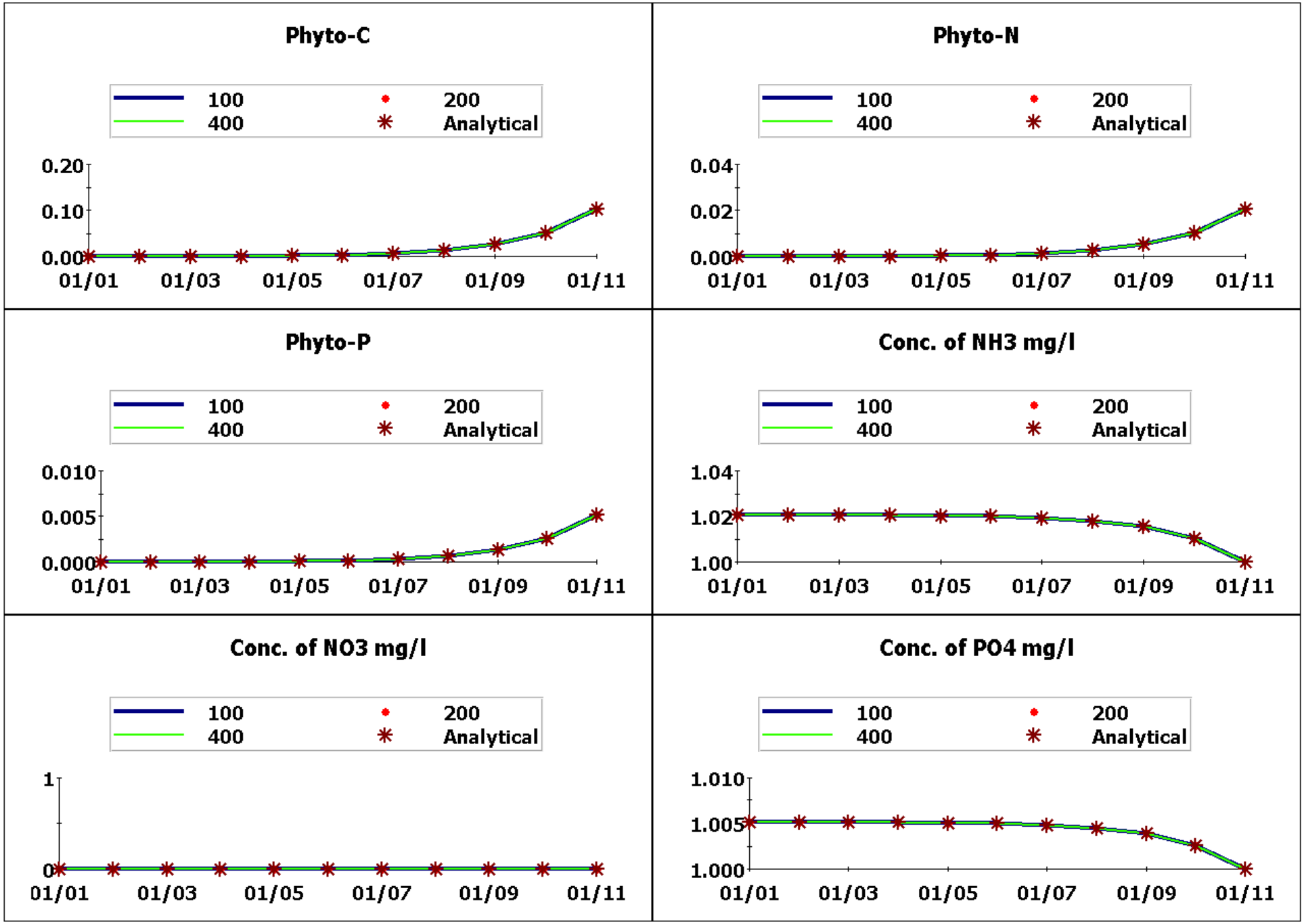
Test 2.7b: Half Saturation Equation



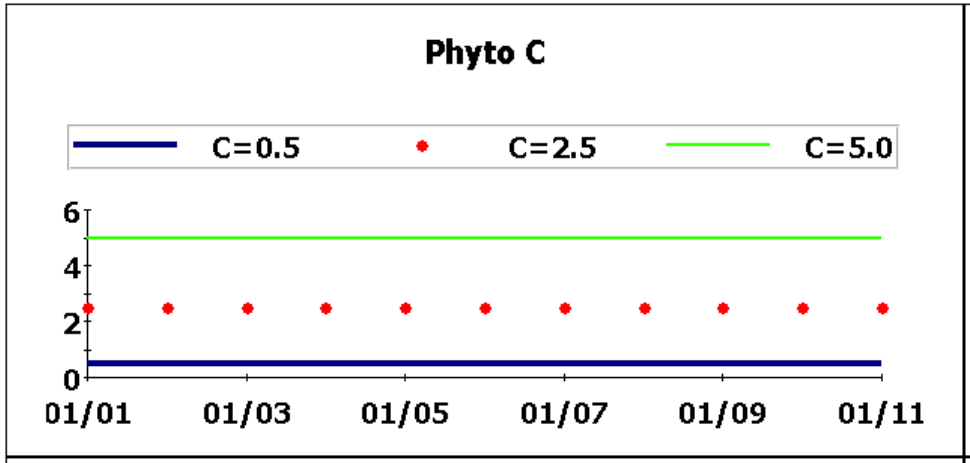
Test 2.7b: Smith Equation

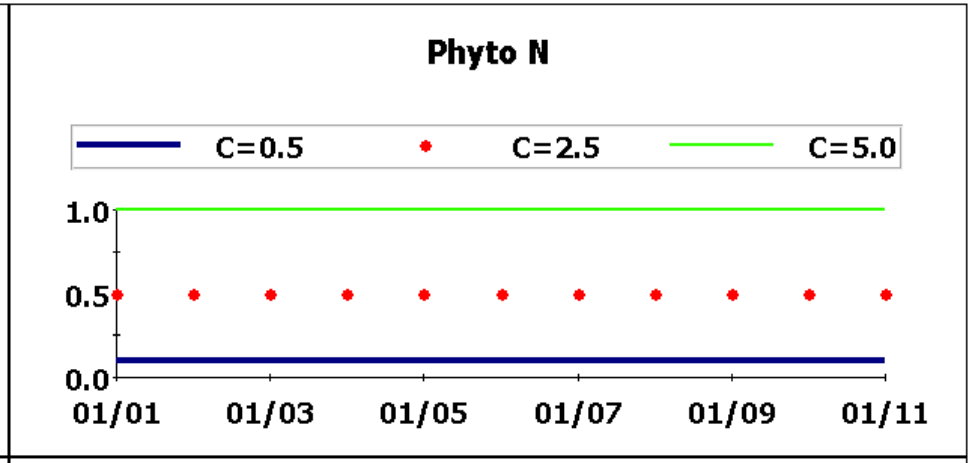


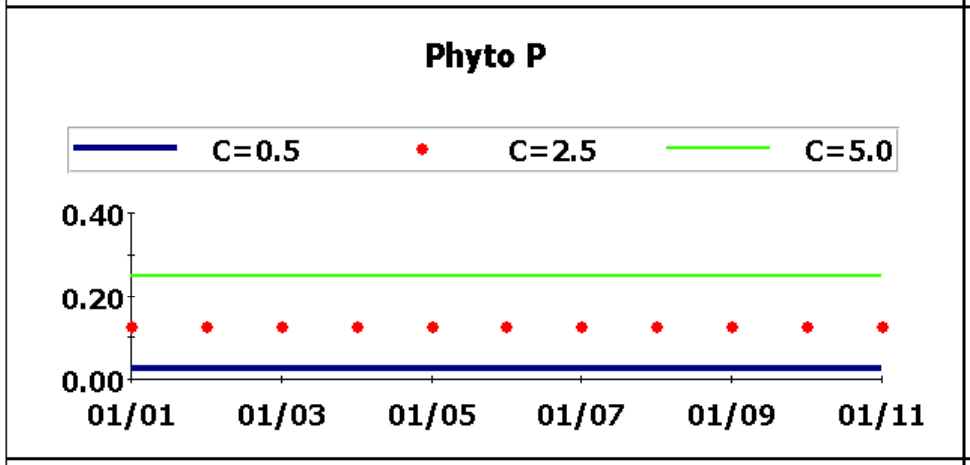
Test 2.7b: Steele Equation

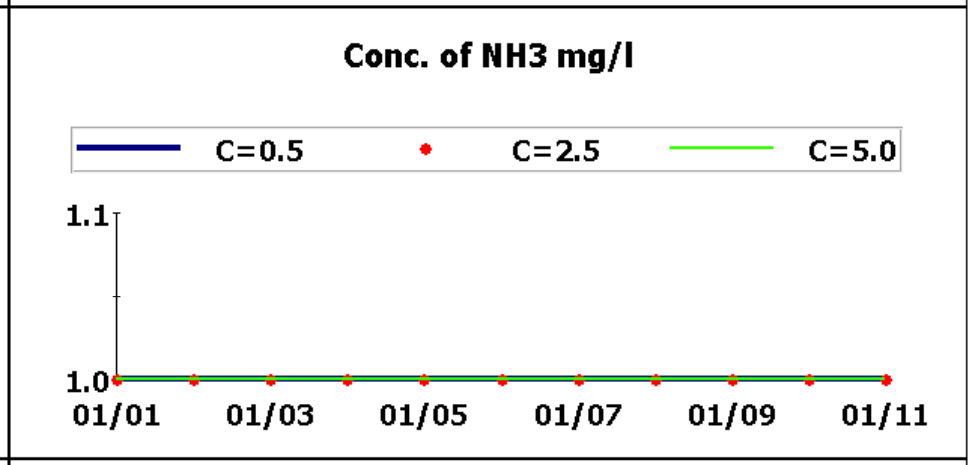


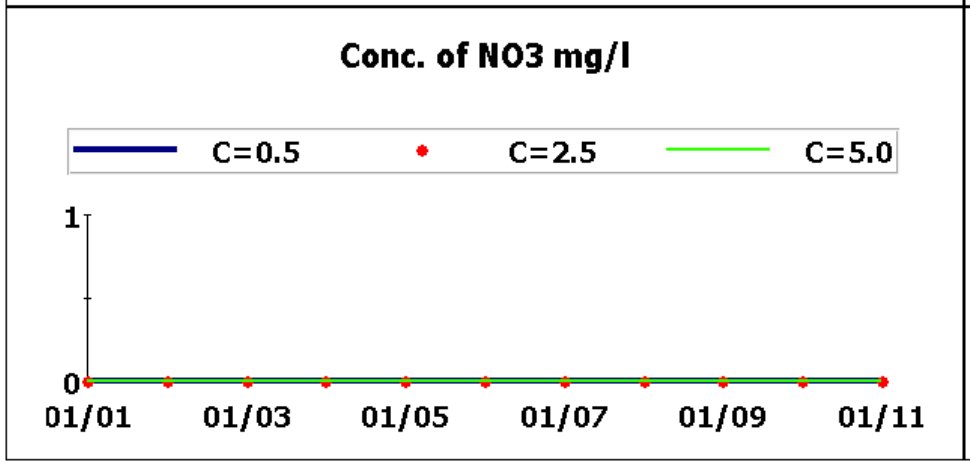
