Karakteristik Spasiotemporal Curah Hujan di Daerah Perkotaan Yogyakarta Sebagai Fungsi Penutup Lahan

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Intisari

Penelitian ini mempunyai tujuan 1) menganalisis sifat curah hujan secara spasial dan temporal di daerah perkotaan Yogyakarta; 2) menganalisis kandungan kimia air hujan yang jatuh di daerah perkotaan Yogyakarta; dan 3) menganalisis hubungan dan pengaruh penutup lahan terhadap curah hujan di daerah perkotaan Yogyakarta.

Metode penelitian menggunakan metode empiris dengan analisis kualitatif dan kuantitatif. Daerah perkotaan Yogyakarta meliputi daerah Kota Yogyakarta hingga wilayah dengan kenampakan morfologi fisik kota. Data yang dianalisis adalah data curah hujan bulanan, musiman, dan tahunan beserta hari hujan dari tahun 1978-2007. Data lain berupa perubahan penggunaan lahan dari beberapa tahun, jumlah penduduk, jumlah kendaraan bermotor, citra TRMM. Pengukuran di lapangan meliputi pengukuran suhu udara dan kelembapan daerah perkotaan Yogyakarta. Analisis yang digunakan adalah statistik deskriptif, analisis variasi, analisis kecenderungan, analisis periodisitas (*wavelet*), korelasi dan regresi. Analisis spasial menggunakan metode *isohyet, inverse distance weighting* (IDW), dan Kriging. Kandungan kimia dalam curah hujan dianalisis menggunakan *Cluster analysis* dan *Factor analysis* untuk mengetahui sumber pencemar dominan dalam curah hujan.

Hasil penelitian menunjukkan 1). curah hujan di musim kemarau lebih bervariasi dibandingkan curah hujan musim penghujan dan curah hujan tahunan, tidak ada stasiun hujan yang memperlihatkan kecenderungan kenaikan dan penurunan yang signifikan. 2) Curah hujan di sekitar daerah perkotaan Yogyakarta dan curah hujan di daerah tujuan angin (*downwind)* lebih tinggi dibandingkan daerah tengah kota, walaupun demikian curah hujan di tengah kota Yogyakarta mulai menunjukkan adanya peningkatan. 3) Curah hujan di daerah perkotaan Yogyakarta mengandung kebasaan yang tinggi. Artinya karbon sangat mempengaruhi curah hujan yang turun di daerah penelitian. 4) Fenomena *Urban Heat Island* yaitu suhu udara yang lebih tinggi dibandingkan daerah sekitarnya dapat diidentifikasi di daerah penelitian. Fenomena tersebut didukung oleh imbangan energi dimana nilai kalor tersimpan sangat tinggi, nilai fluks laten turbulen sangat rendah. Hal ini akan menyebabkan evaporasi menurun dan peningkatan suhu udara. 5). Variabel kepadatan bangunan menunjukkan pengaruh yang sangat besar terhadap curah hujan tahunan, Hal ini ditunjukkan oleh persamaan $Y = 2647{,}076 + 0{,}001x_1 - 14012{,}7x_3 - 7{,}852x_4 - 17{,}511x_5$. Artinya jika kepadatan bangunan berkurang 1 satuan maka curah hujan akan berkurang 14012,7, jika suhu udara berkurang 1 satuan maka curah hujan akan berkurang 7,852 dan jika kelembapan berkurang 1 satuan maka curah hujan berkurang 17,511. Nilai korelasi secara umum antara variabel y dengan seluruh variabel bebas (x) ditunjukkan dengan nilai R = 0,710, sedangkan nilai koefisien determinasi (R^2) sebesar 0,504 artinya 50,4% variabel y dapat dijelaskan oleh jumlah bangunan, kepadatan bangunan, suhu udara dan kelembapan udara. Sisanya 49,6% dipengaruhi oleh variabel lain.

Kata kunci : spasiotemporal, penutup lahan, UHI, konvektif, *downwind*

Spatiotemporal Characteristic of Rainfall in the Urban Area of Yogyakarta As Function of Land Cover

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Abstract

This study is aimed to 1) analyze the characteritics of the rainfall both spatially and temporally in the Yogyakarta urban area; 2) analyze the chemical contents of rainfall in the Yogyakarta urban area; and 3) analyze the relationship and the influence of land cover towards rainfall in Yogyakarta urban area.

This research method is based on empirical methods using qualitative and quantitative analysis. The urban area studied in this research covers an area of Yogyakarta municipality and its surrounding area with urban physical morphology. The data used are namely monthly rainfall data, seasonal rainfall data, and annual rainfall data from 1970 to 2007. Other data also used, namely land use changes in recent several years, number of population, number of vehicles, and TRMM satellite rainfall imagery. In addition to the data analysis, field measurements are conducted in research area, including measurements of air temperature and humidity the urban area. The analysis implemented to the data are descriptive statistics, variance analysis, trend analysis, periodicity analysis (wavelet), correlation and regression analysis. Spatial analysis are also implemented by using isohyets, inverse distance weighting (IDW), and Kriging interpolation. Chemical constituents in precipitation are analyzed using Cluster and Factor analysis to determine the dominant source of pollutants in the precipitation water.

The results indicated that 1). the rainfall in dry season has higher variance than the rainfall in rainy season and annual rainfall, no weather stations showing a tendency to increase and decrease significantly. 2) the rainfall in the surrounding of the urban area and the area following the wind direction (downwind) are higher than in the middle of the city, but rainfall in the urban Yogyakarta tend the increasingly. 3) the rainfall in the urban area contain high alkalinity. This means that the carbon greatly affects rainfall in the study area. 4) urban Heat Island (UHI) phenomenon in which air temperature is higher than the surrounding area can be identified in the study area. This phenomenon is generated by the balance of energy in which calor energy are highly stored, the value of latent turbulent flux is very low. This will cause the evaporation to decrease and increase the air temperature as vice versa. 5). the building density variable shows a very large influence on the annual rainfall, as indicated by the following equation: $Y = 2647{,}076 + 0.001x_1 - 14012{,}7x_3 - 7{,}852x_4 - 17{,}511x_5$. This means that if the density of 1 unit of the building is reduced, rainfall will decrease as much as 14012.7, if the air temperature is reduced for 1 unit, the rainfall will decrease as much as 7.852, and if the humidity is decreased for 1 unit, the rainfall will decrease as much as 17.511.

Correlation value between the value of the variable y with all independent variables (x) in general is indicated by the value of R = 0.710, while the value of the coefficient of determination (R-square) is 0.504, means that 50.4% of variable y can be explained by a number of buildings, building density, temperature and humidity. The remaining 49.6% is influenced by other variables.

Keywords: spatiotemporal, land cover, UHI, convective, downwind