A PRELIMINARY WATER BALANCE FOR ZHALONG WETLAND,NORTHEASTERN CHINA

DAQING LIU [1] and SHIGUO XU [2]

[1] Dr. School of Civil and Hydraulic Engineering, Dalian University of Technology,
2 Linggong, Ganjingzi, Dalian, 116023, China
(Tel: +86-411-84707680, Fax: +86-411-84707680, e-mail: dqliu@student.dlut.edu.cn)
[2] Professor, School of Civil and Hydraulic Engineering ,
Dalian University of Technology ,
2 Linggong, Ganjingzi, Dalian, 116023, China
(Tel: +86-411-84707680, Fax: +86-411-84707680, e-mail: sgxu@dlut.edu.cn)

Hydrology is widely recognized as one of the primary controlling forces in wetlands (Beth Middleton,1999). Wetland classifications, functional assessments, and restoration plans increasingly require knowledge of the sources, amounts and timing of water entering and leaving a wetland (Hollands,1987;Brinson,1993).Unfortunately, because of the complex nature of the wetland/watershed relationship, there is still a great deal of uncertainty over the hydrologic balance and hydrologic functions of different types of wetlands (Carter,1986).In China, most of the existing hydrologic studies of wetlands have been conducted in Xianghai wetland(Zhang et al.,2003)and Sanjiang Plain wetland(Cui,1994), however, studies on the hydrological system in Zhalong wetland(a reed marsh) are not sufficient .

This paper estimates the water balance in Zhalong Wetland, which is a reed marsh in the northeast of China. Due to data constraints, the study is limited to the calendar year period 1956-2000.

The Zhalong Nature Reserve (hereafter ZNR), 47°12'N 124°12'E, alt 140-146m, located 26 km east of Qiqihar City in the west of Heilongjiang Province, China, is a floodplain wetland of 210,000 ha in area situated on the floodplain of the Nen River, The terrain of the site is typical of this area of northeast China, with its mixture of rivers and lakes. There are large numbers of wintering waterbirds, including several endangered species. The climate is continental with an annual mean temperature of about 3°C with strong difference between summer and winter (up 35°C),mean annual rainfall is 418.7mm $year^{-1}$(1956-2000),The evaporation value of 729.6mm reveals an annual water deficit of more than 300mm.

The study used a mass balance to characterize discharge through the study area. The mass balance equation can be described as:

$Q_{ds}=Q_{us}+Q_{rf}+Q_{dw}+Q_{lr}+P-E-ET-Q_{if}-\Delta S_a$

Human activities, such as the discharge regulation by Dongsheng Reservoir and diverting water from Nen River to the wetland, do affect the wetland hydrology systeme, however, those effects have not taken into account in this paper because the lack of the relate data, so water balance of the wetland with his nature condition have been analyzed in this paper, that is to assume that $Q_{dw}=Q_{lr}=0$.

The water balance in zhalong wetland is estimated for period 1956-2000.Table 1 show the water balance of Zhalong wetlad, it can be see that the water storage of Zhalong

wetland had a trend of decreasing by an average of 59.9×10^6m3 per year.The average water inputs into Zhalong wetland were as follows: 61.5% from precipitation, 34.5% from upstream inflow, and 4% from upland runoff. The average water outputs from Zhalong wetland consisted of 74.4% form Evapotranspiration, 14.5% form estimated seepage , and 11.1% form downsteram outflow. The change trend of water storage in Zhalong wetland is show in Fig.3,the water storage was decreased form 1956 to 1980,and increased after then till 1990, and then, a decreased trend is followed till 2000.

Table 1.water balance of Zhalong wetland in the period 1956-2000

Year	Precipitation		Upstream Discharge (10^6m^3)	Local Runoff (10^6m^3)	Evapotranspiration		Infiltration		Downstream Discharge (10^6m^3)	Change in storage (10^6m^3)
	Depth (mm)	Volume (10^6m^3)			Depth (mm)	Volume (10^6m^3)	Depth (mm)	Volume (10^6m^3)		
1956~1960	460.6	801.4	668.0	41.4	578.8	982.5	100	174	298.1	15.8
1961~1970	429.5	747.3	450.5	24.8	514.0	942.8	100	174	143.0	-86.8
1971~1980	350.3	609.5	229.3	0.4	433.1	843.2	100	174	7.6	-236.7
1981~1990	465.6	810.1	472.5	41.8	508.2	895.4	100	174	145.5	67.7
1991~2000	408.5	710.8	457.8	16.6	478.5	847.4	100	174	153.7	-30.2
Average	418.7	728.5	432.0	23.2	491.7	891.2	100	174	133.1	-59.9
Percen (%)	61.5		34.5	4.0	74.4		14.5		11.1	5.0

Water is the dormant item for the wetland, and a sound hydrological water cycle is necessary to sustain a wetland by itself, The result give an information that the water storage in zhalong wetland is gradually deduced. In order to improve hydrological water cycle and to restore many functions of zhalong wetland, some measures can be considered. 1) improving Dongsheng Reservoir to enhance flood discharge to zhalong wetland.2)introducing Nen River floodwater to zhalong wetland.

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