

**SIMULASI DAMPAK PERUBAHAN IKLIM TERHADAP DEBIT
PUNCAK DI SUB-DAS MERAWU MENGGUNAKAN MODEL
KONSEPTUAL *HYDROLOGISKA BYRÅNS
VATTENBALANSAVDELNING* (HBV)**

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INTISARI

Sub-DAS Merawu sebagai bagian dari DAS Serayu merupakan salah satu DAS prioritas pemulihan dalam RPJMN 2014-2019. DAS ini sering mengalami erosi lahan yang dipicu oleh curah hujan tinggi akibat perubahan iklim, sehingga menimbulkan adanya aliran permukaan dan peningkatan debit puncak yang menyebabkan banjir. Penelitian ini bertujuan untuk menganalisis dampak perubahan iklim di masa mendatang terhadap debit puncak di Sub-DAS Merawu.

Simulasi dampak perubahan iklim menggunakan pemodelan hidrologi konseptual *Hydrologiska Byråns Vattenbalansavdelning* (HBV) untuk periode *baseline* (2013-2020) serta skenario RCP 4.5 dan RCP 8.5 pada proyeksi *near future* (2025-2045) dan *middle century* (2046-2065). Pemodelan HBV mencakup proses *warm-up* (2013), kalibrasi (2014-2016), dan validasi (2017-2020). Proses kalibrasi menggunakan metode *Monte Carlo* dengan parameter FC, LP, UZL, PERC, beta, k0, k1, k2, dan MAXBAS. Performa model terbaik ditentukan berdasarkan nilai NSE dan R² tertinggi.

Model HBV menunjukkan performa memuaskan dengan nilai R² sebesar 0,637 dan NSE sebesar 0,608. Proyeksi perubahan iklim menunjukkan penurunan curah hujan pada periode *near future* RCP 4.5 (-17,57%) dan RCP 8.5 (-20,77%), *middle century* RCP 4.5 (-27,83%) dan RCP 8.5 (-12,21%); suhu maksimum pada periode *near future* RCP 4.5 (-2,19%) dan RCP 8.5 (-1,67%), *middle century* RCP 4.5 (-0,34%) dan RCP 8.5 (+1,50%); evapotranspirasi pada periode *near future* RCP 4.5 (-16,45%) dan RCP 8.5 (-13,96%), *middle century* RCP 4.5 (-13,93%) dan RCP 8.5 (-9,24%); dan peningkatan suhu minimum pada periode *near future* RCP 4.5 (+6,84%) dan RCP 8.5 (+7,42%), *middle century* RCP 4.5 (+14,93%) dan RCP 8.5 (+10,93%) yang menyebabkan kenaikan rerata debit bulanan sebesar +253% (RCP 4.5) dan +232% (RCP 8.5) pada proyeksi *near future*, serta +283% (RCP 4.5) dan +255% (RCP 8.5) pada proyeksi *middle century*. Model HBV mampu merespon pola curah hujan rendah dan sedang dengan baik, namun mengalami *underestimation* pada curah hujan tinggi. Hasil simulasi debit yang lebih tinggi berisiko meningkatkan debit puncak akibat aliran permukaan dan potensi banjir, terutama pada skenario RCP 4.5 proyeksi *near future* dan RCP 8.5 proyeksi *middle century*.

Kata Kunci: Skenario RCP, *near future*, *middle century*, parameter HBV, aliran permukaan

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QUANTIFYING THE IMPACTS OF CLIMATE CHANGE ON PEAK
DISCHARGE IN THE MERAWU CATCHMENT USING THE
HYDROLOGISKA BYRÅNS VATTENBALANSAVDELNING (HBV)
CONCEPTUAL MODEL

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ABSTRACT

The Merawu sub-watershed as part of the Serayu watershed is a recovery priority in the RPJMN 2014-2019. This sub-watershed often experiences land erosion triggered by high rainfall due to climate change, resulting in increased surface flow and peak discharge that cause flooding. This study aims to analyze the impact of future climate change on peak discharge in Merawu Sub-watershed.

Simulation of climate change impacts was conducted with the Hydrologiska Byråns Vattenbalansavdelning (HBV) conceptual hydrological modelling for the baseline period (2013-2020) and RCP 4.5 and RCP 8.5 scenarios in the near future (2025-2045) and middle century (2046-2065) projections. HBV modelling processes included warm-up (2013), calibration (2014-2016), and validation (2017-2020). The calibration process employed the Monte Carlo method using parameters FC, LP, UZL, PERC, beta, k0, k1, k2, and MAXBAS. The best model performance was determined based on the highest NSE and R² values.

The HBV simulation performed as satisfactory with an R² value of 0.637 and an NSE of 0.608. Climate change projections showed a decrease in rainfall during the near future for RCP 4.5 (-17.57%) and RCP 8.5 (-20.77%) and during the middle century for RCP 4.5 (-27.83%) and RCP 8.5 (-12.21%); maximum temperature during the near future for RCP 4.5 (-2.19%) and RCP 8.6 (-1.67%) and during the middle century for RCP 4.5 (-0.34%) and RCP 8.5 (+1.50%); evapotranspiration during the near future for RCP 4.5 (-16.45%) and RCP 8.5 (-13.96%) during the middle century for RCP 4.5 (-13.93%) and RCP 8.5 (-9.24%); increase in minimum temperature during the near future for RCP 4.5 (+6.84%) and RCP 8.6 (+7.42%) and during the middle century for RCP 4.5 (+14.93%) and RCP 8.5 (+10.93%), that led to an increase of monthly discharge by +253% (RCP 4.5) and +232% (RCP 8.5) in the near future projection, +283% (RCP 4.5) and +255% (RCP 8.5) in the middle-century projection. The HBV model effectively captured low to moderate rainfall patterns but underestimated high rainfall events. The higher simulated discharges pose a risk of increasing peak discharges due to surface runoff and potential flooding, particularly in the near future RCP 4.5 scenario and middle-century RCP 8.5 scenario.

Keywords: RCP scenarios, near future, middle century, HBV parameters, surface flow

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