Dear Editor-in-Chief of ECRS2023 Conference

First of all, on behalf of co-author, I would like to express our appreciations to the Editor-in-Chief and anonymous reviewers for valuable and constructive comments to this manuscript. We believe that these precious suggestions and comments have greatly strengthened our paper. We answer all reviewer comments point by point below. You will find the reviewer comment in **bold** *and our answer in italic letters. We have addressed all the comments as explained below (**Q#: Question**, A#: Answer and highlight: The related revised text of the paper is reported). We have done many efforts to consider all reviewers' comments and suggestions to improve the paper. So I hope this version of paper could be acceptable for the reviewers.*
Please find enclosed the revised version of our paper ().

Thanks again for your help and support,
Best regards,

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20 January 2024
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Response to Reviewer

The manuscript I interesting and in line with the conference topics. However, there are some points that require further clarification:

C1. Firstly, it is too long. The text needs to be streamlined by removing superfluous parts that do not add meaningful information, such as Tables 1 to 4.

R1: *We are grateful to the reviewer for inviting us to clarify this important point. The removal of the following parts from the text was prompted by the opinions of respected reviewers.*

Page 2, Table 1:

Table 1. *Sentinel 1 database*

	Date	
2020/10/20	2020/06/22	2020/02/23
2020/10/08	2020/06/10	2020/02/11
2020/09/26	2020/05/29	2020/01/30
2020/09/14	2020/05/17	2020/01/18
2020/09/02	2020/05/05	2020/01/06
2020/08/21	2020/04/23	2019/12/25
2020/08/09	2020/04/11	2019/12/13
2020/07/28	2020/03/30	2019/12/01
2020/07/16	2020/03/18	2019/11/19
2020/07/04	2020/03/06	2019/11/07

Page 5, Table 2:

Table 2. *Sentinel 2 database*

	Date	
2020/10/18	2020/06/20	2020/02/21
2020/10/08	2020/06/10	2020/02/11
2020/09/28	2020/05/26	2020/02/06

2020/09/13	*2020/05/16*	*2020/01/17*
2020/09/03	*2020/05/06*	*2020/01/02*
2020/08/19	*2020/04/26*	*2019/12/23*
2020/08/09	*2020/04/11*	*2019/12/18*
2020/07/30	*2020/03/27*	*2019/12/03*
2020/07/15	*2020/03/17*	*2019/11/18*
2020/07/05	*2020/03/07*	*2019/11/08*

Page 5, Lines 7-14: *2.2.3. Ground measurement:*

The International Soil Moisture Network is a combined effort of the Global Energy and Water Exchanges Project (GEWEX), the Committee on Earth Observation Satellites (CEOS), the Global Climate Observing System - Terrestrial Observation Panel for Climate (GCOS-TOPC), the Group of Earth Observation (GEO), and the Global Terrestrial Network on Hydrology (GTN-H). The International Soil Moisture Network has been made possible through financial support of the Earth Observation Programmed of the European Space Agency (ESA) and the many voluntary contributions of scientists and networks from around the world.

Table 4. *Specifications of in situ soil moisture measurement stations*

Ground station	***Latitude***	***Longitude***	***Land cover***
Las Arenas	*41° 22'N*	*−5° 33'E*	*Arable land without irrigation*
Paredinas	*41° 27'N*	*−5° 24'E*	*vineyard*
Zamarron	*41° 14'N*	*−5° 32'E*	*Arable land without irrigation*
Las Bodega	*41° 11'N*	*−5° 28'E*	*Forest of trees*
Carretoro	*41° 16'N*	*−5° 22'E*	*Arable land without irrigation*
Granja G	*41° 18'N*	*−5° 22'E*	*Arable land without irrigation*
Las Victorias	*41° 25'N*	*−5° 22'E*	*Arable land without irrigation*
Las Brozas	*41° 26'N*	*−5° 21'E*	*Agricultural areas/Natural vegetation*
El Coto	*41° 22'N*	*−5° 25'E*	*Arable land without irrigation*

Page 5, Table 3:

Table 3. *Soil moisture is measured*

Date	***Avg.***	***Date***	***Avg.***	***Date***	***Avg.***
2019/11/07	*7.41*	*2020/03/06*	*8.88*	*2020/07/04*	*5.13*
2019/11/19	*8.68*	*2020/03/18*	*12.45*	*2020/07/16*	*5.51*
2019/12/01	*13.18*	*2020/03/30*	*6.7*	*2020/07/28*	*4.2*
2019/12/13	*10.68*	*2020/04/11*	*13.06*	*2020/08/09*	*3.59*
2019/12/20	*11.89*	*2020/04/23*	*12.04*	*2020/08/21*	*5.3*
2020/01/06	*10.49*	*2020/05/05*	*6.13*	*2020/09/02*	*3.67*
2020/01/18	*12.75*	*2020/05/17*	*8.03*	*2020/09/14*	*3.41*
2020/01/30	*13.37*	*2020/05/29*	*5.01*	*2020/09/26*	*8.22*
2020/02/11	*10.77*	*2020/06/10*	*7.17*	*2020/10/08*	*6.55*
2020/02/23	*6.82*	*2020/06/22*	*5.71*	*2020/10/20*	*14.72*

Page 6, Table 4:

Page 10, Figure 6:

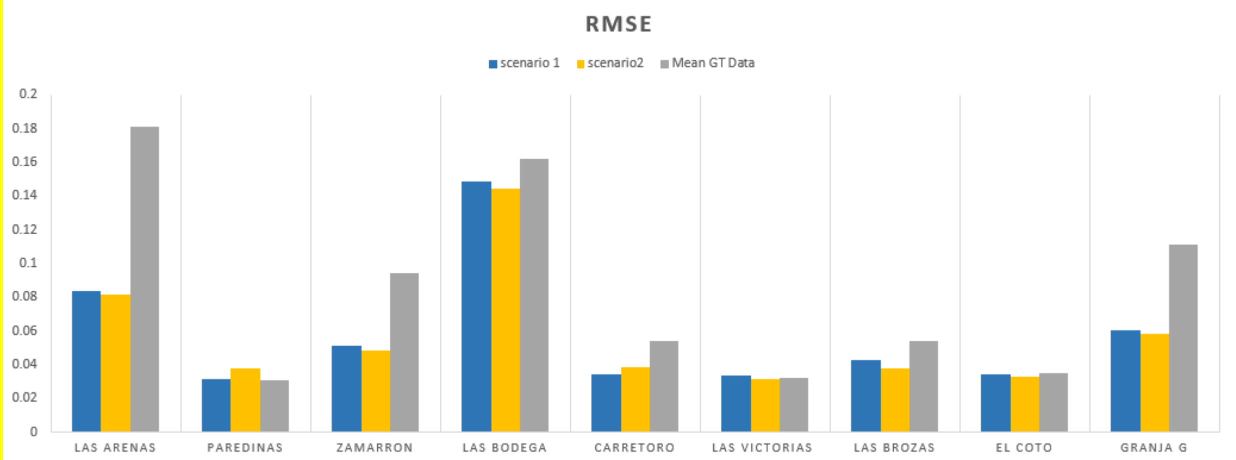


Figure 6. *Calculated RMSE(m^3/m^3) values at each station*

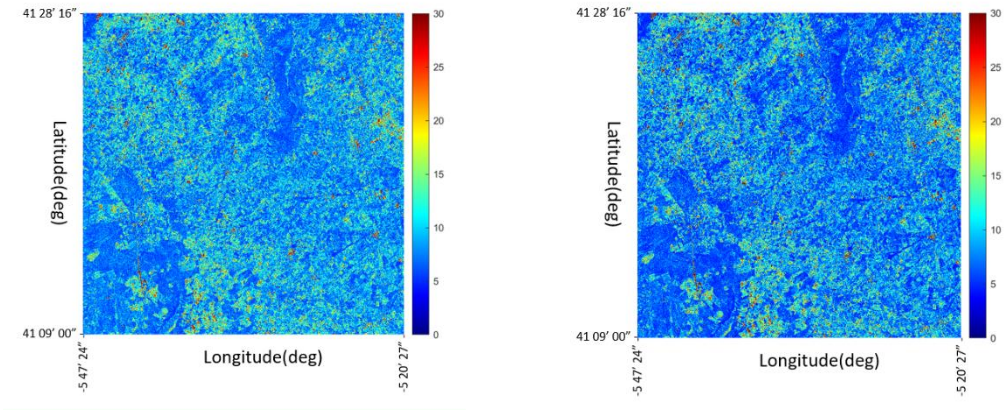
C2. ***Do not use Farsi alphabet in the text. There is a reason why English is the lingua franca of science: the internationalization of a text written in English guarantees maximum distribution and readership. Table 7 is not understandable. References are not in line with editing standards. Mathematical symbols cannot be followed.***