Test 2.7c: Half Saturation Equation

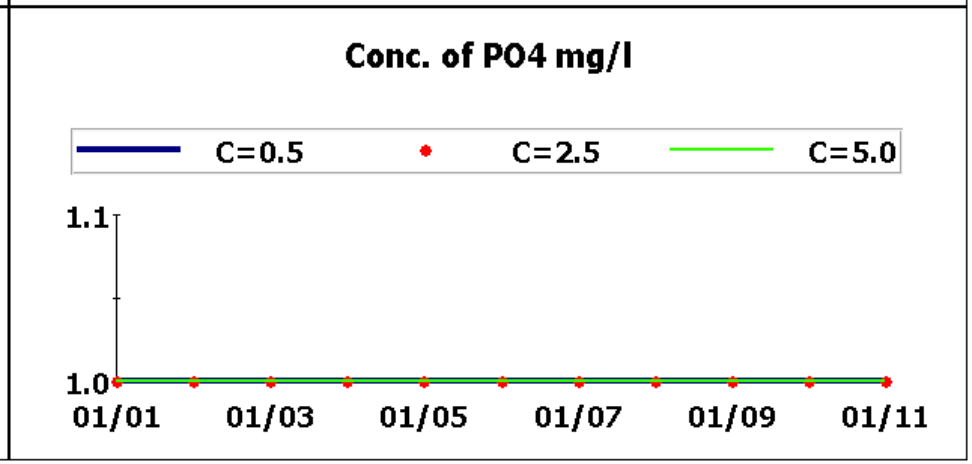




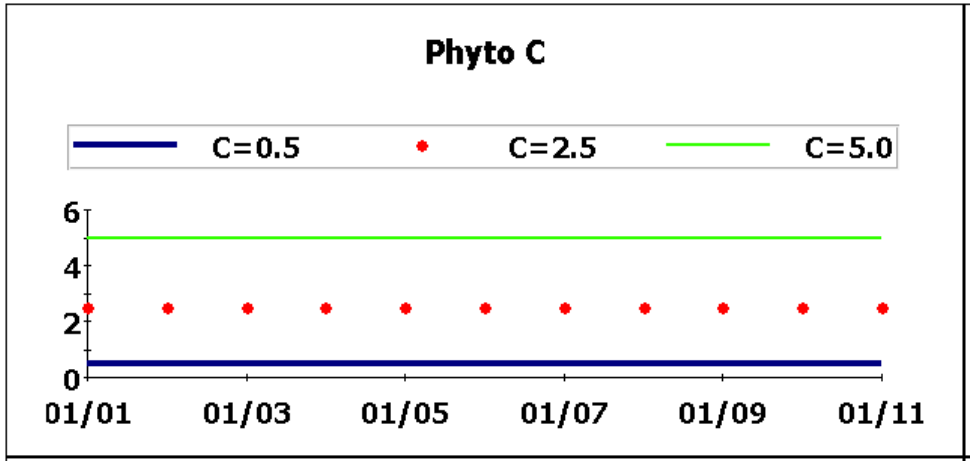


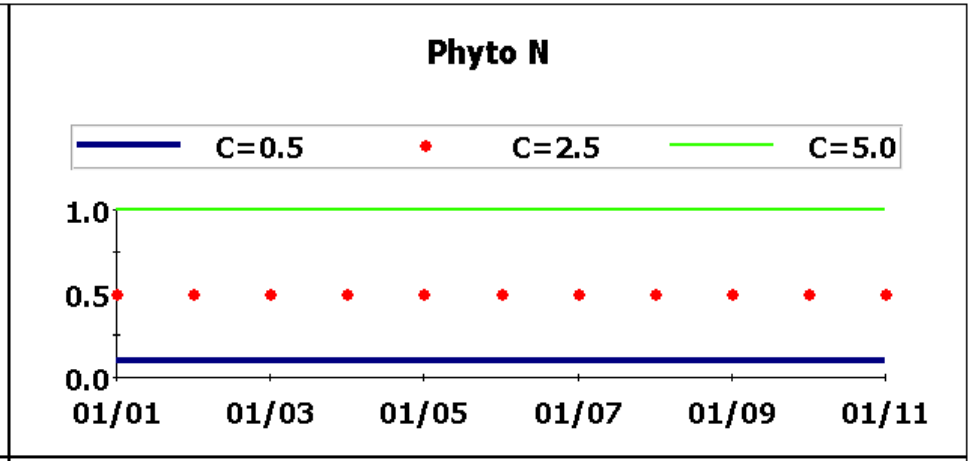


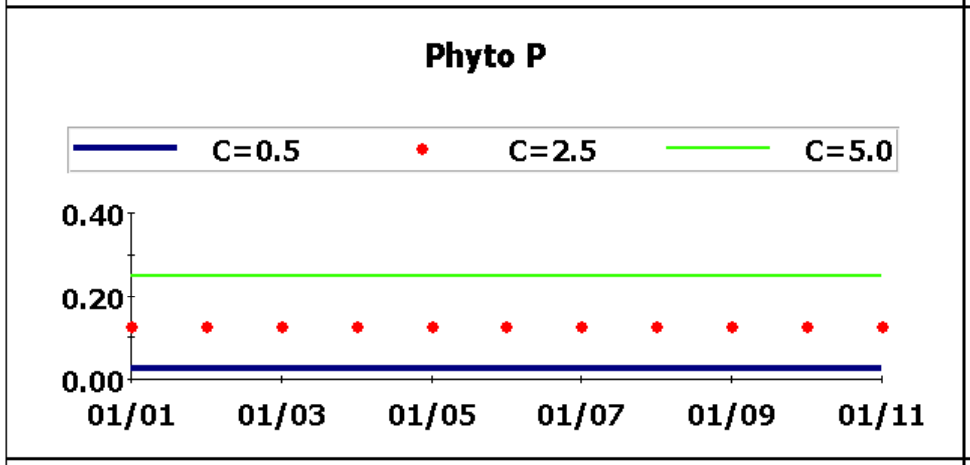


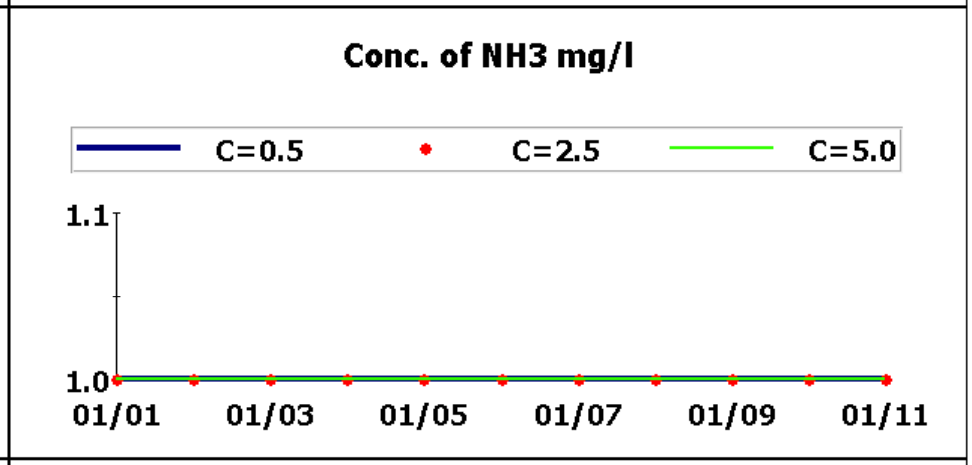


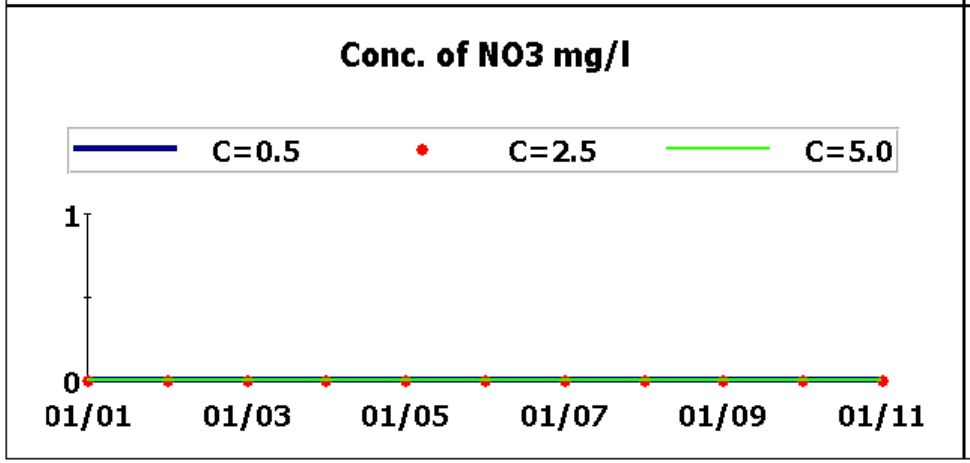
Test 2.7c: Smith Equation

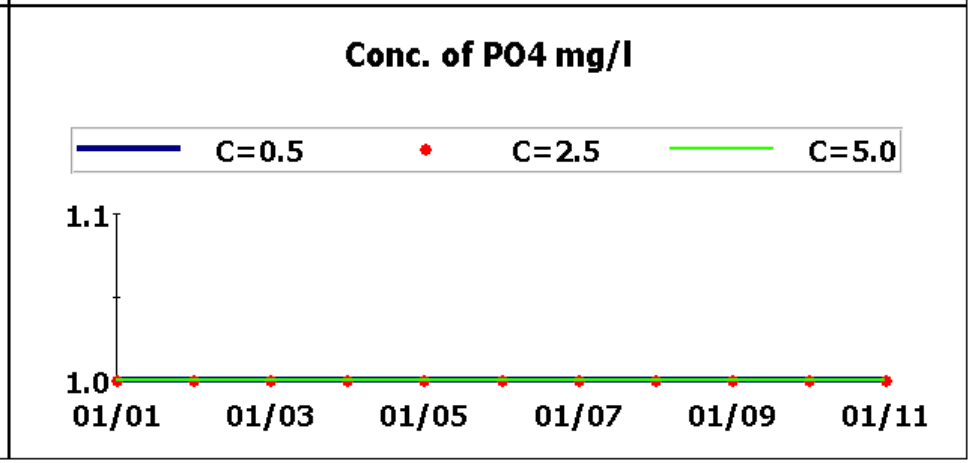




