Answers to Reviewer#3,

The paper shows evidence of an increase in soil erosion rates following a change in land use. More specifically, the authors documented erosion rates in areas covered by forests and in areas where the same forests were replaced by vineyards. The erosion rates for the vineyards were approximately five times those documented for the forests.

The work is based on measurements made in two adjacent and similar hillslopes located in the Zarivar Lake watershed, Kurdestan Province, Iran. The authors selected these sites because this area, like many others in the country, was affected by this land-use conversion several years ago.

The sampling campaigns consisted of collecting a number of soil samples for Cs-137, excess Pb-210 and Pu-239,240 analyses. The area was affected by the Chernobyl accident. In this respect, the authors calculated the Cs-137 Chernobyl component using the ratio Cs-137/Pu-239,240 assuming that for bomb fallout this ratio is 38.4 (as suggested by Hodge, 1996). The proportion of the Chernobyl component was estimated to be ca. 50% of the total fallout (including the bomb-derived).

In general, the manuscript is acceptable and can be considered for publication. However, I have some comments about the methods and about some of the statements provided by the authors. These are as follows.

Thank you for your positive feedback and your time and effort to improve this manuscript. Much appreciated.

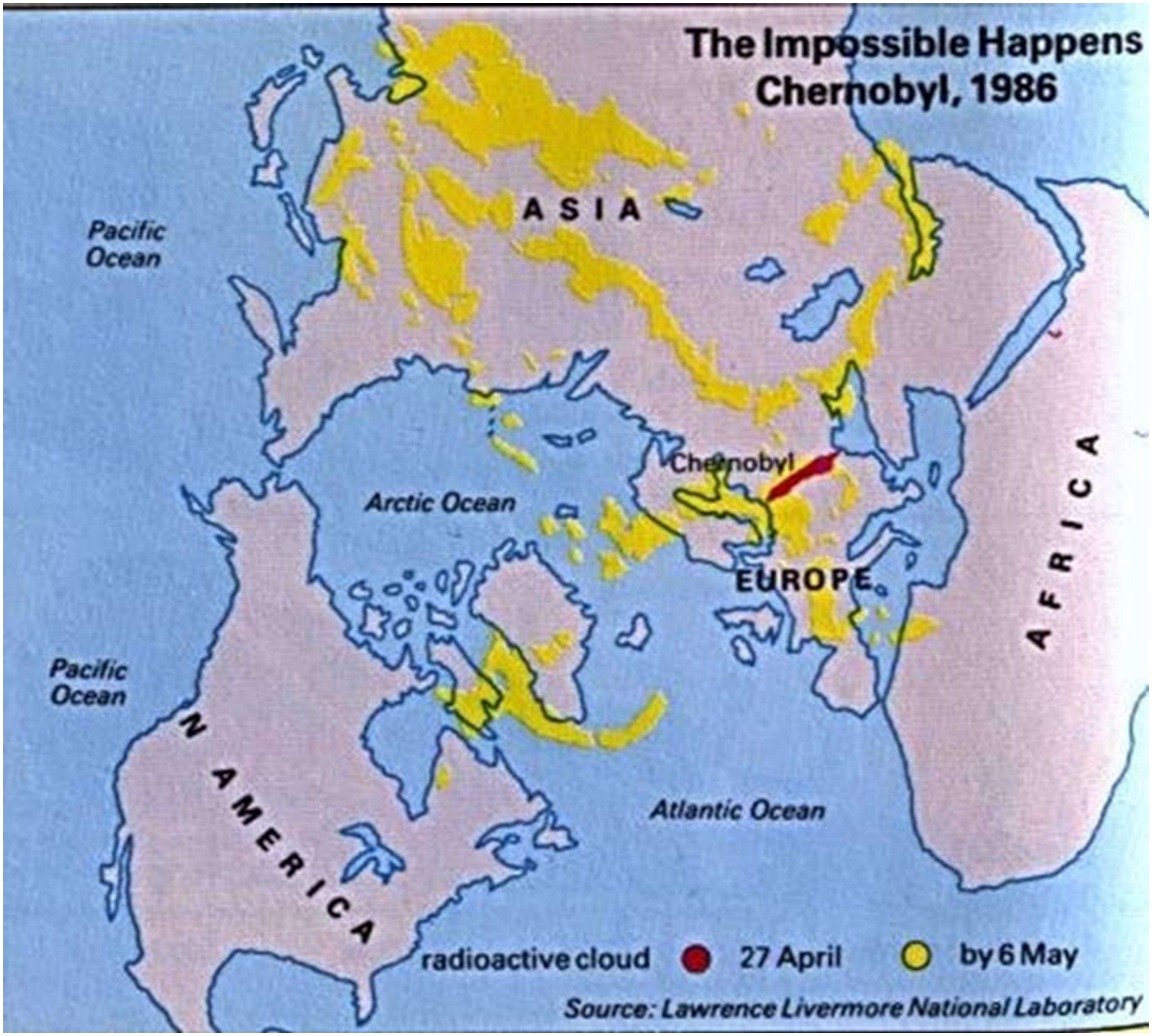
Lines 76-77 - The authors indicated that the global-derived 137Cs fallout ranges between 160 and 3200 Bqm-2 depending on latitude (UNSCEAR, 1969; Garcia Agudo, 1998). Here the authors should say that these two boundary values are referred to 1996 otherwise they need to be decay corrected. Please add some comments.

