

Volcanic geomorphology of Tambora (Sumbawa island, Indonesia) on the basis of SRTM DEM data

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Tambora volcano (ca. 2700 m a.s.l.), famous for its great 1815 eruption, is located at the western tip of Sanggar Peninsula, Sumbawa. It is characterized by trachybasalts, trachyandesites and tephriphonolites that build up a 30 x 40 km and >1000 km³ large shield-like volcano (Self et al. 1984), inferred to be up to 4,300 m high prior to 1815. The volcano was truncated during the 1815 eruption by a 6 x 7 km wide, 1.2 km deep caldera, revealing pre-eruptive units in the caldera walls (e.g. 1-5 ka tuff layers and <43 ka lava series) and minor features of post-1815 activity on the caldera floor.

In our study we use 30 m-resolution SRTM DEM data to constrain the pre-1815 volcanic geomorphology of the volcano. Representative sections along the volcano flanks show that 1) the volcano shape can be best constrained by exponential and not linear profiles, pointing to an original composite- rather than a shield-like volcano, and 2) the edifice is somewhat elongated in NNW-SSE direction, thus having an elliptical and not circular shape. With these findings, we attempted to construct the palaeo-topography of the volcano by fitting a regular surface onto the existent one using the method of Favalli et al. (2014). Our results show that, when fitting the surface to all topography data of the flanks, the reconstructed summit has an elevation of <3,500 m a.s.l., whereas fitting a regular surface from above (i.e. by enhancing topographic outliers), the original volcano summit has an elevation of ~3,900 m. When assessing the altitude, we need to take into account that prior to 1815 the volcano may not have been a simple cone, but a rather more complex edifice with two peaks and/or perhaps a small caldera, so we prefer an original elevation ~3,700 m. This still makes Tambora one of the highest volcanoes along the Sunda arc, comparable to Semeru or Rinjani.

Interpretation of the SRTM DEM surface also allows other volcano-geomorphic features to be inferred. The relatively undissected, elliptical cone surface of the volcano is disturbed only in the NE, where the flank is cut by a number of prominent valleys sometime with a lobed pattern. These are indicated (but not analysed) in Self et al. (1984) as faults; other features such as old sector collapses and amphitheater-valley dissection can also be envisaged. The other, younger, slightly dissected flanks of the volcano are dotted by some twenty parasitic cones.

References:

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Self, S., Rampino, M.R., Newton, M.S. & Wolff, J.A. (1984). Volcanological study of the great Tambora eruption of 1815. *Geology*, v.12, pp.659–663.