Module 7 WSE-HI River basin modelling 2019-2021

Assignment in Catchment modelling

Two sets of questions are introduced from the models developed during the exercises. Each student will need to answer *some selected questions from the three sets*, *as indicated in the table at the end of the assignment*.

Set 1: Analyses of models developed during the classroom exercises

These questions are related to the already developed models during classroom exercises and addressed in the exercise soltions report.

Questions:

1. Consider the model Integrated_1, which was the first integrated model developed. Its analyses is presented in pages 3-20 of the Catchment Modelling exercise report (please revise this part). Four modelling cells need to be compared as presented in table below:

Cell naming	A	B	C	D
Cell numbering in water balnce tool and pre-processed data viewer	(16, 14)	(17,14)	(18, 14)	(19,14)
Cell numbering in Gridded data results viewer	(15,13)	(16,13)	(17,13)	(18,13)

As explained at the end of the exercises handout the Gridded data results viewer has diffferent numbering (starting with (0,0)) from the water balance tool and pre-processed data viewer (starting from (1,1)), so same cells in different interfaces have different numbering, as indicated in the table above.

Use any data and results that you find appropriate to answer the following questions:

- Which of the four cells generate drainflow to river?
- Which of the four cells generate baseflow to river?
- Which of the four cells generate both drainflow and basefow to river?
- Which of the four cells does not generate any drainflow, nor baseflow?
- Make single cell chart water balances for cells B and D and explain the diffeences in the following water balance components: Evapotranspiration, UZ storage change and SZ storage change.

Support each answer with brief explanation and appropriate results.

2. Consider model Integrated_2a (in which land use changes were introduced). Its analyses is presented in pages 21-23 of the Catchment Modelling exercise report (please revise this part). Make accumulated water balance for the overland (OL) and unsaturated zone (UZ) components. Compare these results with the same water balances of model Integrated_1, presented on pages 7-10 of the Catchment Modelling exercise report and explain the differences. Use whatever additional results you find appropriate to support your explanations.
3. Consider model Integrated_2b (in which river-aquifer exchange was modified). Its analyses is presented in pages 24-26 of the Catchment Modelling exercise report (please revise this part). Make accumulated water balance for the overland (OL) and unsaturated zone (UZ) components. Compare these results with the same water balances of model Integrated_1, presented on pages 7-10 of the Catchment Modelling exercise report and explain the differences. Use whatever additional results you find appropriate to support your explanations.
4. Consider model Integrated_2c (in which pumping wells were introduced). Its analyses is presented in pages 27-34 of the Catchment Modelling exercise report (please revise this part). Using the water balance for the whole model calculate the total volume of water (in m^3) that came from the river during the whole simulation period as *baseflow from river*. (The model has 438 active modelling cells with size 1000m x 1000m). Is the contribution of this water balance component coming only to the cells where pumping wells are located? Report the difference in this water balance component (if any) for the whole modelling domain and for all cells that contain pumping wells. Explain and support your answers with additional results, if you think is needed.
5. Consider models Integrated_1 (the first integrated model developed), Integrated_2a (in which land use changes were introduced) and Integrated_2b (in which river-aquifer exchange was modified). Generate the river flow hydrographs at the outlet of the catchment for these three models and explain their differences. For clearer explanations you can also present a zoomed-in graph of these hydrographs for shorter part of the simulation period (for example, the last six months of the simulation). Explain and support your answers with additional results, as you find appropriate.

Set 2: Analyses of modifications introduced in the models developed during classroom exercises

Each of the questions below introduces some changes to the developed models. This means that you will need to introduce the change, re-run the model and then perform the required analysis. Please take care that you re-name all the necessary files (as it was done during the classroom exercises) to avoid confusing results from one model into another.

Questions:

6. In the model Integrated1 change the drain level from -0.5 m to -1 m below land surface. You can name this model Integrated1_A. Generate chart water balance results. Compare the water balance results of this new model (Integrated1_A) with those of Integrated1 and explain the differences. Generate the river flow hydrographs from the two models at the outlet of the catchment and explain the diffrences. Support all your explanations with additional results, as you find appropriate.

7. In the model Integrated1 change the drain time constant from 5.6 x 10^{-7} to 1 x 10^{-7} 1/s. You can name this model Integrated1_B. Generate chart water balance results. Compare the water balance results of this new model (Integrated1_B) with those of Integrated1 and explain the differences. Generate the river flow hydrographs from the two models at the outlet of the catchment and explain the diffrences. Support all your explanations with additional results, as you find appropriate.
8. In the model Integrated1 introduce a constant reference evapotranspiration of 2.5 mm/day throughout the simulation. You can name this model Integrated1_C. Generate chart water balance results. Compare the water balance results of this new model (Integrated1_C) with those of Integrated1 and explain the differences. Prepare incremental water balance(s) and explain the temporal behaviour of the following components: Evapotranspiration, Drainflow to river and UZ storage change.
9. In the model Integrated_1 introduce he pumping wells that were earlier used in the model Integrated_2c. You can name this model Integrated1_D. Generate the single cell chart water balance for for cell (9, 30) of model Integrated1_D (where the well with largest pumping rate is located) and explain the diffrences compared to the same water balance from model Integrated2_c. From the time varying single cell water balances (incremental or accumulated) explain the differences in the following water balance components: Pumping, Baseflow to river, Baseflow from river and Boundary flow (in and out). Support all your explanations with additional results, as you find appropriate.
10. In the model Integrated_1 introduce higher Initial groundwater heads of -0.5 m below soil surface, instead of -3.5 m below soil surface. You can name this model Integrated1_E. Generate chart water balance results. Compare the water balance results of this new model (Integrated1_E) with those of Integrated1 and explain the differences. For cell (18, 19) generate the UZ plot (water content in UZ in time) from this model (Integrated1_E) and compare it with the UZ plot of the same cell from model Integrated1 and explain the differences (an example of this type of plot for another cell is in your exercise report on page 13). Generate the river flow hydrographs from the two models at the outlet of the catchment and explain the diffrences. Support all your explanations with additional results, if you find appropriate.

