Unit 22 Physical Hydrometeorology Applications

1. Graduate students only: Fill the attached matrix of interactions and feedbacks in the hydrometerological cycle with atmospheric, ecological, biogeochemical/physical transport processes by judging the contributions of the processes with respect to the typical magnitudes at the temporal and spatial scales. Here H_n, A_m, L_m, B_m refer to hydrological, atmospheric and land-surface processes and biogeochemical/physical transport, respectively, and the subscripts n=1,10 and m=1,4 refer to the respective individual processes listed as such in the first column. Further, P,S, and T stand for primary, secondary, and total number of links. Mark processes that require two-way coupling with a capital X and those that can be dealt with using one-way coupling with a small x. Count the number of primary, secondary and total links for the various processes.

   Background of this exercise:
   Think of this task as a medium to show that you can excess the importance of processes relative to each other. It examines your ability to combine the material we have covered so far and puts it in the big picture. You may need to revisit some of the reading in your assessment of the magnitude of change caused by a given process. (Hint: This task is also a great opportunity to start you reviewing for the final exam early while applying old material in the context of the new material.)

   Grading of this task:
   Note that there is not an absolute "right" or "wrong" about coupling. It strongly depends on the application for which you do want to couple the models. Think of this task in terms of P/F for each row. Let’s assume, for instance, s.o. would run a glacier model 2-way coupled in a weather prediction model for a 2-days forecast. This part would be evaluate with an F as the glacier movement and discharge processes related to radiative (extension of the glacier with its high albedo vs. no glacier) are many orders of magnitude smaller than the atmospheric processes you are after. Over 2 days the glacier doesn’t change much. When, for instance, s.o. would run the said glacier model in a two-way coupling exchanging in terms of monthly accumulated precipitation, mean temperature, wind, and sublimation) for a climate simulation over 50 years, the coupling makes sense. The person would get a P for that part.

		Hydrological processes H_n, n=1,10										Atmospheric processes A_m, m=1,4				Land-surface processes L_m, m=1,4				Biogeochemical/ physical transport B_m, m=1,4				Sum		
		H_1	H_2	H_3	H_4	H_5	H_6	H_7	H_8	H_9	H_{10}	A_1	A_2	A_3	A_4	L_1	L2	L3	L_4	B_1	B_2	B_3	B_4	P	S	T
Runoff generation H_1																										
Drainage/routing of rivers H_2																										
Storage in lakes/rivers H_3																										
Water storage in soil H_4																										
Infiltration and physical processes in soils H_5																										
Lateral transfer of soil moisture H_6																										
Flow in root/unsaturated zone H_7																										
Groundwater flow H_8																										
Snow and ice storage H_9																										
Soil/ground freezing H_{10}																										
Precipitation A_1																										
Energy and matter fluxes A_2																										
ABL transport processes A_3																										
Free troposphere hydro-thermo dynamics A_4																										
Diurnal changes L1																										
Seasonal dynamics (aggregation) L_2																										
Inter-annual changes L_3																										
Composition/succession of vegetation L_4																										
Sediments/suspended matter B_1																										
Nutrients (N, P, K) B_2																										
Salinization B_3																										
Carbon cycle B_4																										
Number of	Primary links P																									
	Secondary links S																									
	Total links T																									