Pelletier, Greg (ECY)

From: Robert Ambrose [bobambrosejr@gmail.com]
Sent: Wednesday, March 30, 2011 6:07 PM
To: Pelletier, Greg (ECY)
Cc: Sackmann, Brandon (ECY); Ahmed, Anise (ECY)
Subject: Re: FW: base 14 run
Attachments: base15.xls

Attached is my sensitivity spreadsheet for base15. I have high hopes for the regionalization of shallow-deep parameters. Hopefully our net will capture a few very good chl-DO-DIN realizations, allowing us to fine tune the bottom DO and the NH4-NO3 dynamics.

I'll be monitoring my email tonight and tomorrow for followup questions and clarifications. Do not hesitate to modify what I've laid out if you see something that makes more sense.

Bob

p.s., 12.0 base14 hours used; 42.75 remaining hours.

On Wed, Mar 30, 2011 at 6:06 PM, Robert Ambrose <bobambrosejr@gmail.com> wrote:
Greg, I've run out of time before my book group, and have only moderately prepared (luckily they are friendly and talkative). Anyway, I didn't want to rush the spreadsheet completion: recipe for error or at least unclear thinking. Hard enough anyway to chart the best path forward. I'll get back to this at 8:00 EDT.

Bob

On Wed, Mar 30, 2011 at 5:37 PM, Pelletier, Greg (ECY) <gpel461@ecy.wa.gov> wrote:

> Sounds good – we will probably add some extra runs that attack from the direction of using DO and DIN as primary indicators of productivity using lower CChla with lower gmax.
>
> We look forward to your spreadsheet and plan to run all of your recommended runs. Your guidance is extremely valuable to keep us focused.
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> **From:** Robert Ambrose [mailto:bobambrosejr@gmail.com]
> **Sent:** Wednesday, March 30, 2011 2:33 PM
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> **To:** Pelletier, Greg (ECY)
> **Cc:** Sackmann, Brandon (ECY); Ahmed, Anise (ECY)
> **Subject:** Re: FW: base 14 run

Greg, I was finishing my base15 recommendations, then your suggestion about focusing on bottom DO and DIN came in. My first quick reaction is that we need to get the productivity close, then adjust the other parameters (e.g. SOD) for bottom DO. SOD will not affect chl and DIN, but productivity will affect bottom DO.

I have to leave in 30 minutes to lead a book group at church, then will be back around 8:00 EDT. I can re-engage then to finalize things, but I thought I'd finish my sensitivity spreadsheet recommendation hopefully in the next 30 minutes.

Of course, please feel free to modify my recommendations based on your own analyses. It is difficult for me to assimilate everything, and there are different ways to approach this.

Bob

p.s., my hours on base14 are up to 11.5, with 43.25 left.

Analysis of base14 Sensitivity Runs

My initial screening of base 14a,b,c,d results indicated that for the only shallow station, SS08, 14b is best, followed by 14d. In most other stations, which are in deeper areas, 14a is best followed by 14c. Here are some relevant properties:

GAM1:	Isat	Topt	gmax
b,d	40	11	2.4
a,c	30	10	2.2

So, in shallow areas, which should have warmer environments, the best light and temperature parameters are higher than in the deeper, cooler environments. For base15, we should specify parameters much like 14b or 14d in the shallow areas and much like 14a or 14c in the deep areas. Since there were good results for anc values of 0.10 (14a, 14b) and 0.13 (14c, 14d), I recommend that we keep this division in base15. I propose that

we combine the best parameters from 14a and 14b into 15a, and the best parameters from 14c and 14d into 15b. I also recommend base15c and base15d using lower GAM2 cchl and gmax combinations.