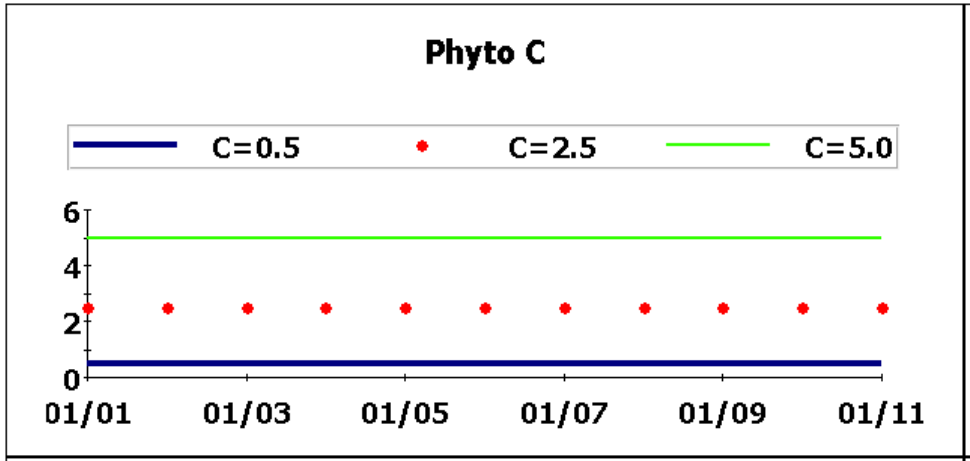


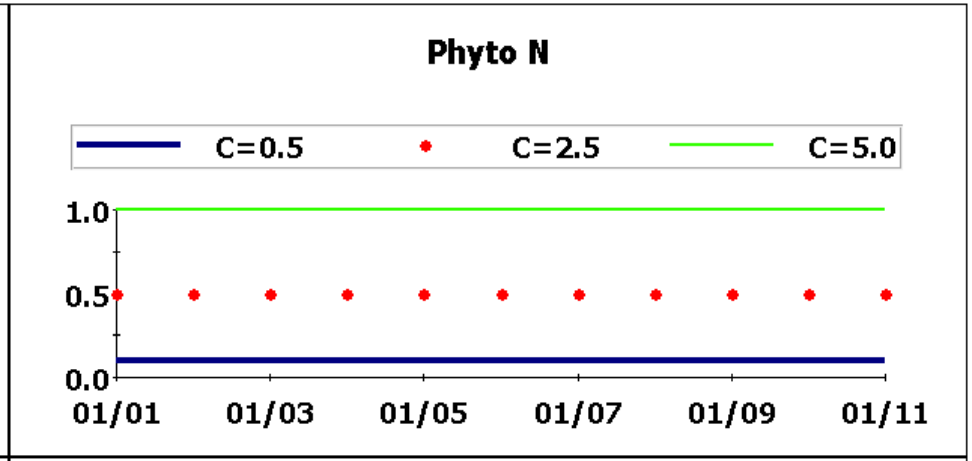


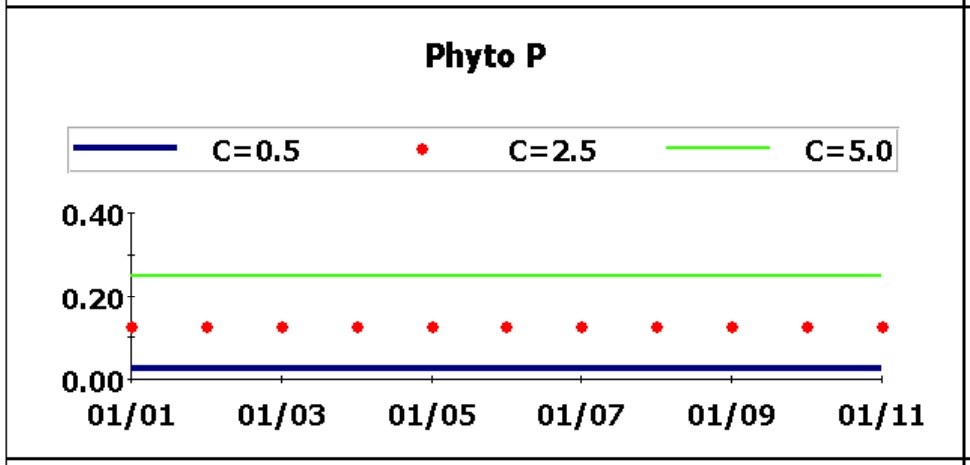


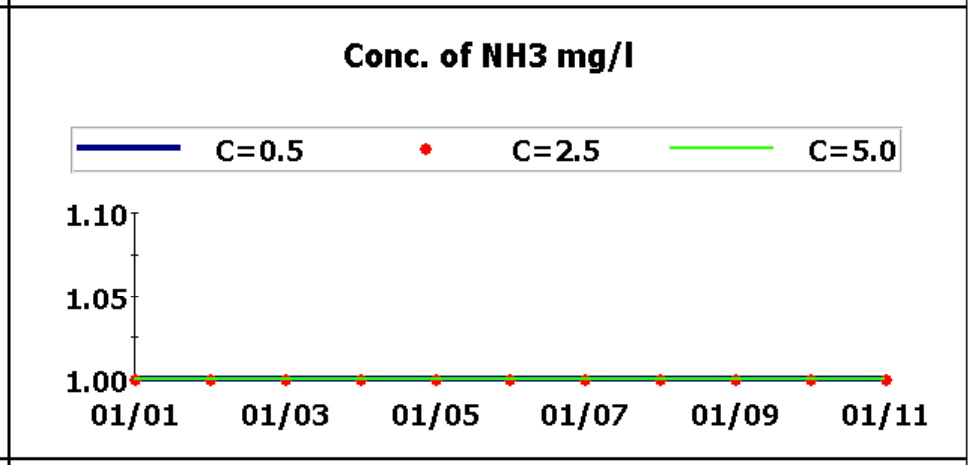


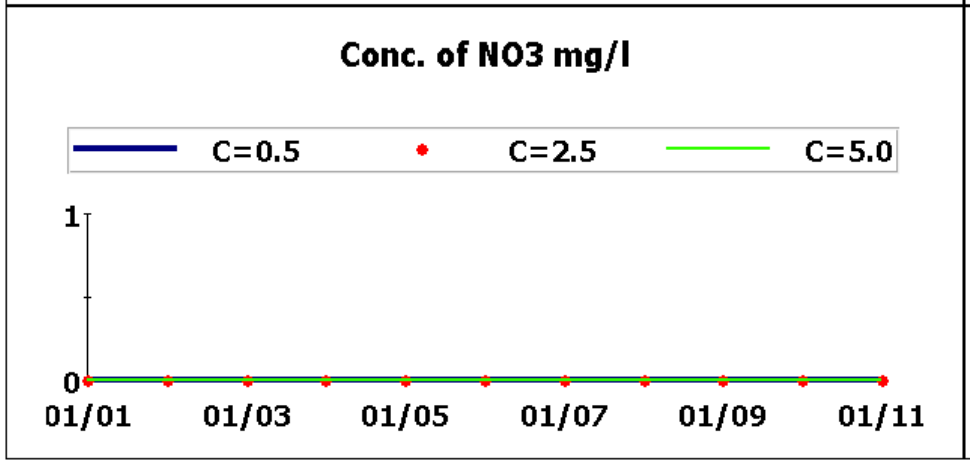
Test 2.7c: Steele Equation

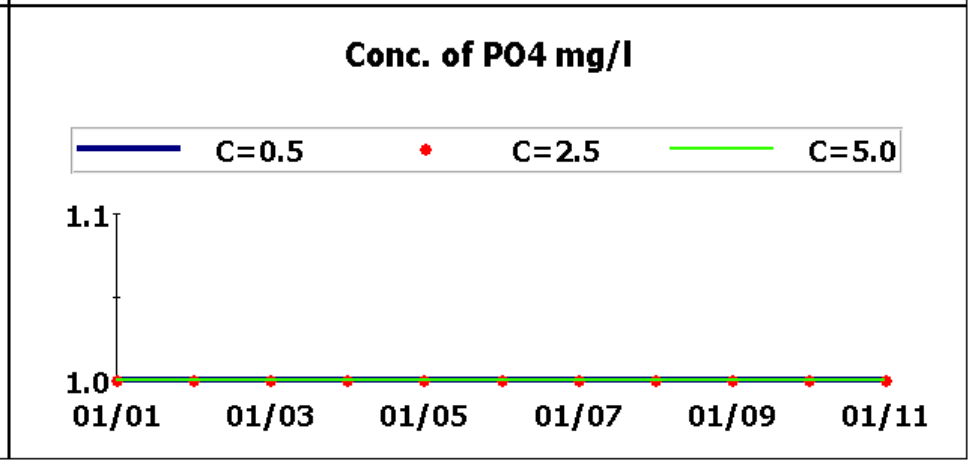




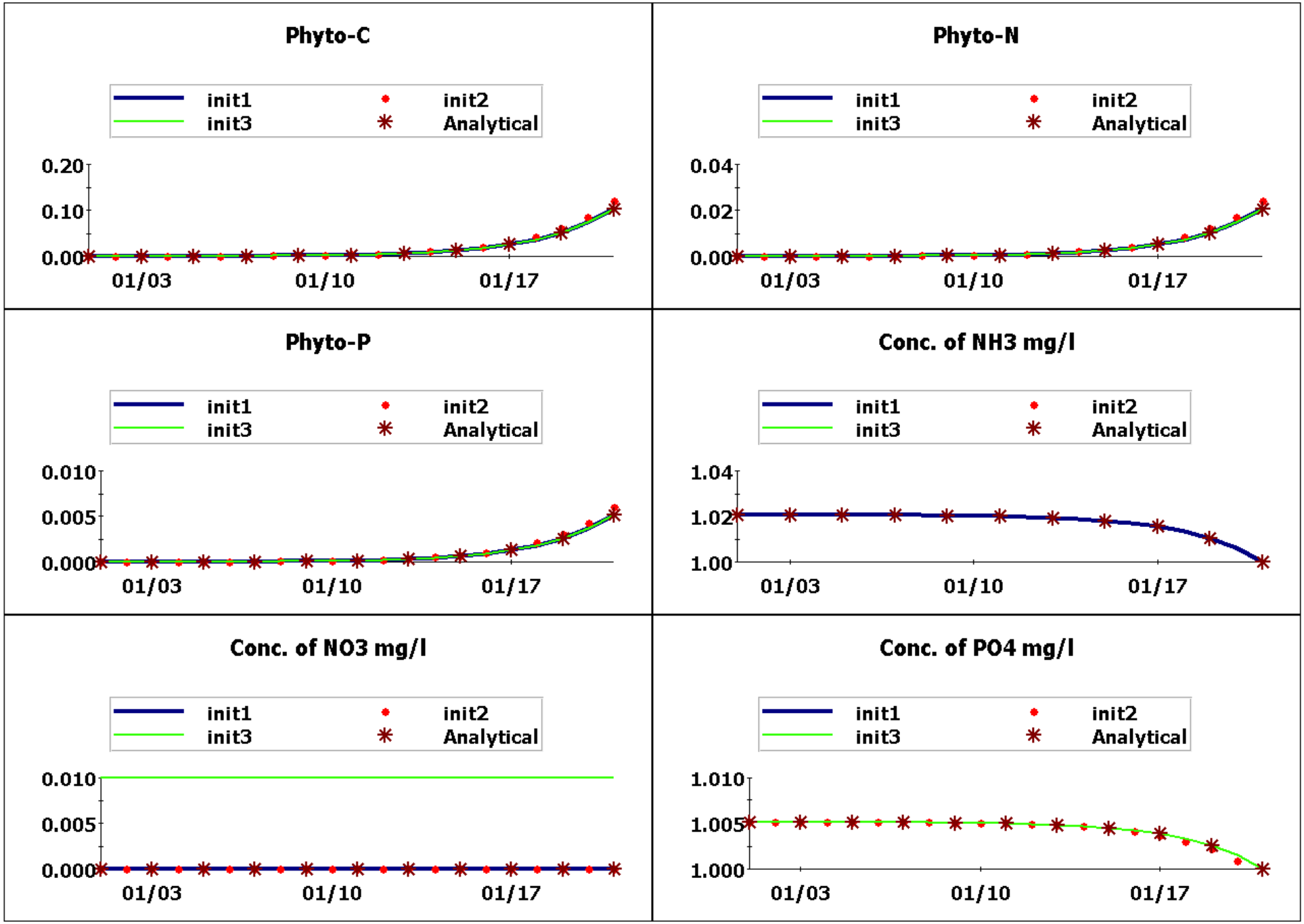