R2: *I have read the text multiple times but did not find the Persian alphabet. I would appreciate it if you could specify where exactly you encountered the Persian alphabet.*

C3. ***The figures have not been created in a rigorous manner: units are missing on many color scales and on the x and/or y axes.***

R3: *Thank you for pointing out this. In the revised manuscript, we have edited the figures and captions, as follows:*

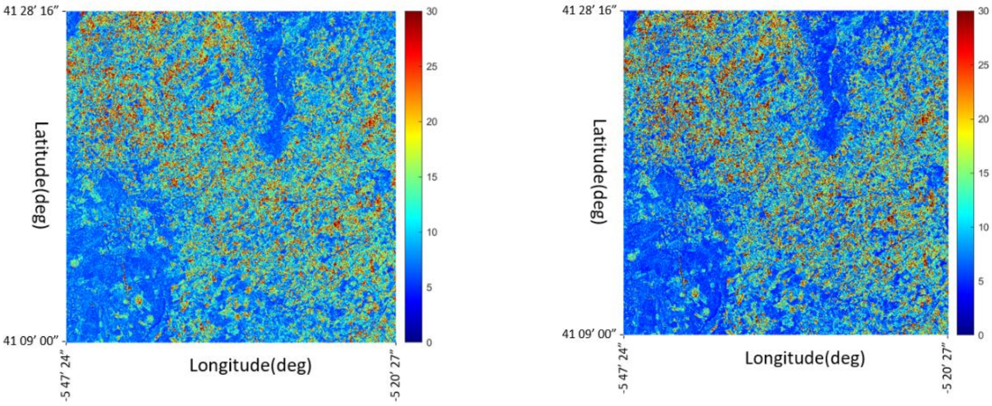
Page 7, Figure 3:



(a) ***(b)***

Figure 3. *Soil Moisture Results on May 17, 2020 : (a) Scenario 1 and (b) Scenario 2 (color bar shows soil moisture values m^3 / $m^3 * 100$)*

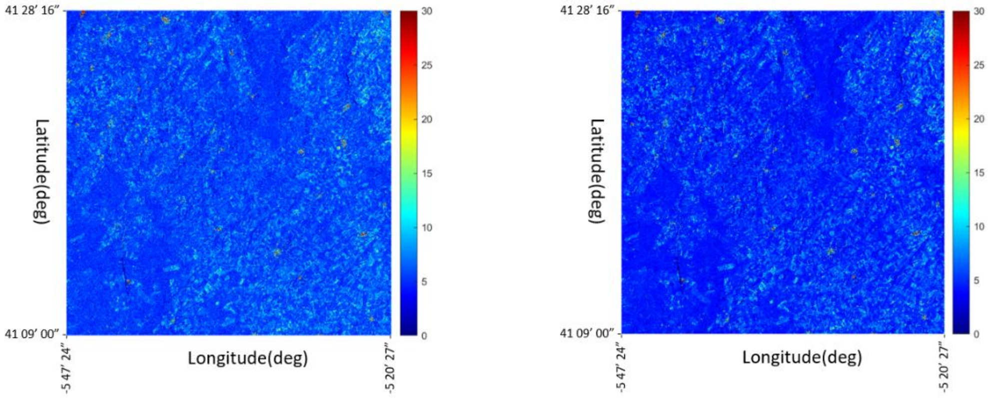
Page 8, Figure 4:



(a) ***(b)***

Figure 4. *Soil Moisture Results on October 20, 2020 : (a) Scenario 1 and (b) Scenario (color bar shows soil moisture values m^3 / $m^3 * 100$)*

Page 8, Figure 5:



(a) ***(b)***

Figure 5. *Soil Moisture Results on September 2, 2020 : (a) Scenario 1 and (b) Scenario 2 (color bar shows soil moisture values m^3 / $m^3 * 100$)*

C4. There is no Conclusion section in your manuscript, where you summarize your findings and the novelty of your research.

