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|  |  | Key features |
| 1 | Basic sim | Conc  Flux  Tdc |
| 2 | Fe SO4 | Add Fe and SO42- |
| 3 | Grid | Maxnpts, job, xl |
| 4 | Depositional flux | w00 |
| 5 | Porosity | p0 p00 |
| 6 | OMModel2 | Compare OMModel1, OMModel2 |
| 7 | Limitation – inhibition | KTEA, KIn |
| 8 | Inorganic reactions | Knh4ox |
| 9 | Adsorption | NH4 adsorption, KPO4P |
| 10 | Bioturb | imix 0, 2, DB0,xs  α0, xirrig |
| 11 | High salinity | Sal1 Sal2 |
| 12 | Sulfide sensitivity | KH2S |
| 13 | MPB | Rgpp |
| 14 | Zones | Add three zones |
| 15 | OM initial profile | OM\_Top, OM\_Min, InitMinDepth |
| 16 | Timing | Spinup, substeps, firststeps, justwaitabit |
| 17 | POM special rectangle | Fluxon, fluxoff |
| 18 | POM special triangle | Swibc |
| 19 | Time and POM | Swibc |
| 20 | kOM | Vary pomspecial2dic |
| 21 | Bottom boundary | Deep\_vals |

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|  | **Exercises** | **Parameters and variables** | **Details** | **Diagram** |
| 1 | Starting example |  | Run the model for one year.  Open candi-examples\_results.code-workspace.  Open the R folder. Open the file SixPlotsCandi-Examples.R. Run this script to generate the plots.  The plots will appear in the same directory as the glm3.nml file. |  |
| 2 | Fe and SO42- | Variables:  Fe and SO42-  aed\_sdg\_vars.csv | Add higher concentrations of Fe(OH)3A and SO42- to the file aed\_sdg\_vars. Add them to the csv column ‘default\_vals’, which sets the flux and concentration at the sediment-water interface. Set ‘feoh3a’ to 100.0E+03 (flux in mmol m-2 y-1) and ‘so4’ to 32.0E+03 (concentration in mmol m-3). Plot the output figures for ‘feoh3a’, ‘feii’, ‘so4’ and ‘h2s’. Also plot ‘ch4’ and compare its concentration to the previous example: the implication is that adding SO42- reduces the creation CH4. |  |
| 3 | Grid structure | Parameters:  maxnpts, job, xl  aed\_candi\_params.csv | Use the parameter ‘job‘ to change the grid from fixed width (0) to exponentially increasing (2).  Use ‘xl’ to change the depth of the sediment simulated, from say, 10 cm to 40 cm.  Use ‘maxnpts’ to set the number of layers simulated. Note that job 0 requires maxnpts to be depth × an integer + 1. |  |
| 4 | Depositional flux | Parameter:  w00  aed\_candi\_params.csv | Set the deposition rate ‘w00’ to be large or small. Plot and save the results after each simulation. |  |
| 5 | Porosity | Parameters:  p0, p00, bp  aed\_candi\_params.csv | Run two simulations with high and low porosity. p0 is the porosity at the sediment-water interface, and p00 is the porosity at the deep. You may find that extremes of porosity, the model experiences errors.  Plot the porosity profiles. |  |
| 6 | Organic matter model | Parameters:  OMModel1, OMModel2  aed\_candi\_params.csv  Variables:  POML, POCL etc,  In aed\_sdg\_vars.csv | Change the organic matter model from the simple model to the mode complex model. Change the parameter ‘OMModel’ in aed\_candi\_params from 1 to 2.  Add higher concentrations of the relevant variables: pocl, ponr, dopl etc. in the ‘default\_vals’ column.  Plot these variables with the RStudio plotting script. Add pocl, ponr, dopl to the ‘files’ variable, towards the top of the script SixPlotsCandi-Examples.R. |  |
| 7 | Organic matter limitation and inhibition | Parameters:  kpo2, kpno3 …  aed\_candi\_params.csv  Extra variables:  FTEA …  aed.nml | Adjust any of the limitation or inhibition constants. The parameters are named as ‘kpo2’, ‘kpno3’ etc. The units of the parameter are in concentration.  You can create images of the limitation and inhibition by adding extra variables. They are listed in aed.nml, at the parameter ‘morevariables’. Examples include ‘FTEAO2’, ‘FINNO3’ etc. The resulting .sed files are saved in the Extras directory, in results/candi\_aed/zone/Extras. Use the plotting script ‘SixplotsExtras.R’. |  |
| 8 | Inorganic reactions | Parameters:  Knh4ox  aed\_candi\_params.csv | Change the parameter ‘knh4ox’ in aed\_candi\_params. This parameter controls the kinetic rate of NH4+ oxidation to NO3- by O2. The plots should show different amounts of O2, NH4+ and NO3-. |  |
| 9 | Adsorption | Parameters:  NH4AdsorptionModel,  knh4p, DOMAdsorptionModel, kdomp,  PO4AdsorptionModel,  kpo4p, ads\_use\_pH  aed\_candi\_params.csv | Change the switches to turn adsorption on, then adjust the adsorption coefficients to change the degree of adsorption, then plot the relevant state variables. |  |
| 10 | Bioturbation and irrigation | Parameters:  imix, DB0,xs, α0, xirrig  aed\_candi\_params.csv | Change the bioturbation and irrigation parameters. There may be a point where the model stops working, due to, for example, too little mixing, or sharp concentration gradients. Plot the shapes of the profiles from the Depths.R. |  |
| 11 | High salinity | Parameters:  Sal1 Sal2  aed\_candi\_params.csv |  |  |
| 12 | Sulfide sensitivity | Parameter:  KH2S  aed\_candi\_params.csv |  |  |
| 13 | Microphytobenthos | Parameter:  Rgpp  aed\_candi\_params.csv |  |  |
| 14 | Zones | Zone parameters and settings:  Add three zones  aed\_candi\_params.csv  aed.nml |  |  |
| 15 | OM initial profile | Parameters:  OM\_Top, OM\_Min, InitMinDepth  aed.nml |  |  |
| 16 | Timing | Parameters:  Spinup, substeps, firststeps, justwaitabit  aed.nml |  |  |
| 17 | POM special rectangle | Parameters:  fluxon, fluxoff  aed.nml |  |  |
| 18 | POM special triangle | swibc |  |  |
| 19 | Time and POM | Swibc |  |  |
| 20 | kOM | Vary pomspecial2dic |  |  |
| 21 | Bottom boundary | Deep\_vals |  |  |