

ESTIMATION OF WATER RESOURCES AND SIMULATION OF SALINITY VARIABILITY IN UNGAUGED HULUN LAKE

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Water resource plays an important role in social and economical activity in semi-arid northern China. Hydrological series record is base for wise management of water resources. In ungauged or poorly gauged basins, reconstruction of the hydrology and hydrochemics of basins become a main challenge for hydrologists.

Hulun Lake is located in the plateau in west Hulun Buir league, Inner Mongolia Autonomous Region(48°40'~49°20'N, 116°58'~117°47'E), with total drainage area 33,469 km² and 2342.5 km² water surface area(Xiangcan Jin, 1995). Its climate belongs semi-arid continental monsoon climate belt of middle temperate zone, with 268 mm precipitation and over 1000mm evaporation. There are two main inflow rivers and one spit-swallow outflow river with discontinual small discharge in Hulun Lake. Most of water withdrew from lake is through evaporation (LRCC,1998). There is only 2 hydrological gauges in 2 inflow rivers respectively, no gauge in outflow river, and one gauge in lake, canceled from 1982-1990, supports annual water level and salinity data. It's ungauged area over 19,000 km². On water resources, published authority series data is rarely. For the purpose of water resources and hydrochemics assessment in Hulun Lake, a two-parameters monthly water balance model (Xiong and Guo, 1999) was adopted in this paper to simulate the hydrological process in Hulun Lake firstly. Then a salinity mass balance equation was developed to predict the salinity variation in lake Hulun during past 42-years (1961-2002) based on water balance simulation.

The Penman-Monteith equation (Richard G. Allen et.al,1998), was adopted in the study to estimate the daily potential evaporation in lake using 39-years (1960-1998) daily observed meteorological data in Manzhouli gauge, which direct distance to Hulun Lake is about 30 km. Monthly runoff was estimated from dividing zone based on Thiessen Polygone method, water balance and salinity in lake was simulated sequentially.

42-years (1961-2002) water balance in Hulun Lake shows, there are 22 years, about 52.3% of total years, with positive water balance. The average annual total inflow water is $23.79 \times 10^8 \text{ m}^3$, in which the precipitation water is $5.76 \times 10^8 \text{ m}^3$ (24.2%), the inflow water from gauged river is $12.07 \times 10^8 \text{ m}^3$ (50.7%), the inflow water from ungauged catchment is $5.96 \times 10^8 \text{ m}^3$ (25.1%). The average annual total withdraw water is $24.76 \times 10^8 \text{ m}^3$, in which evaporation water is $23.32 \times 10^8 \text{ m}^3$ (94.2%), the outflow from Xinkai river is $1.44 \times 10^8 \text{ m}^3$ (5.8%). The decrease rate of lake capacity is $0.97 \times 10^8 \text{ m}^3/\text{year}$ from 1961 to 2002.

The simulated water level was compared with observed three kinds of water level in Fig.1. It shows the variation tendency is close to observed data. The simulated water level located near wholly between the maximum and minimum observed water level before 1981, and is very close to annual mean data after 1991. The simulated salinity was compared well with observed data. The salinity fluctuation is of opposed tendency to the

variation of water level, when water level is lower, the salinity is higher, in reverse, water level higher, the salinity lower. Comparison of simulated and observed data on salinity and water level in five years lists in table 1. It shows simulated data is very close to the observed data, either tendency and amount is reliable and reasonable.

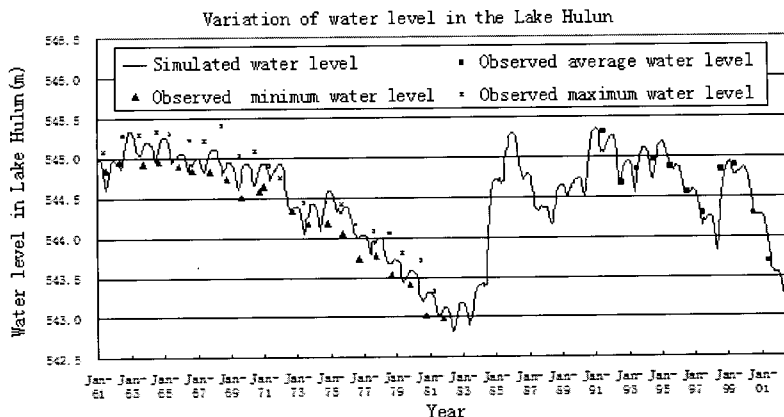


Fig. 1 Variation of water level during 1961-2002 in Hulun Lake.

Table 2. Comparison of simulated and observed data on salinity and water level

Item Year	Annual mean water level (m)		Average capacity of the lake (10^8m^3)		Salinity (mg/l)	
	Observed	Simulated	Observed	Simulated	Observed	Simulated
1963	545.07	545.17	132.91	134.9	990	934.1
1974	544.28	544.37	114.65	117.1	> 1000	977.6
1981	543.15	543.15	90.26	90.7	1261	1285.7
1985	----	544.88	----	128.5	1055	950.6
2002	543.29	543.28	93.17	93.5	1300	1302.1

In sum, the approach developed in the study, can reconstruct the hydrological series effectively in Hunlun Lake. 42-years hydrological and salinity monthly series are reliable, become the solid base for wise management water resources in Lake Hulun.

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