However, there are many exceptions to the map published by Garcia Agudo because 137Cs fallout is very sensitive to precipitation amount as well. See examples in Canada (Mabit et al., 2002), Spain (Navas et al., 2007; 2017), USA (Arnalds et al., 1989), India (Mishra and Sadasivan, 1972), Italy (Porto et al., 2009) etc. where the fallout basic line was correlated with the rainfall amount. Please consider to add some comments and citations about it.

Our aim here was to highlight the expected range of the global-derived 137Cs fallout at reference sites. As suggested, all mentioned literature was investigated. The 137Cs inventory at reference sites and the decay corrected values (if the year of sampling is not mentioned in the publication, we select the publication date) are summarized in the table below. We could not find any unusually high values except for Spain (Navas et al., 2017), which is a site characterized by high Mean Annual Precipitation (MAP) and Italy (Porto et al., 2009). Please also note that "Fallout 137Cs originating from the Chernobyl accident, which affected many areas in Europe, increased the existing bomb-derived inventories by several orders of magnitude in some locations (Mabit et al., 2008)" (also see map below). Thus, the sentence was corrected as follows:

"Generally, the global pattern of global-derived 137Cs fallout indicates that inputs are distributed between 160 and 3200 Bqm-2 (decay corrected to 1996) depending on latitude (UNSCEAR, 1969; Garcia Agudo, 1998)."

Location (Reference)	**137Cs inventory at reference site (Bq m–2)**	**137Cs inventory at reference site decay corrected to 1996 (Bq m–2)**	**Remarks**
Canada (Mabit et al., 2002)	2650	~3043	
India (Mishra and Sadasivan, 1972).	e.g. 40 (?)	?	The reported 137Cs inventories **are not for reference site**s
USA (Arnalds et al., 1989)	1300-7480	~1100-6360	The reported 137Cs inventories **are not for reference sites**
Spain (Navas et al., 2007)	1710	~2203	Central Ebro valley, Spain (MAP=300-500mm)
Spain (Navas et al., 2017)	4500	~7300	Central Spanish Pyrenees (MAP=800-2000mm)
Italy (Porto et al., 2009)	2805-4682	~ 3786- 6319	Southern Italy (MAP=990-1302 mm)



I found interesting the approach used here to investigate the proportion of the Cs-137 Chernobyl fallout. This is already documented in previous papers but it appears to be an effective, independent, method to identify this component in the absence of direct measurements of Cs-134. In fact, the value of 50% is in line with what is documented in previous papers related to another Iranian province located not far from the study site (see Gharibreza et al., 2021; Vahabi-Moghaddam and Khoshbinfar, 2012). The authors may want to have a look at these papers.

Thank you for these suggestions. The Gharibreza et al. (2021) and Vahabi-Moghaddam and Khoshbinfar (2012) studies were added to Table 1 of the MS (see below) and discussed in the text.

“Although some inventories of the ^{137}Cs in different parts of Iran have not shown unusually high inventories (e.g. Afshar et al., 2010; Ayoubi et al., 2012; Rahimi et al., 2013; Khodadadi et al., 2018), moderately high inventories around 4000 Bq m^{-2} in Northeast of Iran (Gharibreza et al., 2020) and fairly high ones around 4420 (Vahabi-Moghaddam and Khoshbinfar , 2012) and 6180 Bq m^{-2} (Gharibreza et al., 2021) in North of Iran were observed, which were quite compatible with our findings in the Northwest of Iran (Table 1).”

Table 1: 137Cs baseline inventory and mean annual precipitation (MAP) in undisturbed locations in different parts of Iran (all values were decay corrected to 1/10/2016).

