Geophysical Research Abstracts, Vol. 9, 10893, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-10893

Spatial optimization of water quality monitoring networks

C.P. Cetinkaya, **N.B. Harmancioglu**

Dokuz Eylul University Water Resources Management Center (SUMER)

Tinaztepe Campus, Buca 35160 Izmir, Turkey

nilgun.harmancioglu@deu.edu.tr / Fax: +90 232-4531192 / Phone: +90 232-4127246

Spatial orientation of sampling sites is the initial and the most crucial step of the water quality monitoring network design and redesign process. Several different approaches have been used within the last 20-30 years in the selection of sampling sites to best represent water quality conditions in the space domain. Review of these investigations and practices shows that the establishment of a multi-site monitoring network is still a controversial issue requiring further research.

The basic problem with multi-site monitoring is the realization of representative sampling. This means to select the sampling points in such a way that the river reach investigated and the sub-basins that contribute to these reaches are the best represented by these sites. If this approach can be realized, then the variability of water quality along the reach may be assessed for management and control purposes. Yet, there are no standard design procedures to accomplish such a network. Often, one has to refer to subjective judgments and assumptions in making his selection of sampling sites. However, there are some scientific methods which may help to minimize the subjective aspects of design, or which may, at least, provide guidelines for an effective design procedure. Currently, none of these methods seem to be widely accepted. They require further investigations to be justified for use in practice.

This paper examines the application of an optimization method that can be used to assess an existing water quality monitoring for information transfer at spatial scales, i.e., among its sampling sites. The method uses dynamic programming to evaluate the reduction of the number of sampling sites in a basin with respect to different monitor-

ing objectives. The methodology is demonstrated in the case of the Gediz River basin in Turkey.

The optimization methodology employed here comprises the use of dynamic programming for systematic consolidation of a fixed station water quality monitoring network. The case study presented here expands on a previous work by Lettenmaier *et al*. (1984) by generating alternative monitoring scenarios with respect to different management objectives. As such, the methodology is used here as an assessment and redesign technique, which foresees effective transfer of information among sites. Another feature of the investigation is that GIS methods are used to delineate the spatial coverage of the monitoring sites.

Water quality in the Gediz River has been observed by DSI at a number of sites since 1980. These observations started at 6 locations and were increased to 33 by 1993. After 1993, DSI reduced the number of sampling sites to 14. The application presented here covers an assessment of alternative combinations of monitoring sites when a total of 14 stations are to be retained in the network.

With respect to the application of the methodology to Gediz River basin, the following general considerations are made: **(a)** alternative stations are obtained for the case of 14 stations to be retained in the network. Selection of the most appropriate one requires two issues to be accomplished: (1) relevant costs of each alternative solution must be analyzed; (2) the monitoring agency has to delineate its own specific objectives for monitoring and then select the solution that best suits these objectives; **(b)** if the monitoring agency prefers to expand the existing network, the results of the study can be used to select the locations of new stations. The methodology further shows which station(s) must be selected when one wants to retain different numbers of stations in the network.