base14b – While the overall RMSE statistics show that 14b and variants do not compare favorably with 14a, 14c, and 14d, results at SS08 indicate that this and 14d are the best for shallow areas. In this light, I examined the 14b parameter sensitivity to see what might improve results for shallow areas. Increasing both GAM1 and GAM2 k_R from 0.07 to 0.08 improved results slightly. Increasing GAM1 k_D from 0.03 to 0.04 helped slightly, though increasing GAM2 k_D had mixed results. It is unclear whether increasing both k_R and k_D would lead to better or worse results. Other parameter changes (k_n, ktg2) had only minor effects. My recommendation for base15a shallow is to use base14b with GAM1 and GAM2 k_R set to 0.08. For the parameter combination GAM2 gmax=2.0, cchl=50, fall productivity was squeezed, giving mixed results. At the surface, DO and DIN were significantly worse, but at depth (K4, KB) chl, DO, and DIN were at least slightly better. Perhaps a combination of gmax=2.2, cchl=50 would be better for base15c.

base14d – While the overall RMSE statistics show that 14d and variants are superior, my own comparison of 14d with 14c indicates that 14c is better in deep water stations. In this light, I examined the 14d parameter sensitivity to see what might improve results for shallow areas. Increasing both GAM1 and GAM2 k_R from 0.07 to 0.08 improved results slightly. Increasing GAM1 and GAM2 k_D from 0.03 to 0.04 also helped slightly. It is unclear whether increasing both k_R and k_D would lead to better or worse results. Other single parameter changes (k_n, ktg2) had only minor effects. My recommendation for base15b shallow is to use base14d with GAM1 and GAM2 k_R set to 0.08. For the parameter combination GAM2 gmax=2.1, cchl=40, fall productivity was squeezed, giving mixed results. Chl looked a little better, DO was better, and DIN improved at K4 but was worse at KT and KB. On balance, this parameter change improved results for SS08. I recommend a combination of gmax=2.2, cchl=40 for base15d.

base14a – Looking at 14a for deep water stations, results improved slightly when GAM1 and GAM2 k_R is increased to 0.08. Changing k_D had small and mixed results, with GAM1 k_D of 0.02 slightly better and GAM2 k_D of 0.04 slightly better Parameter changes for k_n and ktg2 had only minor effects.. I recommend increasing GAM1 and GAM2 k_R to 0.08 and keeping k_D at 0.03 for now. For the parameter combination GAM2 gmax=2.1, cchl=50, fall productivity declined, giving mixed results. The lower chl levels were worse at 3 stations and better at 2 stations. DO was better at 3 stations and worse at 2 stations. Perhaps a combination of gmax=2.3 and cchl=50 would be better for base15c.

base14c – Looking at 14c for deep water stations, results improved slightly when GAM1 k_R is decreased to 0.06. Results were mixed by station for GAM2 k_R. Changing k_D had small and mixed results, with GAM1 k_D of 0.02 slightly better at some stations and 0.04 at others. GAM2 k_D sensitivity was likewise mixed, with 0.04 slightly better. I recommend keeping k_R at 0.07 and k_D at 0.03 for now. Parameter changes for k_n showed very slight improvements for GAM1 k_n=22 and GAM2 k_n=30. Changes in ktg2 had only minor effects. For the parameter combination GAM2 gmax=2.1, cchl=40, fall productivity declined, giving mixed results. Fall chl and DIN were significantly worse at SS52 and slightly worse at SS71 and NSEX01. Fall chl and DIN were slightly better at SS66 and KSPB01. DO was slightly better at all stations but SS71. Perhaps a combination of gmax=2.3 and cchl=40 would be better for base15d.