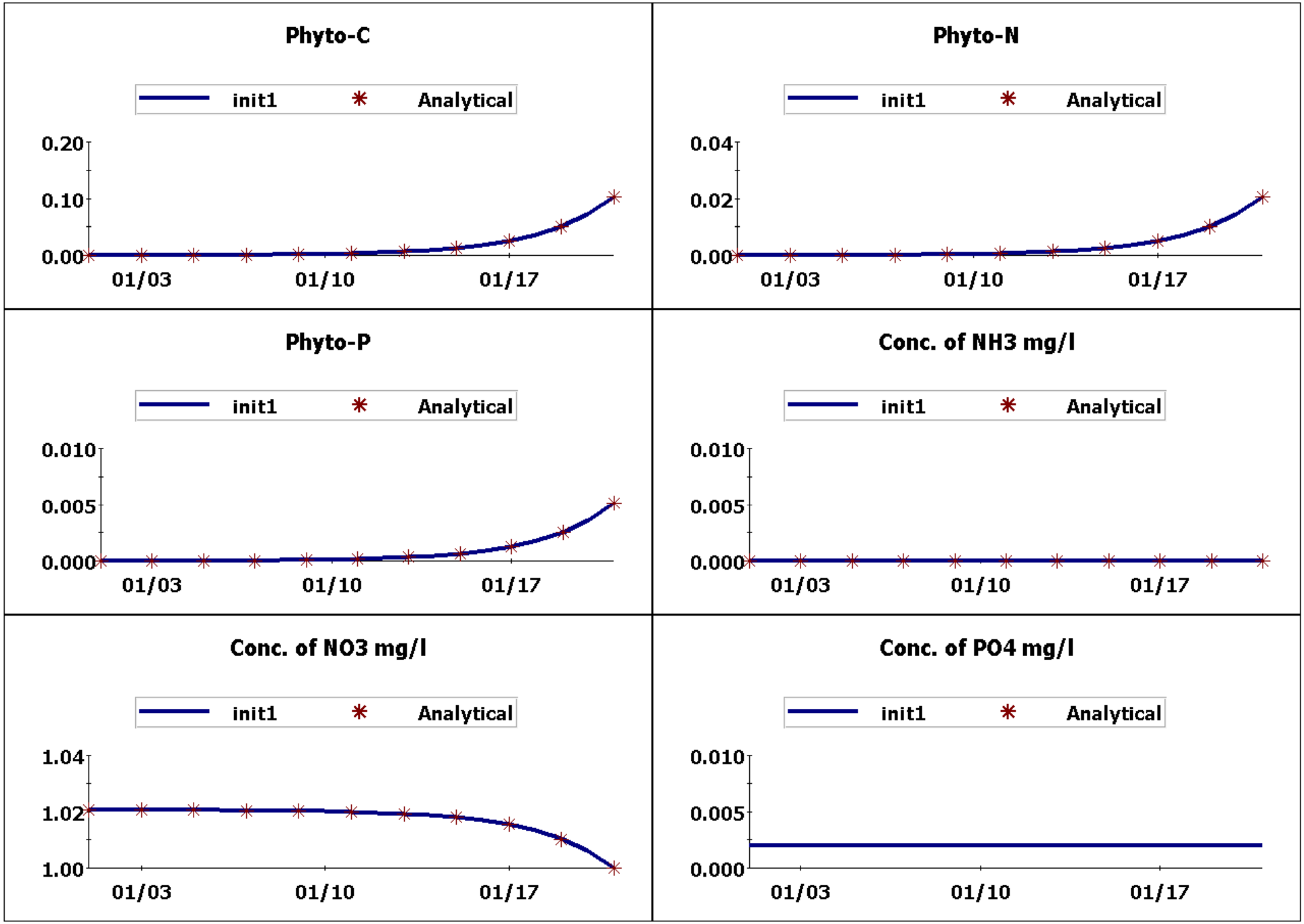




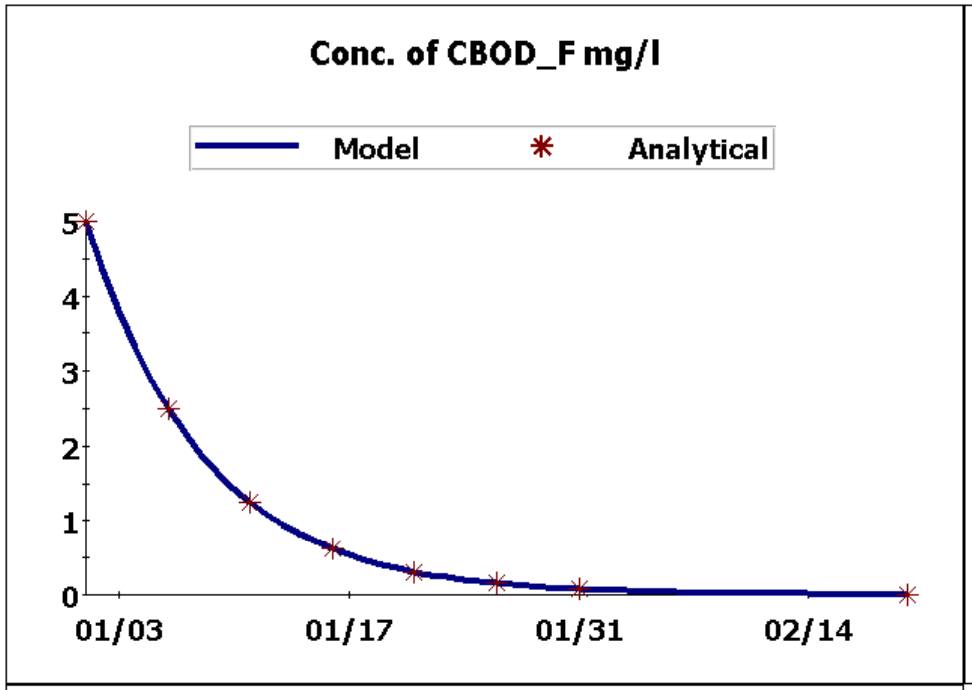
Test 2.7d

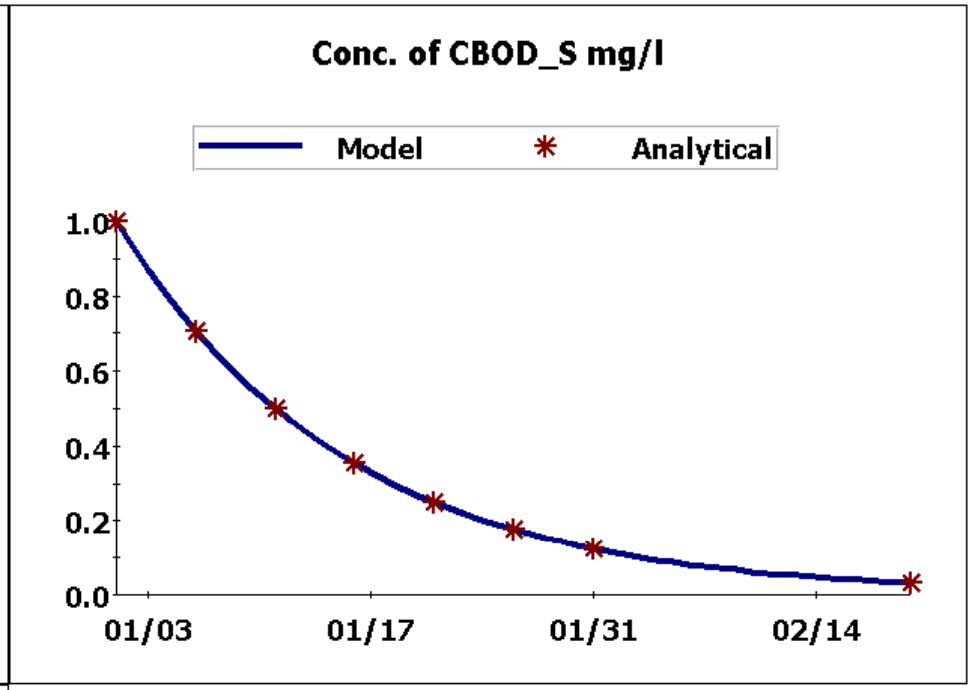

Phyto-C
init1
init2
init3
Analytical
0.20
0.10
0.00
01/03
01/10
01/17
Phyto-N
init1
init2
init3
Analytical
0.04
0.02
0.00
01/03
01/10
01/17
Phyto-P
init1
init2
init3
Analytical
0.010
0.005
0.000
01/03
01/10
01/17
