



## **Turbidity dynamics of the karst spring Ombla (Croatia)**

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Hydrogeological characteristics of the karst are complex and significantly different from the characteristics of granular media. Underground structures of pores, fissures, fractures and conduits of various size and forms with significant spatial and temporal variability and discontinuity of hydraulic and geometric parameters create complex hydrogeological conditions for groundwater flow. Karst aquifers are important fresh water resources but are frequently contaminated by turbidity because of the presence of various degrees of karstified limestone with highly transmissive conduits. Many analyses have shown that the period of turbidity represents the period of increased water pollution with bacteria.

The present study presents the Ombla spring karstic system (Dubrovnik, Croatia). The Ombla Spring is located at an elevation of 2.5 m above sea-level and the river immediately flows into the Adriatic Sea. The water from the Ombla Spring is used for the water supply for the city of Dubrovnik. The precipitation regime is changeable. The average annual rainfall measured in Dubrovnik was 1220 mm. At Vukovići raingauge station, 7 km away, it amounted to 1800 mm and at the Hum raingauge station, 12.5 km from Dubrovnik it reached 2100 mm.

The method applied is based essentially on time series analysis which has wide application in hydrogeological system analysis. A simple analysis gave a definition of the pattern signals of three types of records: rainfall, discharge rate and turbidity. Cross-correlation and spectral analysis were made between rainfall and discharge rates that were considered to be input signal and turbidity values which were considered to be the output signal. Both the simple and cross-analysis were made taking into account time and frequency domain.

Analyzing turbidity as additional output signal parameter and parallel analysis of two responses reveals additional valuable information about the karst spring functioning. Turbidity of water in the Ombla karst springs is relatively common after sudden heavy precipitation. It begins with the arrival of water waves, peaking at the same time as peak discharge, and decreases as flow starts to wane. In some cases, turbidity levels are so high that for a short time, water becomes non-potable. This phenomenon must be taken into account by water treatment stations.