A global morphometric database of composite volcanoes

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Volcano morphologies are the result of the interaction through time of constructive and destructive processes. Although shape and size are basic properties, there is no comprehensive database of volcano morphometry at a global scale. To this end, we have used the near–global SRTM DEM to construct a database of morphometric parameters of ∼750 composite volcanoes included in the Smithsonian Institution Global Volcanism Program database. Thus, our database considers most active and potentially active composite volcanoes of the World. The basal outline of each volcano edifice, a key factor, was defined applying an expressly developed algorithm (NETVOLC) that calculates the outline by minimizing a function based on slope breaks around the edifice. Another code (MORVOLC) then computes a set of morphometric parameters for each edifice. The parameters quantitatively describe edifice size (basal area, AB; basal width, WB; summit width, WS; height, H; volume, V), profile shape (height/basal width ratio, H/WB; summit width/basal width ratio, WS/WB), plan shape (ellipticity index, EI; irregularity index, II), slopes (several slope statistics, SLP) and number of secondary peaks (PK). In addition, ∼100 well defined and large summit craters/calderas were manually delineated and morphometric parameters for these were also extracted (width; depth; volume; elongation; slopes). Considering all volcanoes in the database, most size parameters, the average EI and II, and PK have strong positive asymmetric distributions; H, H/WB and WS/WB have weak positive asymmetric distributions; SLP parameters have symmetric to slightly negative asymmetric distributions. The range, excluding outliers, and median values are: V: 0.2–170, 16 km3; AB: 3–480, 61 km2; WB: 2–36, 8.8 km; WS: 0.2–10, 1.5 km; H: 100–2500, 1020 m; H/WB ratio: 0.01–0.28, 0.12; WS/WB ratio: 0.02–0.62, 0.19; average EI: 1.1–3.4, 1.7; average II: 1.0–2.3, 1.2; average SLP: 3–30, 17°; PK: 0–42, 5. A simple, semi–quantitative classification can be considered consisting of four main types: regular cones, irregular cones, complex edifices and shields. The first three types show a transition of increasing size and complexity, and of decreasing steepness, from regular to irregular cones and to complex edifices. Shields have sizes similar to complex edifices, but are flatter. One–third of shields have large summit craters/calderas, whereas only 10% of the other three types have them. More rigorous quantitative classifications can be obtained by statistical cluster analysis; we present some possible schemes. Correlations between parameters and regional variations are also discussed. We anticipate that the database will be useful for regional comparisons, for quantitative and systematic classifications, and as a tool for studies of associated volcanological processes.