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Fluctuating supply and emplacement dynamic of channelized lava flows

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The evolution of lava flows emplaced on Mount Etna (Italy) in September 2004 is examined in detail through the analysis of morphometric measurements of flow units. The growth of the main channelized flow is consistent with a layering of lava blankets which maintains the initial geometry of the channel (although levees are widened and raised), and is here explicitly related to the repeated overflow of lava pulses. A simple analytical model is introduced describing the evolution of the flow level in a channelized flow unit fed by a fluctuating supply. The model, named FLOWPULSE, shows that a fluctuation in the velocity of lava extrusion at the vent triggers the formation of pulses which become increasingly high the farther they are from the vent, and are invariably destined to overflow within a given distance. The FLOWPULSE simulations are in accordance with the observed morphology, characterized by a very flat initial profile followed by a massive increase in flow unit cross-section area between 600 and 700 m downflow. The modeled emplacement dynamics provides also an explanation for the observed substantial "loss" of the original flowing mass with increasing distance from the vent.