

Manuscript “Tracing the boundaries of Cenozoic volcanic edifices from Sardinia (Italy): a geomorphometric contribution” (Journal: ESurf, Author(s): M.T. Melis et al., MS No.: esurf-2014-13, MS Type: Research Article. Special Issue: Advances in geomorphometry: new technologies, data and software for DEM analysis).

As we had some problems with some referenced page and lines in the referee comments, here we refer to the online pdf file.

Answer to the referee 3: I. Evans

3. 1- In Eq. 8, the factor (1-f) multiplies the product of normalized slope and normalized curvature, so it is just a constant – varying f should have no effect on relative results: please check (you have not varied f...). This differs from the Grosse method, where f varies the weight of normalized slope.

answer: *we agree with this observation; there is an error in the formula 8 and the right is as following:*

$$BDL_{\text{mod}} = (PC_n f) * [S_n (1 - f)]$$

the better results are obtained with $f > 0.5$ and we used 0.7 to compare with the Grosse methodology.

3. 2- Both eq. 5 and eq. 8 – both main methods – will produce different results depending on the area for which max and min are calculated. This must be stated: it is crucial that it should be comparable, between different features to be compared.

answer: *we considered the sub region related to each volcanic edifice and we extracted the minimum and maximum values. I can add a sentence in the text (line 16 p. 367):*

“These values were calculated from a sub-region related to each volcanic edifice, tracing the pixel profile that cuts the landform and extracting the minimum and maximum values for slope and curvature.”

3. 3- P3 lines 17-19 It is not clear why the first approach was unsatisfactory: reword.

answer: *the application of a conservation regulation to the selected landforms imposes to develop a rigorous, objective, reproducible methodology. We think that this algorithm reduces the subjectivity and facilitates their management.*

In order to answer to the needs of legal conservation delimit these areas, a comprehensive morphological, volcanological and morphometrical study was undertaken, proposing a methodology based on the semi-automatic delimitation of the volcanic edifices using a DEM, largely overcoming the subjectivity related to traditional techniques.

3. 4- Section 2.2: is the switch here from ‘volcanic edifice’ to ‘volcanic landform’ deliberate (cf. introduction)?

answer: *we agree with the observation and we modified the text (lines 26, 27, p. 362 and lines 1,2 p. 363) as following:*

“This analysis allowed the identification of volcanic edifices as scoria cones, small shields or domes, and of the related relict forms and products, as craters, necks, dikes, lava flows, debris flow deposits, and coulees. Selection of the volcanic edifices to be studied and delimited was mainly based on this step.”

3. 5- An important point is that when slope is multiplied by curvature, a zero result does NOT just mean ‘horizontal planar’ ; it can mean zero curvature on a steep, straight slope.

answer: *we agree with the sentence and we can change the text as following (line 5 p. 366):*

” The result is a 10-class subdivision, from -5 (strongly sloping and concave areas) to +5 (strongly sloping and convex areas) with zero (horizontal or plain areas)“

3. 6- On page 7, I am not convinced that average gradients (within) are relevant to delimiting features. Are you?

answer: *we agree with the referee comment; in the first step of the study we tried to use these references values for the classification as suggested in the paper by Fornaciai et al. (2012) but the calculated classification was not completely useful for the delimitation and for this reason we applied the methodology proposed by Grosse and then modified.*

3. 7- Figure 4 and 6 strongly suggest the influence of the original contours, on the curvature calculation. If this is not avoidable by better processing of the DEM, it should at least be discussed. How would the maps look if a non-contour-based DEM were used?

answer: *we agree with the observation: we used a contour based DEM because it is the only available DEM for the entire region; we hope to apply the methodology to a DEM extracted from LiDAR data in the next future.*

3. 8- The paper would be improved by a more thorough comparison of the additive and multiplicative methods, e.g. replace the final figure with one showing the two outlines for all the 13 edifices, plus the geological boundaries; scale would have to be larger than Fig.7. Also more explanation of differences between results from the methods (I would give little space to the inferior S/TC method), and a fuller account of how a compromise is reached between morphometric and geological (lithological) boundaries), would make this a stronger paper.. Spell out where manual intervention is still necessary.

answer: *in the manuscript we discussed the differences between the methods for two end-member cases: Mt. Cujaru and Mte Annaru-Poddighe. We think that it will be possible to add, as additional files, the GM and Gmod maps for all the study cases. So it will be more clear the detail and the scale of the final delimitation. At the end of § 5.3 we can add more specifications about the resulted GMod map, as following:*

“In the cases 1, 2, 4, 5, 7 (Fig. 7), the delimitation is mainly based on the results of the GMod algorithm. In these cases, minor deviations from the blu/black boundaries (specifically in the cases 5 and 7) arise considering the circular nature of scoria cones. In the cases 3, 6, 8, 9, 10 and 11, the geology exerts a major control in the delimitation process, as erosion and tectonics deeply modified the original shapes of the cones.”.

We haven't detailed geological maps for all the studied volcanic edifices but we used during the study many geological maps at different scales, photogeological interpretations and field survey.

We have a detailed geological map of M.te Annaru and, as an example, we can substitute the aeral photo in Fig. 6 with the geological map.