

Application of semi-distributed hydrological model to simulate the lake volumes of small closed lakes in the Northern Kazakhstan

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The aim of this study was to simulate lake volumes for two small closed lakes in Northern Kazakhstan (Ulken Shabakty and Burabay), by applying the reservoir function of a semi-distributed hydrological model, ArcSWAT. Previous studies on these lakes showed that their steady long-term water storage decline was mainly due to a natural water balance deficit, with evaporation (from the lakes and catchments) exceeding precipitation^{1,2,3}. To obtain a deeper understanding of this complex lake system, we studied the catchments by applying the hydrological model.

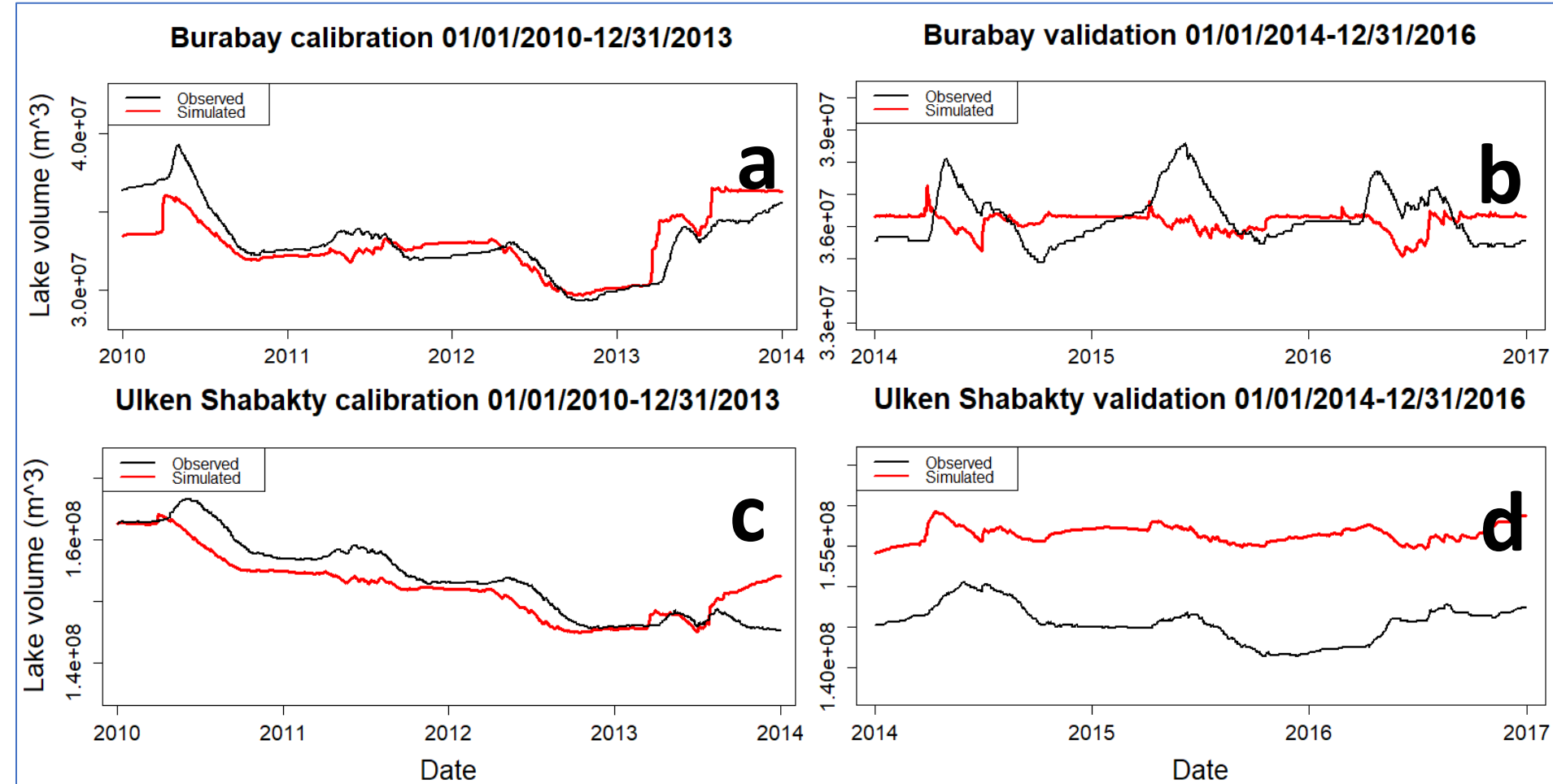
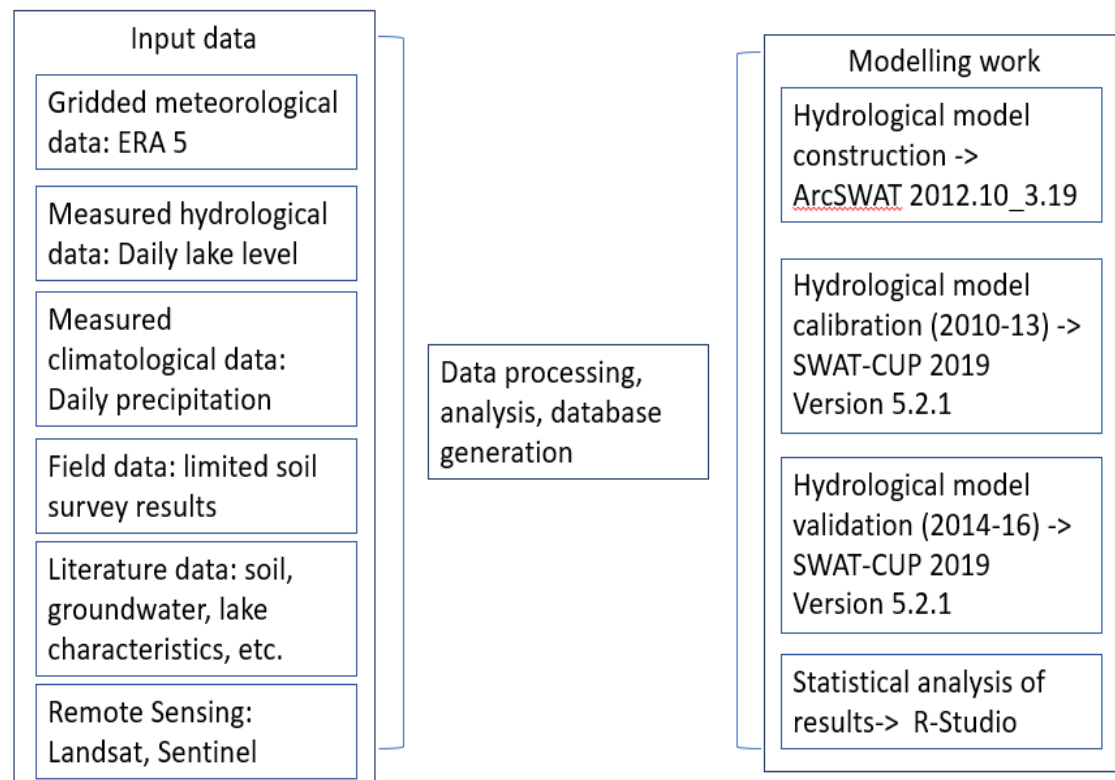
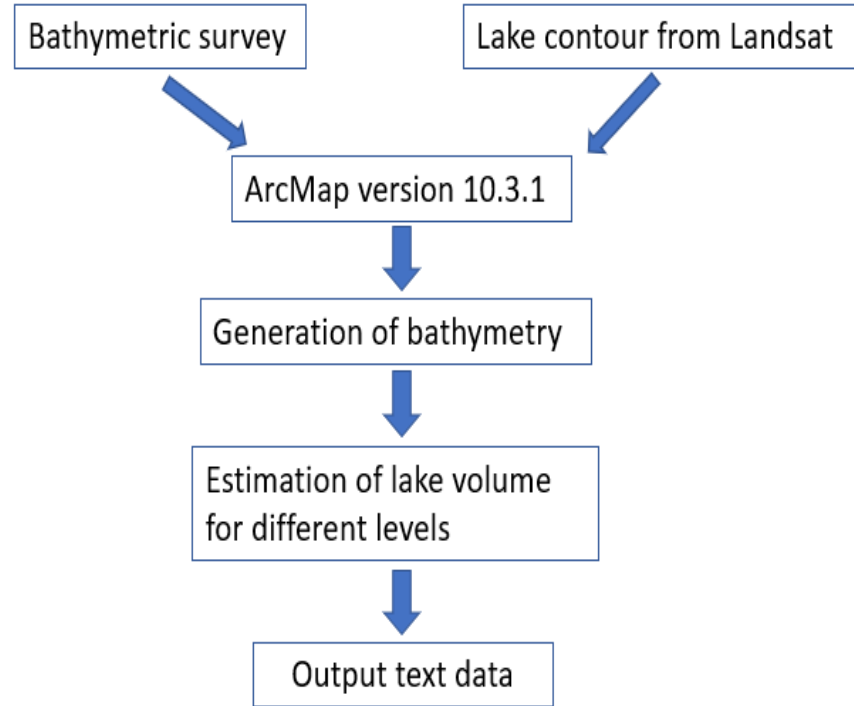
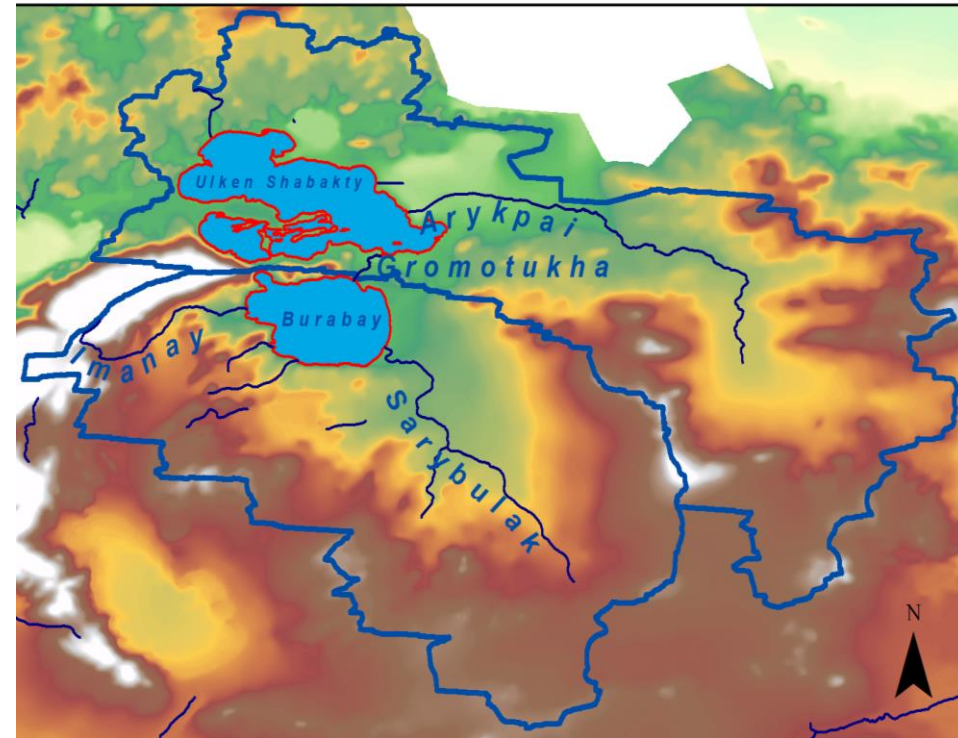


Figure 1. Results of model calibration and validation

Table 1. Results of model calibration and validation

Lake name	Calibration			Validation		
	NSE	KGE	PBIAS	NSE	KGE	PBIAS
Ulken Shabakty	0.71	0.77	-0.9	-23.94	0.12	7.6
Burabay	0.57	0.73	-0.4	-0.35	-0.35	-0.3

Conclusions

- 1) Though calibration results were satisfactory, during validation the model performance decreased, especially for Ulken Shabakty Lake (Figure 1d).
- 2) Simplified representation of groundwater in ArcSWAT may not be suitable for such a heterogeneous and complex hydrologic system.
- 3) In addition, the DEM resolution (10 m) used in the model did not allow correct representation of all contributing areas in the Ulken Shabakty catchment (large right-hand side portion of catchment) during wet years.

References: ¹Yapiyev et al. (2017), ²Yapiyev et al. (2019), ³Yapiyev et al. (2020),

Acknowledgements

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