The following table summarizes the recommended base15 runs:

	Simulation Series							
Parameters	15a		15b		15c		15d	
	shallow	deep	shallow	deep	shallow	deep	shallow	deep
anc	0.10	0.10	0.12	0.12	0.10	0.10	0.12	0.12
GAM1								
gmax	2.4	2.2	2.4	2.2	2.4	2.2	2.4	2.2
Isat	40	30	40	30	40	30	40	30
Topt	11	10	11	10	11	10	11	10
ktg1	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024
ktg2	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024
cchl	70	60	60	60	70	60	60	60
k_n	24	24	24	24	24	24	24	24
k_R	***0.08***	***0.08***	***0.08***	0.07	***0.08***	***0.08***	***0.08***	0.07
k_D	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
w_s	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
GAM2								
gmax	2.4	2.5	2.6	2.6	***2.2***	***2.3***	***2.2***	***2.3***
Isat	70	70	70	70	70	70	70	70
Topt	17	17	17	17	17	17	17	17
ktg1	0.020	0.020	0.015	0.015	0.020	0.020	0.015	0.015
ktg2	0.020	0.020	0.015	0.015	0.020	0.020	0.015	0.015
cchl	60	60	50	50	***50***	***50***	***40***	***40***
k_n	28	28	28	28	28	28	28	28
k_R	***0.08***	***0.08***	***0.08***	***0.08***	***0.08***	***0.08***	***0.08***	***0.08***
k_D	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
w_s	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Bold, italicized values are adjusted from corresponding base14* runs.

Appendix - Comments on statistical survey of base14 results

The results of the overall RMSE ranking suggest that the best runs used either base 14d or 14c with the GAM2 gmax=2.1 with CChl=40, or base14a with GAM2 gmax=2.1 with CChl=50.

For the six plotted stations, I compared XPB12 (14d with GAM2 gmax=2.1, cchl=40) with base14d. For SS08, fall productivity squeezed, giving mixed results. Chl looked a little better, DO was better, but DIN worse at KT, KB. For SS52, the fall productivity was suppressed and chl was significantly worse. DIN was also worse, though DO was good either way. For SS66, chl, DO, and DIN were slightly better. For SS71, no significant

change. For NSEX01, the chl shape was flatter, and worse, though the stats were a little better. DO and DIN were worse. For KSPB01, chl, DO, and DIN were slightly better. So overall, results were mixed with small improvements at some stations, and declines in some variables at other stations. Looking at this run straight up (not comparing), the results looked pretty good overall, especially in the subsurface of deep stations.

For the six stations, I compared base14c XPJ21 with base14d XPB12. For SS08, 14d gave better results for chl, DO, and DIN. For the other stations, 14c was better. In at least one station (NSEX01) the chl shape was better for 14c, but the stats were slightly better for 14d.

Base14b was not as good overall as 14d, 14c, or 14a. The best base14b run was base14b_XPC13 using GAM2 gmax=2.0 with CChl=50 scoring in the middle of the pack overall.

For SS08, 14b looked the best. I did not look at 14b for the deepwater stations.

These results strongly suggest that reducing the GAM2 gmax and CChl improves goodness of fit for all of the bases 14a,b,c,d. For the 5 deepwater stations, these changes improved results for 14d at SS08 (especially subsurface); gave mixed results for 14a (worse at SS52, S66 SS71;NEX01, KSPB01); and gave mixed results for 14c (worse at SS52 and SS71; slightly better at SS66; better at NEX01, KSPB01). From these, I recommend dropping gmax to 2.3, not 2.1.

Setting base14d GAM2 kd=0.04 and kr=0.08 also improved results. Setting base14d GAM1 kr=0.08 also improved results.

For SS08, increasing GAM1 and GAM2 kr and kd helped slightly. It is unclear whether increasing both kr and kd together will help or hurt.

Of the top 10 runs, 8/10 were variations on base14d, 1/10 was a variation on base14c, and 1/10 was a variation on base14a.

Of the top 20 runs, 12/20 were variations on base 14d, 7/20 were variations on base14c, and 1/20 was a variation on base14a.

> The following were the top 10 runs overall:
>
> - Base14d_XPB12_G2gmax21CChl40 (GAM2 gmax=2.1 and CChl=40)
> - Base14c_XPJ21_G2gmax21CChl40 (GAM2 gmax=2.1 and CChl=40)
>
> ...
>
> [Message clipped]