

Analysis of variation and relation of climate, hydrology and water quality in the lower Mekong River

Hanh P.T.M., Anh N.V., Ba D.T., Sthiannopkao S., Kim K.-W.

Center for Marine Environment Survey, Research and Consultation (CMESRC), Institute of Mechanics, 264 Doi Can Street, Hanoi, Viet Nam; Institute of Environmental Science and Engineering (IESE), Hanoi University of Civil Engineering (HUCE), 55 Giai Phong Road, Hanoi, Viet Nam; Hanoi University of Engineering and Technology (UET), Vietnam National University, Hanoi, Viet Nam; International Environmental Research Center (IERC), Gwangju Institute of Science and Technology (GIST), South Korea; Department of Environmental Science and Engineering, Gwangju Institute of Science and Technology (GIST), South Korea

Abstract: In order to determine the influence of climate and hydrology on water quality of the lower Mekong River, the long term monitoring data (from 1985 to 2004) of climatic, hydrological and water quality variables were analyzed. In general, water quality was 'good' or 'very good' for most of the investigated water quality parameters including DO, pH, conductivity, nitrate, phosphate and total phosphorus. All climatic and hydrological elements as well as most of the water quality parameters varied seasonally. Throughout the 18-year period, only evaporation, water level and TSS showed a significant pertinent trend. ARIMA models results reveal that among climatic and hydrological parameters, water quality could be effectively predicted from the data of discharge flow and precipitation. The results showed good R^2 (0.7) estimation between predicted and observed values for TSS, alkalinity and conductivity which are the chemically and biologically conservative parameters. For other water quality parameters such as Ca^{2+} , Mg^{2+} , Si, Cl^- , NO_3^- , and SO_4^{2-} , the predicting results by ARIMA model were reliable in shorter period than the above three mentioned variables. ?? IWA Publishing 2010.

Author Keywords: ARIMA; Climate; Hydrology; Lower mekong river; Water quality

Index Keywords: Analysis of variations; ARIMA; ARIMA models; Climate; Discharge flow; Long term monitoring; Mekong River; Total phosphorus; Water quality parameters; Alkalinity; Hydrology; Phosphorus; Rivers; Water levels; Water pollution; Water quality; calcium ion; magnesium ion; nitrate; phosphate; phosphorus; river water; silicon; sulfate; surface water; climate variation; dissolved oxygen; hydraulic conductivity; hydrological modeling; nitrate; pH; phosphate; phosphorus; water quality; alkalinity; article; chemical analysis; climate; concentration (parameters); conductance; environmental monitoring; evaporation; flow rate; pH; precipitation; prediction; river; surface water hydrology; water quality; Mekong River

Year: 2010

Source title: Water Science and Technology

Volume: 62

Issue: 7

Page : 1587-1594

Link: Scopus Link

Chemicals/CAS: calcium ion, 14127-61-8; magnesium ion, 22537-22-0; nitrate, 14797-55-8; phosphate, 14066-19-4, 14265-44-2; phosphorus, 7723-14-0; silicon, 7440-21-3; sulfate, 14808-79-8

Correspondence Address: Sthiannopkao, S.; International Environmental Research Center (IERC), Gwangju Institute of Science and Technology (GIST) South Korea; email: suthi@gist.ac.kr

ISSN: 2731223

CODEN: WSTED

DOI: 10.2166/wst.2010.449

Language of Original Document: English

Abbreviated Source Title: Water Science and Technology

Document Type: Article

Source: Scopus

Authors with affiliations:

1. Hanh, P.T.M., Center for Marine Environment Survey, Research and Consultation (CMESRC), Institute of Mechanics, 264 Doi Can Street, Hanoi, Viet Nam
2. Anh, N.V., Institute of Environmental Science and Engineering (IESE), Hanoi University of Civil Engineering (HUCE), 55 Giai Phong Road, Hanoi, Viet Nam
3. Ba, D.T., Hanoi University of Engineering and Technology (UET), Vietnam National University, Hanoi, Viet Nam
4. Sthiannopkao, S., International Environmental Research Center (IERC), Gwangju Institute of Science and Technology (GIST), South Korea
5. Kim, K.-W., Department of Environmental Science and Engineering, Gwangju Institute of Science and Technology (GIST), South Korea

