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Interactive comment on "Extrusion dynamics of deep-water volcanoes" *by* Qiliang Sun et al.

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Dear Editor Antonella Longo,

We thank for your comments and the positive assessment of our work. The detailed responses to your comments are listed bellows:

Comment 1: pag. 1, line 18 I expect that your investigation is carried out with passive seismic imagine, if so, it would be important to state that, considering the wide range of earthquakes that usually occurs in the region you are investigating. Response 1: The seismic reflection data we use was collected during hydrocarbon exploration using an active source (i.e. an air-gun).

Comment 2: pag. 2, line 34 I think that a general reader would be interested to know the importance to give such attention to submarine eruptions. Just a quick summary of the potentiality of your study. Any implication for hazard? Just to ask. Response 2: Because our study is focused on the 3D structure and growth of deep-water volcanoes, we have decided not to discuss, in too great a detail, the implications for hazards. By omitting this material we keep the abstract concise and to-the-point. However, we agree that briefly mentioning the potential geohazards associated with deep-water volcanoes could be of interest to the general reader. We have therefore added the following sentences (Lines 58-61) to the Introduction: “Without such information on the structure of deep-water volcanoes, we cannot assess how they grow or what hazard they may pose (e.g. tsunamis induced by flank collapse, seabed deformation and instability induced by highly explosive eruptions)”.

Comment 3: pag. 3, line 60 I am curious to know why did you choose these two volcanoes and not other ones. Response 3: Although several volcanoes are imaged in our study area, only two of them are physically isolated (i.e. the others are physically linked because their related lava flow fields merge). We can therefore confidently separate them, calculate the volume of eruptive material contained in their edifices and flanking lava flow fields, and thus calculate the ratio between material in the volcano edifice vs. the lava flow field. To clarify this, we have added: “These two volcanoes are physically isolated and appear to have been fed by independent, sub-volcanic intrusive bodies (i.e. sills; see below); we can thus confidently characterize each individual volcano and its associated lava flows (Fig. 1b).” (Lines 66-68).

Comment 4: pag. 6, line 115-116 Could you please explanate (I am not an expert on the subject) the words\Bin spacing is 25 m". Furthermore, why the interval of interest of frequencies is 0-400 ms two-way time (twt) of ∼40 Hz? Response 4: Bin is a square and comprises two inlines and two crosslines in the 3D seismic reflection data. Here, ‘Bin spacing is 25 m’ means the inline and crossline are 25 m, respectively. To clarify this, we have changed this sentence to: “The inline and crossline spacing are 25 m, respectively” (Line 122). The frequency of the seismic data is lies within a frequency band ranging from a few Hz to a few hundreds of Hz. The dominant frequency is the maximum frequency encountered in a frequency spectrum. The dominant (and peak) frequency typically decrease downwards from the seabed due to attentuation. Therefore, different depths are characterized by different dominant frequency spectrums (and dominant and peak frequencies). In this study, the dominant frequency in the interval of interest (i.e. 0–400 ms two-way time (twt)) is $\sim$40 Hz.

Comment 5: Table 1 Unit of measure should be written as in Table 2. Response 5: We have revised the units of Table 1 to be the same as those in Table 2.

Comment 6: Table 2 How do you justify the computation of diameter from the area assuming it is a circle? Response 6: The boundaries of lava flow apron are irregular and thus we cannot directly measure its diameter. In this study, we directly measured the lengths of the apron's irregular boundaries and calculated an approximate diameter by assuming it was a circle. We think this was the best estimate for estimating the crude diameter of an apron with irregular boundaries.

Comment 7: Fig. 2 (b) In caption D/T, DT, RHOB, and RC are mentioned but not indicated in Fig. 2(b). Response 7: We have added these to Fig. 2a (Lines 704-705).

Comment 8: pag. 8, line 175 For a better understanding, I would replace the \-" with a \:", the same for the other Seismic Facies. Response 8: We have revised this, in addition to those in Lines 181, 184 and 187.

Comment 9: pag. 10, line 206 Put the deg on 15: 15.0° ±3.6°. Response: We have revised this in the text (Line 213).

Comment 10: pag. 11, line 226 Is it possible to assign an error to the ï¡đ14 km2 area? Response 10: It is difficult to assign a precise error to this area estimation because we do not know how much eruptive material is thinner than the vertical resolution of the seismic data, and thus lies outside of the high-amplitude area used to define the lava flow apron. We used '$\sim$' to represent the uncertainty here.

Comment 11: pag. 11, line 234 As for pag. 10, line 206. Response 11: We have revised this in the text (Line 241).

Comment 12: pag. 11, line 239 Every measurement has an error, or is ï¡đ, why the 9.2 km long lava flow channel has been defined without uncertainty? Response 12: The lava flow channel extend beyond the area imaged by the seismic reflection data, and thus is at least 9.2 km long. To clarify this, we have changed this sentence to: “V2 lacks a lava apron, instead being directly flanked by relatively straight, >9.2 km long lava flow channels extending beyond the seismic survey boundary on its south-eastern side (C4-C7) (Fig. 5a)” (Lines 245-247).

Comment 13: pag. 11, line 241 As for pag. 10, line 206. pag. 12, line 245 As for pag. 10, line 206. pag. 15, line 317 As for pag. 10, line 206. pag. 16, line 334 As for pag. 10, line 206. Response 13: We have revised all of these in the text.

Comment 14: pag. 16, line 337 How is lava viscosity of 9-38 Pa computed? Response 14: 9-38 Pa is an estimate of bulk fluid viscosity in the center of the lava flow calculated using the Giordano et al. (2008) melt viscosity model and an approximated MORB melt composition. This calculation assumes that the melt has equilibrium solubility of H_2O at a pressure pertaining to the eruption depth of 2 km (20 MPa) and at temperatures of 1100-1200°C. The purpose of this calculation is to provide a viscosity comparison with an equivalent basaltic lava flow erupted subaerially vs. that erupted in water depths of 2 km.

Comment 15: pag. 16, line 351 Is it \controls" or \control"? Response 15: We have revised the ‘controls’ to ‘control’ in the text (L361).

Comment 16: pag. 17, line 363 It would be interesting to give an estimate of the cooling rate of underwater lavas. If possible. Response 16: The cooling rates of submarine lava flows are highly dependent on their thickness and effusion rate. While we have good volumetric constraints, effusion rates are much harder to determine for whole-scale lava flow cooling rates. There has been prior work by Gregg and Fornari (1998) that looks at the theoretical surficial cooling rate of lava flows. Compositional data of these lava flows would also be required to make informative estimates of cooling rate. It is an interesting area of study that certainly requires more attention but, we argue, outside of the scope of this paper.

Comment 17: pag. 19, line 417 I would rephrase into \can play a critical role in understanding". Response 17: We have rephrase this sentence (Lines 422-424).

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