Dear Referee

we have answered to your suggestions (you can also have a look to the attached new revised paper):

2R: 1- Point 2.2, pg. 8258, line 23. See reference to" cone group complex Nvm". What does Nvm means? I have not been able to read it anywhere else in the manuscript. It is mentioned in Fig.1. Maybe it should be mentioned.

A: Thanks for the suggestion, we have specified where the Nvm means is reported in the text. [e.g. the main cone group complex Nvm as reported in the legend of Fig. 1]

2R: 2.-Point 2.2, pg.8258, line 24. "groundwater is characterized by a multidirectional flow". Is this "multidirectional flow" controlled by the cone morphology of the volcano slope, or to large-scale geological heterogeneities, as geological contacts, faults, gravitational processes that alter the underground geological structure,…? Please, provide a detailed opinion.

A: Thanks for the suggestion, now we have stressed this point in the text also quoting the previous paper (Ghiglieri et al., 2010). [The cone-shaped relief generates a general groundwater radial flow, which locally is influenced by facture densities and porosities of the different hydrogeological units (Ghiglieri et al., 2010).]

2R: 3.- Point 3.1, pg. 8260, line 20-24. The fluoride content is described in this paragraph. I would suggest to add a histogram showing the number of samples per range of fluoride content, i.e., every 5 mg/L. Looking at Table 1, it looks like most of the samples are below 0.3-0.4 meq/L, and that those large values only correspond to very few samples. Since, later on in the paper, fluoride content is related to two major hydrogeological environments, I suggest differentiating them using a stacked vertical bar chart.

Moreover, I see no problem on using meq/L in Table 1, and mg/L in the text, since meq/L unit are useful for plotting hydrochemical relationships, and mg/L are more understandable units for readers.

A: Thanks for the suggestion, we have added the stacked vertical bar chart in the text.

2R: 4.- Point 3.1., pg. 8261, line 5-8. Those lines provide an early conclusion of the paper. As a reader, when I reached this statement I thought: how? I suggest the authors to add something as: "as we will show later on, the presence of bicarbonate and sodium ions …" or similar.

A: We agree and we have added a phrase according to referee suggestion. [As we will show later on, the presence of bicarbonate and sodium ions ~~The positive correlation between the concentration of fluoride with those of bicarbonate and sodium~~ (Figs. 4 and 5)…]

2R: 5.- Point 3.3, pg. 8262, lines 13-28. There are several questions regarding the discussion of isotopic data. Those are.

• The most common GWML is given by dD=10 + 8d18O, however the authors use a similar one (dD= 10.793 + 8.130d18O) in Fig 6. Could they provide the reference for such a line?

A: We agree that the values in the equation of GMWL line were different from those reported by Craig, (1961) now we have changed with the equation adopted by Craig.

- Why waters show dilution by infiltrated rain water? Do isotopes show this? How?

- In line 22, the authors claim that "some groundwater samples (which ones?) show higher 18O and 2H content, and this is thought to reflect stronger influence of evaporation …". Later on, line 26, they state that "those samples (are those the same ones as in line 18?) plot below the LMWL, indicating the importance of evaporation…. Well. Data do not show a trend of samples that move along an evaporation line of appropriate slope that support some evidence. Just a few samples have a smaller d-excess than the rest of the other ones. Moreover, if those were evaporated samples, the original water would show depleted isotopic content, i.e, d18O<-6%o, so from waters recharge at great altitude. Does this make sense? Could we expect evaporation from waters recharged in the volcano summit? Please, contrast this to support, or neglect, potential evaporation processes.

A: We have answered to these observations with new comments in the text [~~The majority of groundwater samples lay between GMWL and LMWL in the isotope diagram (Fig. 6), which implies relatively depleted levels of ^{18}O and ^{2}H, relatively unaffected by evaporation, and readily diluted by the infiltration of rainwater, as can be expected given the high hydraulic conductivity within the Mt. Meru recharge zone.~~

~~Nevertheless, some groundwater samples do show a higher ^{18}O and ^{2}H content (Table 3), and this is thought to reflect a stronger influence of evaporation, along with a slower rate of infiltration or an appreciable return flow of irrigation water (particularly in sediment and lahar formations), as well as some leaching from the rock into the groundwater. At higher altitudes, with only few exceptions, the water had a high ^{2}H content and a moderately depleted stable isotope content (Fig. 7). Here, the groundwater was likely to have been largely recharged via the infiltration of rainwater through fractures, in line with hydrogeologic evidence (Ghiglieri et al., 2010). On the slope and in the lowland area, the waters were characterized by a rather low ^{2}H content, suggesting a longer residence time. Most of these samples plot below the LMWL, indicating the importance of evaporation during recharge, and suggesting pounding effects in less permeable soil horizons. These same samples showed the greatest degree of ^{18}O depletion, and some originated from the Uwiro graben, the main tectonic depression in the area. In the high eastern part of the study area, the groundwater temperature was more elevated, and its stable isotope and ^{2}H contents were both depleted. So here, recharge could have occurred either through rainwater carrying a depleted isotope content, and/or the current meteoric water has been circulating at a deep level, during which time its isotopic content has become altered by isotope exchange with volcanic CO_2.~~

Plot of Fig. 7 shows two major water groups: the first, containing the majority of samples, falls on the local meteoric water line (LMWL) and the second below this line.

Figure 7

The equation related to the first group gives a line (Fig. 8) that basically overlaps that reported by Dettman *et al.* (2005), despite the limited number of samples collected only in the *masika* period.

