

An Integrated Model for Water Resources Planning and Management of the Transboundary Saskatchewan River Basin, Canada



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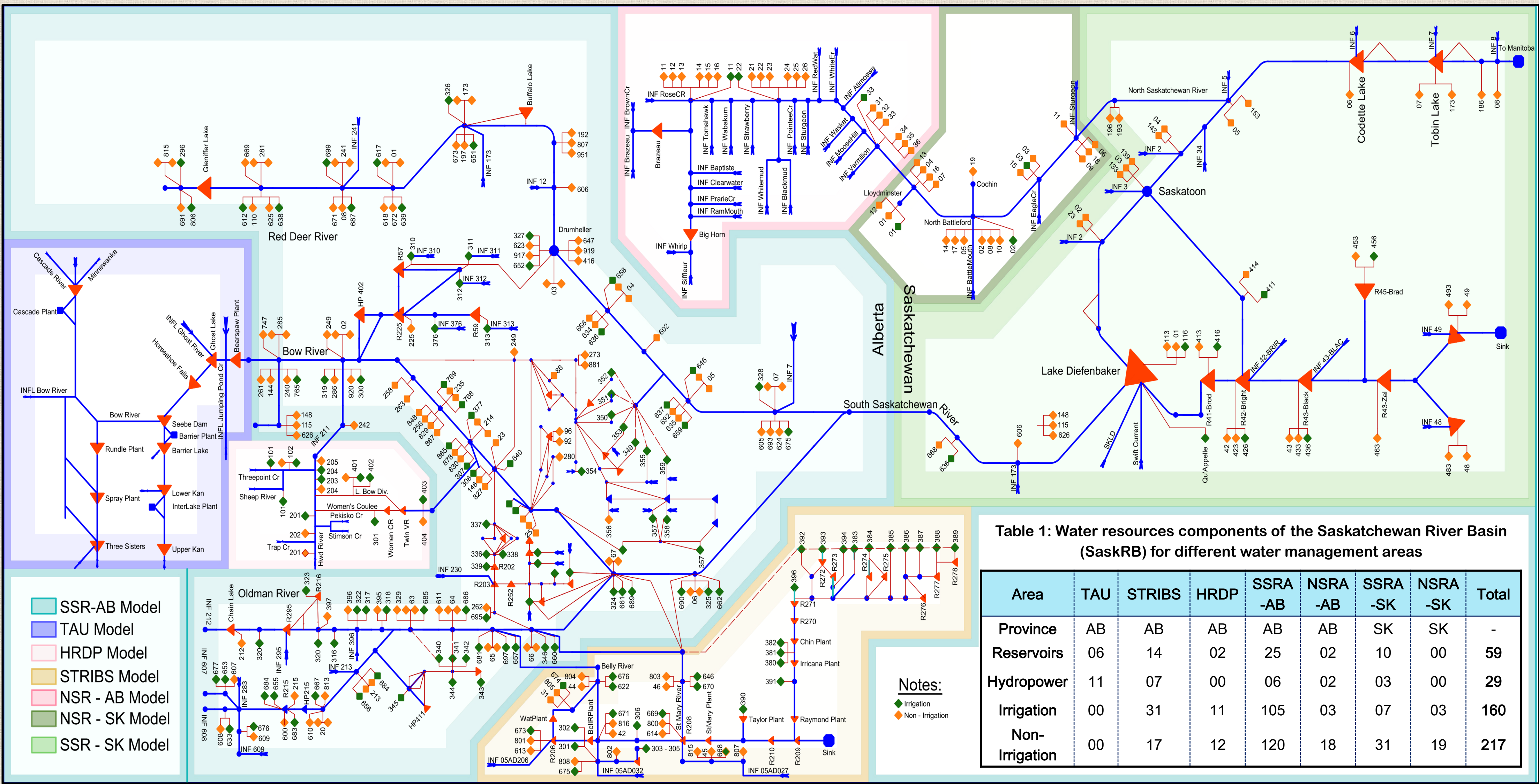
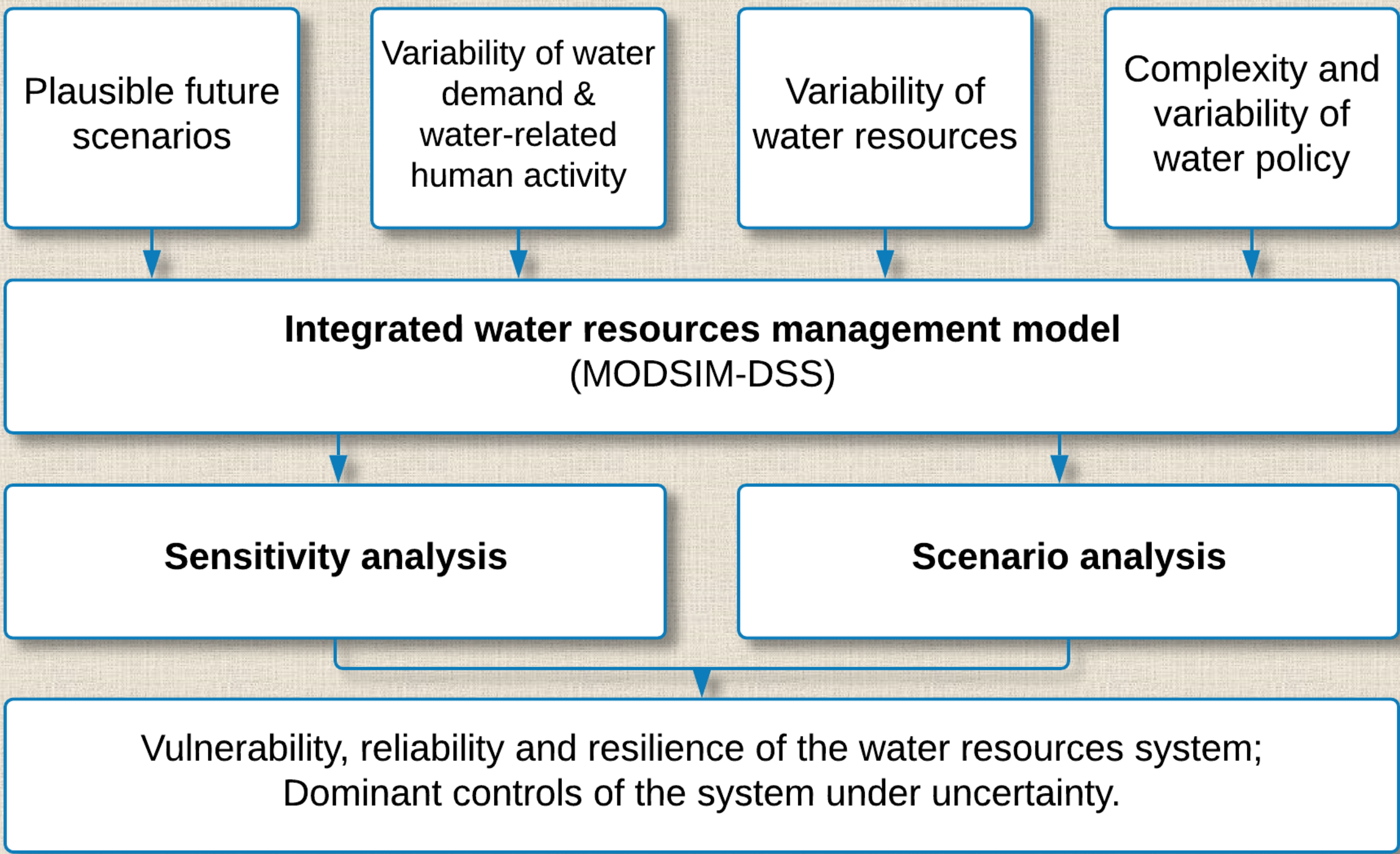
CHALLENGES