Conc. of NH3 mg/l
init1
init2
init3
Analytical
1.04
1.02
1.00
01/03
01/10
01/17
Conc. of NO3 mg/l
init1
init2
init3
Analytical
0.010
0.005
0.000
01/03
01/10
01/17
Conc. of PO4 mg/l
init1
init2
init3
Analytical
1.010
1.005
1.000
01/03
01/10
01/17

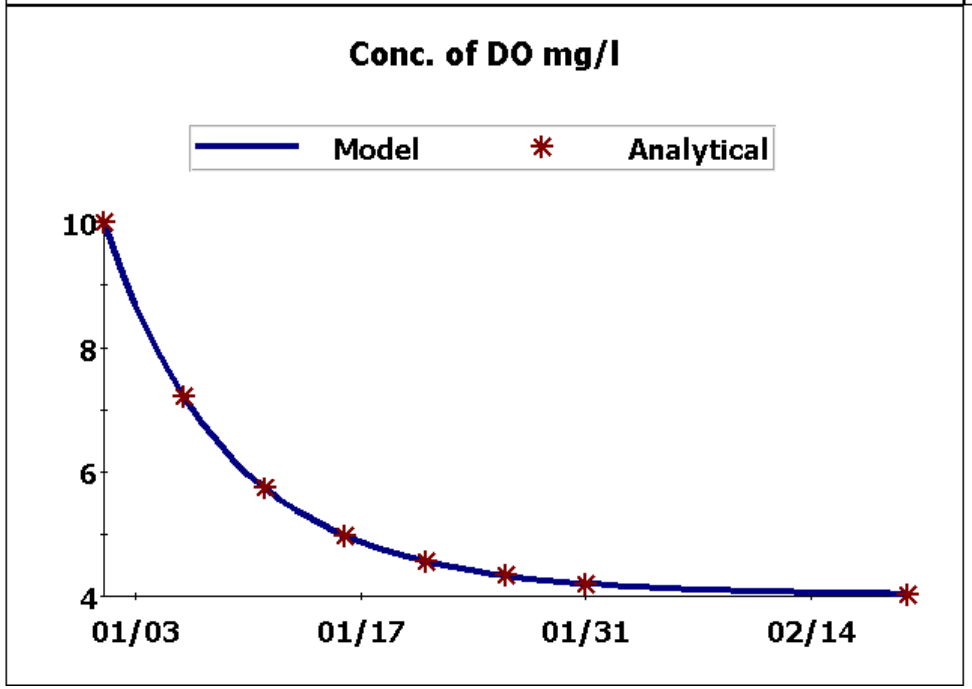
Test 2.7d: First initial condition with NH3 and NO3 switched