Figure 8

However, the sample derived from local recharge (2 OLD) differ from groundwater with deep circulation which infiltrate in the Mt. Meru highs; clearly those waters reflect a depletion in δD and $\delta^{18}O$. The most depleted samples (10 OLD, 6 OLD, 26 ENG) also provide the lower values in ^{3}H (Fig. 9).

The second group which shifts below the LMWL (3 OLD, 5 OLD, 3 ENG, 8 ENG, 29 ENG) gives a regression line with different slope (Fig. 8) . Such a slope ranging between 3–6, according to Craig (1961) and Clark and Fritz (1997), is representative of a non-equilibrium evaporation responsible for higher enrichment of ^{18}O with respect of D.

As reported in Fig. 8 these waters, probably came from an original water (10 OLD), that recharge at great altitude and spring up in the Oldonyo Sambu slope, shows a more negative isotopic value of $\delta^{18}O$ (-6.7 ‰) and rather low ^{3}H content suggesting a long residence time (Fig. 9).

In general, on the slope and in the lowland area, the waters were characterized by a rather low ^{3}H content. At higher altitudes, with only few exceptions, the water had a high ^{3}H content (Fig. 9). Here, the groundwater was likely to have been largely recharged via the infiltration of rainwater through fractures, in line with hydrogeologic evidence (Ghiglieri et al., 2010).]

• The LMWL equation been plotted from a previous reference. Why do not estimate a LMWL from your own data? I think however that samples that could represent isotopic processes should not be included. How your LMWL compare with that of Dettman et al 2005?

A: Unfortunately we have only a few sample representative of water which surely did not experienced isotopic processes.

• About Figure 6, please add a legend. I guess that colours may refer to the geological map in Figure 1, but it should be clearly stated.

A: Thanks, we have added the legend.

2R: 6.- Point 4.1, pg. 8264, line 11-13. Correlation shown in Fig 9 seems obvious as it compares the major anions with respect to the sum of the major cations. So a perfect correlation must appear! Nevertheless, it could be interesting comparing de relationship of alkalinity (mainly as HCO3, I guess) with Ca+Mg, and separately, with Na+K, to point out potential geochemical differences of the cation origin.

A: We agree that the perfect correlation is greatly influenced by the sum of major cations. Now we have compared the relationships separately. [as demonstrated by the positive correlation between alkalinity (bicarbonate content) and (Na^+ + K^+) of Fig. 11. On the contrary (Fig. 12) no correlation was observed between alkalinity and alkali earth metals (Ca^{2+} + Mg^{2+}).]

2R: 7.- Point 4.2, pg. 8264, lines 20. Even though I also use the plot in Fig. 10 to look for exchange processes, I have always wondered if the y-axis value (Ca+Mg)-(HCO3+SO4) is meaningful when we deal with igneous rocks, and Ca + Mg derive from hydrolysis of feldspars and plagioclases. The plot obviously works for groundwater data in sedimentary formations; however…it is not obvious to me that it will be adequate for igneous environments. May the authors go through my doubt (in case I was right)?

A: We agree with both reviewers remarks, nevertheless we noted that this graphical approach is common to some several papers (namely those we have quoted below) in evaluating the ionic exchange also in metamorphic and igneous setting (Subramani et al., 2010; Rajmohan and Elango, 2004; Jalali, 2004). Igneous rocks are able to interact with groundwater depending on their porosity and on the amount of mineral phases capable of ionic exchange and/or dissolution. The plot of figure 11 highlight the gain or the lost of cations taking in account the weathering of study area and the related mineral phases their solubility and / or cation exchange capacity. Particularly If cation exchange is a meaningful process, the plot should exhibit a negative slop.

We acknowledge that we did not specify which mineral phases (responsible for the releasing of the plotted ions) are involved in ionic exchange or dissolution. In any case, the geology reported in the text is exhaustive enough. Glass from volcanic ash, lahar with both clay and zeolite all contain the considered ions. Moreover calcium precipitation/dissolution is testified by widespread calcrete. Also magadi crust (see mineral phase of this concretion in table --) is widespread in the area.

2R: 8.- Comments to Figures:

General comment: please, include a full legend in ALL plots!

Figure 2 (pg. 8276). This ternary plots are somehow a simplification of the usual Piper-Hill diagram; nevertheless, the authors plot sodium and potassium separately as they are the major ions. It sounds good. However, could they state it in the text? Why do not put (Ca+Mg) in the third component? There are some equal-signs (=) in the legend that are difficult to understand.

2R:Fig 3 and so on, claim that legend is as in Fig. 3. It should be Fig. 2, however … include a full

legend in ALL plots!

A: Good suggestion! Now we have included legends in all graphs and modified the ternary diagram.

2R:Fig 8.- I would suggest moving the right vertical axis (that of fluoride) to the top of the graph, and have a real Fluoride-Altitude plot in this figure. In that way, you can substitute the label with the fluoride concentration by the sample code.

A: We agree and the plot now has been corrected.

2R:Fig. 12.- Will it be possible to draw the equilibrium line Ca-F in this graph? It will be helpful to indicate fluorite saturation, and support some of your discussion.

A: We agree that the graph is not a cogent piece of supporting for our considerations. We decided to eliminate it, also in consideration that the reported values are relative to waters coming from phonolite aquifers where only glass and feldspars are involved in dissolution. In any case we think that the occurrence of mineral phases acting as Ca-scavengers reduce the possibility of fluorite precipitation