

RESPON AKUIFER KARST BERDASARKAN *TIME SERIES ANALYSIS* DI MATAAIR KALISIRAH DAN MATAAIR JUMBLENG, KAWASAN KARST GOMBONG SELATAN, JAWA TENGAH

INTISARI

Sistem akuifer karst akan memberikan respon terhadap hujan. Analisis *time series* merupakan salah satu metode yang dapat digunakan untuk mengkarakterisasi akuifer karst dengan menggunakan data hujan dan debit. Penelitian ini dilakukan di Mataair Kalisirah dan Mataair Jumbleng yang berada di Kawasan Karst Gombang Selatan atau Karst Karangbolong. Tujuan dari penelitian ini yaitu : (1) Mengetahui karakteristik aliran Mataair Kalisirah dan Mataair Jumbleng dari pelepasan komponen aliran dan (2) Mengetahui perilaku Mataair Kalisirah dan Mataair Jumbleng dalam merespon curah hujan. Data yang digunakan adalah data hujan dan debit dengan interval 15 menit dari bulan November 2018 hingga Maret 2020. Data debit diperoleh dari hasil pencatatan logger TMA otomatis dan data hujan didapatkan dari stasiun hujan otomatis. Perhitungan debit aliran dilakukan berdasarkan hasil konversi perhitungan *rating curve* dari perbandingan TMA dan debit yang diukur langsung. Perhitungan konstanta resesi digunakan untuk analisis pelepasan aliran. Metode analisis *time series* yang digunakan yaitu *cross-correlation*, *auto-correlation*, *phase function*, *spectral density*, *gain function* dan *coherence function*. Semua metode tersebut digunakan untuk mengetahui respon akuifer terhadap hujan berdasarkan durasi pelepasan aliran *conduit*, *fissure*, dan *diffuse*. Hasil perhitungan konstanta resesi di Mataair Kalisirah memiliki nilai $K_c=0,429$, $K_b=0,995$, $K_i=0,890$ serta di Mataair Jumbleng adalah $K_c=0,640$, $K_i=0,838$, dan $K_b=0,996$. Berdasarkan hasil perhitungan konstanta resesi Mataair Kalisirah memiliki pelepasan aliran *conduit* dan *diffuse* yang lebih cepat daripada Mataair Jumbleng, sedangkan pelepasan aliran *fissure* Mataair Kalisirah lebih lambat daripada Mataair Jumbleng. Hasil analisis *time series* berbanding lurus dengan perhitungan konstanta resesi di kedua mataair. Daerah tangkapan air Mataair Kalisirah lebih luas daripada Mataair Jumbleng, akan tetapi respon aliran *conduit* dan *diffuse* Mataair Kalisirah lebih cepat daripada Mataair Jumbleng. Sementara itu, respon aliran *fissure* Mataair Kalisirah lebih lambat daripada Mataair Jumbleng. Hal ini menunjukkan bahwa tingkat perkembangan akuifer karst Mataair Kalisirah lebih berkembang daripada Mataair. Analisis *coherence function* antara debit dengan debit di kedua mataair memiliki nilai yang rendah ($Coxy=0,55$) sehingga kedua Mataair tidak saling terhubung. Hasil *cross-correlation* debit dengan debit kedua mataair memiliki $Tlag$ yang tinggi yaitu sebesar 0,85 atau dengan kata lain kedua akuifer memiliki respon hidrologi yang sama.

Kata Kunci: *analisis time series, akuifer karst, conduit, diffuse, fissure.*

KARST AQUIFER RESPONSE BY TIME SERIES ANALYSIS IN KALISIRAH AND JUMBLENG SPRINGS, GOMBONG SELATAN KARST AREA, CENTRAL JAVA

ABSTRACT

Karst aquifer system will be response to rainfalls. Time series analysis is a method that can be used to characterizes karst aquifers by using rainfall and discharge data. This research was conducted in Kalisirah and Jumbleng Springs which are in the Gombong Selatan Karst Area or Karangbolong Karst. The objectives of this study are : (1) to know characteristics of Kalisirah and Jumbleng Springs based on the release of flow components and (2) to know the behavior of Kalisirah and Jumbleng Springs to response rainfall. The data used are rainfalls and discharge data at 15 minute intervals from November 2018 to March 2020. The discharge data is obtained by installing an automatic water level logger and rainfalls data were obtained by automatic rain stations. The discharge data is obtained from the results of automatic TMA logger recording and rain data is obtained from automatic rain stations. The flow rate calculation is based on the conversion result of the rating curve calculation from the ratio of TMA and the discharge measured directly. The calculation of the recession constant is used for flow discharge analysis. The time series analysis method used is cross-correlation, auto-correlation, phase function, spectral density, gain function and coherence function. All of these methods are used to determine the aquifer response to rain based on the duration of conduit discharge, fissure, and diffuse. The calculation results of the recession constant in Kalisirah Springs have a value of $K_c = 0.429$, $K_b = 0.995$, $K_i = 0.890$ and $K_c = 0.640$, $K_i = 0.838$, and $K_b = 0.996$ in the Jumbleng Spring. Based on the calculation result, the recession constant of the Kalisirah Springs has a faster discharge and diffuse flow than the Jumbleng Springs, while the fissure flow of the Kalisirah Springs is slower than the Jumbleng Springs. The results of time series analysis are directly proportional to the calculation of recession constants in the two springs. The catchment area of Mataair Kalisirah is wider than Mataair Jumbleng, but the conduit and diffuse flow response of Mataair Kalisirah is faster than Mataair Jumbleng. Meanwhile, the response of the Kalisirah Springs fissure was slower than that of the Jumbleng Springs. This shows that the development rate of the Kalisirah karst aquifer is more developed than that of Mataair. The coherence function analysis between discharge and discharge in both springs has a low value ($C_{oxy} = 0.55$) so that the two springs are not connected to each other. The results of the cross-correlation of the discharge with the discharge of the two springs have a high $Tlag$ of 0.85, or in other words, the two aquifers have the same hydrological response.

Keywords: *time series analysis, karst aquifer, conduit, diffuse, fissure*