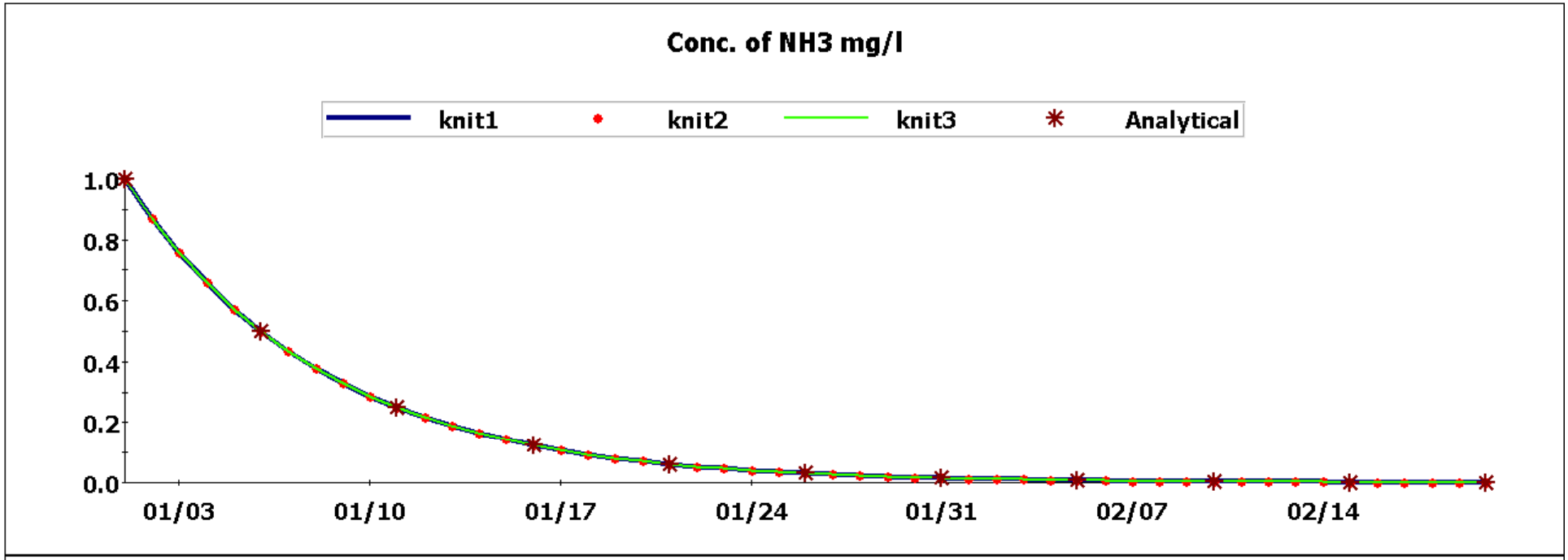
Test 2.8a

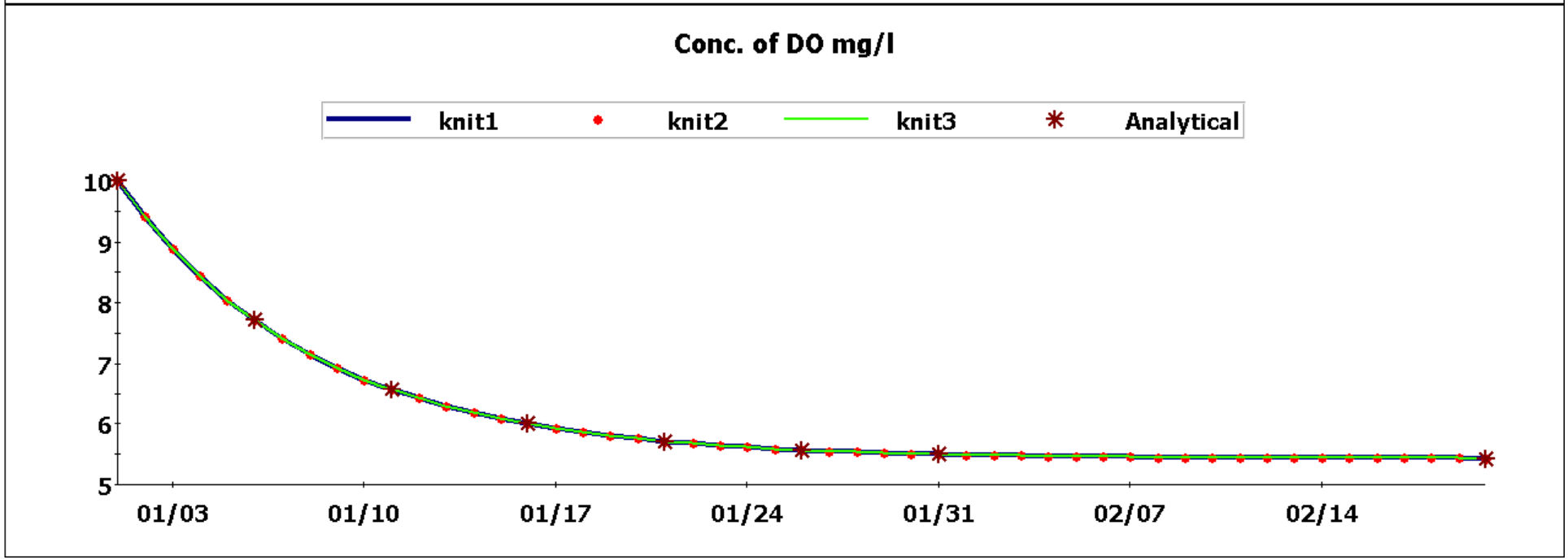

Conc. of CBOD_F mg/l
Model
Analytical
5
4
3
2
1
0
01/03
01/17
01/31
02/14


Conc. of CBOD_S mg/l
Model
Analytical
1.0
0.8
0.6
0.4
0.2
0.0
01/03
01/17
01/31
02/14

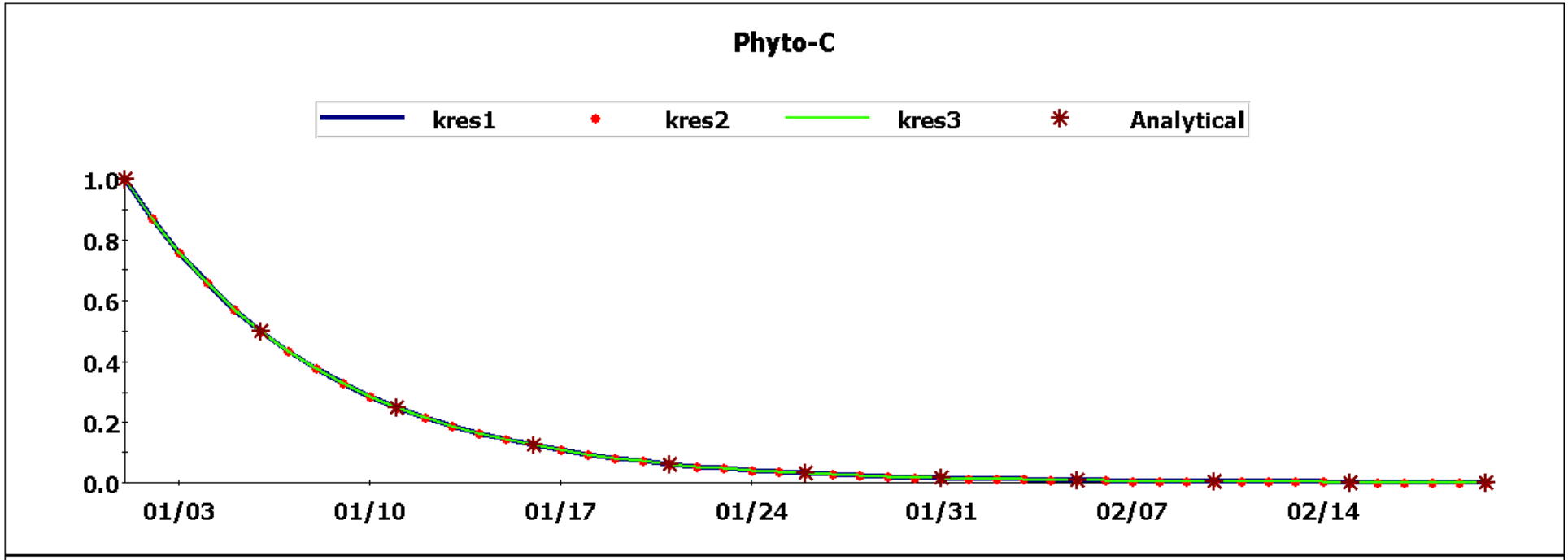

Conc. of DO mg/l
Model
Analytical
10
8
6
4
01/03
01/17
01/31
02/14

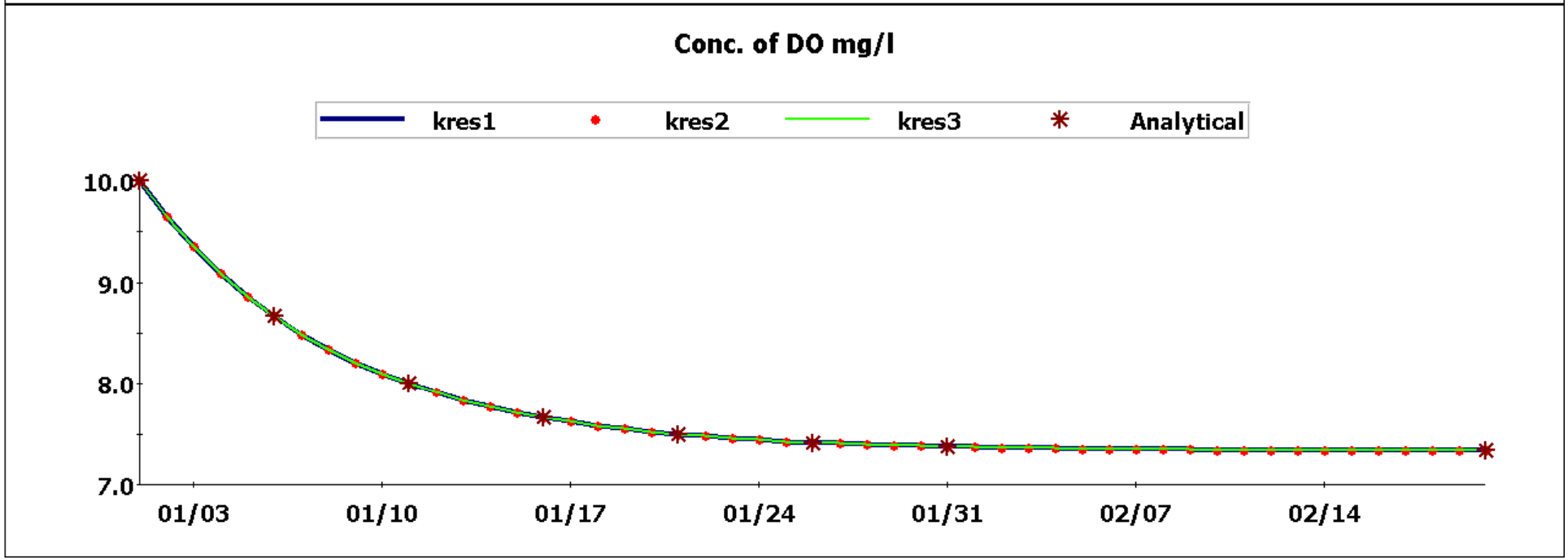
Test 2.8b


Conc. of NH3 mg/l
knit1
knit2
knit3
Analytical
1.0
0.8
0.6
0.4
0.2
0.0
01/03
01/10
01/17
01/24
01/31
02/07
02/14