- Fragmented water management of transboundary water resources.
- Complex operating policy and a large number of water resources components (59 reservoirs and 29 hydropower plants).
- Data sharing privacy and lack of transparency in existing models.
- Future uncertainties: climate change, population and economic growth.

RESEARCH OBJECTIVES

- Integrating the components across the entire Saskatchewan River Basin into a single platform.
- Assessment of the robustness of the water system under a wide variety of plausible future conditions.

MATERIALS AND METHOD

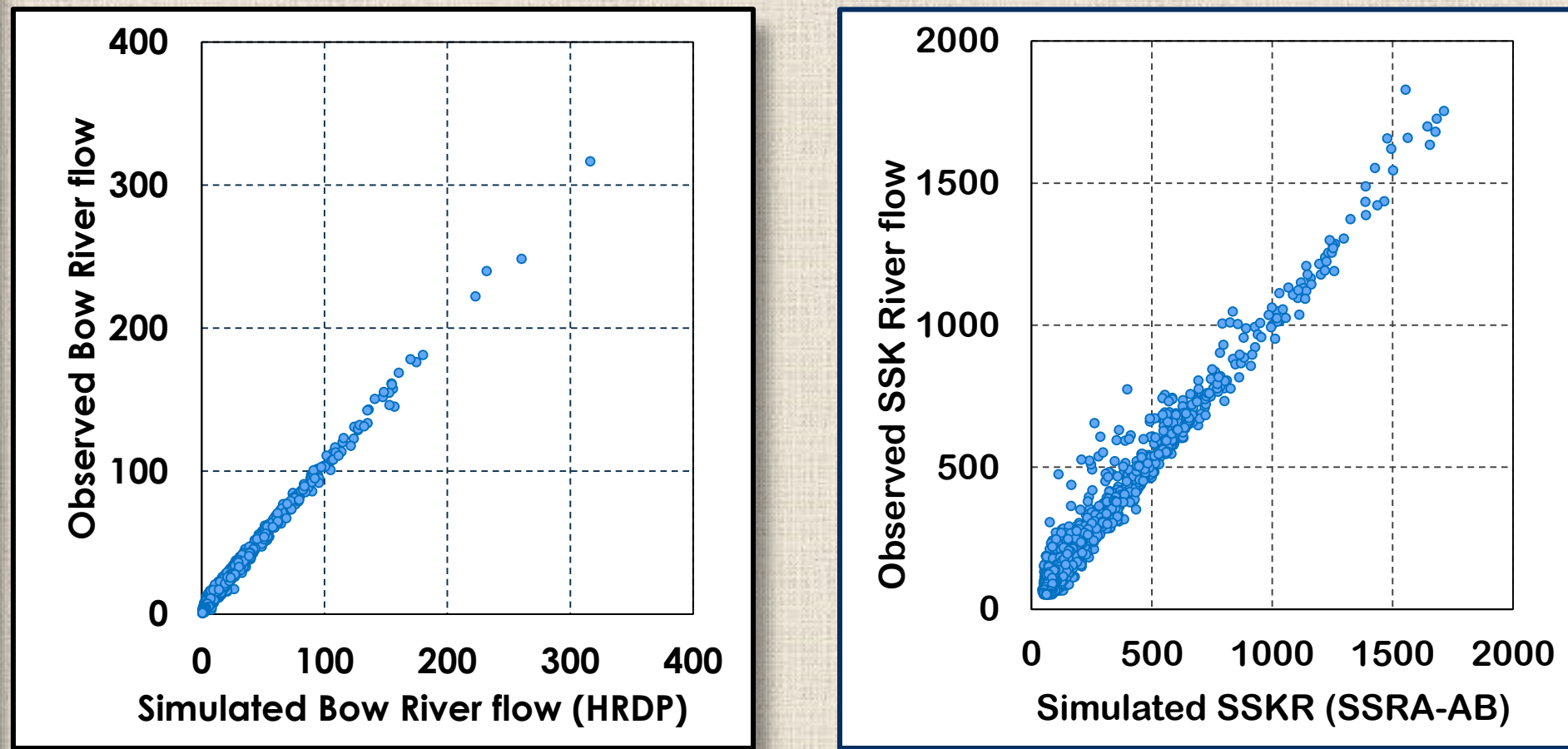


Area	TAU	STRIBS	HRDP	SSRA -AB	NSRA -AB	SSRA -SK	NSRA -SK	Total
Province	AB	AB	AB	AB	AB	SK	SK	-
Reservoirs	06	14	02	25	02	10	00	59
Hydropower	11	07	00	06	02	03	00	29
Irrigation	00	31	11	105	03	07	03	160
Non-Irrigation	00	17	12	120	18	31	19	217

Table 2: Mass balance analysis of the integrated model

#	Category	SSRB - AB	NSR	SSRA - SK
1	Total Inflow	297.09*	258.33	546.31
2	Total Outflow	194.49	249.45	507.49
3	Total Supply	106.68	10.39	30.41
4	Reservoir storage gain/loss	-0.15	0.01	0.03
5	Total reservoir evaporation	9.26	0.64	13.71
6	Total reservoir precipitation	2.74	0.39	2.09
7	Total return flow	11.44	1.82	3.39
8	Total available water	311.12	260.55	551.82
9	Total utilized water	310.44	260.47	551.61
10	Difference	0.68	0.08	0.21
11	% Error	0.21%	0.029%	0.038%
12	% Passed to downstream	63%	96%	92%

