The Integrated Use of Ground and Surface Water in Coastal Water-Absence Irrigation Region

Gao Yufang^{1, 2,*}. Chen Yaodeng³

¹Institute of Heavy Rain, CMA, Wuhan

² Department of Applied Meteorology, Nanjing Information Science & Technology University

^{3.} The Atmospheric Science College, Nanjing Information Science & Technology University *Tel: 18951997015 E-mail: gaoyf@nuist.edu.cn Addresses: College of Applied Meteorogy,219 Ningliu Roda, Nanjing,China Zip code:210044

Simulation and optimization methods of integrated use of ground and surface water have been used widely to determine operating strategies for regional water supplies. But in the studies of the integrated use of ground and surface water in coastal irrigation regions absent the investigation of ground water dynamic movement aroused by human and natural activities. So introducing the investigation of ground water dynamic simulation model into the integrated use of ground and surface water system in coastal irrigation regions is signification to the research of the integrated use of ground and surface water and sustaining development of irrigation in coastal irrigation regions. A coupled model, which can provide a method of the integrated use of ground and surface water with avoiding or controlling seawater intrusion, is developed to determine optimal water allocation policies for hydraulically connected time variant surface and ground water supplies in a hypothetical system. Coupling operation between sub-models can make the best use of the existent information and resources, and insure the share among parameters and validation each other, as a consequence, which increases the precision and efficiency of the integrated use of ground and surface water in coastal irrigation regions.

The main objectives of this paper are to(1) develop a coupled simulation-optimization model for ground and surface water supplies by considering ground water dynamic movement; (2) apply the coupled model in Weihai irrigation demonstration region. The coupled model, maximizing economy net benefit and involving three decision variables: growing area of crops, allocation policies of ground water and of surface water in each sub-regions, is composed with two sub-models. Seawater intrusion is a common water-resources management problem in coastal irrigation regions. So one sub-model is ground water dynamic simulation model which is calculated by numerical simulation and can simulate ground water table with recharge and pump to avoid or control seawater intrusion, and another sub-model is optimization model of water demand allocation of crops which is calculated by the method of system analysis combined with development programming and can optimizes water demand allocation of crops. Use VB6.0 to program for the coupled model. The coupled model is used in water saving irrigation region, Weihai city, Shandong province, to demonstrate the effectiveness and robustness of the management model. The results are reasonable and feasible.

Key words: seawater intrusion, ground water, surface water, integrated use model

References

- Ji chun Wu,Fanhai Meng, and Xiaowen Wang.The development and control of the seawater intrusion in the eastern coastal of Laizhou Bay,China.Environ Geol.54:1763-1770(2005)
- [2] Cheng,A.H.D.,Halhai,D.,Naji,A.and Ouazar,D. Pumping oprimisation in saltwater intruded coastal aquifers.Water resources research.36(8):2155-2165(2000)
- [3] S.V.N.RAO,B.S. Thandaveswara, S.Murty bhallamudi et.al. Planning groundwater Development in coastal deltas with paleo channels. Water Resources Management. 19:625-639(2005)
- [4] R.Rejani,Madan K.Jha,and Sudhindra N.Panda. Simlaton-Optimization modeling for sustainable groundwater management in a coastal basin of Orissa,India.Water Resour Manage.23:235-263(2009)
- [5] ZHANG BAOxiang, W.F.Geiger, S.Kaden. et al. Overall-effective measures for sustainable water resources management in the coastal areas of Shandong province, China. Journal of Ocean university of china. 11:339-344.(2006)
- [6] Christian D., Langevin and Weixing Guo. MODFLOW/MT3DMS-Based simulation of Vsriable-Density ground water flow and transport. Ground water.44(3):339-351(2006)
- [7] Bakker, M., G.H.P.Oude Essink, and C.D.Langevin. The rotating movement of three immiscible fluids-Abenchmark problem. Journal of Hydrology. 287:270-278(2004)
- [8] Ying Yufei, Zheng Xianxin, Wu Liang. Sustainable utilization water resources and environment coastal region of china[J]. Techniques and equipment for enviro.poll.cont. 6: 131-139. (1999)
- [9] Du Wentang. Discussions on the integrated use of surface and ground water. Geotichnical investigation and surveying.2:8-12 (2000)
- [10] Cui Yali.et.al Relation of transform between surface water and ground water in Manasi river valley[J].Hydrogeology and engineering geology. 2 : 9-11. (2001)
- [11] Du Wentang; Zhang Zhongyong. Research on conjunctive planning model of ground water and surface water in Sganjiang watershed[J].Journal of liaoning technical university(natural science edition). 4 : 156-158. (2004)
- [12] M.N. Azaiez M.Hariga, A single-period model for conjunctive use of ground and surface water under sever overdrafts and water deficit[J]. European Journal of Operational Research.133:653-666. (2001)
- [13] Xu Feng; Hong Wei; Zhou Houxing.(2003)The domain decomposition algorithm for three-dimensional complex problems [J]. Journal of electronics and information technology.8:1114-1119.