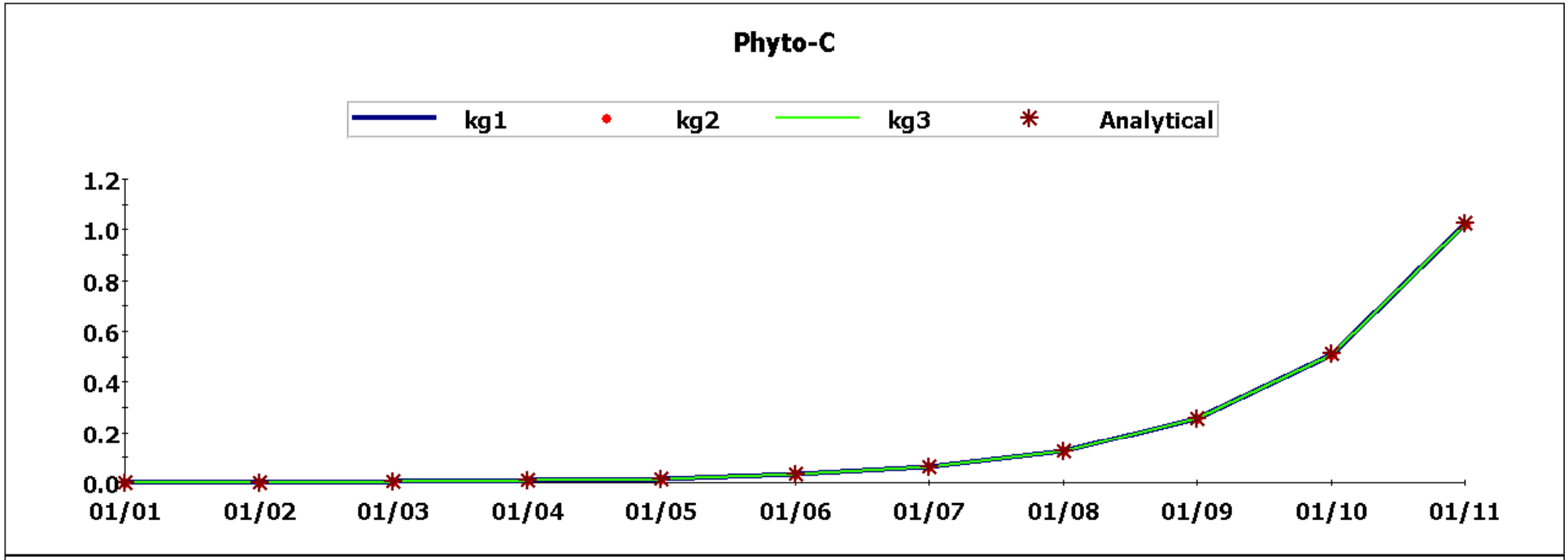

Conc. of DO mg/l
knit1
knit2
knit3
Analytical
10
9
8
7
6
5
01/03
01/10
01/17
01/24
01/31
02/07
02/14

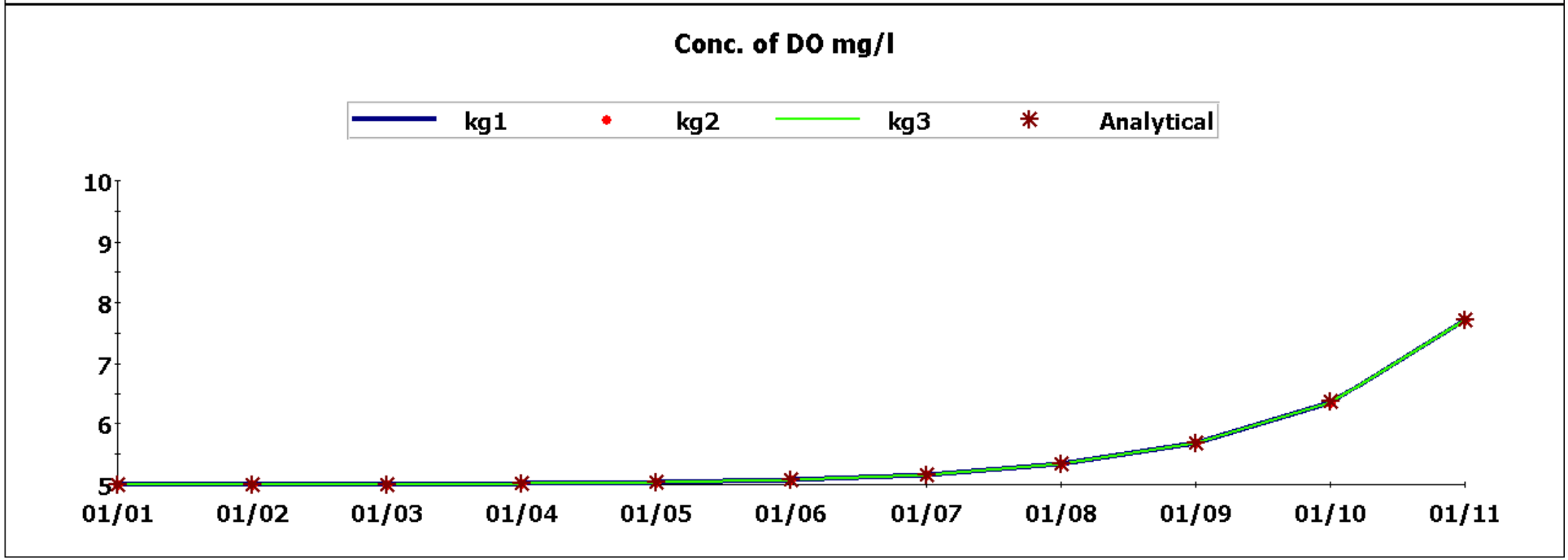
Test 2.8c


Phyto-C
kres1
kres2
kres3
Analytical
1.0
0.8
0.6
0.4
0.2
0.0
01/03
01/10
01/17
01/24
01/31
02/07
02/14

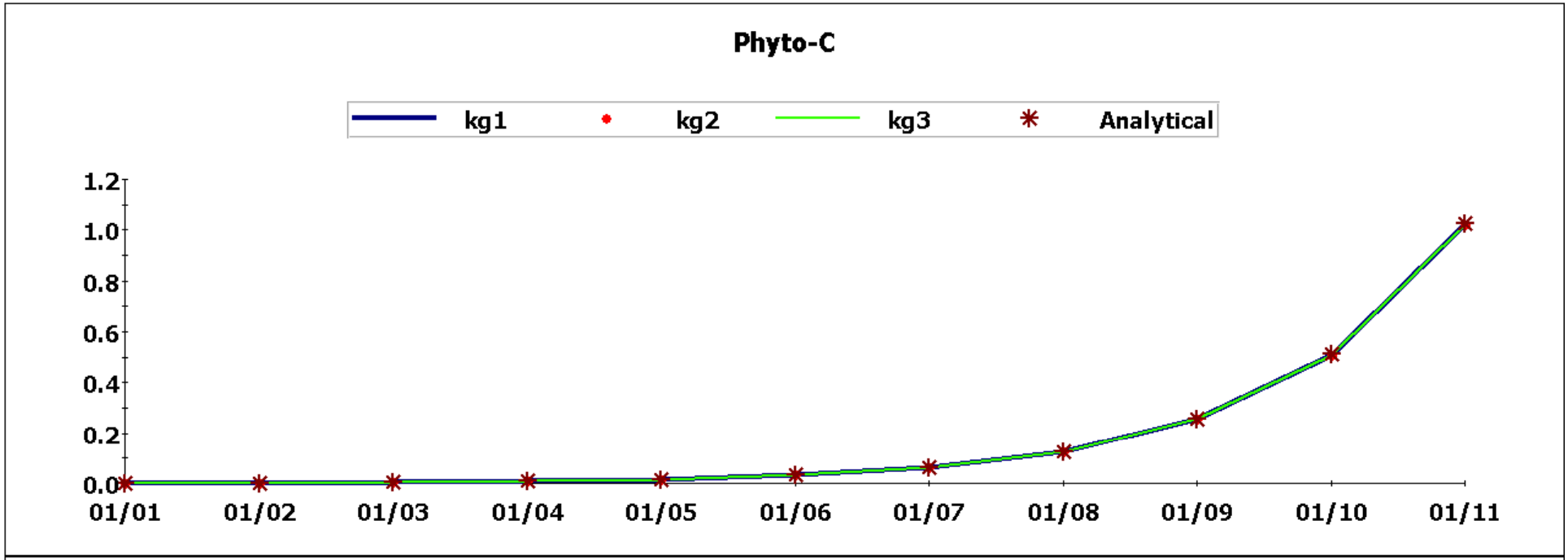

Conc. of DO mg/l
kres1
kres2
kres3
Analytical
10.0
9.0
8.0
7.0
01/03
01/10
01/17
01/24
01/31
02/07
02/14

