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# Thermal behavior of the high-energy PDCs associated with the 2010 Merapi eruption

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Temperature is one of the main parameters of pyroclastic density currents (PDCs) having important implications for hazard assessment. Understanding the thermal behaviour of these complex physical phenomena is crucial for forecasting scenarios for exposed populations. In this work, we investigate the temperature of the high-energy PDCs produced during the explosive outburst at Merapi (Central Java) on 5 November 2010 (Stage 4), the most powerful and devastating event observed at this volcano since 1872, being responsible for more than 200 fatalities and a massive destruction of trees and buildings. We perform optical analyses on charcoal fragments embedded into the turbulent PDCs deposits of stage 4 to determine the emplacement temperature. Samples were collected from 30 localities at varying distances from the vent to analyse the potential temperature drop that might be related to the interaction of PDCs with irregular topography. Results show mean reflectance (Ro%) values between 0.17 and 0.41. These new Ro% data provide minimum temperature of the flow of 240 – 320°C, consistent with previous estimations determined from independent field, engineering, and medical observations published in the literature for this eruption. Charring temperatures show no major differences between proximal and distal deposits, suggesting that PDCs interaction with topography and the effects of air entrainment may not play the main role in the dissipation of particle temperature along the flow path. This also confirms that the PDC temperature dropped very sharply over a very short distance (a few meters) at the very end of the flow runout (9 km from source) when the liftoff cloud formed and the PDC stopped. These temperature data have relevance to constrain the fluid dynamics of PDCs, providing a significant contribution to volcanic hazard mitigation and risk assessment for future eruptions at Merapi and at other dome-forming volcanoes.