R4: *We have added Conclusion as the fifth section:*

Page 10:

According to previous studies, the backscattering of radar signals is sensitive to changes in soil moisture, and in addition, vegetation and soil roughness also affect these signals. Because the method of change detection is used to estimate soil moisture and also changes in soil roughness during the period under study are insignificant and negligible. Due to the selected method in this study as well as studies that have been done in the past, models that use radar data have better accuracy than other models. Also, for vegetated areas, hybrid models perform better in accurately estimating soil moisture. (transferred from the fourth section: Discussion, The second Paragraph)

In this study, an effort has been made to improve the accuracy of soil moisture estimation in agricultural areas and also to increase the spatial accuracy of the final output of soil moisture. For this task, the radar data from the Sentinel 1 sensor and the optical data from the Sentinel 2 sensor, with a spatial accuracy of 10 meters, were utilized. Based on past studies, radar signal backscatter is affected by changes in soil moisture, as well as by vegetation and soil roughness. Using the WCM model, attempts have been made to mitigate the impact of vegetation on radar signals by utilizing suitable data. Because the change detection method is employed to estimate soil moisture, the alterations in soil roughness during the investigated time period are negligible and can be disregarded. The calibration of the WCM model greatly impacts the accuracy of soil moisture estimation. This is achieved using NDVI and EVI indicators obtained from optical data of the Sentinel 2 sensor, in conjunction with soil moisture values measured by fixed stations.

In a study by Gao et al. (2017), the estimation of soil moisture in the agricultural region of north-eastern Spain in the range of 20 x 20 km using two ground stations measuring soil moisture, the value of the correlation coefficient (R^2) is equal to 0.099(m^3/m^3) and the value of RMSE is equal to 0.087 (m^3/m^3) with a spatial resolution of 100 meters. Also, in a study conducted by [18], which used Sentinel 1 radar data and MODIS optical data on an area similar to the study area in this dissertation, the RMSE value was obtained. Is equal to 0.055(m^3/m^3). In this study, in addition to increasing the accuracy of soil moisture estimation (RMSE) from 0.055 to 0.049(m^3/m^3), spatial accuracy also increased from 100m to 10m). (Transferred from the third section: Experimental Results, the last paragraph)

***C5.** Line 26: RMSE is 0.53? I believe this is a typo?*

***R5:** We apologize for this mistake. The typo has been fixed, along with two others:*

***Page 1, Lines 24-27:** The results showed good accuracy between retrieved and ground measurement soil moisture data (Root Mean Square Error (RMSE) of 0.053 m^3/m^3 and the obtained accuracy is promising compared to recent similar works.*

***Page 3, Line 5:** The dimensions of this area are 36 x 24 km.*

***Page 7, Lines 19-20:** The outputs obtained from the model used to have an image size of 3600 x 2400 pixels, each pixel has a spatial resolution of 10 meters.*

***C6.** I noticed that all figures are not cited in the manuscript except Figure 2. Please add citations of these figures in the main text and make appropriate explanations of them.*

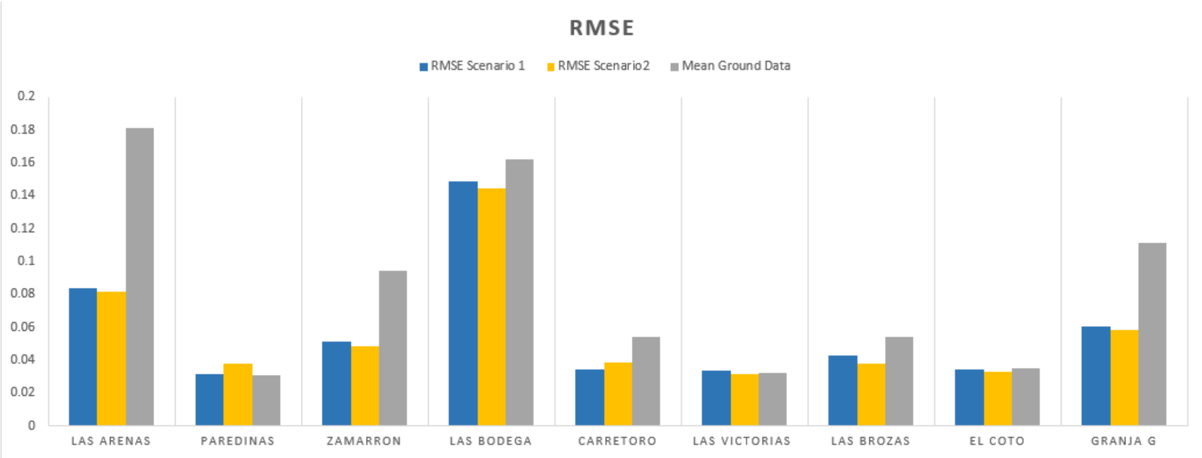
***R6:** Thank you for bringing this to my attention. We added citations for all figures in the main text and provide appropriate explanations for each of them in the manuscript.*