* Values are in m³/s, computed by averaging data from 1928 – 2018



SCENARIO DEVELOPMENT AND ANALYSIS

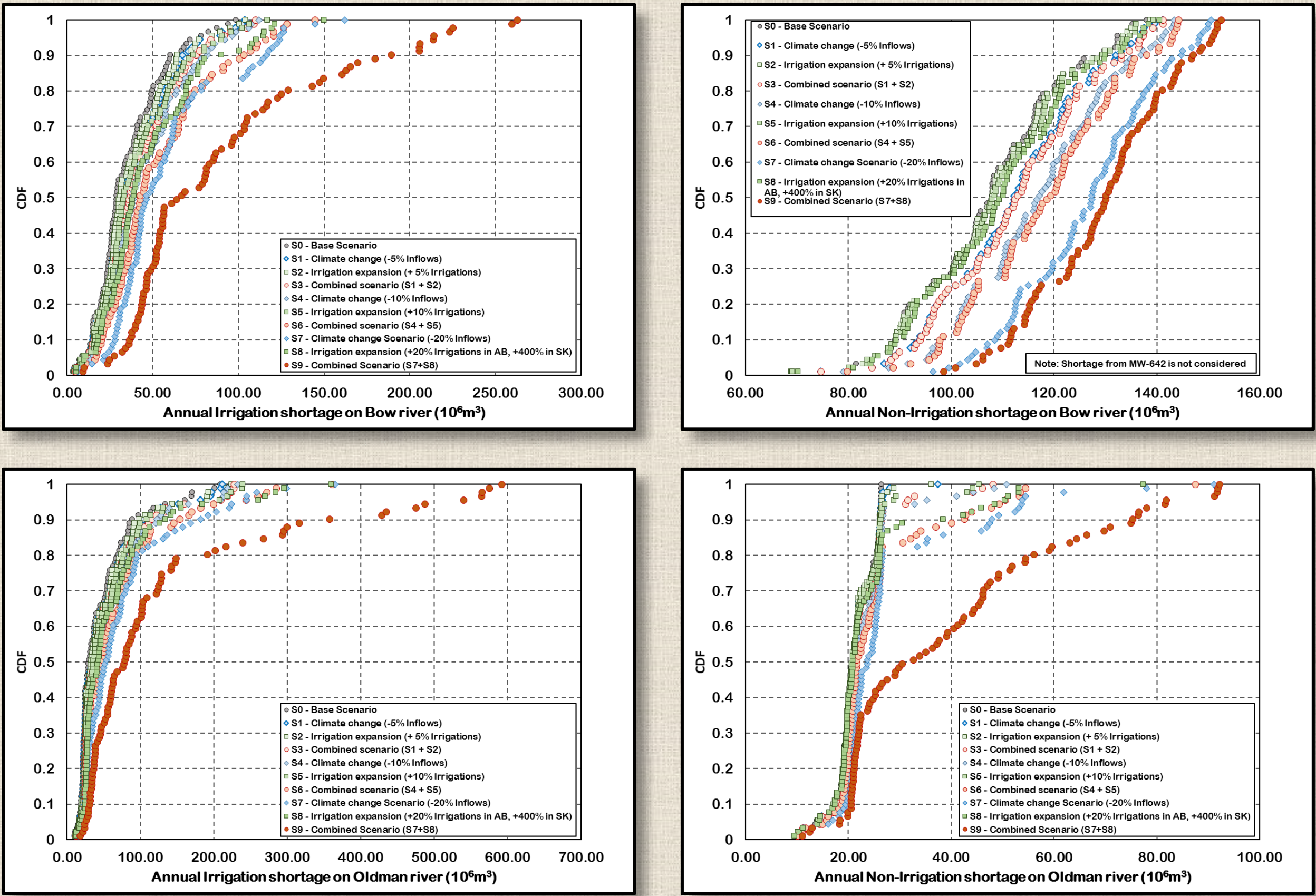


Figure 4: Shortage frequency curves on Bow and Oldman Rivers

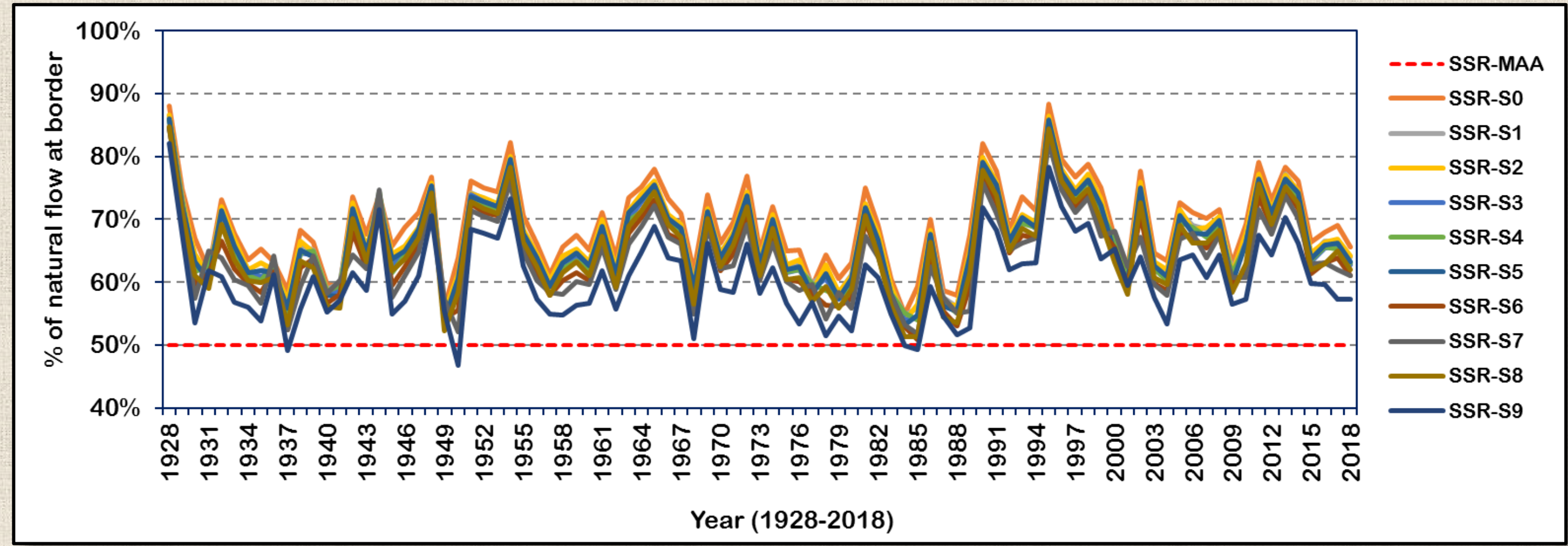


Figure 5: Percentage of apportionable flow delivered to Saskatchewan

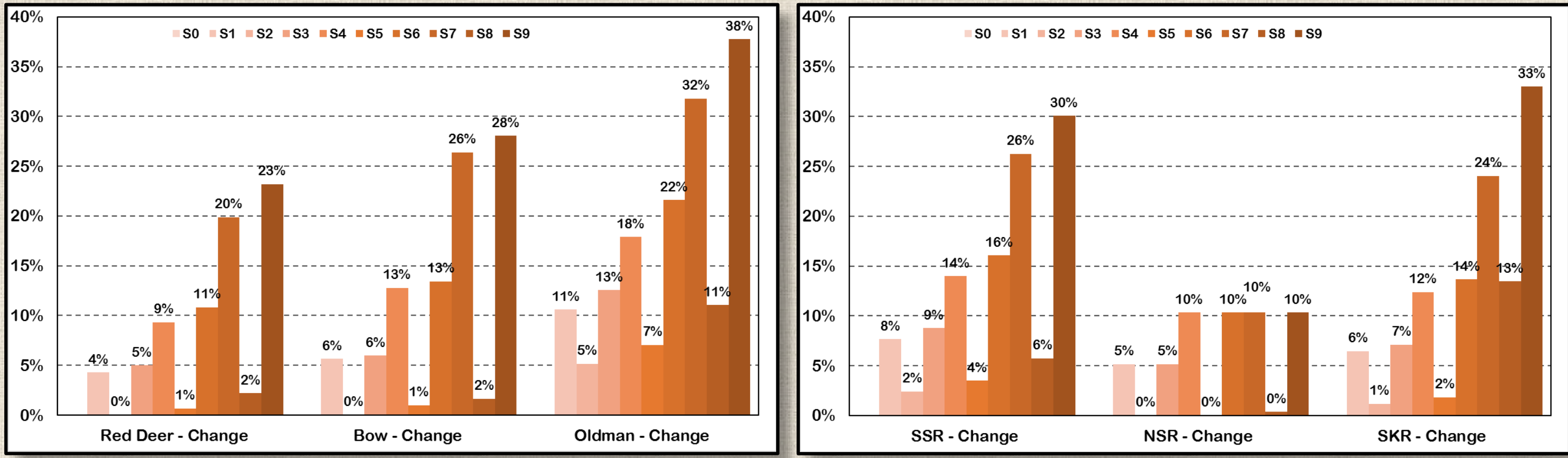


Figure 3: Percentage of changes in flow over the SSRB rivers

CONCLUSIONS

- A total of seven water allocation sub-models were developed and validated for the entire SaskRB.
- MODSIM customization option was used to obtain an integrated model for the SaskRB by running the sub-models in sequence from upstream to downstream.
- The integrated model, when completed, will provide a platform for sensitivity and scenario analysis of demand and supply, and economic evaluation of water management policy.

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