Allocated questions to students for Catchment modelling assignment

Module 7-WSE-HI River basin modelling

Number	Mr/Ms	Name	Allocated questions			
1069195	Mr	Cui Zhewei	1	3	6	8
1066931	Mr	Dong Zhuowen	2	5	7	10
1072186	Mr	Rodrigo Edwin Esquivel Esquivel	4	5	9	10
1072885	Ms	Huang Yiying	2	3	7	8
1069158	Ms	Yue Jia	1	4	6	9
1065576	Mr	Tharindu Udasri Sampath Manamperi	3	5	8	10
1068727	Mr	Sun Tianyi	2	4	7	9
1069406	Mr	Victor Alejandro Arcia Castro	1	4	6	9
1066462	Ms	Vindhya Basnayake Basnayake Mudiyanselage	2	5	7	10
1062906	Ms	Valéria Cristina Prando	1	3	6	8
1066695	Mr	Steven Richard Brazda	2	5	7	10
1060300	Mr	Sivarama Krishna Reddy Chidepudi	3	4	8	9
1066355	Mr	Siamak Farrokhzadeh	1	2	6	7
1070284	Mr	Liang Shuoyuan	3	4	8	9
1064735	Mr	Zheng Shaoxu	2	5	7	10
1066901	Ms	Nowrina Rahim	1	3	6	8
1068950	Ms	Paula Santandreu Vicens	2	5	7	10
1068144	Ms	Nadia Natasha Jethoo	4	5	9	10
1057438	Mr	Masood Rasoli	2	3	7	8
1052068	Mr	Mostafa Mostafa Emam Saleh	1	4	6	9
1059981	Mr	Joaquin Vicente Consunji Ferrer	3	5	8	10
1066817	Mr	Juan Felipe Velandia Ramos	2	4	7	9
1071842	Mr	Jiaxin Wen	1	4	6	9
1041829	Ms	Fatmata Kolliatu Kamara	2	5	7	10
1069728	Mr	Kshitiz Gautam	1	3	6	8
1071079	Mr	Karel Aldrin Sanchez Hernandez	2	5	7	10
1068238	Ms	Kamilla Zhalmurziyeva	3	4	8	9
1069431	Ms	Lidya Lulseged Assefa	1	2	6	7
1069160	Mr	Luiz Eduardo Lucena Justino	3	4	8	9
1075505	Mr	Luis Felipe Sierra Ponguta	2	5	7	10
1067143	Ms	Umutoni Lisa	1	3	6	8
1066417	Mr	Mark Bryan Alivio	2	5	7	10
1072402	Mr	Manuel Antonio Alvarez Chaves	4	5	9	10
1074057	Mr	Alexopoulos Marcos Julien	2	3	7	8
1068718	Mr	Manoel Marcelino De Sá Junior	1	4	6	9
1069191	Mr	Mario Alberto Fuentes Monjaraz	3	5	8	10
1068076	Ms	Mazriha Islam	2	4	7	9
1061032	Mr	Muhammad Jawad	1	4	6	9
1068402	Ms	Le Minh Nguyet	2	5	7	10
1060031	Mr	Hudson Ebadonoi Irivbogbe	1	3	6	8
1070039	Mr	Hemant Servia	2	5	7	10
1058931	Mr	Camilo Andres Gonzalez Ayala	3	4	8	9
1074947	Mr	Carlos Alfredo Mesa Zuluaga	1	2	6	7
1068411	Mr	Dereje Endalkachew Tiruneh	3	4	8	9
1068601	Mr	Daniel Eduardo Villarreal Jaime	2	5	7	10
1052768	Mr	Eugen Balilaj	1	3	6	8
1068292	Mr	Edgar Andres Lopez Garcia	2	5	7	10
1053459	Mr	Faisal Mahmood	4	5	9	10
1067229	Ms	Angie Araya Lescouflair	2	3	7	8
1042956	Mr	Amit Daiman	1	4	6	9
1068260	Ms	Alejandra Lobo Chavarria	3	5	8	10
1008784	Mr	Ahmed Essam Fawky Ramadan Mohammed	2	4	7	9
1067911	Mr	Anietie Edet Okon	1	4	6	9
1066059	Mr	Amin Shakya	2	5	7	10
1057883	Mr	Ammanuel Bekele Tilahun	1	3	6	8
1069689	Ms	Buse Onay	2	5	7	10