***Page 9, Lines 1-4:** Samples of the results from retrieving soil moisture in two scenarios (Table 3) in the study area are visible in the images above. Figure 5 depicts the driest day during the peri-od under review. In figures 3 and 4, the upper right and lower left sections exhibit denser vegetation compared to other areas, as evidenced by the estimation of soil moisture.*

***Page 9, Lines 15-16:** The regression results, in this case, are as follows (Figure 6):*

***C7.** Figure 6: What is Mean GT Data? How did you calculate the RMSE of it? Please give explanations.*

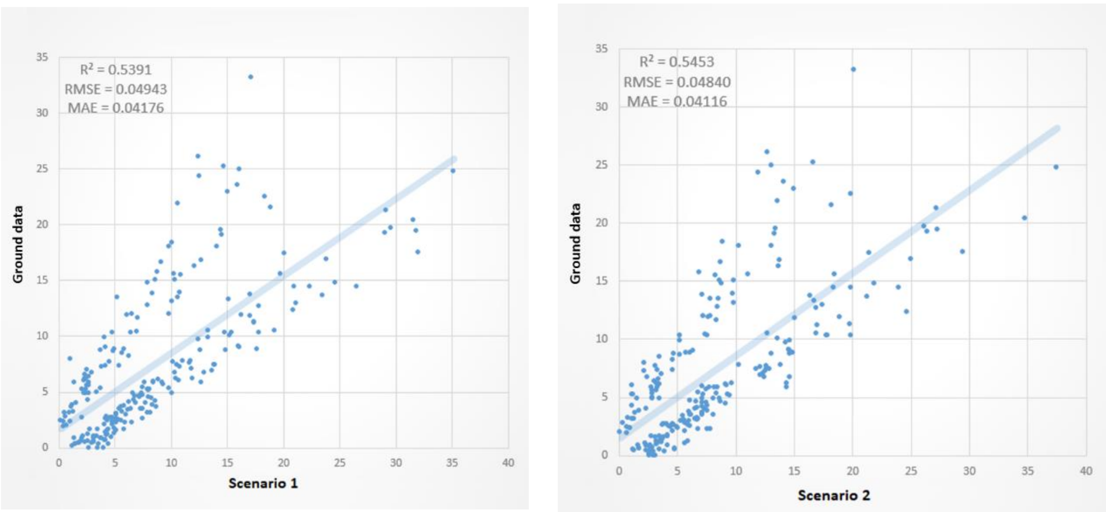
***R6:** We apologize for the inaccuracy in creating this chart. GT is actually Ground Truth replaced by ground data. Please refer to the corrected chart below:*



We have decided to remove this chart from the main text as the information is available in Table 2 (new numbering).

These corrections are also implemented in Figure 6.

Page 9, Figure 6 (**new numbering**):



(a) ***(b)***

Figure 6. *Linear regression between the estimated soil moisture values of scenario 1 and the measured values at the stations (By removing Las Bodega station): (a) Scenario 1 and (b) Scenario 2*

(RMSE unit: $(\mathbf{m^3/m^3})$*)*

C8. Please add the unit of soil moisture to all the values in the text and figures/tables throughout the manuscript.

R6: *We included all soil moisture measurements in the text, figures, and tables in the entire manuscript.*

