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Supplement of

**HESS Opinions: Beyond the long-term water balance:
evolving Budyko’s supply–demand framework for the
Anthropocene towards a global synthesis of land-surface
fluxes under natural and human-altered watersheds**

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Supplemental Information

Table S1 – Standard operating policy for a hypothetical reservoir system (All values are in Million cubic meters (Mm³); maximum storage, $S_{max} = 350$ Mm³; timestep, $t = 1$ month; discharge, Q_t ; demand, D_t ; evaporation, E_t ; initial storage, S_{t-1} ; ending storage, S_t ; inflow, I_t ; actual release, R_t ; spill, SP_t)

Months	Q_t	D_t	E_t	S_t	$S_t+Q_t-E_t$	R_t	SP_t	S_{t+1}	$D_t/(I_t+S_{t-1})$	$R_t/(I_t+S_{t-1})$
1	70.61	51.68	10.00	200.00	260.61	51.68	0.00	208.93	0.20	0.20
2	412.75	127.85	8.00	208.93	613.68	127.85	135.83	350.00	0.21	0.21
3	348.40	127.85	8.00	350.00	690.40	127.85	212.55	350.00	0.19	0.19
4	142.29	65.27	8.00	350.00	484.29	65.27	69.02	350.00	0.13	0.13
5	103.78	27.18	6.00	350.00	447.78	27.18	70.60	350.00	0.06	0.06
6	45.00	203.99	6.00	350.00	389.00	203.99	0.00	185.01	0.52	0.52
7	19.06	203.99	5.00	185.01	199.07	199.07	0.00	0.00	1.02	1.00
8	14.27	179.47	5.00	0.00	9.27	9.27	0.00	0.00	19.36	1.00
9	10.77	89.76	6.00	0.00	4.77	4.77	0.00	0.00	18.82	1.00
10	8.69	0.00	8.00	0.00	0.69	0.00	0.00	0.69	0.00	0.00
11	9.48	0.00	8.00	0.69	2.17	0.00	0.00	2.17	0.00	0.00
12	18.19	0.00	10.00	2.17	10.36	0.00	0.00	10.36	0.00	0.00

Table S2: Hedging operation of a hypothetical reservoir operation ($\alpha = 0.9$) (All values are in Million cubic meters (Mm³); maximum storage, $S_{max} = 350$ Mm³; timestep, $t = 1$ month; discharge, Q_t ; demand, D_t ; evaporation, E_t ; initial storage, S_{t-1} ; ending storage, S_t ; inflow, I_t ; actual release, R_t ; spill, SP_t)

Months	Q_t	D_t	E_t	S_t	$S_t+Q_t-E_t$	R_t	SP_t	S_{t+1}	$D_t/(I_t+S_{t-1})$	$R_t/(I_t+S_{t-1})$
1	70.61	51.68	10.00	200.00	260.61	36.18	0.00	224.43	0.20	0.14
2	412.75	127.85	8.00	224.43	629.18	127.85	151.33	350.00	0.20	0.20
3	348.40	127.85	8.00	350.00	690.40	127.85	212.55	350.00	0.19	0.19
4	142.29	65.27	8.00	350.00	484.29	65.27	69.02	350.00	0.13	0.13
5	103.78	27.18	6.00	350.00	447.78	27.18	70.60	350.00	0.06	0.06
6	45.00	203.99	6.00	350.00	389.00	142.79	0.00	246.21	0.52	0.37
7	19.06	203.99	5.00	246.21	260.27	142.79	0.00	117.47	0.78	0.55
8	14.27	179.47	5.00	117.47	126.74	126.74	0.00	0.00	1.42	1.00
9	10.77	89.76	6.00	0.00	4.77	4.77	0.00	0.00	18.82	1.00
10	8.69	0.00	8.00	0.00	0.69	0.00	0.00	0.69	0.00	0.00
11	9.48	0.00	8.00	0.69	2.17	0.00	0.00	2.17	0.00	0.00
12	18.19	0.00	10.00	2.17	10.36	0.00	0.00	10.36	0.00	0.00

Table S3: Annual operation of the Falls Lake, North Carolina. Data from U.S. Army Corps of Engineers (<https://epec.saw.usace.army.mil/FALLSMSR.txt>). (All values are in acre-feet per year; timestep, $t = 1$ year; initial storage, S_{t-1} ; inflow, I_t ; demand, D_t ; environmental flow, EF_t ; ending storage, S_t)

Year	S_{t-1}	I_t	D_t	EF_t	S_t
1983	8,180.00	25,515.49	20,917.26	815.65	11,962.57
1984	11,962.57	25,448.01	25,634.56	978.39	10,797.63
1985	10,797.63	16,592.91	14,739.33	1,037.92	11,613.29
1986	11,613.29	6,928.10	6,017.19	1,184.78	11,339.42
1987	11,339.42	17,442.30	16,973.94	1,208.60	10,599.18
1988	10,599.18	6,545.08	4,469.23	1,266.15	11,408.88
1989	11,408.88	29,498.50	27,716.36	1,228.44	11,962.57
1990	11,962.57	17,876.92	16,567.11	1,333.62	11,938.76
1991	11,938.76	10,668.99	10,760.28	1,387.21	10,460.26
1992	10,460.26	11,298.10	8,388.74	1,444.76	11,924.86
1993	11,924.86	19,196.65	18,898.96	1,553.91	10,668.64
1994	10,668.64	11,962.93	10,420.92	1,363.39	10,847.25
1995	10,847.25	18,781.88	16,354.76	1,355.45	11,918.91
1996	11,918.91	27,228.16	25,531.36	1,611.46	12,004.25
1997	12,004.25	14,167.77	12,613.86	1,782.13	11,776.02
1998	11,776.02	25,301.16	24,368.41	1,915.10	10,793.67
1999	10,793.67	22,143.72	18,345.27	2,012.34	12,579.77
2000	12,579.77	14,556.75	13,340.21	2,063.94	11,732.36
2001	11,732.36	9,123.02	7,940.22	2,018.30	10,896.86
2002	10,896.86	12,205.04	8,831.29	1,847.63	12,422.99
2003	12,422.99	30,076.01	28,283.95	1,883.35	12,331.70
2004	12,331.70	11,159.18	9,091.27	2,052.04	12,347.58
2005	12,347.58	9,277.82	8,458.19	2,125.46	11,041.74
2006	11,041.74	12,945.28	8,986.09	1,760.30	13,240.63
2007	13,240.63	8,122.80	9,571.53	1,869.46	9,922.44
2008	9,922.44	12,441.21	8,059.30	1,647.18	12,657.17
2009	12,657.17	18,879.12	16,422.23	1,718.63	13,395.42
2010	13,395.42	12,707.14	13,205.26	1,605.51	11,291.79
2011	11,291.79	4,485.11	3,105.84	1,476.51	11,194.55
2012	11,194.55	5,566.69	3,167.36	1,411.02	12,182.86
2013	12,182.86	15,713.75	13,173.51	1,393.16	13,329.93