Our study uses sulfur dioxide degassing rates (obtained in situ), thermal emission rates (obtained from infrared satellite data), and semi-quantitative flow field observations to evaluate the partitioning of lava between surface flows and tube systems at Kilauea, Hawai‘i, over a decadal time scale. For the period, 2000-2009, we found that the infrared spectral radiance measured by MODIS from the flow field, under clear sky conditions, is controlled by the lava effusion rate and the amount of lava accommodated by the tube system. At Kilauea, the degree of lava tube formation is estimated qualitatively using field observations; we show that the satellite data can be used to estimate the percentage of lava on the surface relative to the total daily amount erupted, which is estimated from sulfur dioxide emission rates. This relationship worked to describe the lava flux in the past, at Kilauea, but breaks down when there is a lack of concurrent clear sky radiance and gas data, or when magma is being stored and degassed prior to eruption. Our observations provide a simple way to monitor the partitioning of Kilauea’s lava supply between surface and tube-fed flows. When surface flows dominate the flow field does most of its lateral expansion. The transition between periods when lava is distributed primarily by surface flows to a regime where tubes dominate is indicative of significant changes in the character of such decadal time scale eruptions at this volcano.