References:

1. Ahmad, S., Khan, I.H., Parida, B.P., Performance of stochastic approaches for forecasting river water quality (2001) *Water Res.*, 35 (18), pp. 4261-4266
2. Berner, E.K., Berner, R.A., (1996) *Global Environment. Water, Air and Geochemical Cycles*, , Prentice Hall, Upper Saddle River, NJ
3. Box, G.E.P., Jenkins, G.M., (1976) *Time Series Analysis Forecasting and Control*, , Holden-Day, San Francisco
4. Dai, A., Trenberth, K.E., Estimates of freshwater discharge from continents: Latitudinal and seasonal variations (2002) *J. Hydrometeorology*, 3 (6), pp. 660-687
5. Georgakarakos, S., Koutsoubas, D., Valavanis, V., Time series analysis and forecasting techniques applied on loliginid and ommastrephid landings in Greek waters (2006) *Fish. Res.*, 78, pp. 55-71
6. Ho, S.L., Xie, M., Goh, T.N., A comparative study of neural network and Box-Jenkins ARIMA modeling in time series predictions (2002) *Comput. Ind. Eng.*, 42, pp. 371-375
7. Interlandi, S.J., Crockett, S.C., Recent water quality in the Schuylkill river, Pennsylvania, USA: A preliminary assessment of the relative influences of climate, river discharge and suburban development (2003) *Water Res.*, 37, pp. 1737-1748
8. Jacobs, J.W., Adjusting to climate change in the lower Mekong (1996) *Glob. Environ. Change*, 6 (1), pp. 7-22
9. Kurunc, A., Yurekli, K., Cevik, O., Performance of two stochastic approaches for forecasting water quality and streamflow data from Yeşilirmak River, Turkey (2005) *Environ. Model. Softw.*, 20, pp. 1195-1200
10. Lehmann, A., Rode, M., Long-term behavior and cross-correlation water quality analysis of the river Elbe, Germany (2001) *Water Res.*, 35 (9), pp. 2153-2160

11. Lunchakorn, P., Suthipong, S., Kim, K.W., The relationship of climatic and hydrological parameters to surface water quality in the lower Mekong River (2008) *Environ. Int.*, 34, pp. 860-866
12. Morgan, G.A., Leech, N.L., Gloeckner, G.W., Barrett, K.C., (2007) *SPSS for Introductory Statistics: Use and Interpretation*, , 3rd edition. LEA publishers, London
13. (2003) *State of the Basin Report. Executive Summary 2003*, , MRC (Mekong River Commission) ISSN 1728:3248
14. (2005) *Overview of the Hydrology of the Mekong Basin*, , MRC (Mekong River Commission) ISSN: 1728 3248
15. (2007) *MRC Technical Paper No. 15 Diagnostic Study of Water Quality in the Lower Mekong Basin*, , MRC (Mekong River Commission) ISSN: 1683-1489
16. ??jendal, J., Torell, E., (1997) *The Mighty Mekong Mystery*, , Swedish international development cooperation agency, Sida, Department of natural resources and the environment
17. Ott, L., (1988) *An Introduction to Statistical Methods and Data Analysis*, , 3rd edition. PWS-Kent Publishing Company, Boston
18. Schlesinger, W.H., (1997) *Biogeochemistry*, , Academic Press, San Diego
19. Syst??me d'??valuation de la qualit?? de l'eau des cours d'eau. (River quality assessment system in France) (1999) *SEQ System, Water-SEQ*, p. 59. , *SEQ-Eau Presentation of the (version 1)*, French inter-agences studies group No. 64
20. Smit, B., Ludlow, L., Brklacich, M., *Implications of a global climatic warming for agriculture: A review and appraisal* (1988) *J. Environ. Qual.*, 17 (4), pp. 519-527
21. (2005) *SPSS Trends? 14.0*, , SPSS Inc
22. Wei, W.W.S., (1990) *Time Series Analysis*, , Addition-Wesley Publishing Company Inc, New York
23. White, I., *Water management in the Mekong delta: Changes, conflicts and opportunities* (2002) *International Hydrological Programme*, (61). , UNESCO. Technical Documents in Hydrology