Interactive comment on "One-way coupling of an integrated assessment model and a water resources model: evaluation and implications of future changes over the US Midwest" *by* N. Voisin et al.

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Response to reviewers

The authors would like to thank the two anonymous reviewers for their constructive comments. The clarity of the paper has improved and added information provides more evidence supporting our conclusions. The most important changes are:

- clarification: supply (flow) vs. actual supply (met demand). Figure 2 (modeling frame-

work) has been revised for more clarity on the datasets and models involved as well as their spatial and temporal resolutions. We justify better why the Midwest is a good region for the modeling experiment.

- additional A2 scenario: Figures 7, 8, 9, and 12 , and Tables 2 and 4 have been updated accordingly.

-We added more metrics to provide supporting evidence of the drivers of change for the unmet demand and met demand. Metrics include: relative changes in natural flow, regulated flow, demand, unmet demand and met demand, and corresponding elasticities with respect to changes in natural flow and changes in demand. The elasticities are the ratios of the relative changes in met demand for example, over the relative change in natural flow or demand. It allows quantifying the sensitivity of the variables to changes in predicted flow and demand. Larger elasticities with respect to changes in flow than with respect to changes in demand support that changes in flow are the largest driving component for changes in met and unmet demand. Smaller differences in elasticities indicate a growing significance in the changes in demand in the water resources assessment. Table 3 presents the different metrics for the Missouri, Upper Mississippi, Ohio and Midwest.

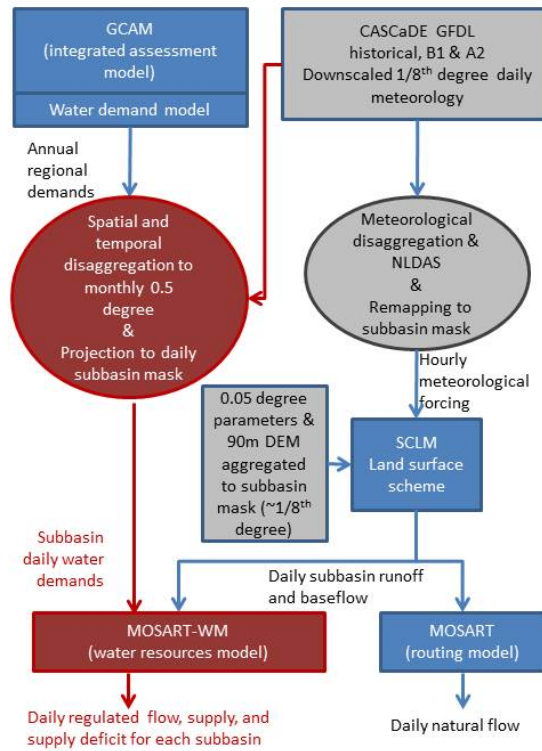Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 6359, 2013.

Fig. 1.

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Missouri		historical	2030s B1	2050s B1	2080s B1	2030s A2	2050s A2	2080s A2
Relative Change in								
	reg flow at Hermann		9%	2%	14%	10%	-5%	-7%
	Natural flow at Hermann		14%	13%	24%	11%	3%	4%
	Water demand		38%	54%	65%	30%	44%	57%
	Water supply		33%	46%	53%	27%	37%	46%
	Supply deficit		343%	504%	785%	212%	411%	711%
Relative supply deficit		2%	5%	7%	9%	4%	6%	9%
Elasticity deficit/demand			9.00	9.42	12.01	6.96	9.36	12.39
Elasticity deficit/runoff			25.02	37.37	32.41	19.69	125.97	177.15
Elasticity supply/demand			0.86	0.86	0.81	0.89	0.85	0.80
Elasticity supply/runoff			2.40	3.39	2.19	2.53	11.44	11.38
Upper Mississippi		historical	2030s B1	2050s B1	2080s B1	2030s A2	2050s A2	2080s A2
Relative Change in								
	reg flow at Grafton		9%	4%	13%	21%	13%	17%
	flow at Grafton		8%	4%	13%	21%	13%	15%
	Water demand		60%	75%	73%	51%	71%	93%
	Water supply		51%	63%	64%	45%	62%	83%
	Supply deficit		165%	213%	187%	114%	159%	186%
Relative supply deficit		8%	13%	14%	13%	13%	14%	14%
Elasticity deficit/demand			2.73	2.83	2.54	2.22	2.24	2.01
Elasticity deficit/runoff			19.39	59.44	14.79	5.56	12.39	12.39
Elasticity supply/demand			0.85	0.84	0.87	0.87	0.87	0.89
Elasticity supply/runoff			6.03	17.64	5.03	2.18	4.81	5.52
Ohio		historical	2030s B1	2050s B1	2080s B1	2030s A2	2050s A2	2080s A2
Relative Change in								
	reg flow at Metropolis		13%	2%	19%	12%	11%	24%
	flow at Metropolis		15%	6%	21%	13%	13%	24%
	Water demand		43%	53%	51%	39%	53%	69%
	Water supply		40%	49%	47%	38%	50%	63%
	Supply deficit		132%	169%	166%	68%	130%	197%
Relative supply deficit		4%	6%	6%	6%	5%	7%	8%
Elasticity deficit/demand			3.09	3.17	3.24	1.75	2.43	2.87
Elasticity deficit/runoff			8.60	28.87	7.83	5.42	9.90	8.24
Elasticity supply/demand			0.92	0.92	0.92	0.97	0.93	0.91
Elasticity supply/runoff			2.57	8.39	2.22	3.00	3.81	2.63
Midwest		historical	2030s B1	2050s B1	2080s B1	2030s A2	2050s A2	2080s A2
Relative Change in								
	flow		12%	6%	18%	16%	11%	15%
	Water demand		43%	58%	66%	36%	51%	66%
	Water supply		37%	49%	55%	32%	43%	55%
	Supply deficit		228%	317%	409%	142%	240%	363%
Relative supply deficit		3%	7%	8%	10%	7%	8%	10%
Elasticity deficit/demand			5.29	5.48	6.22	3.97	4.75	5.51
Elasticity deficit/runoff			19.78	49.27	23.25	8.77	22.41	24.35
Elasticity supply/demand			0.86	0.85	0.83	0.89	0.86	0.83
Elasticity supply/runoff			3.21	7.68	3.10	1.96	4.05	3.67

Fig. 2.

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