Location	Mean Annual Precipitation (mm)	137Cs inventory at reference site (Bq m-2)	Reference
Kouhin, centre of Iran	330	1956 ± 107	Khodadadi et al. (2018)
Aghemam Catchment, North-East of Iran	482	2714	Seyedalipour et al. (2014)
Rimeleh catchment, west of Iran	696	1544	Kalhor (1998); Matinfar et al. (2013)
Chaharmahal and Bakhtiari Province, West-South of Iran	600	1730± 32	Afshar et al. (2010)
Gorgan River watershed, North of Iran	562	2178	Shahoei and Rafahi (1999)
Golestan Province, North of Iran	700-1000	3840-4062	Gharibreza at al. (2020)
	1000	3570 -5270	Vahabi-Moghaddam and Khoshbinfar (2012)
Gilan Province, North of Iran	1209	6180	Gharibreza et al. (2021)
Zarivar lake watershed, North-West of Iran	991	6152±1266	This study

Lines 243-244

The authors mentioned a 137Cs profile obtained in a lake in the vicinity of the study area. They reported the figure in the additional material but the source is not mentioned. Please add a citation for this study.

The authors collected the core within the frame of this study with the aim of confirming whether the site is contaminated with the Chernobyl fallout or not. However, as reviewer# 1 was also confused by this, we deleted this data from the manuscript as it is, in fact, a different story and needs more explanation.

Lines 307-309

The values of K-factor need units. Please add it

The units have been added to the MS.

Lines 384-393

The authors emphasized that the three different FRNs account for diverse time spans. This is correct. They explained that 137Cs, because of the Chernobyl input, is more indicative of what happened after 1986 in terms of soil erosion. Similarly, 210Pb is more sensitive to the erosion rates occurred during the last 2-3 decades. On the contrary, the time frame captured by 239+240Pu has been recorded from mid-1960s onward. Based on these assumptions, the results obtained from 137Cs and 210Pb should be more correlated than the results obtained from 137Cs and 239+240Pu. The information provided in Fig. 7 for the forested hillslopes indicates the opposite i.e. the correlation between 137Cs and 239+240Pu is higher. Can they explain why?

Yes, indeed, thank you for pointing this out. Although diverse time windows related to different FRNs are important, many other factors can give rise to such differences between FRNs' inventories. To begin with, unlike 137Cs and 239+240Pu, the fallout pathway for 210Pbex as a geogenic radionuclide is continuous. Conversion models can account for such non-linear differences between inventory and erosion rate. Another source for the lower R2 might be associated with the measurement uncertainties of 210Pbex. As stated in the MS, the measurement uncertainties of the 210Pbex were far higher than those of 137Cs and 239+240Pu.

Lines 507-508

The authors said that DMM was applied for vineyard. I think it is a mistake because the MBM2 was applied in cultivated areas. Is that correct?

Sorry for this! this was a mistake. As Reviewer# 2 suggested too, we had deleted the sentence.

Lines 511-515

The authors indicated that the change in land use from forest to vineyard resulted in a significant deterioration in soil quality as it was indicated by a significant decline in OM etc. This is in line with what was found by other authors for forest soils subjected to thinning (see Romeo et al., 2020; 2021). In those cases, 137Cs was correlated to the OM in different soil layers. The authors may want to have a look at these papers.

As Reviewer# 2 pointed out we already had too many references, so, we would like to constrain them to the most relevant ones only. So, we decided not to cite those references. Hope you agree.

In Table 3 correct units of K are t ha hr Mj-1 ha-1 mm-1 (the exponent -1 is missing for ha). Please correct it

Thanks, the units were corrected in the MS accordingly.

In Fig. 3b is reported Pu, not Pb as indicated in the caption (see page 35) – Please correct it

Thanks so much, the mistake was corrected in the MS.

References

Arnalds et al. (1989) Cesium-137 in Montana soils. Health Physics Vol. 57, No. 6 (December), pp. 955-958.

Gharibreza et al. (2021). Investigation of onâ 'site implications of tea plantations on soil erosion in Iran using 137Cs method and RUSLE. Environmental Earth Sciences 80:34

Mabit et al. (2002). Quantification of soil redistribution and sediment budget in a Canadian watershed from fallout caesium-137 (137Cs) data. Can. J. Soil. Sci.

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Navas et al. (2007). Variability in 137Cs inventories and potential climatic and lithological controls in the central Ebro valley, Spain. Journal of Radioanalytical and Nuclear Chemistry, Vol. 274, No.2, 331–339.

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Porto et al. (2009). Using caesium-137 and unsupported lead-210 measurements to explore the relationship between sediment mobilisation, sediment delivery and sediment yield for a Calabrian catchment. Marine and Freshwater research, 60: 680-689.

Romeo et al. (2020). Soil biological indicators and caesium-137 to estimate soil erosion in areas with different forest system management. Eur J For Res 139(1):67–81

Romeo, et al. (2021). The relationships between selected soil properties and caesiumâ '137 identify organic carbon, nitrogen and water soluble phenols as indicators of soil erosion processes in different forest stands. J. For. Res.

Vahabi-Moghaddam M, Khoshbinfar S (2012). Vertical migration of 137Cs in the South Caspian soil. Radioprot 47(4):561–573