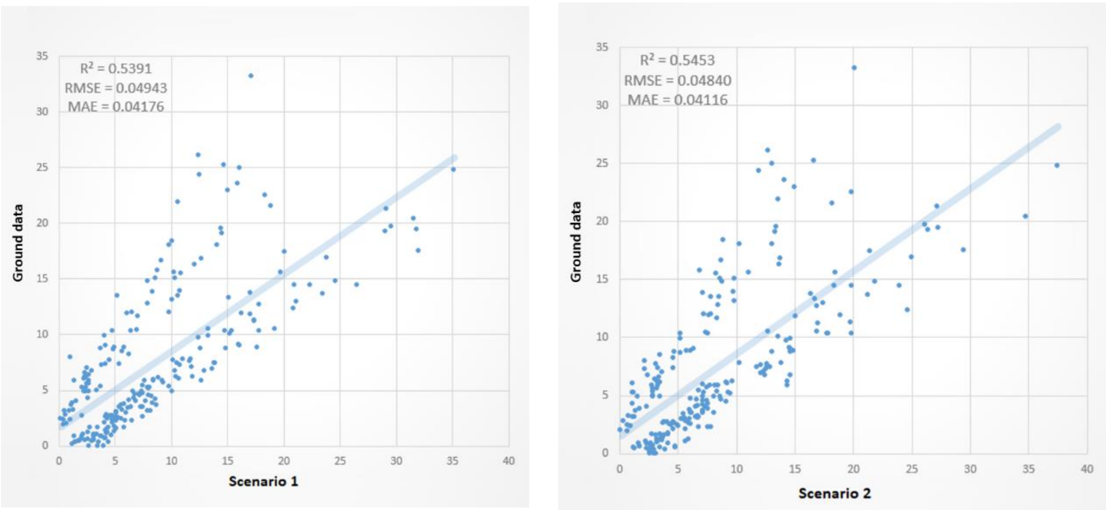
Page 8, Table 2**(new numbering)**:

Page 9, Table 3**(new numbering)**:

***Table 3.** Examining statistical indicators for two scenarios (*: By removing Las Bodega station)*

	RMSE $(\mathbf{m^3/m^3})$	R^2	*MBE*	*MAE*
1^{st} scenario	*0.06807*	*0.2524*	*-0.00680*	*0.05296*
2^{nd} scenario	*0.06626*	*0.2675*	*-0.00654*	*0.05191*
*1^{st} scenario**	*0.04943*	*0.5391*	*0.01018*	*0.04176*
*2^{nd} scenario**	*0.04840*	*0.5453*	*0.00988*	*0.04416*

Page 9, Figure 6** (new numbering)**:



(a) ***(b)***

***Figure 6.** Linear regression between the estimated soil moisture values of scenario 1 and the measured values at the stations (By removing Las Bodega station): (a) Scenario 1 and (b) Scenario 2*

(RMSE unit: $(\mathbf{m^3/m^3})$*)*

***Table 2.** Statistical index values calculated at each station*

Ground station	***RMSE*** $(\mathbf{m^3/m^3})$		***MBE***		***Average station soil moisture*** $(\mathbf{m^3/m^3})$
	1^{st} scenario	***2^{nd} scenario***	***1^{st} scenario***	***2^{nd} scenario***	
Las Arenas	*0.08340*	*0.08123*	*-0.01435*	*-0.01474*	*0.181*
Paredinas	*0.03122*	*0.03800*	*0.01744*	*0.02225*	*0.031*
Zamarron	*0.05093*	*0.04817*	*0.01444*	*0.01438*	*0.094*
Las Bodega	*0.14884*	*0.14416*	*-0.14259*	*-0.13789*	*0.162*
Carretoro	*0.03447*	*0.03817*	*0.01212*	*0.01522*	*0.054*
Granja G	*0.03365*	*0.03176*	*0.01743*	*0.01629*	*0.032*
Las Victorias	*0.04290*	*0.03812*	*0.01563*	*0.01512*	*0.054*
Las Brozas	*0.03449*	*0.03291*	*0.01710*	*0.01498*	*0.035*
El Coto	*0.06062*	*0.05807*	*0.0160*	*-0.04470*	*0.111*

Page 10, Lines 40-48: *In a study by Gao et al. (2017), the estimation of soil moisture in the agricultural region of north-eastern Spain in the range of 20 x 20 km using two ground stations measuring soil moisture, the value of the correlation coefficient (*R^2*) is equal to 0.099(*m^3/m^3*) and the value of RMSE is equal to 0.087 (*m^3/m^3*) with a spatial resolution of 100 meters. Also, in a study conducted by [18], which used Sentinel 1 radar data and MODIS optical data on an area similar to the study area in this dissertation, the RMSE value was obtained. Is equal to 0.055(*m^3/m^3*). In this study, in addition to increasing the accuracy of soil moisture estimation (RMSE) from 0.055 to 0.049(*m^3/m^3*), spatial accuracy also increased from 100m to 10m.*

The authors would like thank again the academic editors and other reviewers for their comments that help us to improve the quality of this manuscript.