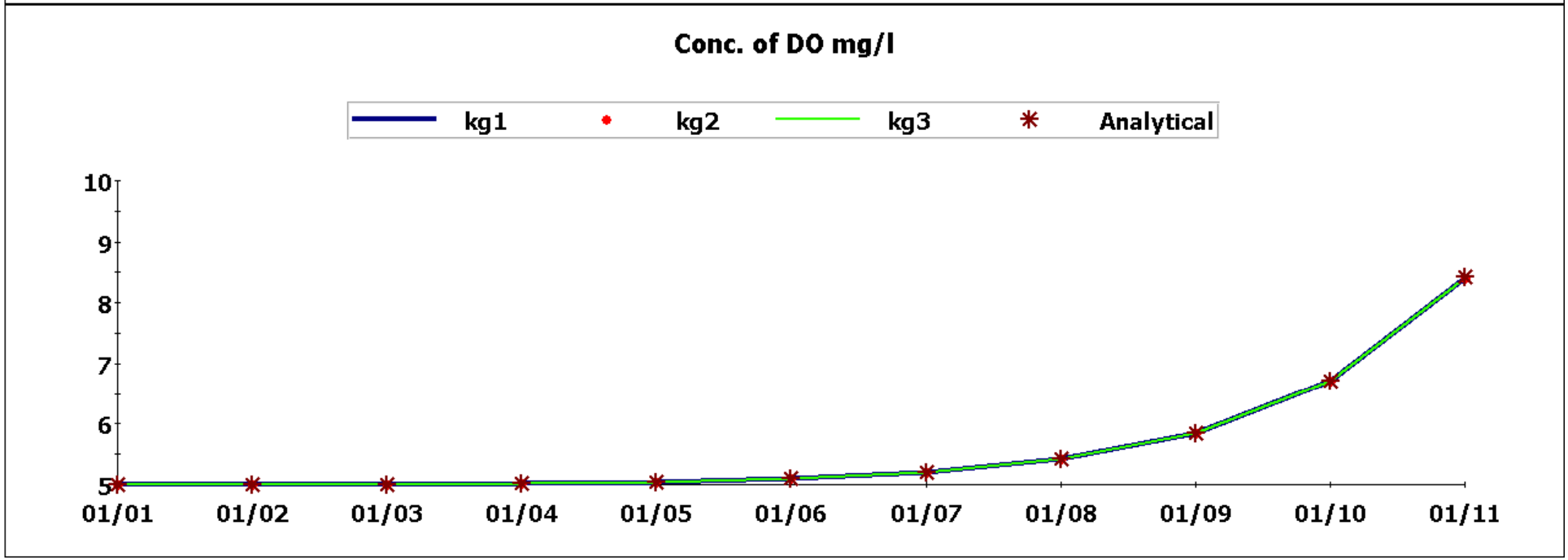
Test 2.8d: NH3 initialization



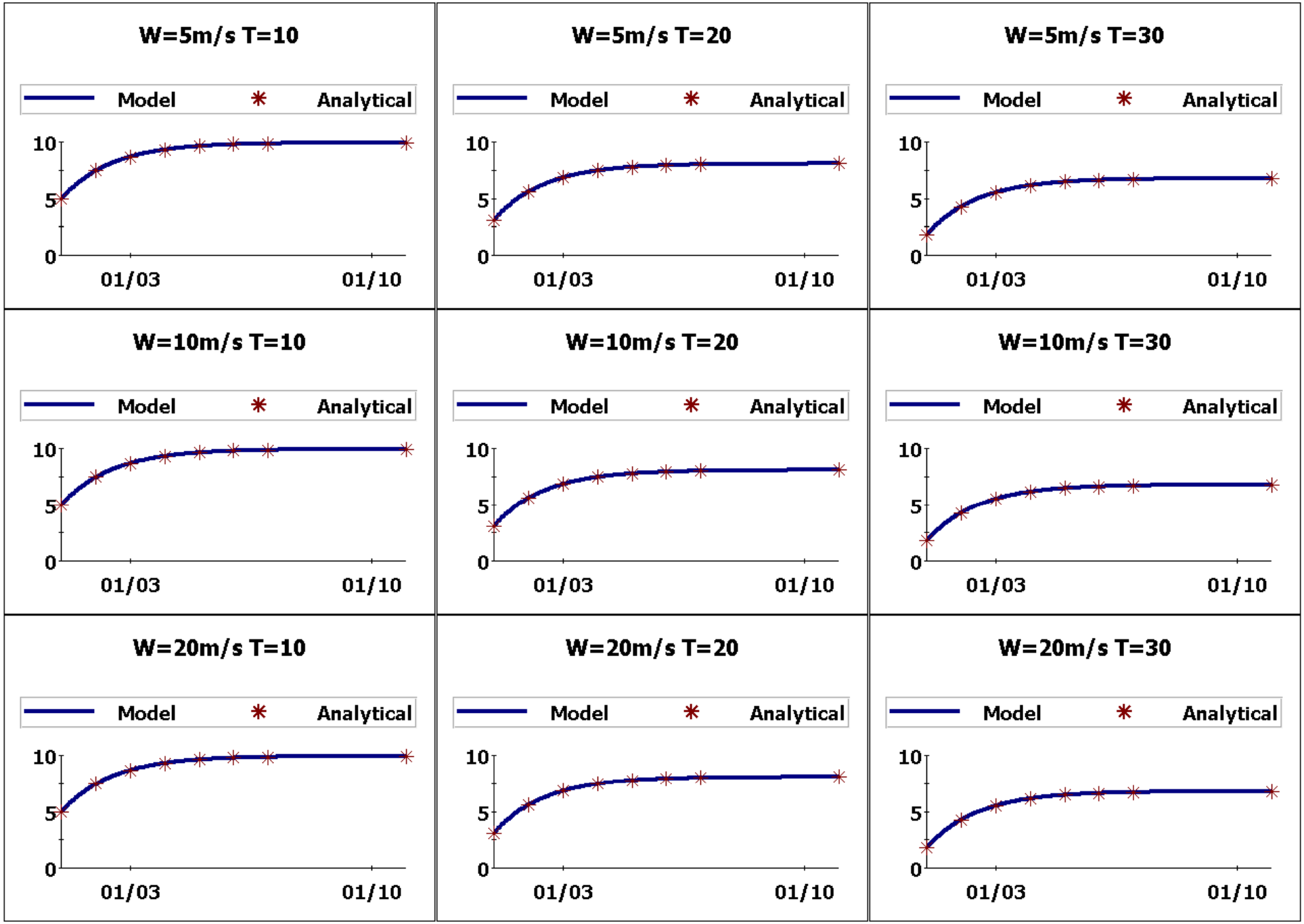
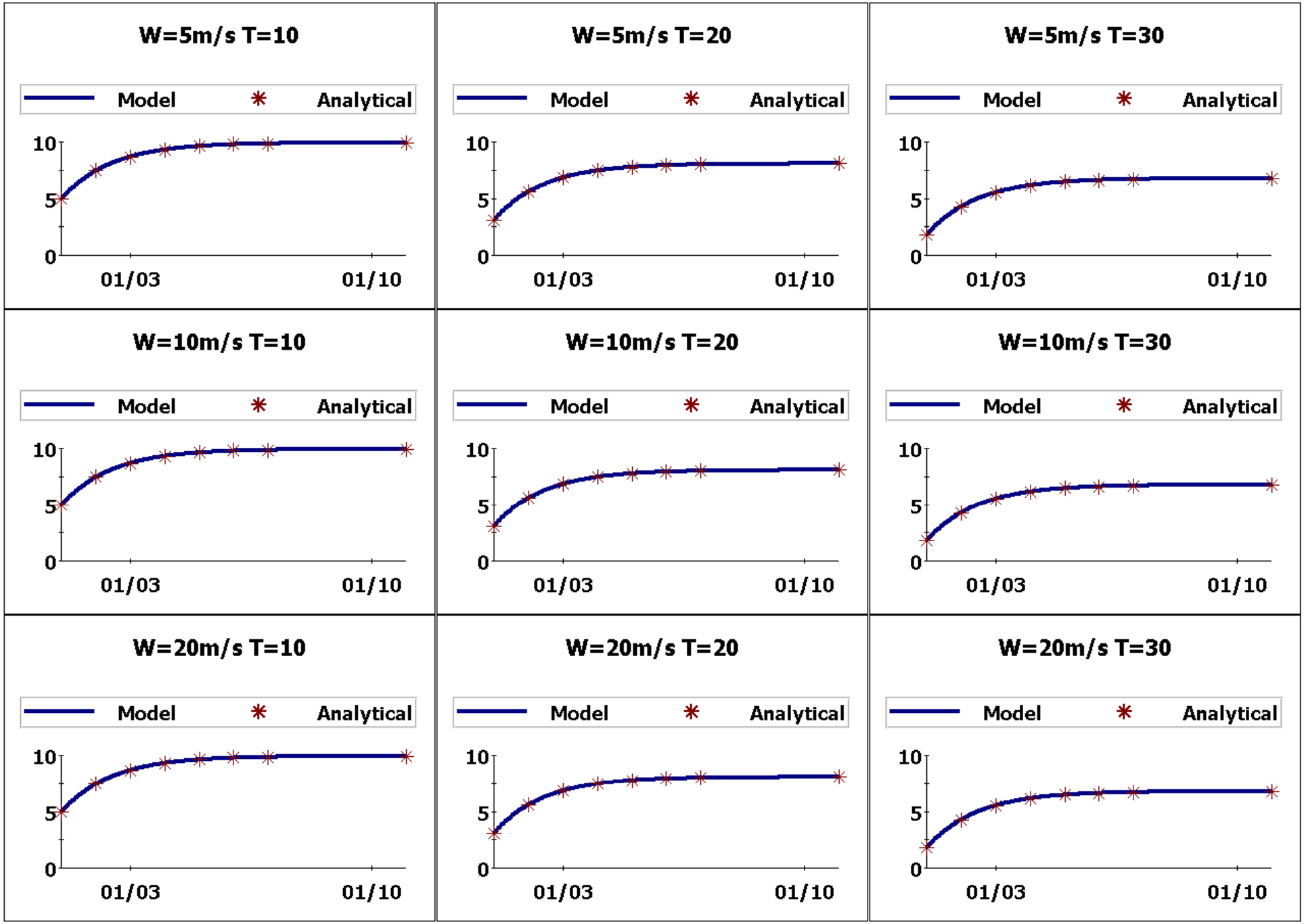


Test 2.8d: NO3 initialization





Test 2.8e: Wanninkhof



Test 2.8e: Chen & Kanwisher